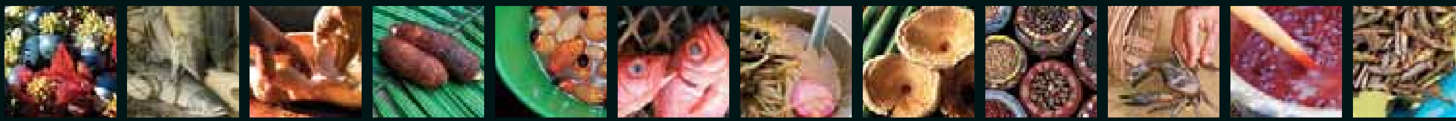
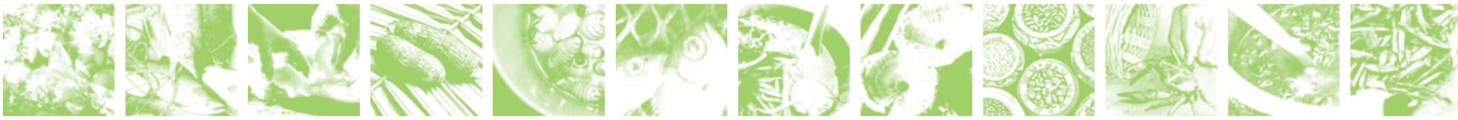


• HARRIET V. KUHNLEIN • BILL ERASMUS • DINA SPIGELSKI

Indigenous Peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health

CINE



● HARRIET V. KUHNLEIN ● BILL ERASMUS ● DINA SPIGELSKI

Indigenous Peoples' food systems:

the many dimensions of culture, diversity and environment for nutrition and health

Food and Agriculture Organization of the United Nations
Centre for Indigenous Peoples' Nutrition and Environment
Rome, 2009

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Preface

It was 1944 when the first draft of FAO's constitution was prepared. Since then, and to this day, that constitution holds that the Organization shall collect, analyse, interpret and disseminate information relating to nutrition, food and agriculture; shall promote and recommend action with respect to scientific, technological, social and economic research relating to nutrition, food and agriculture; shall promote the spread of public knowledge of nutritional and agricultural science and practice; and encourage the conservation of natural resources.

In the letter and spirit of this responsibility, we are privileged to be involved in the preparation and publication of *Indigenous Peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health*.

As its title makes clear, the traditional food systems of Indigenous Peoples touch the full spectrum of life in ways that modern food systems do not. Agriculture's technological developments in the six decades of FAO's existence have led to great disconnections between people and their food. Globalization and homogenization have replaced local food cultures; high-yield crops and monoculture agriculture have taken the place of biodiversity; industrial and high-input farming methods have degraded ecosystems and harmed agro-ecological zones; and modern food industries have led to diet-related chronic diseases and other forms of malnutrition. The successes of modern agriculture are many – and these should not be minimized. Food production now meets the food needs of the planet (albeit not always reaching the communities, households and individuals in need). However, there have been some casualties and unintended consequences along the way, and these cannot be ignored.

There will always be methodological difficulties in evaluating whole intact systems; and sensitivities and sensibilities are vital when dealing with diverse peoples and cultures. In this way, the work is ground-breaking in bringing together the community indigenous leaders and international scientists who managed to converge on the topic – even though from completely divergent entry points. The 12 case studies presented in this book show the wealth of knowledge in indigenous communities, in diverse ecosystems, and the richness of their food resources.

In preparing the food composition data for the traditional foods, the gold standards for data quality were not achieved. Some compromises were made in the areas of sample collection, numbers of samples analysed, and the coverage of nutrients – yet important data are presented. It is clear that people have the potential to solve their problems and the promise of this research will lead to solutions with local food resources.

This book, from project formulation to final publication, and all the heroic efforts in between, is the result of the resolve, vision and hard work of Harriet V. Kuhnlein. She praises and credits the vast network of indigenous leaders and their communities, the chapter authors, and collaborators around the world, who indeed, do deserve credit. But the project as a whole was guided through to its conclusion, with the firm yet gentle leadership of Professor Kuhnlein. Her dedication to the rights of Indigenous Peoples and the importance of their traditional food systems is the reason for the success of this project and the many projects she has led, including others with FAO, with the same successful outcome.

Forward planning benefits from looking back, and the *Indigenous Peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health* contributes to the evidence base and body of knowledge for critically evaluating successes and failures in food systems, in valuing and conserving the future – with policy instruments that enable the conservation and sustainable use of food genetic resources.

This book shows that there are two worlds operating in the same space and time. The future wants and deserves both worlds, and they are not mutually exclusive. This project's goal, and its enduring legacy, will surely be to bring into focus the importance of biodiversity for food and nutrition and traditional food systems for the benefit of all Indigenous Peoples ●

Barbara Burlingame Ph.D.
Rome, 2009

Acknowledgements

Each chapter in this book acknowledges those individuals who have contributed specifically to the chapter's research contributions. In the context of the overall programme, including the six group meetings that we have held, we thank our International Union of Nutritional Sciences (IUNS) committee members, the community leaders of the Indigenous Peoples who have collaborated with the case studies and their academic partners. We also recognize the excellent support that many skilled staff members have provided – both within the Centre for Indigenous Peoples' Nutrition and Environment (CINE) and in the case study teams. In particular, we thank Timothy Johns, Grace Egeland, Nancy Turner, Thelma Harvey, Bill Tallio, Rose Hans, Irma Tuesta, Marion Roche, Adelino Lorens, Kiped Albert, Nkechi Ene-Obong, Igwe P.E. Eze, M. Ozioko, Liliana Madrigal, Mark Plotkin, Camilo Correal, Natividad Mutumbajoy Janasoy, Eva Yela, Hazel Nerysoo, Elizabeth Vittrekwa, Margaret McDonald, Rhonda Francis, Gopa Kothari, Motiram Chaudhary, P.V. Satheesh, Martina Schmid, Joseph Ole Simel, Shadrack Okoth Oiye, Jonah Kilabuk, Looee Okalik, Masami Iwasaki-Goodman, Koichi Kaizawsa, Miwako Kaizawa, Sakorn Dhanamitta, Suttilak Smitasiri, Solot Sirisai, Sinee Chotiboriboon, Sopa Tamachotipong, Anon Setaphan, Sompop Sungklachalatarn and Benjamas Chumvorratayee.

"A photograph is worth a thousand words": we would like to especially thank Peter and Lisa Kuhnlein for providing the high-quality photo and video documentation of the case studies. All the case study partners and the CINE team applaud the artists' skill and sensitivity in depicting the images of the research so beautifully. Full sets of images were returned to case study partners, and DVDs that portray the case studies will assist policy discussions.

For preparation of case-study food lists and food-composition tables in the chapters, we thank Dr Nelofar Sheikh for her knowledgeable assistance, and students John Antony and Sandra Cohen. We are very grateful to Elizabeth Ansell, Donna Leggee and students Kathleen Shaw, Jessica McNeill and Nandita Perumal for editing and reference checking and to Donna-Michele D'Costa for her work on preliminary map preparation. Lauren Goodman, Tanya Nancarrow, Laura Kaufer and Jennifer Jamieson also assisted in preparing the final chapters. We thank Winifred Power (Editor), Chiara Caproni (Designer) and Maddalena di Giorgio (FAO Staff, for species name check).

We are continually appreciative of financial support for segments of the programme from McGill University; the Canadian Institutes of Health Research (Institute of Aboriginal Peoples' Health, Institute of Population and Public Health, and Institute of Nutrition, Metabolism and Diabetes); the International Union of Nutritional Sciences, the International Development Research Centre (Canada); Indian and Northern Affairs Canada; the United Nations World Health Organization, the Convention of Biological Diversity (UNEP), the United States Agency for International Development, the United States Centers for Disease Control, Sight and Life, the Amazon Conservation Team, and several in-country Non-Governmental Organizations, universities, agencies and research institutes.

A "big thank you!" to The Rockefeller Foundation for grants to bring our case study partners together three times – at the lovely Bellagio Study and Conference Centre, in Bellagio, Italy. Our case study partners' meetings were made possible because of grants from three Canadian agencies: the Social Sciences and Humanities Research Council, the International Development Research Centre, and the Canadian Institutes of Health Research. We are very grateful for these contributions to our research efforts.

We are especially indebted to Barbara Burlingame, Senior Officer, Nutrition Assessment and Evaluation, of the United Nations Food and Agriculture Organization, Rome, for her encouragement and assistance for this work from 2001 to the present time, and for this publication. Barbara has contributed outstanding leadership and vision as the champion for development of the sciences of food composition and food use throughout the world, and we are honoured that she included our work within her mandate ●

Project leaders: ***Harriet V. Kuhnlein***, Ph.D., R.D., F.A.S.N., LL.D. (*hon.*), Founding Director, CINE, and Professor of Human Nutrition, McGill University; ***Bill Erasmus***, Chair of the CINE Governing Board and Regional Chief, Assembly of First Nations and National Chief, Dene Nation; and ***Dina Spigelski***, R.D., M.Sc., Coordinator.

2009

Foreword

I am a member of the Yellowknives Dene and live in the community of Ndilo adjacent to Yellowknife, the capital of the Northwest Territories, Canada. I grew up with a great respect for my parents' and our community Elders' knowledge about our Dene food. We learned that our foods are essential to keep our good health, and that the land, water and air in which we live – together with the animals and plants – must be respected and protected. I went on to a university education in Political Science and Anthropology and am now the National Chief of the Dene Nation and Assembly of First Nations Regional Chief of the Northwest Territories, Canada's largest organization dealing with the issues of Indigenous Peoples. It is in this context that I became involved with the Centre for Indigenous Peoples' Nutrition and Environment (CINE) and the project that forms this book.

I have learned that "Food is a human right" and that Indigenous Peoples everywhere want to protect their heritage and the health of their culturally determined foods. They are concerned about the potential loss of both food species and the knowledge about how to use them. They worry that the loss of Elders in the natural cycle of life may mean that knowledge about indigenous foods will not be passed on to the generations that follow. This raises anxieties about the demise of cultural and traditional knowledge associated with their foods and lifestyles. Inidgenous Peoples want to preserve their ecosystems that for so long have provided a healthy environment for animals, plants and people.

This book will help indigenous communities realize that they can understand their own food resources by using tools created by this project. These 12 case studies from different parts of the world are just that – examples that demonstrate the wealth of indigenous knowledge around ecosystems providing food. This book demonstrates how to list the foods and how to understand their healthy properties. It also identifies and demonstrates the importance local foods play in indigenous cultures, and why it is important to protect this knowledge for future generations.

This research originates from the Centre for Indigenous Peoples' Nutrition and Environment (CINE, see www.mcgill.ca/cine), the multidisciplinary research and education resource established in 1992 by Canada's indigenous leaders and McGill University, Montreal. CINE maintains research programmes that address food-system concerns. Its objectives include understanding the benefits for and the risks to Indigenous People in using traditional foods. CINE is unique – it is recognized nationally and internationally for both its research and its method of participatory working with Indigenous Peoples. Indeed, CINE's governing board is made up mainly of indigenous organization representatives, and I am pleased to have chaired the Governing Board of CINE for several years, and to have participated in building the project described here.

Each research area described in the 12 chapters in this book has been fortunate to have had excellent collaboration with academic partners and community leaders. In addition to documenting the food species and varieties/cultivars in the food system, the research looks too at the percentage of energy and nutrients obtained from local food in comparison to that obtained from commercial food items. Using qualitative methods, it documents the many changes in food sources (local versus commercial), environmental quality, physical activity and food security. The chapters present the communities' and their academic partners' perspectives on interventions that could improve nutrition and food security.

We found many common themes across all of the communities – for instance, the twin aims of both increasing the availability of traditional food to communities and of improving the quality of imported industrialized purchased food. The themes of "connection to the land" and "access to resources" prevailed throughout all 12 case studies, underlining the common struggle to protect indigenous cultures and emphasizing the need to conserve those ecosystems that contain the food resources necessary for community health. At the same time, information on nutrient density of what people eat and how to improve the quality of food imported to communities was highly appreciated.

Twelve fascinating and unique stories of descriptions of Indigenous Peoples' food and health circumstances await the reader. The unique styles of conceptualizing food systems and writing about them were preserved as much as possible. The photographs that accompany each chapter help convey the meaning and beauty of local foods.

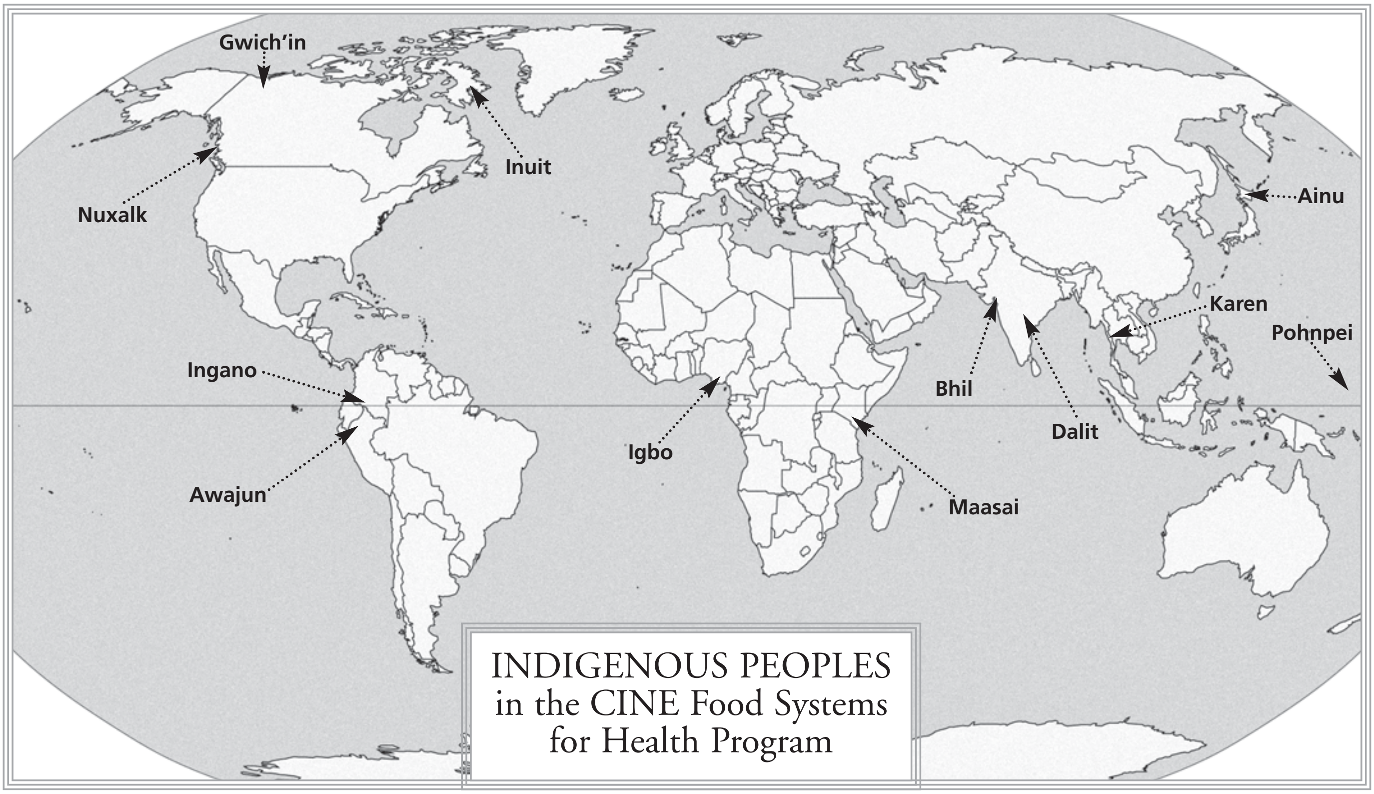
Our entire team is convinced of the necessity of efforts to protect Indigenous Peoples' food systems because of the many benefits they offer to physical health and the continuity of indigenous cultures. This can be seen in many ways – in terms of self-sufficiency, cultural morale, as resources around social activities, for educating children in terms of cultural principles and environmental connectedness. These food systems also provide many economic and nutritional benefits and are an important foundation of food security for Indigenous Peoples in their home regions. Without doubt, for Indigenous Peoples collectively, these resources are of global significance. They need to be protected environmentally and fostered for sustainable use – not only among the women, men and children who hold the traditional knowledge of these cultural treasures, but for our collective human knowledge ●

Dene National Chief Bill Erasmus
Yellowknife, NWT, Canada
2009

Introduction

Why are Indigenous Peoples' food systems important and why do they need documentation?

● HARRIET V. KUHNLEIN, PH.D


Gwich'in
Inuit
Nuxalk
Ainu
Karen
Pohnpei
Ingano
Bhil
Dalit
Igbo
Awajun
Maasai
INDIGENOUS PEOPLES
in the CINE Food Systems
for Health Program

This book is about the food that is close to the hearts of Indigenous Peoples in their local cultural environments. The authors and chapter writers describe 12 diverse global examples of how Indigenous Peoples themselves researched their food diversity, cultural understanding of their food, the impacts of the environment on their food and how these resources they know so well are critical for their nutrition and health. We worked together to figure out ways to capture these essential principles and how to present them to readers who may be indigenous or not, and who may be students, researchers, development advocates and/or policy makers in diverse interdisciplinary fields. By documenting this remarkable knowledge we want to encourage greater appreciation for Indigenous Peoples' food systems and enforce the call for their promotion and protection.

These stories show how Indigenous Peoples' food systems contain treasures of knowledge from long-evolved cultures and patterns of living in local ecosystems. The dimensions of nature and culture that define a food system of an indigenous culture contribute to the whole health picture of the individual and the community – not only physical health but also the emotional, mental and spiritual aspects of health, healing and protection from disease. However, these food systems which are intricately related to the complexities of social and economic circumstances are becoming increasingly more affected by the forces of globalization. Within the larger society in which they live, despite the wealth of knowledge rural Indigenous People have of their local environment and food system, they often face vulnerabilities derived from extreme poverty, discrimination and marginalization. This can mean that access to their resources becomes limited, causing unnecessarily poor health outcomes. It is within this context that the scientific work described in this volume seeks to define and describe the diversity contained in circumstances surrounding 12 rural Indigenous Peoples' food systems that are windows to Indigenous Peoples everywhere. Our long-term goal is to find solutions to difficulties faced in using, developing and sustaining this knowledge to improve the well-being and health of Indigenous Peoples globally.

Context of research

Who are Indigenous People? The definition of indigeneity varies in different global regions, with no single criterion that can be applied universally, except to note the accepted principle that people have the right to define themselves according to their culture. Within the context of the work described here, we maintain that Indigenous People are those who retain knowledge of the land and food resources rooted in historical continuity within their region of residence. The local food systems that they are currently using are those we define as "traditional food systems", which invariably include some foods that may be used by many outside of the indigenous culture (e.g. salmon). In essence, we describe as "traditional foods" those foods that Indigenous Peoples have access to locally, without having to purchase them, and within traditional knowledge and the natural environment from farming or wild harvesting. Alternatively, we define "market foods" as those foods that enter communities often through global industrially sponsored retail outlets, and which must be purchased (e.g. sugar, oil). In some circumstances, Indigenous Peoples may purchase some of their culturally based traditional foods (i.e. wild meat, local rice varieties) from others with land and/or time to harvest them. In other cases, Indigenous Peoples count as their own species that were introduced from other regions (e.g. Karen chilis). Throughout, it is the intent of this volume to document how Indigenous Peoples today think about and use local food resources that are identified within their cultures.

We aspire to strengthen the evidence base of current circumstances surrounding food systems and health by using 12 community groups of Indigenous Peoples located in different global regions: Ainu (Japan), Awajun (Peru), Baffin Inuit (Canada), Bhil (India), Dalit (India), Gwich'in (Canada), Igbo (Nigeria), Ingano (Colombia), Karen (Thailand), Maasai (Kenya), Nuxalk (Canada), and Pohnpei (Federated States of Micronesia). The chapters themselves are presented geographically – from North America to South America, Pacific, Asia and Africa (see Map).

Indigenous People case studies with traditional food descriptions

In these 12 case studies, the Centre for Indigenous Peoples' Nutrition and Environment (CINE), leaders of the communities of Indigenous Peoples and their academic partners in the same country collaborated for research in two phases: 1) documentation of the cultural food system with a defined protocol (see http://www.cine.mcgill.ca/documents/manual.pdf) and 2) implementation of health promotion interventions using culturally sensitive and environmentally relevant elements of the local food system. This volume describes the first phase of the research: documentation of the inherent strengths of the local traditional food system, the influx of industrialized and purchased food, and the circumstances of the nutrition transition in these indigenous communities.

This information sets the stage for the second phase of the research: to demonstrate how these local foods contribute to food security, nutrition and health. Our long-term objectives are to address scientific issues, public health, and policy, with the goal of influencing local, national and international policies for environmental protection of Indigenous Peoples' land and food resources. In this way, communities can be encouraged to strengthen their use of local food and sustain knowledge of their local food systems for essential contributions to cultural protection, well-being and health.

International initiatives stimulating this programme

This effort of Indigenous Peoples and their academic partners takes place within the International Decades of the World's Indigenous Peoples, and the recent Declaration of the Rights of Indigenous Peoples approved in the General Assembly of the United Nations. The research has been supported and presented in several fora of the United Nations System. A basic chronology demonstrating the evolution of the Task Force (TF) on Indigenous Peoples' Food Systems and Nutrition of the International Union of Nutritional Sciences (IUNS) and this project is as follows:

2001. Creation of the TF following the IUNS meeting in Vienna, with the objective to secure support from the Food and Agriculture Organization of the United Nations (FAO) and the International Development Research Centre of Canada (IDRC) to document traditional food systems (TFS) of five groups of Asian Indigenous Peoples: Bhil (India), Dalit (India), Karen (Thailand), Miao (China), and the Mogh and Nayakrishi (Bangladesh).

2001. Meeting of Asian case study partners in Salaya, Thailand, to draft the food system documentation methodology.

2002–2003. Preparation of a United Nations World Health Organization (WHO) publication on Participatory Health Research with Indigenous Peoples: Planning and Management and Preparing Research Agreements (http://www.who.int/ethics/indigenous_peoples/en/index1.html).

2004–2006. Funding quest for 12 case studies for Phase 1 and Phase 2 of the research.

2004. Meeting of case study partners at The Rockefeller Foundation's Bellagio Study and Conference Center in Italy. Confirmation of Phase 1 research methods and plans for intervention proposals. Creation of CINE web document (project Book 1) for Indigenous Peoples' food system methods (http://www.cine.mcgill.ca/documents/manual.pdf).

2005. Meeting of Awajun and Ingano partners in Lima. Preparation of draft versions of adaptable food-security and physical-activity interview methods.

2005. Convention on Biological Diversity (CBD) initiative with the United Nations System Standing Committee on Nutrition (SCN) established in Brazilia.

2005. Funding established for photo documentation of case-study food systems.

2005. Meeting of case study partners in the Futululu Environmental Centre in St Lucia, South Africa. Preparation of publication on intervention methods and evaluation (Public Health Nutrition 9(8): 1013–19, 2006).

2005–2006. Four FAO and IDRC posters prepared and distributed internationally to highlight food diversity and for the International Decades of the World's Indigenous Peoples: Global, Asia, Africa, Pacific Islands.

2006. Case study partners' meeting in Montreal to compile Phase 1 results publications.

2007. Second meeting of case study partners at The Rockefeller Foundation's Bellagio Study and Conference Center. Finishing details on book of chapters of Phase 1 results.[1] Consideration of appropriate definitions of Indigenous Peoples and policy activities for case studies at several levels.

2007. The project is considered in the Standing Committee on Nutrition (SCN) of the United Nations System – the Working Group on Household Food Security and the Working Group on Nutrition, Ethics and Human Rights-Task Force on Indigenous Peoples and the Right to Food.

2007. The publication of this volume was described at the 7th International Food Data Conference in Sao Paulo, Brazil.

2008. This book (Project book 2) was described at the Second International Conference on Health and Biodiversity (COHAB2) in Galway, Ireland.

2008–2009. Phase 2 of case study interventions are discussed at our third meeting at The Rockefeller Bellagio Study and Conference Centre in preparation for a book (Project Book 3) to be presented at the IUNS International Nutrition Congress in Bangkok.

Overview of findings

The information presented in these chapters provides a detailed understanding of the diversity, complexity and cultural appreciation of these food systems of Indigenous Peoples. An impressive array of food species and varieties is documented, some of which still require scientific identifications and nutrient-composition analysis. Locally available food-species numbers varied considerably depending on the ecosystem. For example, the Maasai of Kenya documented 35 food species in an arid, drought-

Table 1 Percentage of adult dietary energy as traditional food and number of species/varieties in the food systems

Indigenous Group	*Energy %*	*No. of species/varieties*
Awajun	93	223
Bhil	59	95
Dalit	43	329
Gwich'in	33	50
Igbo	96	220
Ingano	47	160
Inuit	41	79
Karen	85*	387
Maasai	6	35
Nuxalk	30*	67
Pohnpei	27	381

* Estimated for adults.

[1] At the 2007 meeting of case study partners in Bellagio, Italy, considerable discussion was held on the title for this book. It was agreed to include both nutrition and health in the title, and that a footnote be made to the many dimensions of Indigenous Peoples' food systems that were expressed. These included the concepts of food diversity and/or biodiversity, culture, environment, food security, economy of family food, food self-sufficiency, and self-esteem and cultural morale in using local, cultural food. It is hoped that this introduction captures the diversity of the discussion, and includes the many thoughtful perspectives of our excellent team.

prone zone, while there were 381 local food species/varieties documented for the Pohnpei culture in the Federated States of Micronesia. Other results show 220 species in the Igbo environment in West Africa, 223 for the Amazonian Awajun and 387 for Karen (Table 1). Detailed data on each food system are presented in the chapters.

The extent of use of these impressive food systems also varied (Table 1). For example, the adult Awajun and Igbo were found to consume close to 100 percent of dietary energy from these local food resources. The Maasai, Pohnpei, Ingano, Bhil and Dalit cultures are shown here to have considerable erosion of dietary energy, supplanting traditional species in the form of commercial (or donated) cornmeal or white refined rice. The Canadian Gwich'in and Inuit have less than 45 percent of dietary energy as traditional, local food, with the majority of the balance of energy derived from refined flour, fats and sugar.

Nutrition assessments were made in most cases, using anthropometry and dietary intake, and other biological measures that were accepted within the culture and/or otherwise available. Food composition databases were used as developed within the countries of the academic collaborators, and standards for determination of nutritional adequacy, including views on stunting and other nutrition parameters, were reflective of the home countries.

There are many common themes in the chapters. First, it is important to recognize the need for research methods that are suitable for this diverse set of rural communities of Indigenous Peoples. Academic research partners worked together with community leaders to agree on the goals, objectives, methods and ultimate use of the research findings by creation of meaningful research agreements (see http://www.mcgill.ca/files/cine/partreresearch_english.pdf). It was recognized that this is information from "the people" is to be used for their benefit. In all cases, work was conducted with groups of communities with a total population size that was usually less than 1,000. In several areas it was necessary to overcome skepticism toward the research in these grass-roots communities, so that the necessary in-depth studies within the culture could take place. Assurances had to be given that the research was for the people directly involved, and not for the benefit of pharmaceutical bioprospecting. Usually, there was a reluctance to include blood samples as part of the research process for both adults and children. Nevertheless, we had important and necessary assurance of the willingness and enthusiasm of communities to undertake this work for their benefit. In fact, the research methods, process, goals and end-products became very popular in communities, and in spreading word of success of the projects. Indigenous leaders would like to expand the work to other communities so they may also consider the benefits of greater understanding and use of their local food.

In the 2007 meeting at The Rockefeller Foundation's Bellagio Study and Conference Centre all case studies recognized the value of using traditional food/medicine resources as a platform to conduct awareness building and education on nutrition and health and to conduct education activities. Several of the case studies (Awajun, Nuxalk, Bhil, Ainu, Karen) have prepared photo books of the traditional food resources to be used as educational resources in local schools and at community meetings.

Commonalities also existed on the intention to increase traditional food availability to communities, and to improve the quality of imported industrialized purchased food. The theme of "connection to the land" prevailed throughout all case studies, as a common struggle to protect indigenous cultures, with attention also to the need for conservation of ecosystems containing these resources. At the same time, information on nutrient density and quality of food imported to communities was highly appreciated. Attention to women as gatekeepers to family food availability was consistent across the case studies, with imperatives to increase women's self-esteem and to find ways to lighten the burden of food preparation methods by including food scientists and engineers in project intervention plans. Morevoer, attention to food safety of these food resources was noted.

Understanding the science of these local food resources was recognized to be at the heart of projects in each area, and attempts were made to build the scientific notation and food composition data to benefit community food education, nutrition education and local abilities toward understanding health benefits of foods, especially for youth in the regions. Efforts at food composition analysis were mixed, with some case studies completing more of this work than others. The logistics of sampling and the expense of laboratory work were key factors that limited additional work.

Case study partners had to make compromises when implementing the suggested methodology to collect data. As noted above community areas, by requirement of budget and logistics, were small and limited in numbers participating in age and gender groups. For example, there were small numbers of school-aged children, but sample sizes were still meaningful in identifying anthropometric issues of stunting or obesity. Another example was the difficulties faced in the Ainu study when it was realized that many in the targeted communities were reluctant to identify themselves as Ainu because of the history of discrimination. Throughout, and despite our best efforts, there were few case studies that could give complete information on all the species and varieties of foods in their area. While the frustrations of missing data are recognized, it also highlights the imperative to continue this work.

Even in recognition of these constraints, this book provides 12 fascinating and unique chapters of descriptions of Indigenous Peoples' food and health circumstances. The unique styles of writing and presentation were preserved as much as possible, and the photos presented capture the people, food and environments of these unique traditional food systems. Each of the case studies proceeds independently with publications on their findings, and the reader is encouraged to seek these additional resources.

Policy implications of the research

This project has captured the attention of leaders in many sectors of local, national and international governments and agencies. A forward-looking approach is needed in all sectors to address Indigenous Peoples' food security, and for building attention on the rights of Indigenous Peoples to maintain their cultures, environments and preferred food systems ●

Chapter 1

Back to the future: using traditional food and knowledge to promote a healthy future among Inuit

● GRACE M. EGELAND, PH.D.[1] ● GUYLAINE CHARBONNEAU-ROBERTS[1]

● JOHNNY KULUGUQTUQ[2] ● JONAH KILABUK[2] ● LOOEE OKALIK[3]

● RULA SOUEIDA[1] ● HARRIET V. KUHNLEIN, PH.D.[1]

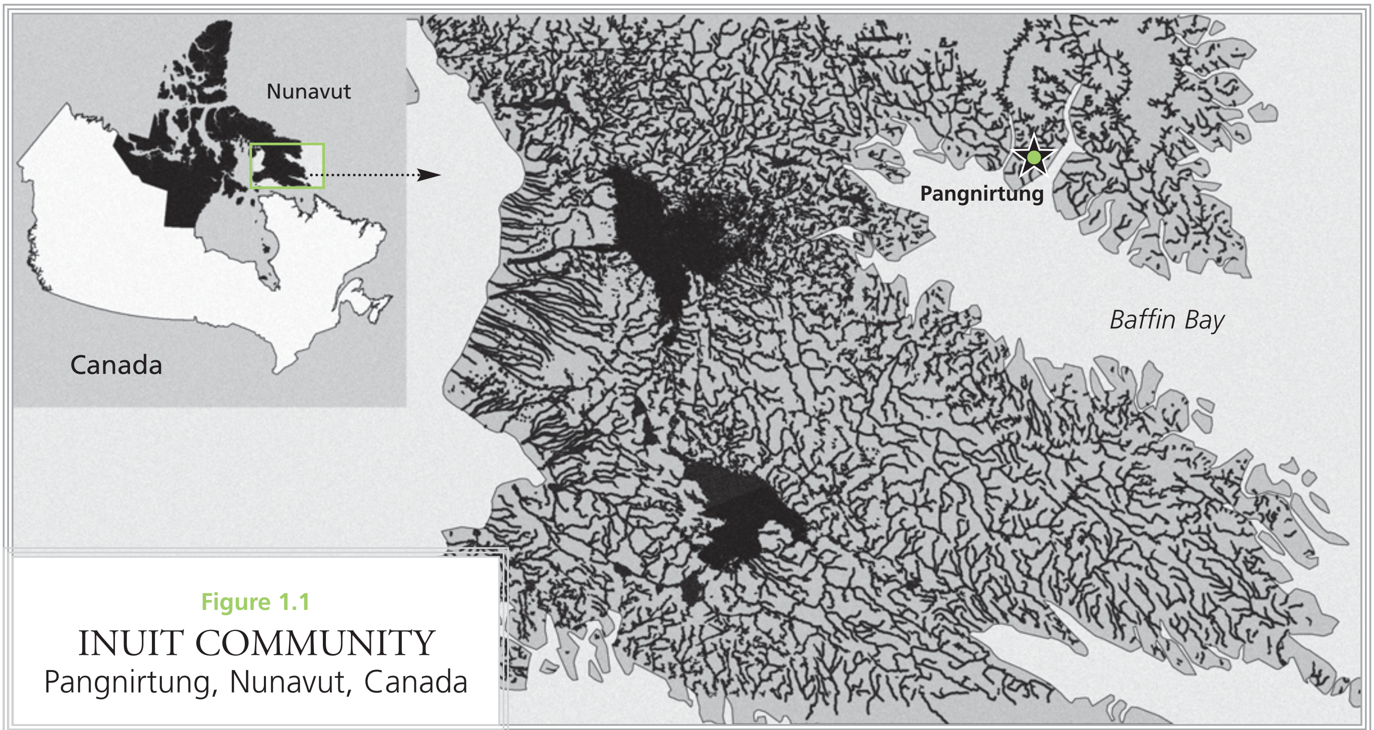


Figure 1.1
INUIT COMMUNITY
Pangnirtung, Nunavut, Canada

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.

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Centre for Indigenous Peoples' Nutrition and Environment (CINE) and School of Dietetics and Human Nutrition, McGill University, Montreal, Québec, Canada

2
Community Steering Committee Member, Pangnirtung, Baffin region, Nunavut Territory, Canada

3
Inuit Tapiriit Kanatami, Health Office, Ottawa, Ontario, Canada

Photographic section >> III

“Give thanks to our food, Elders and ancestors daily.”

Inuit saying

Abstract

Evidence of nutrition and epidemiologic transition in Inuit communities prompted a case study where traditional knowledge and traditional food is used as a basis for a community health-promotion effort to help improve overall diet quality including healthy market food choices. The current Inuit diet in the Baffin community involves a mix of traditional and market food. Caribou was the most commonly consumed traditional food item. Overall, 41 percent of energy was obtained from traditional food among 62 percent of respondents reporting traditional food consumption within the past 24 hours in the community health screening. Simultaneously, 58 percent of adults reported consuming an average of two cans of carbonated beverages in the past day, amounting to 10 percent of energy intake. Furthermore, the percent of n-3 fatty acids in plasma as a marker of traditional food consumption was inversely related to the percent of *trans*-fat in plasma as a marker of unhealthy market food choices (Spearman *rho* = -.44, p-value ≤.01). The data illustrate that traditional food is replaced by unhealthy market food choices.

A high prevalence of metabolic syndrome was observed (34 percent of 47 non-diabetic participants) using the new International Diabetes Federation criteria. Further, food insecurity was commonly reported, with 48 percent indicating that it was true or sometimes true that they “eat less or skip a meal because there isn’t enough money to buy food”; and 28 percent indicating “yes” to “in the last month there was not enough to eat in your house”. Fortunately, nearly all respondents (82 percent) indicated that friends and relatives shared their traditional food. The data illustrate that costs of market food items need to be considered in health promotion campaigns, and that traditional food promotion and sharing networks can help mitigate the rapid acculturation and transitions being observed. Finally, using traditional knowledge of indigenous food systems may be an effective way to promote healthy market food choices in an effort to prevent the adverse effects of acculturation.

Introduction

Rapid changes spanning all dimensions of life are occurring throughout Inuit communities. Key concepts integral to promoting Inuit health and well-being include maintaining cultural identity, positive family dynamics, social support, spirituality, and environmental integrity. Traditional food (called country food among Inuit), features prominently at the centre of Inuit identity and well-being. The hunting, harvesting and sharing of country food ensured survival and provided social cohesion, as they continue to do. The climate and landscape certainly fostered an Inuit spirit of thriving in the face of adversity that is rooted in strong collaboration and a sense of commitment to one’s community. With this strength and resiliency, Inuit are now facing new challenges associated with climate change and environmental degradation, market economies, globalization, acculturation, and nutrition transition – all with far-reaching societal and health implications.

Inuit country food is a rich source of antioxidants, omega-3 fatty acids, monounsaturated fatty acids, protein, and micronutrients (see www.mcgill.ca/cine/resources/nutrient). The dietary composition of country food likely provides invaluable health benefits, as suggested by early observations of the heart-healthy Inuit diet (Bang, Dyerberg and Nielsen, 1971; Bang and Dyerberg, 1972; Dyerberg and Bang, 1978), which inspired decades of nutrition research on the role of fatty acids in health. Today, chronic conditions are emerging that have historically been lower among Inuit than among southern populations (Bjerregaard and Young, 1998). The emerging health patterns likely reflect a response to transition in all facets of life, of which nutrition transition is only one component. Work toward protecting the environment and its ecosystems from further degradation and finding ways to ensure availability of and access to country food will undoubtedly feature prominently in strategies to promote Inuit health and thriving.

Purpose of study

The purpose of the Inuit community case study in Pangnirtung is to utilize traditional knowledge, Inuit story telling, and country food to promote the health and well-being of community members. The study highlights the importance of Inuit culture and country food and the integrity of the Arctic ecosystem for the promotion of Indigenous Peoples' health. The current report discusses two projects. The first was the Baffin component of a five-Inuit region dietary and traditional food-use survey, and the second project is the community health promotion project in which selected results of a baseline adult assessment are reported.

Participatory research

The Baffin component of the five Inuit region dietary survey was developed through participatory processes initiated in 1997 and 1998 by the Centre for Indigenous Peoples' Nutrition and Environment (CINE). Initially, a total of 39 communities sent representatives to workshops to discuss research methods and to identify participating communities. For the community case study reported here, participatory processes were also followed (WHO and CINE, 2003). Comments and feedback were also requested of the Inuit Tapiriit Kanatami (ITK), which is a member of the CINE Governing Board, the Government of Nunavut Health and Social Services Department, and Nunavut Tunngavik Incorporated. Approvals for the community health screening were obtained from the McGill Ethics Review Committee, the Nunavut Research Institute, and the community. A community and CINE research agreement was developed and approved by the Hamlet Council. A community steering committee guided and helped in all aspects of the fieldwork and ensured appropriate and accurate translations of consent forms and questionnaires into Inuktitut. Informed consent was obtained from each participant. The steering committee is self-directed and active in hiring staff and supervising the ongoing work in the community.

Overall description of research site and Indigenous People

Geographic and environmental characteristics

The Territory of Nunavut was formed in 1993, and represents an Inuit self-ruled territory, the name meaning "our land" in Inuktitut (see www.gov.nu.ca/Nunavut). The Baffin Region of Nunavut is the most traditional of Canadian Inuit regions and is home to approximately 12 700 Inuit. The community of Pangnirtung, home to 1 300 Inuit, is situated on a beautiful fjord in South Eastern Baffin in Cumberland Sound (Figure 1.1). The name of Pangnirtung denotes a place of plenty, translating as the place "abundant of bull caribou". By northern standards, Pangnirtung remains a privileged community in terms of access to traditional food. In addition to subsistence food harvests, the local economy is fuelled by commercial fishing and processing at Pangnirtung Fisheries, where Arctic char, shrimp, and Baffin turbot (Greenland halibut) are harvested, then shipped internationally (see http://www.gov.nu.ca/Nunavut/English/about/communities.shtml).

The local economy is also supported by the territorial government sector as it is home to the Baffin region's Government of Nunavut administrative offices. The hamlet municipality is also an employer, and the community is well known for the number and quality of artists in print-making, woven tapestries, and carving. There is some seasonal tourism, which employs local guides as the community is situated near the scenic Auyuittuq National Park.

Cultural characteristics and historical perspectives

Inuit enjoy a rich history of story-telling and subsistence harvesting. They historically travelled in small family groups to ensure year-round access to subsistence species. The Canadian government policies led to forced settlements in the 1950s and families continued to move in to settlements from semi-nomadic existence through the 1970s. The rapid changes from traditional hunting and nomadic life to modern amenities in settlements to the formation of a self-rule government in 1993 illustrate the rapid changes occurring in Northern Canada and the adaptive nature of Inuit.

General description of the food system

Dietary surveys have found that food security is a primary concern throughout Northern Canada (Lawn and Harvey, 2001; Lawn and Langer, 1994) and that five out of six households were food insecure in one Inuit community (Lawn and Harvey, 2001). Also, in the earlier CINE surveys, which included the five Inuit regions, food security concerns were commonly expressed by respondents. More than 50 percent of women respondents in Nunavut and Labrador reported not being able to buy all needed food from the store. Further, many Inuit (up to 45 percent within age groups) reported that they could not afford to go hunting or fishing (Lambden *et al.*, 2006). In a recent market food costs survey, the weekly cost of a food basket for a family of four residing in a remote Baffin community was $CAD265 compared to $CAD144 in Montreal (see www.ainc-ianc.gc.ca/ps/nap/air/fruijui/nfb/nfbbafnuna_e.html). In the context of food insecurity, nutrient-dense country food is replaced by abundantly available and low-cost refined carbohydrates. The Inuit dietary survey conducted by CINE demonstrated that days with country food provided more protein and micronutrients than days without country food, and that carbohydrate intake, particularly refined carbohydrates, increased on days without country food (Kuhnlein *et al.*, 2004; Kuhnlein *et al.*, 2000). Also as younger generations consume less country food, dietary intakes of key micronutrients are more likely to be suboptimal among younger than older Inuit as demonstrated by the striking differences in retinol intake by age in the five Canadian Inuit regions surveyed by CINE in 1998 (Egeland *et al.*, 2004).

The prevalence of overweight and obesity has risen throughout Canada (Statistics Canada and Shields, 2005; Statistics Canada, 2001). Likewise, overweight and obesity is occurring in Inuit communities in Canada (Kuhnlein *et al.*, 2004). In developing countries, nutrition transition has been associated with both under and over-nutrition being noted within the same communities and even the same households (Popkin, 2002). Likewise, both overweight and obesity and sub-optimal nutrient intakes co-occur in Inuit communities and households (Kuhnlein *et al.*, 2004).

In addition to costs, language is a barrier to healthy food choices. During story-telling interviews with Inuit living with diabetes, English food labelling and signs at the grocery store were identified as important factors that hindered the identification of healthy food choices by unilingual Inuktitut adults (Bird *et al.*, 2008).

On a positive note, the Hunters and Trappers Association, and individual hunters within Inuit communities, provide support networks for the sharing of country food with Elders and others who are not able to hunt. Community feasts and informal gatherings provide another avenue for traditional food sharing and the social networks that enhance food security.

Overall health status

Given the different jurisdictions in which Inuit live, available data regarding the leading causes of mortality and morbidity among Inuit represent fragmented information over time and geographic locations. Nonetheless, the picture that emerges from infancy to adulthood is that Inuit suffer from disparities in health and longevity from that of other Canadians (Jenkins *et al.*, 2003; Statistics Canada, 2001). Nonetheless, a key feature of Inuit health is the importance of social networks. In a recent analyses of Statistics Canada Aboriginal Peoples' Survey, social support featured prominently as a key determinant of thriving health among Inuit (Richmond, Ross and Egeland, 2007). Social networks and cohesion often involved the traditional food system (sharing in hunting and harvesting, in preparation of food, in making traditional garments and in community feasts) and represent another avenue in which traditional food systems can indirectly promote health and well-being among Indigenous Peoples.

In terms of the health care system in remote and northern communities, there are many challenges. Two primary challenges are the high employee turnover rate in Nunavut and the lack of Inuit-speaking nurses (Archibald and Grey, 2000; Ellerton *et al.*, 1999). Community health representatives help bridge the cultural and linguistic gap between health care providers and community members, and are the backbone of public health and health care delivery in northern Inuit communities.

Methodology

Background on Baffin food systems and food-use patterns

As part of the large five Inuit region CINE study noted earlier, baseline assessments in Baffin included: 1) deriving estimates of traditional (country) and market food intake, 2) completion of a nutrient and contaminant database, 3) defining the benefits of traditional food in terms of nutritional, socioeconomic, and cultural significance, and 4) defining levels of dietary exposures to contaminants. Details regarding the methodologies and findings have been presented elsewhere (Kuhnlein *et al.*, 2000; Kuhnlein *et al.*, 2004; Kuhnlein *et al.*, 2005). Data gleaned from these activities, particularly from the Baffin region, provide a necessary background for the development of the Inuit community case study under way in Pangnirtung.

Pangnirtung community health promotion project

Through discussions with representatives of the Inuit Tapiriit Kanatami, the parent organization for Canadian Inuit, CINE investigators became aware of a community member interested in facilitating work to combat the adverse health effects associated with the rapid changes occurring in northern Inuit communities. An invitation was extended to CINE investigators and community meetings were held. During community brainstorming sessions and follow-up meetings, community members and community health representatives identified the following needed activities:

1. An adult health screening to generate individual and community awareness.
2. A youth active living and healthy eating survey.
3. Story-telling interviews with Inuit living with diabetes to inform health-care service policy development.
4. Story-telling with Elders regarding their traditional knowledge (Inuit Qaujimajatuqangit regarding the role of country food in health, including spiritual, mental and physical health).
5. Utilization of all of the above information in the development of a culturally appropriate community-based health promotion intervention.
6. A follow-up survey of adults and youth to determine whether the intervention was successful in reducing health risks and improving nutrition.

The long-term goal of the community project is to develop a model intervention that can be adapted to other Inuit communities. To date, the first four community activities have been completed. The initial story-telling activities and selected results of the adult health survey are presented elsewhere (Charbonneau-Roberts *et al.*, 2007; Bird *et al.*, 2008). The current chapter focuses on a description of the traditional Inuit food system, extent of reliance upon traditional food, food security, and data regarding nutrition and epidemiologic transition from the regional Baffin survey and the adult screening conducted in Pangnirtung.

Community adult health screening

The adult health survey took place during eight working days in May 2005, with preparations including translations of questionnaire items and review of appropriateness and relevance of all assessments. For the adult health screening, volunteers were recruited through community radio announcements and information sessions where bilingual community research assistants explained the screening, informed consent forms, and its importance to community members. The health-screening data included 24-hour dietary recalls, market and traditional food frequency questionnaires, food security, a health and demographic status questionnaire, a physical activity

Table 1.1 Baffin Inuit traditional foods *(79 species/varieties)*

	Scientific name	*English / common name*	*Local name*	*Seasonality **
	Fish and seafood			
1	*Aeginella longicornis*	Shrimp, longhorn-skeleton	–	–
2	*Artediellus atlanticus*	Sculpin, Atlantic hookear	–	January–October
3	*Artediellus uncinatus*	Sculpin, other species	–	January–October
4	*Bentheogennema borealis* (2 var.)	Shrimp, Northern blunt-tailed, sculpin, pallid	–	–
5	*Bentheogennema borealis*	–	–	January–October
6	*Boreogadus saida*	Cod, Arctic	–	January–May, October–December
7	*Caprella laeviuscula*	Shrimp, smooth-skeleton	–	–
8	*Chionoecetes opilio*	Crab, snow	–	–
9	*Coregonus clupeaformis*	Whitefish, lake	–	–
10	*Coregonus nasus*	Whitefish, broad	–	–
11	*Coregonus* sp.	Cisco	–	–
12	*Cottunculus microps*	Sculpin, snowflake hookear	–	January–October
13	*Cottunculus thomsoni*	Sculpin polar	–	January–October
14	*Eleginus gracilis*	Cod, saffron	–	January–May, October–December
15	*Ensis directus*	Clam, razor	–	July–August
16	*Gastropoda* sp.	Snail	–	–
17	*Gymnocanthus tricuspis*	Sculpin Arctic staghorn	–	January–October
18	*Hippoglossus hippoglossus*	Halibut, Atlantic flounder (American plaice) halibut, winter flounder	–	–
19	*Microgadus tomcod*	Cod, tom	–	January–May, October–December
20	*Mya arenaria*	Clam, softshell	–	July–August
21	*Myoxocephalus*	Sculpin, fourhorn	–	January–October
22	*Mytilus edulis*	Mussel	–	January–October
23	*Placopecten magellanicus*	Scallop, sea	–	July–August
24	*Quadricornis*	Sculpin Northern blunt tailed	–	January–October
25	*Reinhardtius hippoglossoides*	Turbot, Greenland halibut	–	–
26	*Salvelinus alpinus* sp.	Char, Arctic (trout, saltwater trout, redfish)	iqluppik	January–December
27	*Salvelinus alpinus* sp.	Char, landlocked	–	January–December
28	*Salvelinus fontinalis*	Trout, lake, brook	–	May–October
29	*Salvenilus namaycush*	Trout, speckled, sea	–	–
30	*Stenodus leucichthys*	Connie/coney (inconnu)	–	–
31	*Strongylocentrotus* sp.	Sea urchin	–	July–August
32	–	Code lake	–	January–May, October–December
33	–	Code salt	–	August
	Sea mammals			
1	*Balaena mysticetus*	Bowhead whale	arvitt	–
2	*Delphinapterus leucas*	Beluga whale (white whale)	oilalugat	August–September
3	*Erignathus barbatus*	Bearded seal	ugyuk	January–December
4	*Mirounga angustirostris*	Elephant seal	–	–

Continued

Table 1.1 *(continued)* **Baffin Inuit traditional foods** *(79 species/varieties)*

	Scientific name	*English / common name*	*Local name*	*Seasonality **
5	*Monodon monoceros*	Narwhal	oilalugat tugaliit	May–September
6	*Odobenus rosmarus*	Walrus	aiviq	March–September
7	*Phoca groenlandica*	Harp seal	–	May–September
8	*Phoca hispida*	Ringed seal (jar seal)	nattiq	January–December
	Land mammals			
1	*Lepus americanus*	Rabbit, snowshoe hare	–	–
2	*Lepus arcticus*	Rabbit, Arctic hare	ukalik	January–July, September–December
3	*Ovibos moschatus*	Muskox	umingmak	March–May, October
4	*Rangifer tarandus* ssp. *arcticus*, *caribou*, *granti*, *groenlandicus*, *pearyi*, *tarandus*	Caribou	tuktu	January–December
5	*Ursus maritimus, Thalarctos maritimus*	Polar bear	nanuq	–
	Game and birds			
1	*Alca torda*	Seabirds, razorbill auk (turre)	–	–
2	*Anas acuta*	Pintail	–	–
3	*Branta bernicla*	Goose, brant Atlantic, black	nirliq	June–September
4	*Branta canadensis*	Goose, Canada	uluagullik	May–August
5	*Cepphus grylle*	Seabirds, black guillemot (pigeon)	pitsiulaaq	July–August
6	*Chen caerulescens caerulescens*	Goose, snow (wavies)	kanguq	May–Sept
7	*Clangula hyemalis*	Diving ducks, squaw duck (oldsquaw, hound diver)	kivgaluk	July–August
8	*Gavia adamsii*	Fish-eating birds, yellow-billed loon	–	June–September
9	*Gavia arctica*	Fish-eating birds, Arctic loon	–	June–September
10	*Gavia immer*	Fish-eating birds, common loon	–	–
11	*Gavia stellata*	Fish-eating birds, red-throated loon (wobby)	–	–
12	*Lagopus lagopus*	Ptarmigan, willow (white partridge, brooker)	–	–
13	*Lagopus mutus*	Ptarmigan, rock	–	January–June, September–December
14	*Larus argentatus*	Gulls and terns, herring gull (seagull)	–	June
15	*Mergus merganser*	Fish-eating birds, common merganser (pie duck)	oarsauq	–
16	*Somateria mollissima*	Diving ducks, common eider (shore duck)	mitiq	May–September
17	*Somateria spectabilis*	Diving ducks, king eider	oingalik	May–September
18	*Sterna paradisaea*	Gulls and terns, Arctic tern	imiqqtailat	June–July
19	*Uria aalge*	Seabirds, common (thin-billed murre, turre, tinker)	–	–
20	*Uria lomvia*	Seabirds, brunnich's (thick-billed murre, tinker)	aqpak	May–September
	Vegetables and berries			
1	*Agarum turneri Lessoniaceae* family (*Rhodymenia* sp., *Laminaria* sp. among others)	Seaweed/kelp	–	January–December
2	*Daucus carota*	Carrot root	–	June–August
3	*Empetrum nigrum*	Crowberries (blackberry)	pownuk	August–September
4	*Oxalis oregana*	Sorrel, wood	–	June–September

Continued

Table 1.1 *(continued)* **Baffin Inuit traditional foods** *(79 species/varieties)*

	Scientific name	*English / common name*	*Local name*	*Seasonality **
5	*Oxyria digyna*	Sorrel, mountain	–	June–September
6	*Rubus Chamaemorus*	Bakeapple (cloudberry)	–	–
7	*Salix arctica*	Willow	uqaujuk	July–September
8	*Saxifraga oppositifolia*	Saxifrage, purple	–	July–September
9	*Saxifraga* sp.	Saxifrage, red	–	June–August
10	*Taraxacum lacerum*	Dandelion	–	–
11	*Vaccinium myrtillus*	Blueberries, dwarf bilberry	–	August–September
12	*Vaccinium oxycoccus*	Cranberries, bog	–	June, September–October
13	*Vaccinium uliginosum*	Blueberries, bog bilberry	–	August–September
14	*Vaccinium vitis-idaea*	Cranberries, low bush (rock, mountain, red, partridge)	–	June, September–October
15	*Viburnum edule*	Cranberries, high bush (squash berry)	–	June, September–October

Note: Searched on the Internet. Some species that are mentioned here might be not only for Baffin but for other Inuit regions.
* Information retrieved from Harvest calendars obtained in four out of the five Baffin communities surveyed in 1998/99.
– No data.

assessment and anthropometric measures. In addition, a fasting venous blood sample was taken in the morning after an overnight fast of at least eight hours, and a two-hour 75 gram OGTT was administered. Details of the fasting serum lipid, glucose and insulin measures are described elsewhere (Charbonneau-Roberts *et al.*, 2007). In addition, plasma fatty acids (as a marker of recent dietary fat intake) were analysed using a Varian 100 m capillary column – Select CB for analyses of fatty acid methyl esters (FAMEs) (Varian 3400 CX Gas Chromatograph, Varian Inc., Palo Alto, CA). Individual FAMEs were quantified and multiplied by a conversion factor for converting FAMEs to their corresponding fatty acids as reported by the Association of Official Analytical Chemists (AOAC) method 996.06D. Fatty acids are expressed as a percentage of total fatty acids present.

In total, 52 adults participated in the health screening, which represented one in ten adults and one in ten community households. The ages of adult participants ranged from 19–77 years of age, with a mean age of 45 years (SD = 17). The majority of participants were women (77.1 percent).

Results

Background of Baffin food systems and use patterns

The background Inuit survey work in the Baffin region identified numerous species of fish and shellfish, marine and land mammals, birds, plants and berries, and season of harvest for the traditional food system (Table 1.1). Seventy-nine species were identified, with English and Inuktitut names. It is evident that a rich diversity of wildlife foods are available year-round in the Baffin food system.

A table of nutrient composition of selected Baffin Inuit foods illustrates the rich nutrient qualities of the Baffin food system (Table 1.2). The food system provides an excellent source of micronutrients such as vitamin A, D, and C, iron, folate, and zinc, all of which enabled Inuit to survive with little or no access to fruit and vegetables. Historically, the nutrients in narwhal, seal, caribou, and beluga when consumed regularly and in ample quantities likely yielded all necessary nutrients for all Inuit.

For adults, caribou ranked highest as the most liked and appreciated country food species. For children, adults responded that children most often disliked seal

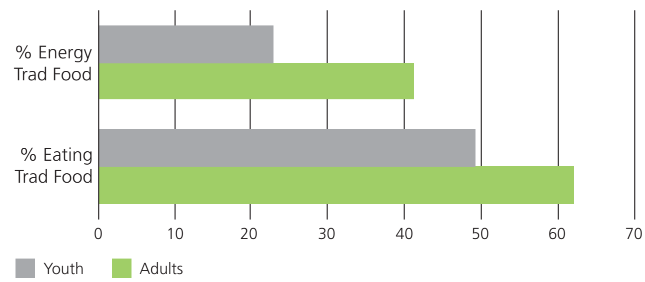
Table 1.2 Nutrient composition of important and unique Baffin Inuit traditional food *(per 100 g edible portion, raw)*

Food items	*Moisture*	*Energy*		*Protein*	*Fat*	*CHO*	*Ash*	*PUFA*	*Omega 3*	*Vitamin A RAE*	*Vitamin D*	*Vitamin E*	*Vitamin C*	*Folate*	*Calcium*	*Iron*	*Zinc*
	g	*kcal*	*kJ*	*g*	*g*	*g*	*g*	*g*	*g*	*µg*	*µg*	*mg*	*mg*	*µg*	*mg*	*mg*	*mg*
Fish and seafood																	
Char, Arctic, flesh, raw	77.37	105	439	19.03	2.65	0.00	1.17	0.85	0.730	18.93	29.77	0.19	1.23	–	12.07	0.46	0.36
Land mammals																	
Bear, Polar, flesh, raw	74.27	120	502	21.72	3.11	0.29	1.13	0.53	0.350	234.64	0.00	0.59	–	7.08	3.74	4.34	5.50
Caribou, Barrenland, flesh, raw	71.98	133	556	23.53	3.63	1.20	1.2	0.55	–	71.84	0.00	0.19	0.98	11.75	4.51	4.98	3.19
Hare, Arctic, flesh, raw	74.46	104	435	21.85	1.26	1.21	1.18	0.50	0.075	39.19	0.00	390.33	0.00	11.87	33.83	4.33	1.78
Muskox, flesh, dried/jerky	28.48	301	1 258	60.82	4.95	1.12	2.6	0.68	–	3.67	0.00	0.35	0.50	9.50	14.64	11.21	9.02
Muskox, flesh, raw	76.62	111	464	17.77	4.40	0.00	1.2	–	–	17.05	–	0.00	–	–	3.25	4.53	2.36
Marine/sea mammals																	
Beluga, blubber, raw	22.38	640	2 675	10.02	66.24	0.00	0.1	5.35	4.325	1700	–	–	–	–	2.33	0.52	0.16
Narwhal, blubber, raw	10.26	754	3 152	5.26	82.63	0.00	0.01	4.42	3.600	1826	9.95	31.01	0.00	0.00	3.00	0.80	0.36
Narwal, flesh, dried	17.00	425	1 777	77.0	11.00	0.00	3.80	0.30	0.250	4.00	0.0	560.79	1.14	54.83	11.0	70.0	7.0
Narwhal, muktuk, skin, raw	71.39	132	552	22.01	4.23	1.85	0.96	0.45	0.325	286.9	0.00	1.46	31.51	0.00	5.29	0.31	7.7
Seal, ringed, blubber, raw	4.21	820	3 428	2.24	88.64	2.65	0.04	15.70	14.50	508.22	1.55	694.44	0.00	0.00	1.35	2.00	0.30
Seal, ringed, flesh, raw	70.28	128	535	26.16	1.99	0.42	1.23	0.38	0.250	90.70	0.03	0.07	1.55	15.10	20.69	19.10	2.10
Walrus, flesh, aged	67.35	171	715	25.09	6.95	0.00	1.07	0.70	0.600	28.14	0.00	0.08	0.85	7.90	5.79	19.60	5.42
Seaweed and berries																	
Blackberries, raw	87.86	50	209	0.41	0.98	10.91	0.23	0.05	0.025	11.00	0.00	1.17	2.41	0.00	4.87	0.24	0.07
Blueberries, raw	86.41	62	259	0.76	0.97	12.97	0.3	0.05	–	3.00	0.00	0.57	25.93	42.50	15.43	0.30	0.18
Seaweed, stems & leaves, raw	81.00	73	305	81.00	4.06	2.19	4.1	0.20	–	6.00	0.00	1.49	16.37	235.95	200.12	1.99	0.34

CHO Carbohydrate.
– No data.
Kuhnlein, H. V., Kubow, S. & Soueida, R. 1991.
Kuhnlein, H. V. & Soueida, R. 1992.
Fediuk, K., Hidiroglou, N., Madère, R. & Kuhnlein, H.V. 2002.
Kuhnlein, H. V., Chan, H. M., Leggee, D. & Barthet, V. 2002.
Kuhnlein, H. V., Barthet, V., Farren, E., Falahi, E., Leggee, D., Receveur, O. and Berti, P. 2006.

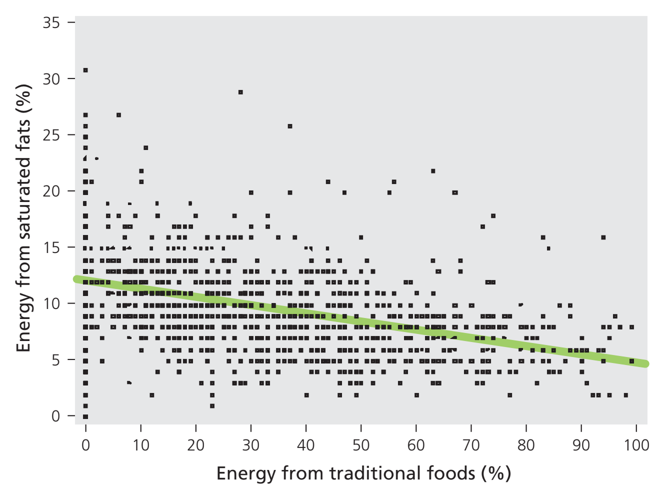
and walrus meat and liver, and fish. By far, the top contributor to protein in the Baffin adult diet in the 1998–1999 survey was from caribou meat (20.8 percent of energy in the autumn and 32.6 percent of energy in the late winter). This was followed by ringed seal meat and Arctic char, which contributed 17 percent and 7.4 percent of energy as protein, respectively in the autumn and 11.5 and 10.4 percent of energy as protein in the late-winter. Traditional food was also a top contributor to micronutrients, with ringed seal contributing to 42.6 percent of iron consumed in the autumn, and 35.4 percent of iron consumed in late winter, while caribou contributed 24.6 percent of the zinc intake in the autumn and 36.9 percent of zinc intake in the late winter. In contrast, the top contributors to carbohydrate intake were from table sugar, soft drinks, and bannock (18.1 percent, 11.8 percent, 10.3 percent, respectively in the autumn; and 13 percent, 10.9 percent and 9.2 percent respectively in the late-winter). Market and traditional food items contributed to vitamin C (12.9 percent from orange juice and 10.5 percent from narwhal *maktaaq* in the autumn and 16.6 percent and 15.3 percent respectively in the late-winter). Leading contributors to folate intake included bannock, spaghetti, and bread following the introduction of fortification of flour in Canada.

Figure 1.2 Percent youths and adults consuming traditional food and percent energy from traditional food



Source: Pangnirtung Adult and Youth Survey, 2005–2006.

Figure 1.3 Relationship between traditional food consumption and saturated fat intake (as % of energy), 5 Inuit regions *(n = 1,624)*



Source: CINE Dietary Survey, 1998–1999.

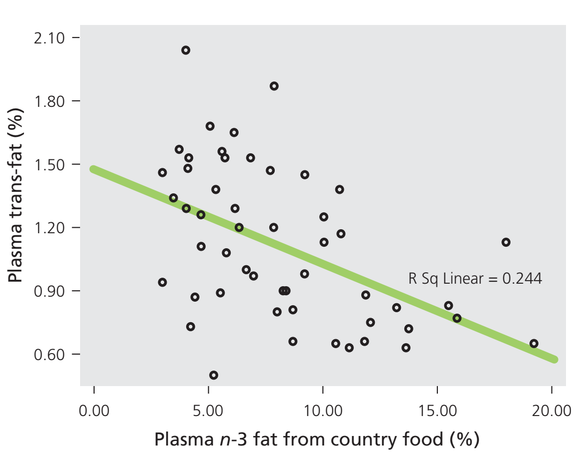
Traditional food and diet quality

Overall, 31 percent of total energy came from traditional food sources in the Baffin region during the 1998–1999 CINE survey among 69 percent consuming traditional food in the past day. In contrast, in Pangnirtung (2005–2006), 41 percent of energy came from traditional food among 62 percent of adults consuming any traditional food in the past day (Figure 1.2). The data indicate the current-day importance of the Inuit traditional food system.

In addition to the cultural and nutrient value of traditional food, country food replaced market food items that pose health risks. For example, the percent of energy from traditional food was inversely related to the percent of energy from saturated fat in all five Inuit regions combined (Figure 1.3) – results were similar in the Baffin region when examined separately. When no traditional food was consumed, the average percent of energy as saturated fat was twice (12 percent) that of when the majority of energy was from traditional food (6 percent). Similarly, in Pangnirtung's adult health survey, traditional food intake as a percent of energy was positively correlated to plasma *n*-3 fatty acids (Spearman *rho* = 0.58, $p < .001$) and inversely correlated to plasma *trans*-fats (Spearman *rho* = -.44; $p < .01$) as percent of total fatty acids in plasma. As *n*-3 fatty acids increased (as a marker of the degree of recent country food intake) the percent of fatty acids as *trans*-fat decreased (Figure 1.4, *rho* = -0.53; p <.001). These data illustrate the multiple nutritional exposures that are simultaneously influenced by the loss of traditional food in the contemporary Inuit diet.

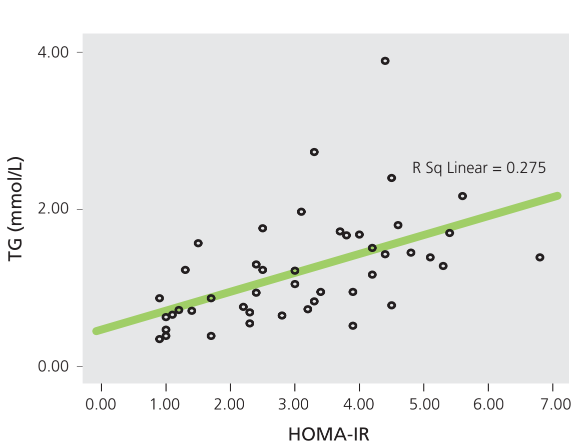
While country food remained an important source of nutrients and energy for the Inuit, the Pangnirtung survey of adults indicated a high prevalence of carbonated beverage consumption: 86 percent reported consuming carbonated beverages in the past year and 58 percent of adults reported drinking carbonated beverages in the past day, with an average consumption of two cans (12 fluid ounces each) per day (which contributed to nearly 10 percent of energy intake/day among consumers). While Inuit historically received their carbohydrates from the glycogen of raw meat and blood, and from plants, berries, and caribou stomach contents, overall historical carbohydrate intake was relatively low. Against this relatively recent dietary context, the current exposures to high amounts of refined carbohydrates are alarming and will undoubtedly have implications for excess energy intake and subsequent increases in obesity and obesity-related health complications.

Figure 1.4 Relationship between *n*-3 fatty acids and trans-fatty acids as percent of total fatty acids in plasma



Source: Pangnirtung Adult Survey, Baffin region, 2005.

Figure 1.5 HOMA-insulin resistance predicts fasting triglycerides (TG) in non-diabetic participants



Source: Pangnirtung Adult Survey, Baffin Community Health Screening, 2005.

Food security

Responses to food security questions indicated that in this relatively well-off community by northern Inuit standards, food insecurity remained an issue. A total of 80 percent of adults surveyed in Pangnirtung reported that it was often true or sometimes true that "we worry that our food will run out before we get money to buy more". Sixty percent reported that it was often true or sometimes true that "we can't afford to eat healthy meals". Forty-eight percent indicated that it was true or sometimes true that "I eat less or skip a meal because there isn't enough money to buy food". Fifty-two percent indicated that it is often true or sometimes true that "there is no 'country food' to eat when I want it", and 28 percent indicated "yes" that they agreed with the statement that "in the last month there was not enough to eat in your house". Fortunately, nearly all respondents (82 percent) indicated that friends and relatives shared their country food.

Nutritional status assessed by anthropometry

Overweight and obesity prevalence among the randomly selected Inuit participating in the 1998–1999 Baffin survey indicated that 36 percent of men and 38 percent of women were overweight (BMI 25–29.9), and that 37 percent of women and 18 percent of men were obese (BMI ≥ 30). It is anticipated, however, that these figures may overestimate to some degree obesity and overweight among Inuit, given that BMI overestimates adiposity in individuals with a long torso relative to standing height (Charbonneau-Roberts *et al.*, 2005; Norgan, 1994). However, BMI does not capture the extent of visceral adiposity. Among the adults in the Pangnirtung survey, a high prevalence of central fat patterning was observed and all measures of obesity were identified as strong predictors of insulin resistance (Charbonneau-Roberts *et al.*, 2007). The findings are noteworthy in that they suggest the emergence of obesity among Inuit will have health consequences contrary to previous research which has suggested that obesity is not as metabolically active among Inuit as it is in non-Inuit comparison populations (Young, 1996; Jorgensen *et al.*, 2002).

Epidemiologic transition

Among adult participants in the Pangnirtung Health screening, evidence of an epidemiologic transition was observed. While no new diabetic cases were identified through the screening, five participants had pre-existing Type 2 DM, which was confirmed by medications prescribed and used. After excluding the pre-existing cases of Type 2 DM, a high prevalence of lipid abnormalities were noted: 61.7 percent (29/47) had low HDL-cholesterol (chol) according to new gender-specific International Diabetes Federation (IDF) criteria (IDF, 2005); 19 percent (9/47) had high LDL-chol (>3.4 mmol/l); 34 percent (16/47) had a high total chol to HDL-chol ratio (>5.0), and 19 percent (9/47) had a high triglyceride level (>1.7 mmol/l). In addition, a total of 34 percent (n = 16) of those without pre-existing diabetes met the IDF criteria of metabolic syndrome, which requires the presence of central obesity with two additional metabolic syndrome risk factors (IDF, 2005).

In linear regression analyses, the homeostasis model assessment for insulin resistance (HOMA-IR) developed by Mathews and colleagues (1985) and fasting insulin were inversely related to HDL-chol and accounted for a large percent of the variance in HDL-chol (22 percent and 20 percent, respectively). HOMA-IR remained a significant predictor of HDL-chol in additional analyses adjusting for age and gender. Similar findings were observed for triglycerides in regard to insulin indices. HOMA-IR and fasting insulin were positively related to triglyceride levels when considered separately in age and gender adjusted linear regression analyses ($p < .01$), with HOMA-IR accounting for 27.5 percent and fasting insulin accounting for 19.8 percent of the variance in triglycerides (Figure 1.5). Similarly, the insulin sensitivity index (ISI 0,120) developed by Gutt and colleagues (2004) significantly predicted systolic blood pressure.

The current results are noteworthy in that insulin resistance as measured by HOMA-IR, fasting insulin, and the ISI 0,120 were identified as important underlying determinants of dyslipidemia and systolic blood pressure among the health-screening participants in the Baffin community. Insulin resistance is now considered the underlying common mechanism explaining the co-existence of Type 2 DM and atherosclerotic cardiovascular disease. Also, as dyslipidemia has been noted to precede the development of Type 2 DM in normoglycemic populations followed over time (McPhillips, Barrett-Connor and Wingard, 1990; Mykkanen *et al.*, 1993), the high prevalence of participants with dyslipidemia is of concern. In Finland, those with an HDL-chol less than 1.0 mmol/l had a 2.1 fold (95 percent CI = 1.2-3.6) increase and those with triglyceride levels greater than 2.5 mmol/l had a 2.7 fold increase (95 percent CI = 1.5-4.6) in developing Type 2 DM over a 3.5 year period (Mykkanen *et al.*, 1993). Also, among 1 847 normoglycemic men and women in Rancho Bernardo, California, Type 2 DM increased with every quartile of baseline triglyceride levels (McPhillips, Barrett-Connor and Wingard, 1990). Furthermore, insulin sensitivity was inversely related to incident cardiovascular events in Framingham offspring (Rutter *et al.*, 2005).

Intervention strategies and future plans

Prompted by the findings of the survey, the community embarked (in 2006–2007) upon an intervention strategy that was designed by and with the community of Pangnirtung and respects the traditional knowledge principles of Inuit Qaujimajatuqangit (IQ) as a framework for the proposed intervention. The activities suggested are:

1 Document traditional knowledge of country food and its spiritual and health-giving attributes and use this knowledge to promote country food use and healthy market food choices in the community.
2 Engage in radio drama and story-telling in Inuktitut to provide entertainment and information regarding the health-giving attributes of country food and healthy market food choices.
3 Coordinate local radio programmes with grocery store initiatives to increase healthy food choices.

The Pangnirtung Health Screening and Promotion Committee requires that the interventions be fun, and involve the community radio, schools and grocery stores. The activities should be cost effective and be able to be implemented across all Inuit regions. Radio programmes will be taped and those that are successful (as evidenced by grocery store sales data) could be utilized in other communities. Radio is a common means of communication in northern communities and may prove to be an effective public health intervention tool for marketing social change/behaviour. For youth, a youth-led initiative is likely be the best approach.

Summary and future policy considerations

The current data provide evidence of nutrition transition and they provide an early warning for the emergence of cardiovascular disease and Type 2 DM in this Inuit community. These data add to the accumulating evidence suggesting that Inuit are losing the protection that spared them from the epidemic in Type 2 DM that emerged among Canadian First Nations and American Indians decades ago (Brassard *et al.*, 1993). The findings are relevant in that interventions at the early stages of insulin resistance are more likely to be successful than after the development of Type 2 DM (McAuley *et al.*, 2001).

While traditional food features prominently in the modern-day Inuit diet, the total diet is a mixed diet high in market food carbohydrates, particularly refined carbohydrates. Also, consumption of traditional food items is being replaced by market food sources of *trans*-fat as evidenced by the striking inverse relationship of these fatty acids in plasma. Programmes and policies are needed to improve food security, encourage healthy market food choices and to promote locally available traditional food in an effort to mitigate the nutrition and epidemiologic transition.

Similarly, the work done in Pangnirtung stimulated interest in a Canadian-wide Inuit Health Survey with International Polar Year funding and in international collaborations to conduct an International Inuit Cohort study to inform policy to help prevent the nutrition and epidemiologic transition. Finally, global policies to prevent further environmental degradation, food chain contamination, and global warming are needed to promote long-term ecosystem and human health ●

Acknowledgements

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Chapter 2

The Nuxalk Food and Nutrition Program, coastal British Columbia, Canada: 1981–2006

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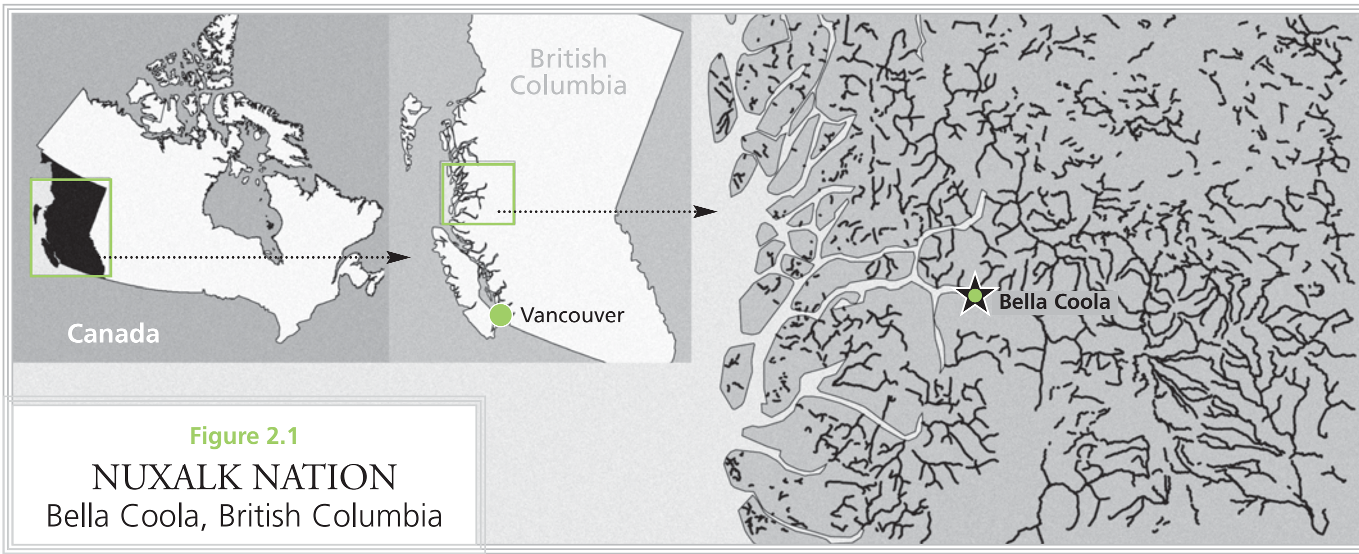

Figure 2.1

NUXALK NATION
Bella Coola, British Columbia

Data from ESRI Global GIS, 2006.
Walter Hitschfield
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1
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Photographic section >> VI

"The old foods are the new foods!"

Dr Margaret Siwallace, Nuxalk Elder

Abstract

The Nuxalk have occupied their home territory along the rugged British Columbia coast for an unknown amount of time – certainly thousands of years. For many generations, the people relied on a diversity of fish, game, berries, roots and other nutritious food. However, within the past 50 years or so, their traditional food resources have been eroded, salmon runs and other aquatic resources have been depleted, and lifestyle changes have decreased the time available for hunting, fishing and berry picking. As with many other indigenous communities, the Nuxalk experienced a dramatic dietary shift towards consumption of less nutritious, processed and packaged foods higher in calories and unhealthy fats. Younger people have been most susceptible to this dietary change.

The Nuxalk Food and Nutrition Program, originating in 1980, was a collaborative effort to document past and contemporary Nuxalk diet, assess nutritional values of traditional food, determine overall health status, and promote healthy traditional food. With Elders' advice and knowledge, a multi-faceted programme began with emphasis on documenting the food system: nutrient analysis of fish, berries and other foods, and dietary and health assessments. This led to education programmes aimed at raising awareness and knowledge of harvesting and preparing traditional food, as well as workshops and community meetings to promote healthy lifestyles and diet. The publication of a Nuxalk Food and Nutrition Handbook and a companion recipe book, *Kanusyam a Snknic*, were very popular. Many publications have been produced documenting various aspects of the overall programme. Over twenty years on, the positive effects of the Nuxalk Food and Nutrition Program are still evident, and it stands as an example for other initiatives to promote traditional food systems in indigenous communities. This chapter describes the Nuxalk food system and nutritional status, the ecological setting, and the background for establishing an intervention initiative by Nuxalk leaders in partnership with their academic colleagues.

Introduction

The Nuxalk ('Noo-halk') Indigenous People have occupied their traditional territory for thousands of years, living from the bounty of the land, river and ocean. Bella Coola, the home community of the Nuxalk, is situated at the mouth of the Bella Coola River within a steep-sided scenic valley on the central coast of British Columbia. Over centuries, they developed an immense base of knowledge and skills to enable them to harvest and process their food efficiently, effectively and sustainably generation after generation. However, as with many indigenous communities, the traditional food system of the Nuxalk has been eroded – especially over the past 50 or 60 years – and their diet has become less healthy. It is within this context of concern for dietary change and its effects on health that the Nuxalk Food and Nutrition Program was established.

In the early 1980s, a study of Nuxalk food and nutrition was initiated in collaboration with local and regional Nuxalk leaders. A constellation of related health and nutrition studies was initiated, involving the community health centre, Band Council, as well as Elders and Nuxalk youth. This was a pioneering venture – the first of its kind in Canada at this level of engagement between academic researchers and an entire indigenous community. The goals of the programme were to promote health through traditional food use, using traditional food as a venue and pathway for understanding and promoting good health.

Research as community-based and participatory

The Nuxalk Food and Nutrition Program began officially in January 1983, but it was preceded by background research on food system documentation and planning. Prior to the initial study in 1980 the Union of British Columbia Indian Chiefs identified the Nuxalk Nation as being interested in participating in research on indigenous food use and community health. Agreement was reached between the research leader and the Band Council outlining how initial studies would proceed, budgeting and planning of activities. Initial studies focused on ooligan (*Thaleichthys pacificus*), a traditionally important small fish used in many cultural ways. In 1983, the research group obtained a major grant to begin health promotion activities, with an ethics review by the University of British Columbia. The Nuxalk community health nurse and community health representative worked in close collaboration with the researchers with guidance by Elders and Band Council members. Individuals who were interviewed were informed about the project and its goals and how the information they provided would be used. Throughout the entire programme, Nuxalk community researchers and health promotion staff were hired to undertake the interviewing and health promotion activities, including various activities in the schools and the health centre.

Throughout the research protocols, the confidentiality and anonymity of respondents were maintained. All papers and publications derived from the project were shared and reviewed by the Nuxalk Nation. A primary outcome was the production of two books for community households: one a reference guide to Nuxalk traditional food and its processing and production, and the second a popular recipe book for preparing healthy meals (Nuxalk Food and Nutrition Program Staff 1984, 1985). These books were well received and were found to be in use in schools and community centres as resource materials more than 20 years later.

The people of the Nuxalk Nation in historical and ecological setting

The Nuxalk language is classed in the Salish language family. However, the Nuxalk are geographically and linguistically isolated from other Salishan peoples, and their language forms a separate division, indicating a relatively long period of separation from other Salishan-speaking peoples. The Nuxalk territory is bordered by Wakashan-speaking peoples (Haisla and Hanaksiala, Heiltsuk, and Kwakwaka'wakw) on the north, west and south sides respectively, and by the Ulkatcho Dakelh (Carrier) Athapaskan-speaking people to the east. Culturally, the Nuxalk are closely aligned with their western neighbours, the Heiltsuk, and this similarity is reflected in their rich and complex ceremonial traditions, including elaborate winter dances, feasts and potlatches. Nuxalk trade with the Heiltsuk and other coastal groups provided food from the outer coast, such as dried seaweed, edible mussels and clams. In exchange, the Nuxalk facilitated trade from inland groups, the Ulkatcho and Tsilhqut'in (Chilcotin), providing outer-coast peoples with some interior resources. Although the Nuxalk traded and intermarried with their various neighbours, they also are known to have historically engaged in war with them on occasion (Kennedy and Bouchard, 1990).

At the time of the first contact with Europeans in the late-eighteenth century, the Nuxalk Nation peoples occupied a number – as many as 30 – of permanent villages situated along the major waterways of the Bella Coola Valley, North and South Bentinck Arms, Dean Channel and Kwatna Inlet. These last two regions were shared with the Heiltsuk (or Bella Bella) people – for a map of the original settlements in the Nuxalk territory, see Kennedy and Bouchard (1990). From this time, and especially as they endured waves of disease epidemics during the trade and colonial periods, the Nuxalk began to abandon their villages, and by the early 1900s almost all had moved to a village called *7alhqlaxlh*, at the mouth of the Bella Coola River, on the north shore. A major flood in 1936 forced relocation to the south side of the river, to the present village of Bella Coola. A newer subdivision about 8 km east and up the valley was developed in the 1980s and many Nuxalk reside there today (see Figure 2.1).

The Nuxalk traditional territory covers a diverse landscape and geographic region, ranging from deep ocean inlets, valley bottoms and rugged mountainous terrain, with many rivers and fast moving streams, ponds, marshes, rocky slopes and dense forested areas. These lands and waters provide a range of habitats for a wealth of traditional foods. The ocean inlets are very significant for food resources – various sea mammals (seal, sea lion, etc.), and many types of fish and shellfish have always been available. The rivers provide spawning and rearing habitat for all five common species of Pacific salmon, as well as steelhead. In past years, the rivers, especially the Bella Coola, served as a major spawning destination for ooligan (also eulachon), a type of smelt that spawns in the lower reaches of coastal rivers. The ooligan was second only to salmon in importance to the Nuxalk (Kennedy and Bouchard, 1990), and the grease rendered from ooligan has been a key food and condiment (Kuhnlein *et al.*, 1996).

The estuarine tidal marshes are host to a number of different root vegetables that people traditionally harvested, as well as areas of prime hunting for ducks, geese, deer and bear. Various food resources are found in the low valley bottoms – huckleberries, blueberries, red elderberries, salmonberry, thimbleberry, cow parsnip and fireweed (for green shoots), wood fern (rootstocks), and black cottonwood (inner bark) – as well as a wide range of different medicinal and material plant resources. Most notably, western red cedar provided wood for canoes, houses and food storage and cooking boxes, and inner bark for mats, clothing and baskets. More types of berries and other food plants grow on the lower slopes of the mountains, as well as material and medicine plants, and game animals like mule deer and black-tailed deer. At the head of the valley are soapberries, black mountain huckleberries and other types of berries that are not available lower in the valley. On the upper slopes, mountain goat continue to be hunted for meat and fat, as well as for their skins. Lepofsky, Turner and Kuhnlein (1985) describe the main resource harvesting zones of the Nuxalk, while Pojar and Mackinnon (1994) provide a good general reference on coastal vegetation, including that of the Nuxalk territory.

To access food and other resources, the Nuxalk historically employed different types of dugout canoes, including a long, narrow river canoe and four types of sea-going canoes. Sometimes they used sails for these canoes, and paddles were often made from red alder. Snowshoes of two main designs were used for winter hunting. A variety of containers, especially cedarwood bent boxes and cedarbark baskets, were used to transport and store the foods they relied on. In recent times these have given way to burlap sacks, metal pots, and glass jars, and more recently plastic buckets, plastic bags and useable salvage.

Demographic characteristics

Population estimates vary for the Nuxalk, with pre-contact numbers around 2 000 or possibly more (McIlwraith, 1948). Diseases, such as smallpox, took a heavy toll on all First Nations communities in the region, and Boyd (1990) noted that the smallpox epidemic of 1836–1837 caused a 46 percent loss for the Nuxalk, with their population falling from 1 940 to 1 056 in a single year. The population has increased, however, and in 2000, there were approximately 1 200 Nuxalk Band members, of whom around 980 lived in the Bella Coola Valley. During the research period in the 1980s, there were 675 residents in 125 households on the Bella Coola Reserve, with another 200 members living in the valley or in urban areas of the province.

During the study period, census data revealed that about half of the adult population attained a Grade 9 education, and unemployment was at about 20 percent, with an average family income at about half that of the provincial average, typical of First Nation communities at the time. An average of 5.3 persons occupied homes, many of which had only two rooms. Two food stores operated in the community that provided an array of market food, but with limited fresh food availability (dependent on season and time of the week). There was a once-weekly delivery of food supplied to the Co-op food store overland on an unpaved road from Williams Lake (500 km distant), and minor supplies of fresh beef, chicken, milk and eggs and some produce from valley farmers (Kuhnlein, 1984).

A community health centre has been maintained on the reserve, including services for Elders, pregnant women, infants and toddlers and diabetics. A hospital in the Bella Coola community has a staff of three physicians, several nurses and a diagnostic laboratory.

Nuxalk culture

The household is the prime unit of the Nuxalk social structure. Traditionally, high-ranking individuals maintained their position and status through generosity to their family members; the more they were able to provide for their family, the larger the extended family group they attracted to their household. A high position carried with it the responsibility of sharing and distributing resources. The social organization of the Nuxalk is based to some extent on the region of origin of one's lineage. People strongly identified with their ancestral villages, which were founded by one or more mythical ancestors, as described by McIlwraith (1948). Each lineage claimed its own private origin stories, considered private property, which were validated and perpetuated by ceremonial enactments during the winter dance season. These traditions are still maintained to some degree, although the amalgamation of the villages along with subsequent lifestyle changes have resulted in an erosion of cultural traditions, particularly by the 1970s. However, some of these are being renewed and revived today.

General ethnographic references for the Nuxalk (formerly known as Bella Coola) include Boas (1898), McIlwraith (1948), and Kennedy and Bouchard (1990). Smith (1928) and Edwards (1980) provide information specifically on Nuxalk medicines, and Turner (1973, 1995) describes Nuxalk ethnobotany. A detailed article by Edwards (1979) describes a traditionally important root vegetable, springbank clover, now little used anywhere on the coast (Turner and Kuhnlein, 1982).

General description of the Nuxalk food system and health

The dietary intake of the Nuxalk follows the general trend for Indigenous Peoples of Canada. The approach of Canadian Indigenous Peoples towards their traditional food is as relevant for the Nuxalk as for others:

> The traditional diet consisted mainly of meat or fish supplemented by berries, wild greens, roots, bulbs, nuts and seeds. As long as supplies were plentiful, people were able to maintain a healthy diet. The native people learned, through experience, to select those foods in proper amounts to supply the body with the nutrients it needs. Respect for the land, and the food it provided, led to the wise use of animals, fish and plants. Very little was wasted. Food was considered sacred.
>
> *(Health and Welfare Canada, 1985, p. 7)*

As noted previously, the Nuxalk traditional food system is a healthy one. When local foods were the only dietary source for sustenance and survival, the food system required physical work and a great deal of skill and knowledge applied at all stages of food production, from harvesting to processing, storage and serving. Traditionally, Nuxalk families moved from location to location throughout their traditional territory over the course of the seasons to harvest and process different food as it became available. The harvested food was carefully preserved – usually by dehydration, but also by smoking, and in some cases fermenting or storing fresh in cache pits and containers. This lifestyle kept people active and fit, as they often travelled long distances by foot or canoe, working outdoors, particularly during the growing season. Winters were more sedentary, but people remained active with household activities, special ceremonies and social activities.

During the period of this study, the generally recognized health problems with nutritional implications were alcoholism, poor dental health, obesity, diabetes and those associated with high-risk infants. Before the initiation of this study, there were no reports of dietary intake or adequacy for the Nuxalk.

As well as the ethnographic and ethnobotanical references mentioned previously, a number of publications relating to Nuxalk foods and nutrition resulting, in whole or in part, from the Nuxalk food and Nutrition Program, provide information on specific Nuxalk foods, and are cited in the references: Kuhnlein (1989b, 1990); Kuhnlein, Turner and Kluckner (1982); Kuhnlein and Turner (1986); Turner and Kuhnlein (1982, 1983); Turner *et al.* (1992). A description of traditional and contemporary Nuxalk foods was reported in Kuhnlein (1984). The two community books (Nuxalk Food and Nutrition Program Staff 1984, 1985) also provide important information on Nuxalk food. Lepofsky, Turner and Kuhnlein (1985) provide specific habitat information for 42 plant species, including harvesting efficiency tests for 14 of the 20 most readily available species. Two more general publications that incorporate Nuxalk food are Kuhnlein and Turner's *Traditional Plant Foods of Canadian Indigenous Peoples* (1991) and Turner's *Food Plants of Coastal First Peoples* (1995). Other articles by Kuhnlein (1984, 1989a, 1992) and Kuhnlein and colleagues (Barr and Kuhnlein, 1985; Kuhnlein and Moody, 1989; Kuhnlein and Burgess, 1997) discuss how the Nuxalk diet has changed over time.

Methodology

The Nuxalk Nation Council approved and encouraged the Nuxalk Food and Nutrition Program from its inception. The protocols for interviewing, recording, photography and health assessments followed the dual approval requirements of the University of British Columbia's ethics regulations and those established for the work by the Nuxalk Nation in consultation with the researchers. The programme serves, even 25 years later, as a model for community-based collaborative research, one on which much of the subsequent research from CINE, and its Indigenous Peoples' Food Systems for Health Program, is based.

A number of methods for collecting and analysing data were applied for different aspects of the research:

1. Community Interviews on Food Use, Dietary Intake and Change: Elders' meetings (1980–1982), family interviews (1981, 1985) and grandmother-mother-daughter interviews (1982 to 1983).
2. Food Availability Assessment (1982).
3. Traditional Food Nutritional Quality Assessments (1980–1986).
4. Health Status Assessments (1983, 1986).
5. Health Promotion Activities (1983–1986): Use of traditional Nuxalk foods, use of available marketed foods of good quality, enhancing healthful lifestyle habits and educational programmes.
6. Revisiting the Nuxalk Food and Nutrition Program (2006).

Community interviews on food use, dietary intake and change

The initial requirements of the programme were to establish foods the Nuxalk used in the past, those which current residents still have a working knowledge, and how people's diets have changed over the years. Information from existing literature (McIlwraith, 1948; Turner, 1973) needed elaboration and confirmation through interviews with contemporary Nuxalk community members. From 1980 to 1982, in a series of meetings organized by the research team, Elders were consulted about what traditional foods they had eaten, which foods were considered to be important, which were still being used, and how these foods were traditionally harvested, processed and prepared. The format enabled discussions and comparisons among Elders, as well as helped to directly inform younger community members about Nuxalk food traditions. Meetings were informal and social occasions, and were usually accompanied by serving traditional food.

In 1981, two community residents interviewed Nuxalk households, both on their reserve and in urban centres, about overall dietary intake and food use. Family members (mainly women) who actually did the food shopping and cooking were asked about their use of traditional foods in general, as well as what foods, store-bought and traditional, were eaten on the day of the interview. Analyses of the diet reports were compared to Canadian Recommended Nutrient Intakes at the time (Kuhnlein, 1984). Frequency and quantity of traditional foods were also asked about during the 1981 survey, and repeated in 1985 (Kuhnlein and Moody, 1989).

In 1982–1983, an interview study intended to track and document dietary change and food-use frequency was conducted with grandmothers, mothers and daughters of the same families living on the Nuxalk reserve. In 1983 and 1985, interviews on dietary intake were undertaken as part of the health assessment process.

Food-availability assessments

In 1982, an ecological study with Nuxalk student assistants evaluated the availability of traditional Nuxalk plant foods within the traditional territory as well as people's accessibility to berries and other traditional food resources, including fish and game. Forty-two plant species were included in the study, and standard ecological survey techniques were applied in measuring their abundance, frequency and cover. Twelve cover-types based on the type of vegetation predominating were identified and, within each, randomly placed quadrats were used to facilitate estimates of cover for various species (Lepofsky, Turner and Kuhnlein, 1985). In addition, harvesting efficiency data were gathered for several of the plant foods; the time required to harvest 250 ml of food by one person, and the area needed to collect this amount, were recorded, as well as the traditional harvesting sites and seasons for each type of food.

Traditional food nutrient composition

Throughout the programme, nutrient analyses were undertaken on traditional Nuxalk foods to determine key nutrients, which could then be matched with dietary intake information to determine any risks or deficiencies that people might be incurring. Standard practices for sample collection and nutrient analysis were applied (Kuhnlein, 1986). Several Nuxalk salmon and ooligan grease preparations were described and analysed (Kennelly, 1986; Kuhnlein *et al.*, 1982; Kuhnlein *et al.*, 1996). Wild berries and wild greens, as well as some of the root vegetables, were also analysed (Kuhnlein, Turner and Kluckner, 1982; Turner and Kuhnlein, 1983; Kuhnlein and Turner, 1987; Kuhnlein, 1989b).

Health status assessments

In May 1983, the programme ran a health assessment clinic, which was free to all Nuxalk Band members and relatives. In total, 370 people – from infants to Elders – took advantage of the clinic, with sessions of approximately one hour that included several measurements. Interviews were made on diet and physical activity, general fitness level assessed by riding a stationary bicycle and skinfold thickness, blood pressure, and examinations for dental health, hearing and vision. Height and weight measurements were found, using a stadiometer and beam balance, and body mass index (BMI) was calculated as kg/m^2.

Approximately 30 ml of non-fasting venous blood from 199 Nuxalk participants (teens ≥13 years and adults) was portioned, frozen, shipped to the laboratory and frozen at -70º C until analysis, which was within three months of collection. Successful analysis of all measures was completed for 187 samples. Serum ferritin was determined using an ELISA assay (New England Immunology Associates, Cambridge MA). Hemoglobin and hematocrit were measured in the Nuxalk clinic prior to shipment using the cyanomethaemoblobin and electronic reading and centrifugation in capillary tubes. Red cell folate (RBC folate) was determined by microbiological assay using L. *casei*, with ascorbate as preservative. Plasma retinol and carotene were determined by a micromethod, and carotene was determined to reflect dietary sources of provitamin A and antioxidant protection. Serum cholesterol and HDL cholesterol were determined with enzymatic procedures (Barr and Kuhnlein, 1985). The Statistical Package for the Social Sciences (SPSS) was used for Pearson correlation analysis and partial correlations of BMI and HDL cholesterol (Kuhnlein and Burgess, 1997; Barr and Kuhnlein, 1985).

In 1986, follow-up assessments of many of these measures took place to determine impact of the health promotion activities. This report emphasizes anthropometry and blood results from the pre-intervention assessments; a following publication will report the health promotion intervention activities led by Nuxalk health staff, Elders and Council, and evaluation of the programme.

Revisiting the Nuxalk Food and Nutrition Program

In July 2006, the community and several original programme participants were revisited, with discussion including many of the original Nuxalk participants. The objective of discussions with Elders and leaders was to obtain information on the use of key traditional foods 20 years following the programme, and to document elements of the project on film.

Results and discussion

Community interviews on food use, dietary intake and change

The Elders' meetings and household interviews yielded important baseline information on which the main programme was based. They provided an extensive list of traditional foods being used, many which were noted in the literature reviewed earlier, and which became the focus of the research. These foods included all types of salmon and salmon roe, steelhead, trout, cod, herring, ooligans, sea urchins, crab, clams, seal, abalone, sea cucumbers and mussels. Game animals included moose, duck, grouse, mountain goat, deer and rabbit. Tree foods used were cottonwood inner-bark, hemlock inner-bark and crabapples. Many kinds of berries were used, plus rose hips, silverweed roots, clover roots, cow-parsnip, seaweed, young stinging nettles, and the shoots of fireweed, thimbleberry and salmonberry. Labrador tea and salmonberry bark tea were also used (Nuxalk Food and Nutrition Program Staff, 1985).

Table 2.1 lists 67 species of foods known and used traditionally by the Nuxalk. It is derived from earlier ethnographies and from key informant interviews conducted with Elders during 1980–1984. It presents the scientific names, common names, local names in linguistic terminology, season of use, food preparation and an appreciation score. Seasonality and appreciation scores are from Kuhnlein (1992).

Interviews determined that all household members of the Nuxalk community took most of their dietary energy from store-bought food, and that, except for fish, very little traditional food was being consumed (cf. Kuhnlein, 1984). The Nuxalk families on the reserve were much more likely to use traditional food than those off the reserve. All on-reserve families interviewed used fish, and their use was five times more than that of the city families; on-reserve families (average household size of 5.3 individuals) consumed an average of 428 pounds of salmon and an additional 150 pounds of other fish and shellfish during the 1981 survey year. Of other traditional food, 65 percent of on-reserve families and 57 percent of off-reserve families used berries, 46 percent of on-reserve families and 21 percent of off-reserve families used game foods, and 35 percent of on-reserve and 29 percent of off-reserve families used other traditional foods (Nuxalk Food and Nutrition Program Staff, 1985). Only 51 percent of the on-reserve adults interviewed and 31 percent of the off-reserve adults had eaten fruit or juice on the day of the interview and, other than potatoes, only 39 percent of on-reserve adults and 56 percent of city adults had eaten vegetables.

In general, reserve families were consuming limited amounts of iron, vitamin A and folic acid, as well as low calcium, vitamin E, vitamin D, vitamin C and fibre (Kuhnlein, 1984; Kuhnlein and Moody, 1989). In contrast, intakes of phosphorus and sodium were high and exceeded recommended balance with calcium and potassium. Women in their childbearing years and pregnant women were seen to be particularly at risk. The identified foods that could provide these nutrients included fruits and vegetables (vitamin C, A, E and folic acid) and ooligan grease (vitamins A and E). Preserved salmon and other fish with bone and skin were recommended foods containing calcium, while meat, fish and shellfish were obvious sources of iron. At the time of the interviews, diabetes was emerging in this population, but this research study had not yet identified it as a major health problem. Locally available and cost-efficient foods could supply all of the nutrients that were seen as sufficient, and could provide people with a complete and healthy diet (Nuxalk Food and Nutrition Program Staff, 1985).

Fifty-four foods were discussed in the grandmother, mother and daughter interviews, including game, fish, shellfish, teas, berries, roots and greens. Of these, 34 species (mostly fish and seafood, berries and some game) were still being used by women of all three generations, but there was a general decline over time in frequency of use, as well as in the total numbers of foods being used. Of all the foods, several fish species accessed from the Bella Coola River were maintained as those most frequently harvested and used, and most highly appreciated for taste appeal. Decline in use of traditional food took place in the early twentieth century, as indicated by the frequency of use of each traditional food across the three generations of women. The research also showed that taste appreciation was linked to declining traditional food use, in that when a particular food was not consumed frequently women did not have as high an appreciation of its taste. It also showed not surprisingly that loss of easy access (proximity and time for harvest) to traditional food was a factor in its declining use. Factors influencing this change were noted as legislation restricting use of traditional food increasing pressure on local resources by increasing population, availability of new foods – and acceptability of these – by gardening and food markets; employment

Table 2.1 Nuxalk traditional food *(67 species)*

	Scientific name	*English / common name*	*Local name*	*Seasonality*	*Preparation*	*Appreciation Women[1]* *Score 1 – 5[2] (5 = highest)*
	Fish and seafood					
1	*Clupea pallasi*	Herring and roe	klkl;at	February–April	Boiled, canned, pickled	4.4
2	*Haliotis* spp.	Abalone	plxani	January–December	Fried, canned	4.1
3	*Mytilus edulis*	Mussels, blue	smiks	January–December	Steamed, fried, baked	3.8
4	*Neptunes* sp.	Crab	k'inacw	January–December	Steamed, boiled, smoked	4.5
5	*Ophiodon elongatus*	Ling cod	nalhm	January–December	Deep fried, smoked	3.9
6	*Oncorhynchus gorbuscha*	Hump salmon (pink)	kap'y	June–July	Dried, poached, barbequed, sluq	3.6
7	*Oncorhynchus keta*	Chum salmon (dog)	t'li	July–September	Canned, salted, smoked	3.7
8	*Oncorhynchus kisutch*	Coho salmon (silver)	ways	August–October	K'num, sluq, boiled, fried, baked, smoked	4.1
9	*Oncorhynchus nerka*	Sockeye salmon	samlh	June–July	Steak, canned, barbequed	4.5
10	*Oncorhynchus tshawytscha*	Spring salmon (Chinook)	amlh	April–June	Dried, baked, smoked, canned	4.3
11	*Parastichopus californicus*	Sea cucumber	7lats	January–December	Pickled, boiled	4.0
12	*Phoca* sp.	Seal, hair	ascw	January–December	Boiled, baked	3.4
13	*Platichthys stellatus*	Flounder, starry	pays, nukakals	January–December	Baked, boiled, smoked, fried, salted	3.6
14	*Salmo gairdneri*	Steelhead	k'lat	October–April	Smoked, baked, boiled, fried, salted	4.1
15	*Salmo* sp.	Trout	tutup	January–December	Baked, boiled, fried, smoked, salted	3.8
16	*Sebastes ruberrimus*	Red cod, snapper	lc7iixw	January–December	Fried, baked	4.0
17	Several genera	Clams	ts'ikwa	May–February	Fresh, fried, steamed, cooked, boiled	4.1
18	*Strongylocentrotus* sp.	Sea urchin	mtm	October–January	Raw, dried	4.2
19	*Thaleichthys pacificus*	Ooligan, Eulachon	sputc	March–April	Baked, boiled, fried, grease	4.2
	Game					
1	*Alces alces*	Moose	skma	September–December	Roasted, smoked, dried, canned	3.9
2	*Anas* sp.	Duck	naxnx	September–December	Smoked, dried, steamed	4.1
3	*Canachites* spp.	Grouse (ruffed) (blue)	takws, ,mucwmukwt	September–December	Smoked, dried, steamed	3.7
4	*Odocoileus* spp.	Deer	scwpanilh	September–February	Smoked, dried, steamed	4.3
5	*Oreamnos americanus*	Mountain goat	yaki, qwwaax	September–February	Smoked, dried, steamed	4.1
6	*Sylvilagus* sp.	Rabbit	qax	January–December	Fried, baked, steamed, cooked	3.8
	Berries					
1	*Amelanchier alnifolia*	Saskatoon berry	sq'sk	August–September	Dried, jam	3.9
2	*Arctostaphylos uva-ursi*	Kinnikinnick berry	milicw	July–September	Dried, cooked	3.5
3	*Cornus canadensis*	Bunchberry	p'xwlht	June–August	Jam	3.7
4	*Crataegus douglasii*	Black hawthorn	q'ay	July–August	Boiled, jam	3.6
5	*Empetrum nigrum*	Crowberry	–	July–August	Jam	–
6	*Fragaria vesca, F. virginiana*	Wild strawberry	qululuuxu	June–July	Fresh	4.2
7	*Ribes bracteosum*	Stink currant	q'is	July–August	Fresh, frozen, jam	4.0
8	*Ribes divaricatum*	Wild black gooseberry	atl'anulh	June–August	Fresh, jam	3.6
9	*Ribes divaricatum*	Wild green gooseberry and leaves	atl'anulh	June–August	Cooked	3.6

Continued

Table 2.1 *(continued)* **Nuxalk traditional food** *(67 species)*

	Scientific name	*English / common name*	*Local name*	*Seasonality*	*Preparation*	*Appreciation Women*[1] *Score 1 – 5*[2] *(5 = highest)*
10	*Ribes lacustre*	Swamp gooseberry	mnmntsa	June–August	Fresh, dried	3.5
11	*Ribes laxiflorum*	Wild blue currant	ts'ipscili	June–August	Fresh, cooked	3.8
12	*Ribes parviflorus*	Thimbleberry	snutatiiqw/sxtsi	June–August	Fresh, dried, jam	4.0
13	*Rosa nutkana*	Rosehip	skupik	August–October	Fresh, dried for tea, jam	3.6
14	*Rubus idaeus*	Wild raspberry	qalhqa	June–July	Fresh, dried, jam	4.3
15	*Rubus leucodermis*	Blackcap raspberry	usukw'ltlh	June–August	Fresh, dried, jam	4.5
16	*Rubus spectabilis*	Salmonberry	qaax	February–April	Fresh, dried, jam	4.3
17	*Sambucus racemosa*	Red elderberry	k'ipt	July–September	Fresh, cooked, jam	3.6
18	*Shepherdia canadensis*	Soapberry	nuxwski	July–September	Dried, canned, fresh	4.2
19	*Vaccinium alaskense*	Watery blueberry	snuqlxlayk	July–September	Fresh, dried, jam	4.1
20	*Vaccinium membranaceum*	Mountain bilberry	sqaluts	June–August	Fresh, dried, jam	4.3
21	*Vaccinium ovalifolium*	Oval-leaved blueberry	spuuxaltswa	June–August	Fresh, dried, jam	4.1
22	*Vaccinium parvifolium*	Red huckleberry	sqala	July–August	Fresh, dried, jam	4.1
23	*Vaccinium uliginosum*	Bog blueberry	–	July–August	Fresh, dried, jam	–
24	*Viburnum edule*	Highbush cranberry	st'ls	July–October	Cooked	3.9
	Greens, roots and other plants					
1	*Chenopodium album*	Lambsquarters	ts'icts'ikmlhp	February–April	Raw, steamed	4.0
2	*Dryopteris expansa*	Spiny wood fern	sqw'alm	September–February	Cooked	4.3
3	*Epilobium angustifolium*	Fireweed shoots	ts'ayxlhp	March–May	Peeled shoots, raw	4.0
4	*Fritillaria camschatcensis*	Rice roots	ilk	September–February	Boiled, mashed	3.8
5	*Heracleum lanatum*	Cow parsnip stems	xwiq'	February–April	Raw, peeled stems	3.6
6	*Ledum groenlandicum*	Labrador tea leaves	pu7yaas	October–February	Boiled for tea	4.0
7	*Lupinus nootkatensis*	Lupine root	q'akwtsnk	–	Cooked	–
8	*Populus balsamifera* spp. *trichocarpa*	Black cottonwood	aq'miixalhp	June–July	Raw scraped inner bark	4.3
9	*Polypodium glycyrrhiza*	Licorice fern root	k'tsaatsay	–	Raw	3.8
10	*Porphyra abbottiae* *Porphyra perforate*	Seaweed (laver)	ihaq's	January–December	Dried, cooked	4.4
11	*Potentilla pacifica*	Silverweed root	uq'al	October–February	Cooked	4.2
12	*Pteridium aquilinum*	Bracken fern	sacsakwmlhpnk	–	Cooked	3.5
13	*Pyrus fusca*	Pacific crabapple	p'c	September–October	Cooked	3.8
14	*Rubus parviflorus*	Thimbleberry shoots	sxtsi	February–April	Raw, peeled shoots, tea	4.0
15	*Rubus spectabilis*	Salmonberry shoots	qaxalxlhpsxts'	February–April	Raw, peeled shoots, tea	4.0
16	*Rumex acetosella*	Sheep sorrel	yumyumalcwlhp	February–April	Raw, cooked	3.7
17	*Trifolium wormskioldii*	Springbank clover rhizomes	t'xwsus	October–March	Cooked	4.3
18	*Urtica dioica*	Stinging nettle	tsna	February–April	Boiled	3.9

1 Total number of women in the study was 61.
2 Taste scores were recorded by women who used the foods (i.e. use frequency >1).
– No data.

and concerns for time, money and personal energy for harvesting and preparation activities; and interruption of knowledge transfer to younger generations about food harvest and use (Kuhnlein, 1989a, 1992).

These interviews showed that there was a marked change in the foods used by Nuxalk women and families over the three generations. The grandmother generation remembered using a number of foods but, as of 1983, many of them were rarely or no longer being eaten by their daughters and granddaughters. These included: gray currants and trailing currants, red elderberries, highbush cranberries, salal berries, wild gooseberries, bunchberries, wild crabapples, cottonwood inner bark, hemlock inner bark, clover roots, silverweed roots, salmonberry shoots, herring sea urchin, abalone, mussels, seal, mountain goat and rabbit. Grandmothers remembered liking all foods that they had eaten in former times. Foods still being used by the younger generations included all the salmon, steelhead, trout, herring, ooligans, cod species, salmon eggs, crab, clams, some of the berries (e.g. blackcaps, wild raspberries, salmonberries, soapberries), thimbleberry shoots, seaweed, Labrador tea, cow-parsnip, deer, moose, duck and grouse.

Nuxalk foods were harvested throughout the year, and each month produced important components of the diet, although most of the plant foods in particular were harvested in the spring, summer or autumn. Many of the fish and shellfish, including steelhead, trout, ling cod, flounder, mussels, sea urchin and crabs, were available during the winter months, and some of these could be harvested year-round. The herring spawning and ooligan spawning season marked the times when herring roe and ooligans could be obtained, and this was generally in early spring, around February and March. The greens – nettles, cow parsnip, fireweed and thimbleberry and salmonberry shoots – are tender and good to eat only for a few weeks in the spring, and seaweed, obtained from the Heiltsuk on the outer coast, was harvested usually in the month of May. From May onwards, the berries ripen in succession: salmonberries, wild strawberries, red elderberries, huckleberries and blueberries, currants and gooseberries, thimbleberries, raspberries and blackcaps, and finally, in late summer and autumn, wild crabapples and highbush cranberries.

The salmon species each have their spawning season. In July, for example, people netted the last runs of spring salmon, as well as pink (hump) salmon, sockeye salmon and dog salmon. Dog salmon and coho salmon predominate in the autumn. Root vegetables were generally harvested in the autumn, after the leaves started to die back but while they were still visible; they could also be harvested through the winter until they start to sprout in spring. In earlier days, entire families would travel to harvesting locations within their territories to take advantage of the different resources as they became ready. Often the men hunted and fished, while the women picked berries and other plant foods, and processed the food for winter.

The traditional ways of preserving food included: dehydrating (in the sun or over a fire) for berries, salmon, halibut and some other food; smoking (for some of the salmon and salmon eggs, clams and some meat); storing in cedarwood boxes under water or in ooligan grease (e.g. crabapples and highbush cranberries); and fermenting (used for some salmon roe). Cedarwood frames were used to support a surface layer of skunk cabbage leaves or other large leaves, and the berries were mashed, cooked to a jam-like consistency and dried in large cakes, first on one side and then turned over and dried on the other. Dried berry cakes could be rolled up and stored in openwork baskets or in cedarwood boxes in a dry place, and, to use, were simply reconstituted in water overnight. After sugar was introduced in the late-ninetenth century, many people learned to prepare jam and jelly from wild berries. Canning and jarring technologies allowed people to store many types of food more conveniently. Many people started partially smoking their fish and then jarring it. Finally, during the 1950s home freezers were introduced and first used, often with vacuum packing, to retain the maximum freshness for fish and seafood, as well for berries and other foods. Some people debone their salmon and make it into patties, then jar it with their own homemade salsa; others marinate salmon with demerara sugar and salt before barbecuing or adding other flavourings. Of all the types of traditional food, as of 2006, salmon was still the most popular in Nuxalk households.

Shortages and lack of accessibility to some traditional Nuxalk foods meant that fewer were being used regularly, but most were still remembered in the community and there was interest in them among the current generations of youth and young adults. The inner bark of trees and root vegetables were traditional plant foods scarcely used.

Food availability assessments

The results of the 1983–1984 ecological study on food availability and accessibility showed that all of the salmon species, steelhead and ooligan were still available and could be harvested in the Bella Coola River. Other fish (e.g. cod, flounder and halibut) and shellfish were available on a more limited scale, mostly brought home by Nuxalk fishers from the outer coast. Herring eggs and seaweed, brought in from Bella Bella on the outer coast area, were sometimes in limited supply. Game, including deer and moose, were still used, but mountain goat and duck were little used, and game in general were seen to have become scarcer than in previous times. Plant foods still readily available included some fruits (Pacific crabapple, Saskatoon berries, wild gooseberries, rose hips, wild raspberries, thimbleberries, salmonberries, red elderberries, oval-leaved blueberries, highbush cranberries, bunchberries); inner bark (black cottonwood, western hemlock); greens (fireweed, cow-parsnip); root vegetables (springbank clover, Pacific silverweed); and Labrador tea (Nuxalk Food and Nutrition Program Staff, 1984; Kuhnlein, 1989a, 1989b; Kuhnlein *et al.*, 1982; Lepofsky, 1985; Lepofsky, Turner and Kuhnlein, 1985).

At least 18 plant foods of a total of 42 were identified that were readily available to the Nuxalk within the Bella Coola area. These included several types of berries, greens, and root vegetables, as well as the trees from which the inner bark can be harvested. It was noted that the berries were harder to find because many of the places where people used to pick them (blueberries, huckleberries, gray currants and others) have grown over and, although the bushes still grew there, the berries tended to be small and unproductive. The fish and shellfish available in the 1980s included all the salmon, steelhead, ooligans, as well as the shellfish, cod, flounder, and halibut. Of game foods, deer and moose were the most commonly used, with mountain goat and duck hunted rarely, and seal was infrequently used (Lepofsky, Turner and Kuhnlein, 1985).

Traditional food nutrient composition

Analysis of ooligan grease (Kuhnlein, Turner and Kluckner, 1982; Kuhnlein *et al.*, 1996) showed that this culturally valued product contained more vitamin A and vitamin E than other fats commonly used for cooking on the reserve. It was also noted that it contained a good balance of fats, with about 65 percent monounsaturated fat, 33 percent saturated fat, and the rest polyunsaturated fat, as well as meaningful amounts of protein, calcium, and vitamin K. Ooligan grease was also documented to contain several organochlorine contaminants (Chan *et al.*, 1996). Of the berries, thimbleberries and salal berries had higher vitamin C and calcium than store-bought strawberries and blueberries. Salmonberries and soapberries were good sources of calcium, with salmonberries being found to be a source of carotene (Nuxalk Food and Nutrition Program Staff, 1984; see also Kuhnlein, 1989b, 1990). Most analyses included levels of protein, fat, total calories, and dietary fibre, as well as selected minerals and vitamins. Nutrients from traditional plant foods are summarized in the appendices in Kuhnlein and Turner (1991). Table 2.2 shows selected nutrient composition data for Nuxalk food.

The nutrient analyses from the programme confirmed that the traditional Nuxalk foods provided the full complement of nutrients required for good health. Table 2.3 summarizes key nutrients, including micronutrients, and traditional foods and food groups known to provide them.

Health status assessments

The 1983 assessment results showed several health measures influenced by nutrition. Table 2.4 demonstrates that women aged 20 to 60, in particular, and some younger men, were iron deficient. In addition, many

Table 2.2 Nutrient composition of Nuxalk traditional foods *(per 100 g of edible portion)*

Food items	*Moisture* g	*Energy* kcal	kJ	*Protein* g	*Fat* g	*CHO* g	*Fiber* g	*Ash* g	*SAFA* g	*MUFA* g	*PUFA* g	*Retinol* µg	*ß Carotene* µg
Fish and Seafood													
Abalone, flour coated, fried[a]	60.1	148	619	19.6	2.8	11.1	0	1.8	1.7	2.7	1.5	2	0
Abalone, raw[a]	74.6	100	418	17.1	0.8	6	0	1.6	0.15	0.11	0.1	2	0
Blue mussels, raw[a]	80.6	82	343	11.9	2.2	3.7	–	1.6	0.43	0.51	0.61	48	0
Blue mussels, steamed, boiled[a]	61.2	165	690	23.8	4.5	7.4	0	3.2	0.85	1.01	1.21	91	1
Chum salmon (dog), poached[b]	70.6	113	472	22.3	2.6	0	0	2	0.7	0.92	0.88	5	0
Chum salmon (dog), raw[b]	73.3	126	527	23.1	3.7	0	0	1.3	0.94	1.3	1.3	30	0
Clams, boiled, steamed[a]	63.6	101	422	15.6	2	5.1	0	3.7	0.19	0.17	0.55	171	0
Clams, raw[a]	81.8	71	297	12.8	1	2.6	0	1.9	0.094	0.08	0.28	90	0
Coho salmon (silver), K'num[b]	45	267	1 116	29	11	13	–	2	–	–	–	103	–
Coho salmon (silver), fillet, raw[b]	75	105	439	23	1	1	–	2	–	–	–	67	–
Coho salmon (silver), raw[b]	65	172	719	18	8	7	–	1	–	–	–	26	–
Coho, salmon (silver), Sluq[b]	26	295	1 233	60	3	7	–	7	–	–	–	74	–
Crab, raw[a]	79.6	79	330	18.3	0.6	0		1.8	0.09	0.08	0.13	7	1
Flounder, baked[a]	73.2	110	460	24.2	1.5	0	0	1.5	0.36	0.28	0.65	13	0
Flounder, raw[a]	79.1	86	359	18.8	1.2	0	0	1.2	0.28	0.23	0.33	10	0
Herring roe, raw[a]	81.2	74	309	9.6	1.9	4.5	–	2.8	0.43	0.42	0.71	–	–
Hump salmon (pink), poached[b]	69.2	144	602	24.1	5.3	0	0	1.5	1.3	1.9	1.8	21	0
Hump salmon (pink), raw[b]	71.5	142	594	20.4	6.7	0	0	1.4	1.7	2.4	2.3	35	0
Ooligan, dried[c]	69.6	197	823	–	15.5		–	–	–	–	–	2 021	–
Ooligan, grease[c]	1.4	882	3 687	–	98	–	–	–	19	36	–	2 400	–
Ooligan, raw[c]	72.2	140	585	–	16.7	–	–	–	–	–	–	3 196	–
Ooligan, smoked[c]	59.2	882	3 687	–	21.9	–	–	–	27.1	54.8	–	4 439	–
Red cod snapper, baked[a]	70.4	121	506	26.3	1.7	0	0	1.4	0.37	0.32	0.59	35	0
Red cod snapper, raw[a]	76.9	94	393	20.5	1.3	0	0	1.3	0.29	0.25	0.46	30	0
Sockeye salmon, BBQ, canned[b]	55	208	869	28	8	6	–	3	–	–	–	146	–
Sockeye salmon, BBQ[b]	60	173	723	28	5	4	–	3	–	–	–	120	–
Sockeye salmon, canned[b]	66	158	660	20	6	6	–	3	–	–	–	70	–
Sockeye salmon, raw[b]	70	137	573	20	5	3	–	2	–	–	–	50	–
Spring chinook (King), baked[b]	65.6	223	932	25.7	13.4	0	0	1.8	3.2	5.74	2.66	149	0
Spring chinook (King), raw[b]	71.6	173	723	19.9	10.4	0	0	1.3	3.1	4.4	2.8	136	0
Spring chinook (King), smoked[b]	72	112	468	18.3	4.3	0	0	2.6	0.93	2	1	26	0
Trout, baked[a]	63.4	183	765	26.6	8.5	0	0	1.5	1.5	4.2	1.9	19	0
Trout, raw[a]	71.4	143	598	20.8	6.6	0	0	1.2	1.15	3.25	1.5	17	0
Game													
Deer[a]	75	111	464	21.5	2.7	0.2	–	0.6	0.63	0.34	0.35	–	–
Duck, flesh, skin, raw[a]	66.5	206	861	17.4	15.2	0	0	1.2	5.04	6.8	2.02	26	1
Moose, cooked[a]	61	152	635	35	1.3	0	0	0.6	0.29	0.2	0.31	0	0
Moose, raw[a]	73	115	481	22	3	0	0	0.7	0.22	0.15	0.24	2	0
Rabbit, cooked[a]	67.5	135	564	29	2.1	0	0	1	2	1.1	1.3	0	0
Rabbit, raw[a]	75.5	96	401	21.5	1.1	0	0	1.1	0.5	0.2	0.2	0	0

Vitamin A RE_µg	Vitamin A RAE_µg	Thiamine mg	Riboflavin mg	Niacin (NE) mg	Folic Acid (DFE) µg	Folate µg	Vitamin B_{12} µg	Zinc mg	Iron mg	Calcium mg	Phosphorous mg	Sodium mg	Magnesium mg	Copper µg	Manganese mg	Selenium µg
2	2	0.22	0.13	5.6	20	5	0.69	0.95	3.8	37	217	591	56	228	0.07	51.8
2	2	0.19	0.1	4.7	5	5	0.73	0.82	3.2	31	190	301	48	196	0.04	44.8
48	48	0.16	0.05	3.8	42	42	12	1.6	4	26	197	286	34	94	3.4	44.8
91	91	0.3	0.42	3.5	76	76	24	2.64	6.7	33	285	369	37	150	6.8	89.6
5	5	0.08	0.1	20.9	4	4	2	0.61	0.7	50	742	79	32	61	0.02	–
30	30	0.09	0.1	15.4	4	4	3.3	0.58	0.7	44	724	93	31	63	0.02	36.5
171	171	0.15	0.43	8.1	29	29	99	2.73	28	92	338	112	18	690	1	64
90	90	0.08	0.213	4.2	16	16	49.4	1.37	14	46	169	56	9	344	0.5	24.3
103	103	0.09	0.29	5.4	15	15	–	1	0.7	128	407	89	42	158	0.05	–
67	67	0.35	0.1	4.1	5	5	–	0.4	0.4	8	250	35	29	271	0.01	–
26	26	0.77	0.22	3.1	6	6	–	0.7	0.6	66	217	53	24	364	0.02	–
74	74	0.05	0.25	11.6	9	9	–	0.9	0.9	21	687	197	84	490	0.07	–
7	7	0.043	0.043	5.4	44	44	9	5.95	0.6	46	219	836	49	920	0.04	36.4
13	13	0.08	0.114	6.7	9	9	2.5	0.63	0.3	18	289	105	58	26	0.02	58.2
10	10	0.09	0.076	6.4	8	8	1.5	0.45	0.36	18	184	81	31	32	0.02	32.7
–	–	0.1	0.12	3.6	–	–	–	–	2.7	19	61	–	–	–	–	–
21	21	0.15	0.1	22.3	4	4	3.5	0.67	0.8	30	779	58	35	90	0.02	–
35	35	0.17	0.1	19.2	4	4	3.2	0.67	0.8	29	754	68	32	80	0.02	–
2 021	2 021	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2 400	2 400	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3 196	3 196	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4 439	4 439	–	–	–	–	–	–	2.2	1.8	405	–	–	–	–	–	–
35	35	0.053	0.004	5.3	6	6	3.5	0.44	0.24	40	201	57	37	46	0.02	49
30	30	0.046	0.003	4.1	5	5	3	0.36	0.18	32	198	64	32	30	0.01	38.2
146	146	0.03	0.43	6.1	7	7	–	1	0.9	70	325	438	33	624	0.07	–
120	120	0.19	0.54	6.4	14	14	–	1.3	1.3	81	361	270	36	1 390	0.07	–
70	70	0.14	0.16	4.6	6	6	–	0.6	0.3	59	238	783	20	166	0.01	–
50	50	0.4	0.28	4.6	7	7	–	0.9	0.8	52	216	58	25	665	0.02	–
149	149	0.044	0.154	14.9	35	35	2.9	0.56	0.9	28	371	60	0.56	53	0.02	46.8
136	136	0.054	0.113	8.4	30	30	1.3	0.44	0.3	26	289	47	95	41	0.02	36.5
26	26	0.023	0.1	8.1	2	2	3.3	0.31	0.85	11	164	784	18	230	0.02	32.4
19	19	0.43	0.42	10.7	15	15	7.5	0.85	1.9	55	314	67	28	240	1.09	16.2
17	17	0.35	0.33	8.4	13	13	7.8	0.66	1.5	43	245	52	22	190	0.85	12.6
–	–	0.2	0.36	10.5	–	–	–	–	2.9	7	–	–	–	–		–
–	–	0.2	0.3	7.3	21	21	0.65	0.77	4.2	5	168	56	20	310	0.02	12.8
26	26	0.35	0.34	11.7	4	4	6.31	7.5	5	5	250	50	30	200	0.02	12.8
0	0	0.05	0.27	9	–	–	–	5	3	6	158	65	33	100	0.02	3
2	2	0.06	0.07	13.6	8	8	6.5	2.8	5.8	33	209	52	28	220	0.04	15.2
0	0	0.02	0.06	11.3	–	–	–	0.5	3.4	33	30	40	3	200	0.01	10

Continued

Table 2.2 *(continued)* **Nutrient composition of Nuxalk traditional foods** *(per 100 g of edible portion)*

Food Items	*Moisture* g	*Energy* kcal	kJ	*Protein* g	*Fat* g	*CHO* g	*Fiber* g	*Ash* g	*Thiamine* mg
Green Roots and other Plants									
Black cottonwood[d]	92	31	130	0.2	0.5	6.3	1.5	0.77	–
Bracken fern[d]	–	–	–	–	–	–	–	–	–
Cow parsnip stems[d]	95	20	84	0.2	0.3	4	0.9	0.51	T
Fireweed shoots[d]	92	30	125	0.3	0.4	6.4	0.8	0.56	–
Labrador tea leaves[d]	42	–	–	–	0.7	–	–	–	0.01
Lambsquarters[d]	88	41	171	3.3	0.6	5.7	1.5	2.3	T
Licorice fern root[d]	70	141	589	0.9	4.6	24	8.2	0.89	–
Lupine root[d]	82	73	305	2	0.4	15.4	7.38	0.78	0.04
Pacific crabapple[d]	79	90	376	1.2	1.6	17.7	6	0.79	0.03
Rice roots[d]	74	102	426	2.9	0.3	21.8	1.9	0.95	0.04
Salmonberry shoots[d]	93	31	130	0.5	0.6	5.8	1	0.28	0.05
Seaweed, laver[d]	10	303	1 267	24.4	1.4	48.2	25	16	–
Sheep sorrel[d]	88	48	201	1.1	0.6	9.6	1.1	0.86	0.02
Silverweed or cinquefoil[d]	66	136	568	3.1	0.6	29.5	9.5	0.9	0.01
Spiny wood fern[d]	68	128	535	2.5	1	27.3	3.7	0.76	–
Springbank clover rhizomes[d]	81	73	305	0.7	0.5	16.5	6.5	1	0.06
Stinging nettle[d]	89	44	184	1.8	0.6	7.9	1.4	1.2	0.08
Thimbleberry shoots[d]	93	28	117	0.6	0.4	5.5	1	0.63	0.01
Wild Berries									
Black hawthorn[e]	84	73	305	0.3	1.4	14.9	2.6	0.68	–
Blackcap raspberry[e]	79	87	364	1.2	1.4	17.5	11.5	0.46	0.01
Bog blueberry[e]	88	51	213	0.7	0.6	10.6	3.3	0.23	–
Bunchberry[e]	81	76	318	0.6	0.8	16.6	5.2	0.5	0.01
Crowberry[e]	89	45	188	0.2	0.7	9.5	5.9	0.71	0
Grey blueberry[e]	87	54	226	1.1	0.5	11.3	3.3	0.23	0
Highbush cranberry[e]	89	42	176	0.1	0.4	9.4	3.8	0.53	–
Kinnikinnick berry[e]	75	102	426	0.7	1.1	22.4	14.8	0.64	–
Mountain bilberry[e]	86	59	247	0.6	0.5	13.1	2	0.14	–
Red elderberry, cooked[e]	78	110	460	2.9	4.8	13.9	8.2	0.73	–
Red elderberry, fresh[e]	78	113	472	1.1	5.6	14.6	9.3	0.94	–
Red huckleberry[e]	87	56	234	0.8	0.5	12	3.9	0.13	0.02
Rosehip[e]	79	82	343	1.6	0.6	17.6	4.4	1.4	–
Salmonberry[e]	88	52	217	1.4	0.8	9.9	2.6	0.16	0.04
Saskatoon berry[e]	76	99	414	0.7	1.2	21.4	6.4	0.65	T
Soapberry[e]	81	80	334	1.8	0.7	16.6	5.3	0.35	0.01
Stink currant[e]	83	70	293	0.8	1.2	13.9	4.4	0.82	–
Swamp gooseberry[e]	86	66	276	1.5	2.3	9.7	3.5	0.9	0.04
Thimbleberry[e]	74	110	460	1.7	1.2	23	11.9	0.62	0.03

Riboflavin mg	Niacin (NE) mg	Vitamin C mg	Folic Acid (DFE) µg	Zinc mg	Iron mg	Calcium mg	Phosphorous mg	Sodium mg	Magnesium mg	Copper µg	Manganese mg
–	–	–	68.5	0.4	0.3	10	39		8	400	0.07
–	–	–	–	–	–	–	–	–	–	–	
T	0.26	3.5	16.1	0.4	0.2	29	16	0.7	11	100	0.06
–	–	–	–	0.7	0.5	32	31	0.6	20	700	0.18
0.39	92	98	–	2.4	184	215	93	3.7	73	2 400	45.4
0.02	T	70	–	2.3	1.8	246	49	0.8	41	2 300	0.63
–	–	–	–	0.7	4.4	84	37	1.6	53	700	2.62
0.05	T	–	–	0.2	10	31	33	123	78	200	0.53
0.01	1.9	–	–	0.2	0.6	29	33	21.2	28	500	0.33
0.04	0.02	29	36.5	0.7	2.2	10	61	18.4	23	200	0.44
0.02	0.22	7.5	–	0.2	0.3	8	27	2.5	17	100	0.73
–	–	–	–	1.7	2.9	230	474	3 300	623	1 700	1.61
0.12	0.43	33.5	–	1.2	2.3	57	45	2.3	31	1 200	0.92
0.01	2.4	–	–	1.1	3.5	37	109	65	60	1 100	0.84
–	–	–	–	1.5	0.8	56	63	1.4	44	1500	3.19
0.04	0.64	–	–	0.3	4.5	34	38	–	68	300	0.32
0.22	0.27	1.5	–	1.9	1	236	73	0.8	63	1 900	0.74
0.09	0.29	5.9	–	0.4	0.4	24	26	1	29	400	0.17
–	–	9.5	–	0.2	0.5	31	12	6.9	12	300	0.2
0	0.01	6.5	20.9	0.6	0.7	38	40	0.8	28	200	0.3
–	–	–	–	0.3	0.2	19	13	–	8	200	2.7
0.03	0.5	2.1	10.5	0.1	0.6	52	19	0.4	12	100	0.1
0	0.1	16.4	–	0.1	0.4	9	11	2.5	4	1 000	0.4
0	0.4	6.2	7.4	0.2	0.4	16	21	0.9	9	600	1.3
–	–	13.4	–	0.1	0.3	24	23	0.6	11	100	0.1
–	–	–	–	0.5	0.7	37	35	0.5	17	1 300	0.2
–	–	6.6	–	0.1	0.2	14	17	0.4	8	100	2.5
–	–	30.9	–	0.7	1	89	77	1.9	40	500	0.6
–	–	36.7	68.3	0.5	1.1	98	84	1.3	44	800	1
0.01	0.5	6.2	2.8	0.2	0.3	22	16	0.8	7	400	4.5
–	–	414	–	0.2	0.3	77	37	1.8	26	T	0.9
0	0.5	14.4	16.5	0.2	0.6	15	24	2.6	16	500	0.7
0	0.3	10.9	–	0.4	0.5	69	40	0.6	26	400	2.2
0.1	0.2	165.6	–	1.4	0.5	16	21	0.5	8	300	0.2
–	–	27.5	–	0.8	0.8	98	47	1.8	19	700	0.6
T	T	58.2	–	0.2	0.4	68	47	0.6	22	100	0.3
T	T	63.6	–	0.4	0.7	89	62	0.8	44	200	1.8

Continued

Table 2.2 *(continued)* **Nutrient composition of Nuxalk traditional foods** *(per 100 g of edible portion)*

Food Items	*Moisture* g	*Energy* kcal	kJ	*Protein* g	*Fat* g	*CHO* g	*Fiber* g	*Ash* g	*Thiamine* mg
Wild Berries *(continued)*									
Watery blueberry[e]	82	74	309	0.9	0.6	16.2	2.8	0.86	0.02
Wild black gooseberry[e]	82	77	322	1.1	1.5	14.7	4.6	0.87	0.02
Wild blue currant[e]	84	65	272	0.7	0.6	14.2	5.2	0.52	0
Wild green gooseberry and leaves[e]	85	65	272	1.7	0.9	12.5	4.3	0.2	0.01
Wild raspberry[e]	83	73	305	0.6	0.8	15.8	4.5	0.34	0.01
Wild strawberry[e]	85	61	255	0.6	0.9	12.5	2.9	0.63	0.01

[a] Canadian Nutrient File, 2005.
[b] Kennelly, A.C. 1986.
[c] Kuhnlein, H.V. *et al.* 1996.
[d] Kuhnlein, H.V. 1990.
[e] Kuhnlein, H.V. 1989.
T Trace value.
– No data.

adults, both male and female, were low in blood folic acid and vitamin A as both retinol and ß-carotene. Of 187 persons evaluated, those at risk for deficiency of retinol, iron (ferritin) and folic acid were 27 percent, 18 percent, and 26 percent, respectively. Deficiencies in these essential nutrients put people at risk of poor vision, unhealthy pregnancy, various infections and poor dental health. As a result of the health assessments, several individuals were referred for dental care, hearing aids and glasses.

Table 2.3 Key nutrient-rich Nuxalk traditional foods

Nutrient	*Sources in traditional diet*
Vitamin A	Wild greens, wild berries (e.g. salmonberries), fish and shellfish
Vitamin D	Fish and shellfish
Vitamin E	Fish and shellfish, especially eulachon grease
Vitamin C	Wild greens, wild berries (e.g. strawberries, huckleberries)
Thiamin (B_1)	Fish and shellfish
Riboflavin (B_2)	Fish and shellfish
Niacin (B_3)	Fish and shellfish, seaweed
Folic acid	Wild greens and wild berries
Calcium	Wild greens, wild berries, hemlock inner bark, fish (cooked with the bones)
Iron	Wild greens (e.g. stinging nettles), wild berries, hemlock inner bark; fish and shellfish
Magnesium	Wild greens, wild berries, fish and shellfish
Carbohydrate	Greens, roots, berries
Fat	Fish and shellfish, particularly eulachon grease; also seal oil, deer fat, bear fat
Protein	Fish, meat and shellfish (e.g. salmon is an excellent source)

Adapted from Nuxalk Food and Nutrition Handbook, 1984, pp. 86-87; see also Kuhnlein, 1980, 1990; Kuhnlein *et al.*, 1982 (ooligan grease); Kuhnlein *et al.*, 1982 (clover and silverweed); Kuhnlein and Turner, 1982; Turner and Kuhnlein, 1982, 1983; Turner *et al.*, 1992.

As shown in Table 2.5, all age and gender categories demonstrated obesity expressed as a proportion of the population exceeding the Nutrition Canada Survey 95th percentile of weight for height (boys and girls) or high body mass index (BMI) (Demirjian, 1980). Adults and teens tended to have poor diets and to develop overweight or obesity, although teens were the most active and fit. Regular physical activity, combined with better diets and less dietary energy, was recognized as the best remedy (Kuhnlein and Moody, 1989; Barr and Kuhnlein, 1985; Nuxalk Food and Nutrition Program Staff, 1984).

As expected, cholesterol levels were positively correlated with age and BMI, and total cholesterol was higher than Caucasian values reported in the Nutrition Canada National Survey of 1975. HDL cholesterol was negatively correlated with BMI, and was not different by gender.

Health promotion activities

Following the 1983 health assessments, efforts were made within the programme to improve traditional

Riboflavin mg	Niacin (NE) mg	Vitamin C mg	Folic Acid (DFE) µg	Zinc mg	Iron mg	Calcium mg	Phosphorous mg	Sodium mg	Magnesium mg	Copper µ g	Manganese mg
0	0.4	3.3	4.9	0.2	0.5	24	21	1	9	300	0.1
0	1	40.2	19.9	0.2	0.7	111	53	0.6	23	400	0.5
T	T	61.5	–	0.4	0.6	51	23	1.8	18	100	1.2
0.01	0.5	12.6	–	0.4	0.9	124	46	1.1	26	400	0.4
0	0.4	30.7	61.8	0.4	0.7	36	38	0.4	17	600	0.4
0.03	T	23.8	–	0.2	0.4	64	35	0.6	54	800	0.8

Note: See original publications for n of samples, sample size and analytical methods.

food use and use of quality market foods. Attention was given to improving physical activity for the entire community and focusing on improving nutrient intakes of iron, folate and vitamin A i terms of general dietary improvements. Two community assistants worked under the guidance of the community health nurse and community health representative to conduct a broad range of programme activities (Kuhnlein and Moody, 1989).

In summary, intervention activities included promotion of traditional Nuxalk foods through food-gathering outings and expeditions, and through luncheons and feasts featuring healthy traditional foods. Often, younger researchers and participants gathered and prepared the food under the advice and direction of Elders, with the Elders hosted by the youth when the food was served. The project participants made ooligan grease each year in 1983, 1984 and 1985, and also cut, smoked and barbecued salmon. Other activities included: classes promoting traditional foods, good nutrition and healthful lifestyle habits for school children and adults; fitness classes from Bogie's Fitness (a Vancouver consultant) – including sessions at the school for those who were overweight as well as the general public; designing and installing a demonstration traditional food garden in the yard of the health centre; displays,

Table 2.4 Summary of Nuxalk nutritional status for ß-carotene, retinol, ferritin, haemoglobin and folate, 1983

Age	Gender	n	ß-carotene µg/dl	Retinol µg/dl	Ferritin µg/ml	RBC Folate ng/ml	Hb g/dl
13–19	F	13	42.3 ± 3.9	26.9 ± 6.9	16.3 ± 3.6	185 ± 15	12.6 ± 0.3
	M	18	40.4 ± 2.2	24.5 ±1.2	19.4 ± 3.6	211 ± 17	14.6 ± 0.3
20–40	F	41	37.0 ± 2.4	21.6 ± 0.07	25.4 ± 4.5	252 ± 20	12.8 ± 0.2
	M	51	40.1 ± 1.5	24.8 ± 0.7	58.2 ± 5.8	227 ± 9	14.7 ± 0.2
41–60	F	24	33.3 ± 3.0	25.1 ± 1.1	34.8 ± 8.2	212 ± 20	12.4 ± 0.4
	M	22	35.7 ± 3.2	24.4 ± 1.8	69.4 ± 10.5	185 ± 16	14.6 ± 0.3
> 60	F	11	36.1 ± 3.0	22.4 ± 2.1	53.1 ± 11.1	186 ± 44	13.2 ± 0.5
	M	7	32.1 ± 4.5	21.9 ± 1.3	63.6 ± 11.5	197 ± 44	14.1 ± 0.5

Normal values were assumed to be: ß-carotene > 40 µg/dl; Retinol > 20 µg/dl; Ferritin > 10 ng/ml; Red cell folate > 60 ng/ml;
Female haemoglobin > 11.5 g/dl if < 17 yr and >12 g/dl if >17 yr; Male haemoglobin > 13 g/dl if < 17 yr and >14 g/dl if >17 yr (Adapted from Kuhnlein and Burgess, 1997).

Table 2.5 Nuxalk children and adults at health risk for obesity, 1983

	Age	Total (n)	#	%	Mean BMI ± SD
Children					
Girls	1–5	24	8	33	–
	6–12	57	13	23	–
	13–19	32	8	25	–
Boys	1–5	19	7	27	–
	6–12	52	12	23	–
	13–19	31	7	23	–
Adults					
Women	20–40	47	10	21	28 ± 61
	41–60	22	10	46	33 ± 4.1
	> 60	13	5	39	33 ± 7.3
Men	20–40	55	9	26	28 ± 4.6
	41–60	22	6	27	29 ± 3.7
	> 60	7	4	57	31 ± 4.4

Note: ≥ 95% of Nutrition Canada Survey of Weight for Height and Adult BMI > 30 (Demirjian, 1980).
– Not applicable.

posters, flyers and pamphlets on good nutrition; publication of the two books by the Nuxalk Food and Nutrition Program Staff (1984, 1985); nutrition classes for pregnant women and mothers; dental health classes; workshops for diabetics; and classes for children and adults on healthy lifestyles and disease prevention. These activities of the intervention programme will be discussed in more detail in a future publication.

Revisiting the Nuxalk Food and Nutrition Program

Discussion with Nuxalk leaders in 2006 reaffirmed continued use of programme materials, particularly the community handbooks used in local schools and the recipe books used by families. Use of fish from the Bella Coola River was still the most important traditional food activity, employing traditional preservation and processing methods of drying and smoking with alder wood.

Council members and former leaders of the programme expressed concern with increasing diabetes and related health problems, as well as continuing interest in preserving their traditional food practices for the nutritional and cultural benefits provided. A recent update of incidence of chronic disease among residents in the Bella Coola Valley was made using a mail-in survey by Thommasen and Zhang (2006). They confirmed that chronic disease, including obesity and diabetes, were serious problems for valley residents, with *diabetes mellitus* documented at 7 percent. However, this survey of valley residents included less than 50 percent aboriginal people, most of whom were Nuxalk.

Major environmental deterioration resulted in the decline and disappearance of several important Nuxalk cultural food resources. For example, ooligan from the Bella Coola River declined to the extent that during the 2002–2006 period it was not possible to net enough fish to make ooligan grease. Further, Nuxalk residents reported some salmon, particularly the favored sockeye, becoming rare in the Bella Coola River. Abalone harvesting has been banned after it declined drastically following the opening of a commercial harvest. Commercial harvesting of herring and herring roe was believed to greatly reduce the availability of herring. Finally, the tidal flats were reported to have become so polluted from village sewage that residents were advised not to harvest traditional root foods from the area.

Conclusion

This documentation of the Nuxalk traditional food system included extensive data collection and measurement, giving important information on food use, food quality and health status of the Nuxalk. The knowledge of unique and diverse species in the Nuxalk food system in the coastal rain forest environment of British Columbia, Canada, is extensive, including many species of fish, plants and wild animal foods. Nutrient-rich foods contained in the Nuxalk food system include ooligan fat, salmon and shellfish, all excellent sources of fat-soluble vitamins and omega-3 fats; and several species of berries, roots and greens. As expected, the amount of traditional food consumed by reserve-residents was much greater than by those living in urban areas, but reserve families each consumed an average of about 570 lbs of fish and shellfish, particularly salmon. This extent of use may have contributed to the high levels of healthy HDL cholesterol among adults in the 1980s. Overweight and obesity among children and adults were present, and there were lower than desirable levels of ß-carotene, retinol, ferritin, hemoglobin and red cell folate in blood, which followed from dietary reports of limited vitamin A, iron and folate.

All data derived from the programme were shared widely in the community, which led to Nuxalk community leaders expressing great enthusiasm for development of an education-based intervention to improve nutrition and health emphasizing traditional food knowledge. This led to funding for activities to promote greater use of local traditional foods and improving quality of locally available market foods and active lifestyles. Discussions held by researchers in the community in 2006, 20 years after completing the intervention, revealed that enthusiasm for traditional Nuxalk foods remained high, and continued to be promoted through the Band Council, the health clinics, and in health classes in the local schools. The intervention, its success, and its evaluation will be presented in a future publication.

Unfortunately, despite these successes, obesity and diabetes – in both Nuxalk and non-Nuxalk – became prominent in the valley in the intervening years, raising concerns about an increase in related chronic diseases. Simultaneously, environmental shifts created declining availability of some key Nuxalk foods, particularly ooligan, salmon and herring, which are excellent nutrient sources. It is hoped that attention to this threat of losing key environmental treasures will lead to more effective environmental protection programmes within the Nuxalk territory and in surrounding areas affecting the food system.

The loss of practice of local food traditions reflects a general, global trend among indigenous and local peoples, with increasingly more of the food that is produced, processed and marketed at a global scale being readily available and purchased in low-income areas. For many indigenous communities in North America this creates diets high in energy density but poor in nutrient quality, leading to obesity and other global lifestyle and health concerns (Kuhnlein *et al.*, 2006; Pelto and Vargus, 1992; Turner and Turner, 2006; Popkin, 2007).

Further research to build on the results of the Nuxalk Food and Nutrition Program could improve understanding of the forces driving negative environmental change that is decreasing availability of key food resources, and how to reverse these trends with local, regional and national policies. Understanding how to improve food choices, particularly among young reserve residents, of both traditional and purchased foods with education and other incentives is greatly needed in low-income First Nations areas.

The Nuxalk food system and active practice and use of it in Bella Coola clearly have many excellent health benefits. Combining these benefits with cultural activities that promote fitness and social events can serve the Nuxalk well. Most importantly, protection of the land and sea environments that produce the Nuxalk traditional food system will add immeasurably to the overall picture of health determinants for the Nuxalk, as it will for all citizens in the coastal region of British Columbia ●

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Chapter 3

Gwich'in traditional food for health: Phase 1

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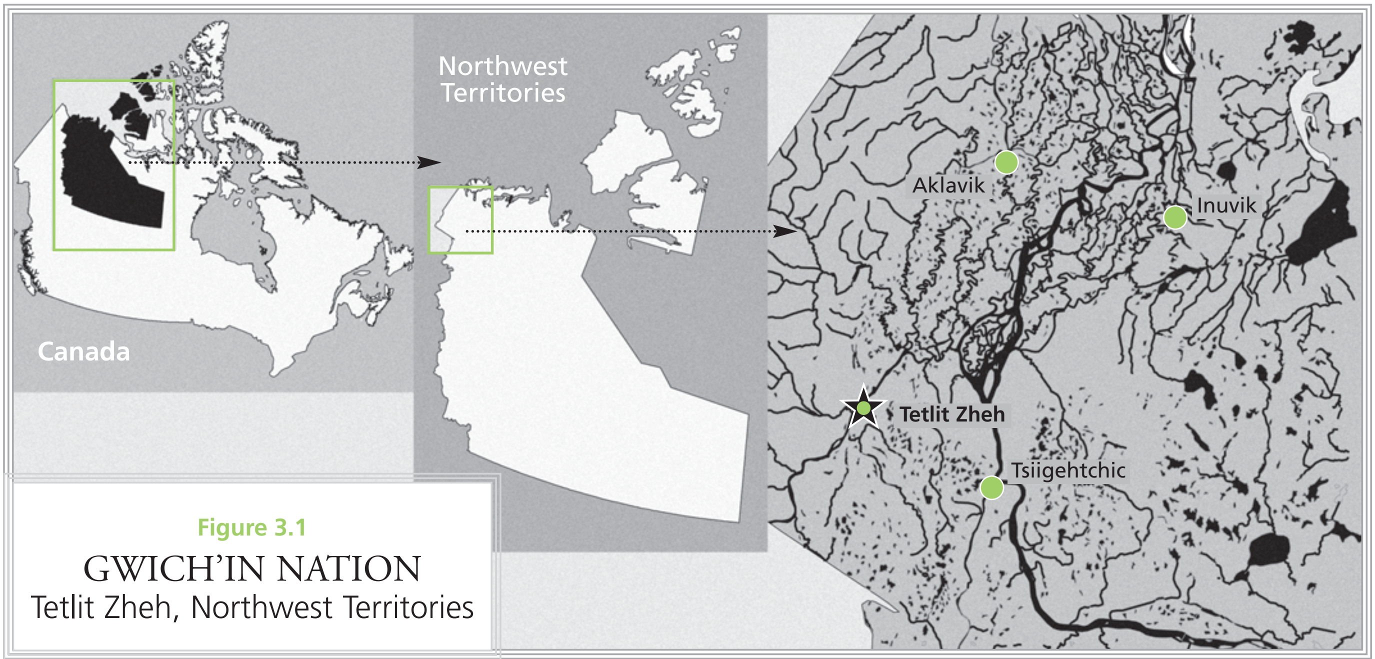

Figure 3.1

GWICH'IN NATION

Tetlit Zheh, Northwest Territories

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
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"Caribou blood gives strength and warmth, and it keeps you from getting hungry for a long time."

Woody Elias, Gwich'in Elder, 2006

Abstract

The objective of the research described in this chapter is to present the food system and nutrition situation of the Tetlit Gwich'in community, and to understand many of the nutritional and cultural circumstances that lead to planning an intervention to promote health through improved food use.

The Tetlit Gwich'in reside in a First Nation community in the northern Northwest Territories of Canada. Several research studies have taken place in partnership with this community and the Centre for Indigenous Peoples' Nutrition and Environment since the 1990s. As a result, this effort to document the Tetlit Gwich'in food system has been welcomed and considered successful. Within the larger Dene community, the Gwich'in in this region recorded 50 species of traditional animal and plant foods, all of which are wildlife foods, and many parts are edible and enjoyed.

Nevertheless, market foods are available in this Arctic community, and in early 2000 approximately 33 percent of adult energy was derived from traditional Gwich'in food, but children's diets contained much less traditional food (about 6 percent of energy). Caribou and several species of fish were popular in all seasons.

Children's diets were found to contain more than 40 percent of daily energy from fat and sweet foods, but the small amounts of traditional meats and fish ensured adequate protein, iron, zinc, copper and vitamin B_6. Calcium, vitamin D, vitamin A, vitamin E, magnesium and fibre were probably inadequate for both adults and children. Results of anthropometry studies revealed that the incidence of overweight and obesity in adults was more than 50 percent.

Traditional Gwich'in food holds many cultural attributes, and community members were aware of the healthy, low-fat properties of their food. Women responding to interviews (n = 69) said they would like to have more traditional food if it was easier to get. At the same time many said they could not afford to buy all the food they needed from the stores. The community is poised to engage in an intervention that will make more traditional food available, and improve purchasing habits of higher quality market food.

Introduction

In this report we aim to provide an understanding of the nutritional diversity of food consumed as both traditional and market items and the impact of food on culture and health among the Tetlit Gwich'in of the Northwest Territories (NWT). The Gwich'in people reside in communities in the NWT, northern Yukon Territory and in northern interior Alaska (Gwich'in Council International, 2007). Political organizations represented in Canada are the Dene Nation, the Métis Nation of the NWT and Yukon First Nations. Data reported here are from Gwich'in communities in the NWT (Tsiigehtchic, Aklavik and Tetlit Zheh – originally spelled Teetl'it Zheh) and from Old Crow in the Yukon. Traditional food-systems data from studies in the region conducted with the Dene and Dene/Métis, which include the Gwich'in, are also included to highlight and support basic concepts.

As part of research activities conducted by the Centre for Indigenous Peoples' Nutrition and Environment (CINE), studies with Gwich'in were conducted during the mid-1990s on the benefits and risks of use of Arctic indigenous food. The NWT Gwich'in were part of these studies conducted with 16 communities in the Dene/Métis component of this research that also included Yukon First Nations and Inuit. In early-2000, studies on anthropometry and dietary patterns with Dene/Métis children in three Dene communities in the NWT (including Tetlit Zheh) and two in Yukon (including Old Crow) were conducted. In 2005, the community of Tetlit Zheh engaged in a dietary improvement intervention study to demonstrate benefits of using local Gwich'in cultural food; results of which are intended to apply to Gwich'in communities in the NWT region; young women (20–40 years of age) and youth (10–15 years of age) were the indicator population subsets upon which measures were taken. Throughout all of these studies, documentation was made of traditional Gwich'in food species and their use, and this forms the basis of this report.

The Tetlit Zheh Gwich'in

The Tetlit Zheh Gwich'in community in the NWT was established in 1840 by the Hudson's Bay Company as a trading post to purchase furs from the Gwich'in and Inuvialuit (Inuit). In 1848, the community was moved 6 km down the Peel River to its present location (Figure 3.1) and was named Fort McPherson after the chief trader of the Hudson's Bay Company, Murdoch McPherson. The traditional name for the community is Tetlit Zheh, after the Gwich'in name for the Peel River (Gwich'in Social and Cultural Institute, 2007). A comprehensive land claims agreement was signed in 1992 with the Governments of Canada and the NWT, with administration for all beneficiaries conducted through the Gwich'in Tribal Council, which is based in Inuvik. In Tetlit Zheh there are two local governments: the Tetlit Gwich'in Council and the Fort McPherson Hamlet Council. The Dempster Highway runs through the community connecting to Inuvik in the north and Dawson in the south.

Geography and environment

The Gwich'in are a nation of Athabascan people who maintained a nomadic hunting, fishing and gathering lifestyle until the mid-1800s, after which communities developed around forts and trading posts established by fur traders. Since the 1960s, residents of Tetlit Zheh are settled year round, but still retain knowledge and access to their food system which comprises 75–100 species of animals, fish and plant food species. The climate of the region is "interior Subarctic" with long, cold winters and short, warm summers. The area is covered with Boreal forest and includes some of the delta of the Mackenzie River (early ethnographic accounts have been summarized by Slobodin [1981]).

The Gwich'in closely identify themselves with the Porcupine caribou (*Rangifer tarandus granti*), culturally regarded as the most important food species, seen to be a source of traditional food energy. This population of migratory barren ground caribou ranges across the Yukon, the NWT and the state of Alaska. A photocensus in 1989 estimated the population size as 178 000 (Russell and McNeil, 2005); the current population estimate is between 110 000 and 115 000 (Porcupine Caribou Management Board, 2007). The herd is named after the Porcupine River, which they cross each spring and autumn.

The region is rural (without farming) and very beautiful. Current environment issues of concern to the community in 2006 were the protection of the Porcupine caribou calving grounds, climate change (Russell and McNeil, 2005), environmental pollution, and development of natural resources including a proposed natural gas pipeline and drilling in the Arctic National Wildlife Refuge (Porcupine Caribou Management Board, 2005). Divided perspectives exist on the proposed multi-billion dollar industry of the Mackenzie Gas Project that may offer employment, but would involve far-reaching social, economic and environmental change for the region (Nuttall, 2006).

Demography and community situation

In 2005, there were 823 residents in Tetlit Zheh, with most having aboriginal ancestry, either Tetlit Gwich'in or Métis. Both Gwich'in and English are spoken in Tetlit Zheh. More than 70 percent were 15 years or older and 38 percent had completed high school or higher education. Thirty-four percent of adults 15 years or older were employed. The average family income (2004) was $CAD 62 138, with 33.3 percent of households in the community having less than $CAD 25 000 annually. Cost of living and food costs in market stores in Tetlit Zheh were about 50 percent greater than in cities in southern areas of Canada (NWT Bureau of Statistics, 2005). The primary employment in the community was with the public sector (government, education, policing, highway maintenance, recreation, wellness), and there were two general stores, a hotel-restaurant and gas station, and a canvas-tent manufacturing centre and outlet.

Missionaries established a community school in 1900, which became part of the federal school system in 1946. During much of the twentieth century, education was conducted in residential schools operated by the religious sector. The codes of conduct in these schools for Aboriginal children from Tetlit Zheh were harsh, and many suffered abuse. Community members expressed this abuse as being responsible for high rates of alcohol, tobacco and drug use and abuse, and other social ills such as family violence and criminal activity (Auchterlonie, 2005).

Culture

The traditional diet is based on large animals, primarily caribou and moose, although Dall sheep and bear were also eaten in the past. Small mammals include rabbit, beaver, muskrat, squirrel, porcupine, etc. Fish are important with whitefish, char, trout, loche, and inconnu being most dominant in the traditional diet. Birds include migratory ducks, geese and swan as well as ptarmigan and spruce hen. Plants of several kinds are harvested for food and medicine (Andre and Fehr, 2002; Murray *et al.*, 2005). The Gwich'in have traditional cultural values which require the full use of all edible parts of animals and plants, taking only what is needed, and sharing within the community. Careful attention is given to the protection and preservation of animal and plant species. For example, in spring when migratory birds land, only male birds are harvested. Children are taught these values at an early age and are expected to pass this knowledge to the next generation. Elders are very important in the community and form an Elders' Council who focus on community harmony. They work with issues of language, traditional knowledge and lifestyles.

Volunteer activities support many cultural functions (Auchterlonie, 2005), and provide a means to promote healthy communities. For example, an annual music festival is held in the summer of each year bringing in musicians and local talent, in an alcohol- and drug-free environment. Volunteers contribute organization, meals, beverages, etc., for these carnival festivities and other annual events. Community feasts, canoe races, hockey, curling, and snowshoeing are promoted as family and community events.

Patterns of acculturation for the Gwich'in have progressed steadily since establishment of the community. Today the food system includes both traditional Gwich'in food as well as market food. Dietary studies have shown that the latter contributed the majority of energy for both adults (average of more than 60 percent) and children (over 90 percent) as described in the following sections.

Research methods

Research agreements

Three research agreements have been made with the Tetlit Zheh Gwich'in and CINE. The first agreement was for the project in cooperation with the Dene Nation and the Métis Nation of the Northwest Territories, and negotiated with the community using a format originating with the Dene Nation (Masuzumi and Quirk, 1993). CINE researchers collaborated with the community to conduct the food use and dietary research and to prepare a research report (Receveur *et al.*, 1996). The second agreement was in the context of the children's research project with five Dene communities and followed a similar format with each participating community. The research agreement for the intervention study was prepared only with Tetlit Zheh using the format now universally recognized for its process with participatory research (Sims and Kuhnlein, 2003). For all studies, data were archived at the offices of the Dene Nation in Yellowknife and at CINE, McGill University, in Montreal. The community was provided with research summaries, hard copies and electronic forms of the data.

Research process

Implementation of the first project was conducted in four stages with each of 16 Dene/Métis communities, representing about 18 000 Dene/Métis in the region. Stage I was conducted from May to October 1993, and consisted of community consultation, development of the food list, and pilot projects to test interview instruments. Stage II, conducted in 1994, consisted of interviews (24-hour recalls and traditional food frequency) and food sample collection during two seasons: the season of highest traditional food use (October–November) and the season of lowest traditional food use (March–April). Stage III, conducted in January to September 1995, consisted of data management and analysis, and Stage IV, conducted in October 1995 to September 1996, was the reporting period. Dietary assessment interviews with Gwich'in were conducted in Tetlit Zheh, Tsiigehtchic and Aklavik in 1994. These data provided the Dene and Gwich'in food lists, frequency and seasonality of traditional food use and market food use, perceptions of traditional food and food security, and understanding of dietary adequacy (Kuhnlein *et al.*, 2007; Kuhnlein and Receveur, 2007; Kuhnlein *et al.*, 2004; Lambden and Kuhnlein, 2007; Lambden *et al.*, 2006; Receveur *et al.*, 1997; Receveur *et al.*, 1996).

The second project on children's food use and anthropometry, and factors influencing mothers' food choices for family provisioning, was conducted during two seasons: November 2000–January 2001 and August–October 2001. All children 10–12 years of age (n = 114) and their mothers (n = 69) in five Dene/Métis and Yukon communities (Fort McPherson, Tulita, Fort Resolution, Old Crow and Carcross) were invited and encouraged to participate. Dietary 24-hour recall interviews were conducted and anthropometric measurements were taken. Results were returned to communities by researchers and Gwich'in project assistants in March 2001 (Nakano *et al.*, 2005a; Nakano *et al.*, 2005b).

The third project to develop an intervention to improve nutrition and health with emphasis on locally available traditional food is currently (2006–2009) in process. Baseline data were collected in February 2006, and selected preliminary data are reported here.

Results

Food species diversity in the Gwich'in traditional food system

Within the entire Dene territory 101 species of wildlife animals and plants were found to form the traditional food system (Kuhnlein *et al.*, 2001). Within the Gwich'in area of the Northern NWT, 50 species were noted in frequency interviews (Table 3.1). This food list includes species reported used for all Gwich'in communities, and includes the scientific names, common names and local language names, as well as seasonality in Tetlit Zheh. Animal and fish species dominated the traditional diet, with several parts of the animals being used as food.

Caribou was found to be the most popular traditional food, with barrenland and woodland caribou harvested, as well as moose. Many parts of the large mammals were consumed regularly: flesh, blood, bone marrow, heart, tongue, head, kidney, liver, brain, fat, and stomach, etc. Organs and parts of smaller animals were also consumed in addition to meat: liver, brain, ribs, etc. Of fish, the most popular were whitefish, inconnu, Arctic char, loche and trout. In addition to the fish flesh, other parts consumed included the skin, eggs, intestine, head, liver, and for some species the fins and tail. Birds were also important, and seasonally present. Again, eggs and organ meats were regularly consumed (gizzard, heart, liver, kidney, eggs, etc.) (Receveur *et al.*, 1996). In general, most meats can be stored frozen or dried, with favourite dried foods being caribou, moose and fish. Meats were always cooked with common methods being roasting, boiling, stewing or cooking on a barbeque fire. An exception is the use of raw muktuk of beluga by some community members who may share a heritage with Inuvialuit.

Plants were also important, with berries (including cranberries, blueberries, cloudberries, raspberries, gooseberries, currants, crowberries) very popular in season, and frozen or jarred for use during the winter.

Table 3.1 Gwich'in traditional food

	Scientific name	English / common name	Local name	Seasonality in Tetlit Zheh*
	Land Mammals			
1	*Alces alces*	Moose	dinjik	Fall–Winter (November–March) Summer–Fall (August–September)
2	*Castor canadensis*	Beaver	tsee'	Spring (April–May) Fall–Winter (November–March)
3	*Erethizon dorsatum*	Porcupine	ts'it	Summer–Fall (July–September)
4	*Lepus americanus*	Rabbit, snowshoe hare	geh	Fall–Winter (September–March)
5	*Ondatra zibethicus*	Muskrat	dzan	Spring (March)
6	*Ovis dalli*	Dall sheep	divii	Summer–Fall (August–November)
7	*Rangifer tarandus granti*	Caribou, barrenground	chuu choo vadzaih	Fall–Winter (November–March) Fall (September)
8	*Ursus americanus*	Bear, black	shoh	Summer–Fall (August–September)
9	*Ursus arctos*	Bear, grizzly	shih	Summer–Fall (August–September)
	Fish, Seafood and Sea Mammals			
1	*Coregonus artedii*	Cisco, lake herring	treeluk	Summer–Fall (July–November)
2	*Coregonus clupeaformis*	Whitefish, lake	luk dagaii, luk zheii	Summer–Fall (July–November)
3	*Coregonus nasus*	Whitefish, broad	luk dagaii, luk zheii	Summer–Fall (July–November)
4	*Delphinus leucas*	Whale, beluga	kaleeluk	–
5	*Lota lota*	Loche, burbot	chehluk	Fall (September–November)
6	*Prosopium cylindraceum*	Whitefish, round	luk dagaii, luk zheii	Summer–Fall (July–November)
7	*Salvelinus alpinus*	Arctic char, Arctic salmon	dhik'ii	Summer–Fall (August–November)
8	*Salvelinus namaycush*	Trout, lake	vit	Fall (September)
9	*Stenodus leucichthys*	Inconnu, connie, coney	sruh	Summer–Fall (July–November)
10	*Thymallus arcticus*	Arctic grayling, bluefish	shriijaa	Fall (September–October)
	Birds			
1	*Anas acuta*	Duck, pintail	naak'oh jidigaii	Spring (May–June) Fall (September–October)
2	*Anas americana*	Duck, whistling, American widgeon	–	Spring (May–June) Fall (September–October)
3	*Anas platyrhynchos*	Duck, mallard	neet'aii	Spring (May–June) Fall (September–October)
4	*Aythya valisineria*	Duck, canvasback	entsihyden	Spring (May–June) Fall (September–October)
5	*Branta canadensis*	Goose, Canada	kheh	Spring (May–June) Fall (September–October)
6	*Chen caerulescens*	Goose, snow, wavies	gugeh	Spring (April–May), Fall (September)
7	*Clangula hyemalis*	Duck, squaw, oldsquaw	a'aanlak	–
8	*Cygnus buccinator*	Swan, trumpeter	daazraii	Summer (June) Fall (September)
9	*Cygnus columbianus*	Swan, tundra	daazraii	Summer (June) Fall (September)
10	*Dendragapus canadensis*	Grouse, spruce, spruce partdrige	daih	Jaunuary–December
11	*Lagopus lagopus*	Ptarmigan, willow	daagoo	January–December

Continued

Table 3.1 *(continued)* **Gwich'in traditional food**

	Scientific name	*English / common name*	*Local name*	*Seasonality in Tetlit Zheh**
12	*Lagopus mutus*	Ptarmigan, rock	daagoo	January–December
13	*Melanitta fusca*	Duck, black, scoter, white-winged	njaa	Summer (June–July), Fall (October)
14	*Melanitta perspicillata*	Duck, black, scoter, surf	deetree'aa	Summer (June–July), Fall (October)
15	*Mergus merganser*	Merganser, common	–	–
16	*Mergus serrator*	Merganser, red–breasted	–	–
	Plants & Berries			
1	*Empetrum nigrum*	Blackberry	dineech'uh	Summer (July–August)
2	*Ledum groenlandicum; L. palustre*	Labrador tea	lidu muskit	January–December
3	*Polygonum alaskum*	Wild rhubarb	tsii'gyuu	Summer (June)
4	*Rheum rhaponticum*	Wild rhubarb	tsii'gyuu	Summer (June)
5	*Rubus idaeus*	Raspberry	ts'au nakal'	Summer (July–August)
6	*Ribes hudsonianum*	Currant, black	deetree' ják	Summer (July–August)
7	*Ribes oxyacanthoides*	Gooseberry, Canada, green	–	–
8	*Ribes triste*	Currant, red	nee'uu	Summer (July–August)
9	*Rosa acicularis*	Rosehip	nichih	Summer–Fall (August–September)
10	*Rubus chamaemorus*	Cloudberry, knuckleberry	nakal	Summer (July–August)
11	*Vaccinium membranaceum*	Blueberry, high	jak naalyuu	Summer (July–August)
12	*Vaccinium myrtilloides*	Blueberry, low	jak zheii	–
13	*Vaccinium oxycoccus*	Cranberry, bog	natl'at	Fall (September)
14	*Vaccinium vitis-idaea*	Cranberry, lowbush	natl'at	Fall (September)
15	*Viburnum edule*	Cranberry, highbush	natl'at	Fall (September)

– No data.
* List obtained from the Dene/Métis survey (Receveur *et al.*, 1996) of adults in three Gwich'in communities: Tetlit Zheh, Tsiigehtchic and Aklavik. Data from Tetlit Zheh were collected in autumn, 1994.

Berries can be included in muffins, cakes or made into jelly or syrup; they can also be mashed and pounded with meat or fish into pemmican. Murray *et al.* (2005) estimated 7 670 litres of the most common berries (cloudberries, blueberries, currants) were harvested by Tetlit Zheh households in the summer of 2000. Labrador tea (muskeg tea) can be harvested during most of the year, with tea being made from the leaves, stems, and flowers (in spring). For a complete list of berries and other plants used by the Gwich'in, refer to Andre and Fehr (2002).

Several unique Gwich'in foods and their preparation techniques are presented with nutrient composition data in Table 3.2. Sample sizes and variance in values are found in the published papers presented in the footnotes. It is clear that the diversity of species and their organs and other parts created a highly nutritious traditional diet. When combining these highly nutritious foods with the physical effort needed for traditional food harvest, processing and cooking, the Gwich'in have the potential to be very healthy people.

Contemporary traditional food contributions to daily dietary nutrients

Of all 16 Dene/Métis communities where adult recalls were taken, Tetlit Zheh had the highest community average of daily energy supplied by traditional food (33 percent) (Receveur *et al.*, 1997) – often large daily portions (up to 600 g) of wildlife were consumed by individuals. In the children's survey, the Gwich'in

Table 3.2 Nutrient composition of Gwich'in traditional food

Food Items	Moisture	Energy		Protein	Fat	CHO	Ash	PUFA	Omega 3	Vitamin A RAE	Vitamin D	Vitamin E	Vitamin C	Folate	Calcium	Iron	Zinc
	g	kcal	kJ	g	g	g	g	g	g	µg	µg	mg	mg	µg	mg	mg	mg
Land Mammals																	
Caribou, bone marrow, cooked[a,b]	49.2	404	1689	8.9	40.9	0.0	0.98	0.99†	0.33†	142	bdl†	bdl	0.00c	4.95	6.10	6.90	0.98
Caribou, fat, cooked*	12.7†	757	3164	4.0†	82.3†	0.1†	0.04†	1.32†	0.77†	31.9†	3.20†	0.68†	0.00c	0.00†	4.47†	1.74†	0.36†
Caribou, flesh, baked[b,e,f,h]	65.6	142	594	30.1	2.4	0.0	1.29	0.51	0.14	bdl	bdl†	0.54†	0.55†	4.95†	5.40	4.59	5.69
Caribou, flesh, dried[a,b,e,f,g,h,i]	28.5	293	1225	60.8	4.9	1.1	2.62	0.68	0.11	3.67	bdl†	0.35	0.50†	9.50†	14.6	11.2	9.02
Caribou, heart, boiled[a,b]	66.7	145	606	28.3	3.6	0.0	1.46	0.55†	0.11†	8.88	1.10†	0.34	1.76†	4.29†	5.28	8.80	2.31
Caribou, kidney, cooked[c,j]	65.1	181	757	24.6	9.2	0.0	1.11	1.78	0.15	106	0.88†	0.09	7.24	81.7	12.2	5.50	3.89
Caribou, liver, baked[a,e,f,h,j]	65.5	150	627	24.6	3.5	5.0	1.54	0.77	0.22	24689	1.10†	19.8	23.2†	231†	4.40	35.9	4.84
Moose, blood, raw[e,f,h]	79	92	385	21.0	0.5	0.0	0.81	bdl	0.00	bdl	0.00c	0.15†	0.98†	11.8†	2.10	62.0	0.20
Moose, flesh, baked[b,e,f,h]	60	167	698	35.9	1.5	1.0	0.41	0.33	0.10	0.00	0.00†	0.55†	0.55†	4.95†	4.18	4.07	7.48
Muskrat, flesh, raw[e,f,h]	68	139	581	25.2	4.2	0.0	1.15	1.65	0.77	bdl	0.00c	0.79†	3.00†	14.7†	20.0	10.8	2.56
Rabbit, flesh, boiled[a,b,e,f,h,j]	66.9	141	589	29.5	2.4	0.3	0.99	0.64	0.04	12.3	0.00c	0.89	0.00†	8.90	35.0	5.72	2.75
Fish, Seafood and Sea Mammals																	
Arctic char, flesh, boiled[g,i]	69	151	631	26.1	5.2	0.0	1.69	1.32	1.10	88.5	26.8†	0.22†	0.90†	43.2†	30.0	0.49	0.63
Inconnu, flesh, baked[e,f,h]	74	117	489	22.0	3.2	0.0	1.20	0.77	0.55	0.00	13.4†	0.22	0.90†	43.2†	20.0	0.40	0.40
Inconnu, flesh, smoked/dried[e,f,h]	18	408	1705	57.0	20.0	0.0	3.20	2.45	2.00	76.0	10.4†	2.858†	0.00†	21.9†	40.0	4.00	1.00
Loche, flesh, baked[e,f,h]	76	97	405	22.0	1.0	0.0	1.10	0.43	0.33	8.00	0.44	0.0	0.00†	1.00†	35.0	0.55	0.77
Loche, liver, baked[e,f,h]	38	459	1919	12.0	43.0	6.1	1.30	4.40†	2.97†	3000	331†	0.66†	8.70†	1.00†	2.60	1.60	1.32
Trout, lake, flesh, cooked[e,f,h]	70	146	610	22.2	5.9	0.5	0.90	0.63	0.50	61.0	20.5†	0.17†	1.80†	43.2†	22.2	0.64	0.60
Whitefish, eggs, baked[e,f,h]	50.6	269	1124	25.6	15.7	6.4	1.69	3.19	2.42	bdl	11.3†	3.52†	49.6†	187†	39.1	1.65	3.96
Whitefish, flesh, baked[b,e,f,h]	72.6	126	527	22.4	4.0	0.4	1.04	0.77	0.45	8.6	2.80†	1.76†	2.15†	2.75†	14.3	0.33	0.44
Whitefish, flesh, smoked/dried[e,f,h,i]	14.9	385	1609	67.0	13.0	0.0	4.00	1.43	0.88	19.0	10.45	2.86†	0.00	21.9	61.3	2.53	1.43

Continued

Table 3.2 *(continued)* Nutrient composition of Gwich'in traditional food

Food Items	*Moisture*	*Energy*		*Protein*	*Fat*	*CHO*	*Ash*	*PUFA*	*Omega 3*	*Vitamin A RAE*	*Vitamin D*	*Vitamin E*	*Vitamin C*	*Folate*	*Calcium*	*Iron*	*Zinc*
	g	*kcal*	*kJ*	*g*	*g*	*g*	*g*	*g*	*g*	*µg*	*µg*	*mg*	*mg*	*µg*	*mg*	*mg*	*mg*
Birds																	
Duck, flesh, boiled[a,b,f,g,h,i]	63	151	631	28.5	3.0	0.6	–	0.63	0.55	26.39	0.00c	0.12	1.27	25.8	50.8	10.61	2.85
Goose, Canada, flesh, boiled[d]	52.4	236	986	33.9	11.2	0.0	0.70	1.54	0.11	31.0†	0.00†	1.43	1.27†	25.9	6.09	9.03	3.96
Swan, flesh, cooked*	63†	180†	752	30.1†	5.7†	0.0†	1.00†	0.77†	0.33†	0.00†	0.00†	0.11†	0.11†	19.8†	6.05†	8.03†	2.53†
Berries																	
Blackberries, raw[b,c,e,g,,j,i]	87.6	57	238	0.4	1.0	11.6	0.26	0.05	0.03	11.0†	0.00c	1.17†	2.41	0.00	5.54	0.25	0.08
Blueberries, raw[b,c,e,j]	85	62	259	0.7	1.0	13.0	0.25	0.05†	0.03†	3.00†	0.00c	0.57†	26.2	42.5	15.0	0.32	0.22
Cloudberries, raw[e,h,j]	84	50	209	2.0	1.0	9.5	0.51	0.00	0.00	3.00†	0.00c	1.20†	130†	19.5†	16.2	0.41	39.1
Cranberries, raw[b,c,e,j]	83	74	309	0.7	1.2	15.2	0.31	0.0†	0.0†	3.00†	0.00c	1.21†	3.88	19.5	17.2	0.33	0.22

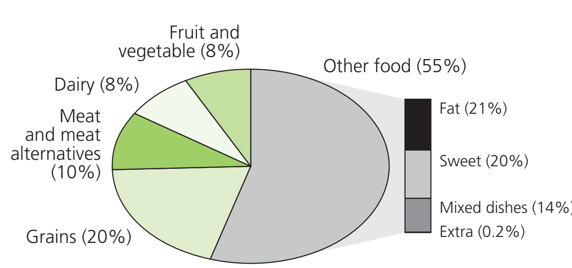
a Kuhnlein, H.V. *et al.* 2006.
b Kuhnlein, H.V. *et al.* 2002.
c Fediuk, K. *et al.* 2002.
d Belinski, D. L. & Kuhnlein, H.V. 2000.
e Kuhnlein, H.V. *et al.* 1994.
f Morrison, N. & Kuhnlein, H.V. 1993.
g Kuhnlein, H.V. & Soueida, R. 1992.
h Appavoo, D. *et al.* 1991.
i Kuhnlein, H.V. *et al.* 1991.
* All values substituted by one other food item.
† Imputed value from similar tissue or literature.
bdl Below detection limit.
– No data.

Table 3.3 Twenty most consumed market foods as identified by 24-hour recalls in the Dene/Métis and food choice surveys, Gwich'in communities only

D/M survey, adults only (195 recalls)	*Average grams/day*	*FC survey, children only/ 10 to 12yrs (222 recalls)*	*Average grams/day*
Coffee, brewed	816	Powdered drinks (fortified and non-fortified)	193
Tea, brewed	622	Soft drinks	121
Powdered drinks	135	Milk, 2% fat	98
Potatoes	71	Fruit drinks	32
Soup, chicken noodle	65	Soup, chicken noodle	30
Soft drinks	55	Macaroni/cheese	26
Bread, white	52	Bread, white	21
Milk, 2% fat	42	Potatoes	19
Rice	41	Spaghetti in tomato sauce w/cheese	16
Macaroni/cheese	41	Orange juice canned	15
Bannock	36	Pizza	15
Oats	32	Oats	15
Sugar	31	French fries	14
Eggs	31	Chicken	13
Soup, tomato	28	Tea, brewed	13
Chicken	26	Orange juice, frozen	13
Spaghetti	22	Spaghetti w/meatballs and tomato sauce	11
Beef hamburger	20	Apple	11
Fruit drinks	19	Soup, vegetable beef	11
Soup, vegetable beef	18	Hotdogs	11

communities of Old Crow and Tetlit Zheh had the highest community averages of traditional food use (10.7 percent and 5.9 percent, respectively) (Nakano *et al.*, 2005b). Analysis of adult diets from Gwich'in communities showed that caribou (various parts) was the most important food source of daily energy, protein, vitamin A, iron, and zinc, and within the top ten contributors of fatty acids (saturated and unsaturated). Although children's diets had much less traditional food as a percentage of daily energy, caribou was still within the top ten contributors to intake of energy, protein, iron and zinc. In considering food contributions to energy from the 24 hour data, the majority of energy was provided by market food. More detailed observation of the types of market food consumed by adults in Tetlit Zheh, Tsiigehtchic and Aklavik (n = 195 recalls) during the 1994 research, and of all Dene/Métis children in the 2000/–2001 survey (n = 222 recalls), showed the kinds of market food contributing to dietary energy for both men and women (Table 3.3). The top 20 frequently consumed foods were highly processed and least-cost foods, with major emphasis on sugars and carbohydrates.

Figure 3.2 Market food (MF) groups as percent of total energy from MF consumed by Dene/Métis and Yukon children *(n = 222)*



Source: Nakano *et al.*, 2005b.

Further analysis of Dene/Métis children's diets showed more than 40 percent of energy being contributed by fat and sweet foods (Figure 3.2). High intakes of sucrose (18–19 percent of energy) and total sugars (25–26 percent of energy) were contributed by sugar added to beverages, powdered drinks, commercial cereals, commercial cakes, fruit drinks, cookies, candy and other sweets. It is therefore clear that use of market food in large measure decreases nutrient density of Gwich'in diets and especially that of children. Nevertheless, use of traditional, cultural foods ensured that both adults and children have adequate intakes of protein, iron, zinc, copper and vitamin B_6. In contrast, contemporary intakes of calcium, vitamin D, vitamin A, vitamin E, magnesium, and fibre were limited and probably inadequate (Kuhnlein*et al.*, 2006; Kuhnlein *et al.*, 2007; Nakano *et al.*, 2005a, 2005b).

Cultural attributes of traditional food

Exploring the cultural attributes of Gwich'in traditional food took place during all three surveys. In the 1993–1994 study of adults, a series of interview questions addressed agreement on whether harvesting and using traditional food by the family contributed important cultural attributes. More than 85 percent (n = 59) of Gwich'in respondents agreed that these practices around traditional food provided physical fitness and good health, favourite outdoor recreation, healthy food, as well as keeping people "in tune with" nature, favours sharing in the community, saves money, is an essential part of culture, is a way for adults to display responsibility for children, brings respect from others, builds pride and confidence, provides education on the natural environment, contributes to children's education, provides survival skills, provides food-preparation skills, and is an opportunity for children to learn patience and other personality qualities (Kuhnlein *et al.*, 2001). Further, adults were well aware of the healthy, low-fat qualities of their traditional food, and that it was fresh and additive/pesticide free while being of comparatively low cost. Adults also recognized that the purchase of market food was convenient and provided variety to the diet (Lambden *et al.*, 2006).

During the study of children in 2000–2001, mothers (n = 69) were asked for their reasons for selecting traditional and market foods for the family. The most frequent responses for selecting traditional food were that it was considered healthier than store-bought meat, it tastes better and it is less expensive. Mothers also responded that they would serve more traditional food if it was easier to get, and if they were less concerned about environmental contaminants. The major barriers to having more traditional food were the time and costs for hunting, fishing and gathering, but that having a hunter/fisher in the family, and sharing with family and friends, all help in having traditional food. Regarding women's perceptions of why children eat less wild meats and fish than adults, replies centred on the fact that children spend more time in town, and both women and children have less opportunity to harvest and prepare traditional food.

Infant-feeding practices

At the time of this study, breastfeeding was promoted and in practice by about 70 percent of mothers of infants in Tetlit Zheh (Tena Blake, personal communication, 2007). Formerly, breastfeeding was exclusive during infancy with first introduced foods being meat-based. Examples of these foods are meat and fish broth, pre-masticated meat and fish and other table food. Teething aids were bones (ribs) of mammals, rabbit, and other animals (McDonald and Vittrekwa, personal communication, 2006).

Anthropometry

Results from anthropometry of children from the five Dene/Métis communities during the children's study in 2000–2001 showed that there are few underweight children in the sample (Table 3.4). All children in the 10–12 year age range were invited to the study, and most children were measured in both seasons. Results showed that over half the children were normal weight, and about one-third were either overweight or obese (Nakano *et al.*, 2005a). Preliminary results from women's (n = 45) anthropometry data in 2006 showed 33 percent

Table 3.4 Percentage of Dene/Métis and Yukon children in underweight[1], normal weight[2], risk of overweight[3] and overweight[4] categories of the 2000 CDC Growth Charts

	Season 1 (n=102)			*Season 2 (n=114)*		
	Girls (n=62)	*Boys (n=40)*	*Total (n=102)*	*Girls (n=63)*	*Boys (n=51)*	*Total (n=114)*
Underweight	2	3	2	2	2	2
Normal weight	65	70	67	65	71	68
Risk of overweight	16	8	13	16	10	13
Overweight	18	20	19	18	18	18

1 BMI for age < 5th percentile
2 5th ≤ BMI-for-age < 85th percentile
3 95th > BMI-for-age ≥ 85th percentile
4 BMI for age ≥ 95th percentile
Season 1 = November–January; Season 2 = August–October; most children from season 1 participated in season 2.

as overweight (BMI 26–30) and 47 percent obese (BMI >30). The extent of those overweight and obese children and adults leads to concerns for diseases associated with the nutrition transition – obesity, diabetes, heart disease and certain kinds of cancer – and is one focus of the need for change during the planned intervention.

Food security

A cross-sectional survey of Yukon First Nations, Dene/Métis and Inuit used socio-cultural questionnaires to evaluate women's access to traditional and market foods. In all three regions, including the subset of Gwich'in women, women's food security was found to be affected by affordability of market food and accessibility to hunting and fishing (Lambden *et al.*, 2006). The percentage of respondents who could not afford to buy all their food from the store in Tetlit Zheh was 86 percent (Receveur *et al.*, 1996).

Outlook

Project activities in the intervention with the Tetlit Zheh community have been ongoing or planned subsequent to baseline measures of diet and overall health (January–March 2006). Strategies focus on healthy eating and healthy physical activity. A Gwich'in recipe book based on local foods is being developed using recipes gathered from members of the community. Activities to encourage healthy eating in school-aged children have included the "Drop the Pop NWT Challenge" (Department of Health and Social Services, 2007), where students were challenged to stop drinking pop (carbonated soft drink) for five days, a field trip to pick edible plants, a community fish cookout that encouraged different methods of fish preparation and promotion of the benefits of eating traditional food at an annual health fair. A physical activity programme for women in the community includes group walking in the evenings and courses given by the school physical education teacher. Other activities will be planned with community leaders based on the findings from the studies reported here for implementation during the two-year project.

Throughout food-use research with Dene adults and children, and specifically with the Gwich'in, it is clear that traditional food is critically important to maintain dietary quality and that community members recognize that it is important to make more traditional food available for all families. This will not only improve dietary quality, but also enhance food security and cultural continuity. It is also recognized that improving availability and access to high-quality market food will contribute to positive dietary intakes, and that attention to positive lifestyle and health habits should be fostered to reverse the current trends in overweight and obesity ●

Acknowledgements

We recognize the many researchers' contributions to the overall research with Dene/Métis communities.

Team members 1994–1996

For this first study with Dene/Métis, Olivier Receveur, Université de Montréal, Département de Nutrition (formerly of McGill University, Centre for Indigenous Peoples' Nutrition and Environment [CINE]) was the overall data collection supervisor. Marjolaine Boulay, McGill University, was CINE's data and statistical assistant, William Carpenter, Métis Nation (Northwest Territories) was the Environment Manager, and Carole Mills, The Dene Nation, Lands and Environment Department facilitated local arrangements. This project was successful thanks to the support and hard work of community members, staff and volunteers at Dene Community Councils, the Dene

Nation and CINE. The participants of the methodology development workshop that finalized the study design included Charlie Furlong, Roy Doolittle, Mary Lafferty, Pat Larocque, Violet Beaulieu, Martie Kunnizie, Bella T'Seleie, Don Antoine, Antoine Michel, and Barney Masuzumi. Members of the Tetlit Zheh Community Council that supported implementation of the project were Chief Joe Charlie and Richard Wilson. The project coordinator was Laurie Chapman and interviewer was Patricia Stewart. Funding for this project was provided by the Arctic Environmental Strategy (AES), Department of Indian Affairs and Northern Development (DIAND), Hull, Quebec.

Team members 2000–2001

There were several contributors to the second study with children, which was funded by the Northern Contaminants Program of DIAND. Initial arrangements for the five Dene communities were made by Karen Fediuk and Norma Kassi. Within Tetlit Zheh, process and arrangements were facilitated by Liz Wright and Sharon Snowshoe. Data entry was completed by Karen Fediuk and analysis completed by Tomoko Nakano and Rula Soueida at CINE.

Team members 2006

The research, which began in 2006 for this case study, included several community members and researchers. Funding, provided by the Canadian Institutes of Health Research (Institutes of Aboriginal Peoples' Health and Nutrition, Metabolism and Diabetes), was awarded to Harriet Kuhnlein, Olivier Receveur, Laurie Chan and Bill Erasmus. The community contacts for the Council at the time of submitting the proposal were Sharon Snowshoe and Hazel Nerysoo. Those responsible for the project in the Tetlit Zheh community were Margaret McDonald, Elizabeth Vittrekwa, Rhonda Francis and other colleagues in the Tl'oondih Healing Society and in the community. Data preparation for the study, and for this report, was guided by Dina Spigelski, Rula Soueida, Lisa Elvidge, Jill Lambden, Lauren Goodman and Nelofar Athar Sheikh.

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Chapter 4

Traditional food system of an Awajun community in Peru

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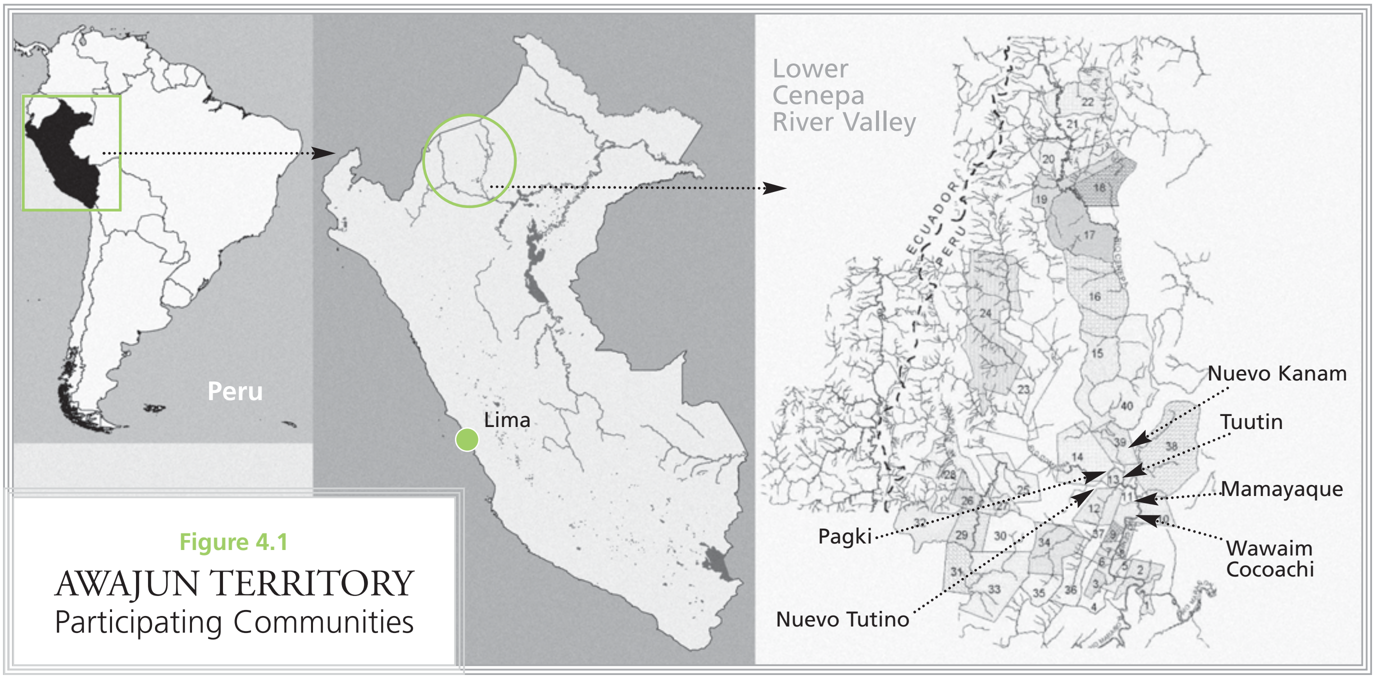

Figure 4.1
AWAJUN TERRITORY
Participating Communities

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.
With addtion from
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Photographic section >> XII

“Ina yutai namakia ajatmay, sinchn sukagtawai nantsaptin ekantawai.”

“With our foods from the wild, the river and our fields we are strong and alert.”

Awajun saying

Abstract

The traditional food system of the Awajun population of Bajo Cenepa in the Peruvian Amazon is described in this chapter, using a variety of quantitative and qualitative participatory techniques. A wide diversity of food exists – a total of 223 are listed. However, the availability of several of these foods has diminished in recent decades due to changes in community living, farming, hunting and collecting patterns. Scientific identification and nutrient composition data for these foods were found for 82 foods, but such information was not available for the remaining indigenous foods.

Most foods included in this research were produced, collected, hunted or fished locally. Only 12 of the foods listed were purchased from outside of the area, and seven foods were available through government donation programmes. Most foods identified in this study were prepared by boiling, roasting and smoking. Dietary energy intake, evaluated by 24-hour dietary-evaluation recall, appeared to be adequate; the major sources of energy were cassava and banana. Intake of animal source foods, particularly meat and fish, were generally low and infrequent and depended on seasonal availability.

Thus, micronutrient intakes, especially from high bio-available sources of iron (meat and fish products), were low for children. The consumption of vegetables, seeds and fruits was varied and seasonal. Infectious diseases and parasites were predominant health problems and there was a high prevalence of stunting among children. Thirty-four foods, potentially rich micronutrient sources, were selected for further study of their potential promotion in dietary interventions. Mothers’ perceptions of these foods were mostly favourable. The information obtained through this study was developed for application to interventions focusing on increased production, knowledge and use of these traditional foods to enhance the health, nutrition and culture of the population.

Introduction

In Peru there are 45 Indigenous Peoples in the Amazon rain forest, comprising a total population of around 300 000 Peruvians (Peru, Ministerio de Salud, Oficina General de Epidemiología, 2003). Although information regarding the nutrition and health situation of these various peoples is scarce, that which is available indicates that 50 percent die before reaching 40 years old and 25 percent before reaching 9 years. Rates of illiteracy (25–45 percent) and fecundity (7.9 children per woman) are high, as well as infant and maternal morbidity and mortality, parasitosis, malnutrition and anaemia (Peru, Ministerio de Salud, Oficina General de Epidemiología, 2002; Peru, Instituto Nacional de Estadística e Informática, 2005).

One of the most important of these Indigenous Peoples is the Awajun, comprised of more than 45 100 inhabitants and living principally in the Department of Amazonas (Peru, Instituto Nacional de Estadística e Informática, 1993). A recent study of the Awajun population described prevalences of chronic malnutrition at 33.4 percent, anaemia at 77 percent in children under three years, and prevalence of anaemia at 50 percent in women of fertile age (Huamán-Espino and Valladares, 2006); the highest prevalences were found in the population of Cenepa. Reasons for this situation have been attributed to the changing ecological, cultural and food systems in that part of Peru (Huamán-Espino, 2006).

The purpose of this study is to describe the traditional food system of the Awajun population of Bajo Cenepa of the Amazon rain forest of Peru, through the application of the guidelines developed by the Centre for Indigenous Peoples' Nutrition and Environment (CINE) to document traditional food systems of Indigenous Peoples. This assessment was designed to provide essential information to help understand the nutrition and food system of the population with the objective of finding ways to design appropriate food-based interventions to improve micronutrient nutrition in the community. The procedure involved a number of steps using a variety of participatory research methodologies with the community.

Overall description of Cenepa and the Awajun

Geographic location

The Awajun people are indigenous to the tropical rain forest of the Amazon in north-east Peru, residing along the Upper Marañon river and most of its tributaries, at elevations ranging 200–2 000 metres above sea level (Figure 4.1). While the precise geographic limits of the rain forest's extension are not known, it may encompass as much as 22 000 km^2, stretching from the eastern boundary of the river Santiago to the Cordillera del Cóndor to the west, the Pongo de Maseriche to the south, and almost to the Peru-Ecuadorian border to the north (Berlin and Markell, 1977). The district of Cenepa extends from the mouth of the Cenepa River where it joins the Marañón, between the cordilleras (mountain ranges) to the frontier with Ecuador. The source of the Cenepa river is in the Cordillera del Cóndor and extends for a length of 185 km (AECI *et al.*, 2000). In the last two decades the frontier conflicts between Peru and Ecuador have affected the lives of many of the local communities.

This area is known as "high jungle" (*seja de selva*), it is covered by dense rain forest vegetation and the climate is tropical. The annual rainfall is around 3 000 mm, the maximum is during March to April and the minimum is in December to January, humidity is 91 percent. The average annual temperature is 26 °C (AECI *et al.*, 2000), while the maximum rises to around 40 °C and minimum to 15 °C.

Demographic characteristics

Traditionally the Awajun lived in widely dispersed hamlets, each consisting of several related households. At the time of this study the majority resided in communities on or near the major rivers of the region. In the 1950s, the Peruvian government coordinated with Jesuit and Protestant missionaries to build schools and missions in the Upper Marañon. Subsequently, many new Awajun communities formed near these schools (Berlin and Markell, 1977). The Jesuits brought the Catholic religion to the Awajun, and in the twentieth century Protestant, and more recently Evangelical, denominations have been introduced.

The district of Cenepa was created by law in September 1941, and in 2000 had an estimated population of 8 000 inhabitants, with a density of 1.5 inhabitants/km^2 (AECI *et al.*, 2000). There are three principal areas: Low Cenepa, Middle Cenepa and High Cenepa with a total of 52 communities. Most of the population settled in the Low and Middle Cenepa. It is the only district in all the Alto Marañón without colonial settlements from other parts of Peru. The present study was conducted with the Awajun communities living on the river in Low Cenepa (Bajo Cenepa).

The population of Cenepa was Awajun with the exception of the district capital Huampami, where 15 percent of the population was of mixed race (*mestizo*). Several public institutions including the district municipality, governor, justice of the peace, police, a health centre and primary and secondary school were located in Huampami.

The economic activity of the Awajun of Cenepa was mostly subsistence farming, hunting and fishing (Ramos Calderon, 1999). The Awajun generally did not sell their produce, which was, for the most part, produced for their families and communities. The few who had cash primarily worked with local organizations or had their own small shops, although collecting gold has been a more recent source of income. Money that was obtained was mostly spent on wood for their housing, medicines, clothes or cooking saucepans.

The principal network of transportation was by river and the feasibility of transport depended on the volume of water in the river. At times of low tides, boats could not enter the river and the small canoes floated with difficulty; when the water level was high it was often dangerous to navigate. The high cost of fuel posed limitations. Cenepa did not have direct access to any of the highways that link the Alto Marañon to the rest of the country. Communication between communities was also on foot along narrow and steep trails (AECI *et al.*, 2000). Thus, the communities within Cenepa were limited in their connections within the locality, the rest of the province and the outside world. Some communities had a radiophone service and a few had a public telephone, but the service had limited access. The Spanish-speaking radio broadcasting stations of Ecuador and Colombia covered this area and their stronger signals often blocked the scarce transmissions from Peruvian radio broadcasts.

The river and streams were the main sources of water for the population. There was no potable water treatment service in the district; in Huampami there was a water network installed but the water was untreated. There was no sewage system. Rubbish was thrown into the river and faeces elimination was in the open vegetation, or more recently, by use of latrines installed during the last decade by a government agency for development. People washed in the rivers or gorges. *Masato* (fermented cassava) was the most common drink, although when water was drunk it was usually taken directly from the rivers and streams.

There was no electricity in the communities. Only the district capital had electricity, limited to a few hours per day but with frequent interruptions, because of lack of fuel and capacity to support a sustainable service. Generators were present in a few of the communities, primarily used to power radio communication.

Cultural characteristics

Linguistically, the Awajun are one of the four large tribes of the Jivaroan family (Shell and Wise, 1971; Guallart, 1964). They are the largest indigenous population in Peru.

In the Alto Marañón region, Cenepa rates third for its agricultural and forestry potential. This comprises 16 000 hectares for farming and 131 000 hectares available for forestry. At the time of this study, it was estimated that 22 percent of the agricultural potential was being used. In general, the land is agriculturally poor, aggravated by the frequent erosion to which the area is exposed. The physical geographic characteristics also make any interventions difficult. According to the Farming Census of 1994 only 4 percent of land was used for agrarian farming; 95.5 percent was *monte* (wild land) and forest.

Ownership of the land by different extended Awajun families resulted from their occupation of it for numerous generations – sometimes it was obtained peacefully, while at others it came into their possession (as trophies of war) because of conflicts with neighbours. The Awajun are not traditionally sedentary agrarian, but semi-nomadic with economic activities consisting of collecting, hunting, fishing, extraction of wood and resin in small quantities and agricultural activities by clearing. This explains many of the local customs and the search for an ecological balance which leads to periodic migrations to prevent the extinction of hunting and fishing activities and the depletion of the land used for agriculture.

A population centre of the Awajun traditionally comprised several nuclear families related to each other, in a semi-dispersed pattern with houses next to cultivated fields, yet relatively near to each other. These families extended as the daughters married and their new husbands came to live on the lands occupied by his wife's family. In recent times there has been a tendency for several extended families to group together. The family structure was primarily patriarchal, where the man was the principal authority.

In 2000, 99 percent of the houses were built with local material, mostly wood with palm leaf roof, although corrugated iron usage was becoming more common. A house generally consisted of a single rectangular room with a very limited amount of furniture, with small stools and benches used for sitting. At one end of the room was the kitchen, although some families cooked in a separate area (AECI *et al.*, 2000).

The traditional dress of the men is the *Itiak* (men's skirt), but at the time of the study few men used this: the general tendency was to use western clothing, such as trousers and shirts. The women used the *Tarachi*, generally of garnet or blue in colour and traditionally made with cotton fabrics and woven on a traditional loom. The tendency was to use dresses made of tocuyo (a purchased linen-type cloth). The women adorned themselves with bracelets, necklaces and belts, made from seeds, monkey teeth, small snail shells, feathers and bird beaks.

The Awajun Apu, or Chief, holds the maximum authority in the community, accompanied by the Vice Apu, and two other members, each elected by the community assembly. This assembly, according to the Peruvian Constitution, has autonomy and can apply justice. In the assembly all members including the women must agree when making a decision. At the district level the authorities are the mayor, lieutenant governor and justices of the peace. In only one community was there a notary clerk responsible for registering births.

The primary school curriculum was bilingual. However, the education level was deficient, primarily because of the inadequate training, high turnover of teachers and low salaries. The education infrastructure was precarious with a lack of general educational material, and that which did exist was not adapted to the local context. For instance, there was no educational content relating to their local and traditional foods – in terms of their production, nutritional or cultural roles. Although most of the boys attended primary school, many of the girls did not and very few went to secondary school: hence, the high prevalence of women who were unable to read and write.

Overall health and nutrition status at the time of the study

National data in 2001 reported 25.5 percent of children in Peru under five years of age was stunted, although the prevalence of acute malnutrition was low (Instituto Nacional de Estadistica e Informatica, 2001). However, the nutritional status of children in the rain forest areas was poorer than the national average. Thirty-six percent of children under five years in the Department of Amazonas, including both indigenous and mestizo (mixed) populations, was stunted (Instituto Nacional de Estadistica e Informatica, 2001). Further, 42 percent of children suffered from anaemia, probably owing to low iron intakes and high parasitic load (a nutritional situation similar to that described by Huamán-Espino and Valladares [2006] for the Awajun).

In the Awajun culture there are many taboos affecting women, especially during pregnancy. A pregnant woman tends not to identify her pregnancy because she fears the transmission of bad spirits and believes these may interfere with her pregnancy. The husband attends childbirth and there is a fear that bad spirits may enter the women if another person is present. It is believed that when a woman is menstruating she should not participate in the activities of sowing seeds or fishing.

The most prevalent health problems in the district were shown to include skin infections, poisoning from serpents, helminth infection, intestinal and respiratory infections, mycosis, women's reproductive health problems, as well as suicides and accidents, among others (Instituto Nacional de Salud, Ministerio de Salud, 2000). Medicines provided by the health posts, local shops and medicinal plants are used for treating illness.

In Cenepa, there was a health centre in Huampami serving 1 721 people (20 percent of the population of the district) at the time of this study. Additionally, there were health posts in 14 of the communities. In general terms, the situation of the health sector in the district was deficient, because of both the precarious infrastructure and inadequate implementation of the health posts. The lack of technical and medical personnel, no remuneration for health promoters and the long distances and difficulties of access to the different communities aggravated this situation. Programmes offered in the principal health centre of Huampami included immunization, treatment of diarrhoea and respiratory infections, a growth and development monitoring programme, oral health, food and nutrition, family planning, perinatal health, malaria and tuberculosis control. Parallel to the government health sector, health care was provided by missionary nuns who served community-administered first aid units in 32 communities, with training for health promoters and medicines sold through a government programme.

Vaccination campaigns, carried out by house-to-house visits, using vaccines provided by the Ministry of Health were conducted by health promoters or the health technician responsible for the local health post. The vaccines given include BCG, polio, DPT, measles, tetanus, rabies and yellow fever. However, the percentage of children between 18 and 29 months who received all their vaccines in the Department of Amazonas was 53 percent, one of the lowest of the country at that time (Instituto Nacional de Estadistica e Informatica, 2001).

As well as the health networks the parallel practice of seeking empirical healers and witchcraft was important to locals, especially for serious diseases.

Methodology

The project was presented initially to the authorities of Organización de Desarrollo de las Comunidades Fronterizas de Cenepa (ODECOFROC) and was approved by the Ethics Committee of the Instituto de Investigación Nutricional, Lima, and the Research Ethics Board of McGill University, Canada. A research agreement was made between the research institutions and ODECOFROC and signed by all parties. The project objectives and participatory methodologies were presented to, and agreements obtained from, each of the participating village assemblies before starting – these placed emphasis on those aspects in which the communities had particular interest, namely further knowledge of their foods, and respecting the limits of the study requested by some communities. Each person interviewed during the course of the study gave prior verbal consent, as did all people photographed.

The study was conducted in six communities in Bajo Cenepa (Table 4.1).

A total of 20 multidisciplinary researchers and assistants, from the four participating institutions and the communities, participated in the fieldwork conducted from February to May 2004. The data collectors were trained and standardized in the research methods using the CINE Manual (Kuhnlein *et al.*, 2006) over a period of two weeks. All interviews were conducted with the assistance of two male translators and one female translator (Awajun-Spanish) who participated in the training process.

Table 4.1 Total population of the participating communities

Community	*Approx No. Inhabitants*	*No. families*
Mamayaque	350	65
Tuutin	350	61
Cocoachi (annex of Wawaim)	638	101
Nuevo Kanam	217	47
Pagki	60	10
Nuevo Tutino	110	22

Preliminary information on the list of local foods and their seasonality was obtained initially through interviews with nine local key informants recognized as having knowledge of the local food system. This list of foods was presented to groups of 25 adults in three community discussion group sessions, lasting two and a half hours each in Mamayaque, where a consensus of the accessibility, preference, and seasonality of Awajun food items for Bajo Cenepa was established and a seasonal calendar developed. Seven Elders were interviewed, one from each of the study communities, to explore foods that were used now infrequently but had been used in the past.

An exercise to identify micronutrient-rich foods was conducted by the project team, including community members and key informants. From the list of all foods, 34 were selected as potentially micronutrient-rich foods for further exploration, with a view to selecting foods for promotion in an intervention to improve the dietary intake of the population, particularly for women and children.

Because of a lack of scientific identification of several plants, 40 plants with Awajun names were selected for identification. Plant specimens (mostly leaves) were prepared according to established procedures and taken to Lima for identification by a botanist, (specialist in plants of this rain-forest region).

Four foods from the region (*suri, ugkush*, *macambo* and *masato*) were submitted for proximal analysis for energy, protein, carbohydrate and fat content. The total amount of each of the foods received (*suri* 59.6 g, *ugkush* 108.9 g, *macambo* 246.3 g and *masato* 442.4 g) was lyophilized and homogenized and three samples of each were submitted to standard analytical procedures in the IIN laboratory.

The exploration of the cultural context of the key foods and the diet was conducted through interviews with 49 mothers who had children under six years of age. Several women preferred to have the interview and dietary recall at a central place in the hamlet rather than at their homes. The qualitative exercises, such as understanding the grouping of foods through pile sorting, the exploration of the perceptions of the attributes of foods for young children and taste preferences were conducted with 37 mothers.

Drawings of the different foods were made on cards, or in some cases, the actual foods themselves were used, for these interactive exercises with mothers. Each card was numbered to facilitate coding and subsequent analysis. At the start of each interview the cards were validated to ensure that each mother recognized the foods represented. The pile sort exercise was conducted with 34 mothers with children under two years. Mothers were asked to group the foods freely according to their own perceptions of which foods go together using the cards, and then describe the reasons for each group. This was not an easy task for some of the mothers, as they found it difficult to understand what to do, particularly in giving the reasons for their groupings. The ANTHROPAC software (Analytic Technologies, Harvard, MA) was used for analysis, showing the composite groups and clustering of the foods by all the mothers using Multiple Dimensional Scaling.

Taste preferences were explored for the key foods with 37 mothers and for their 22 children under two years and 29 children over two years. The perceived attributes of the foods for young children were explored with mothers of 31 children under two years and of 30 children over two years. Using the cards, mothers were asked to describe whatever they thought about each of the individual 34 key foods, in relation to their young child. Thirty-one mothers with children under two years of age were interviewed regarding the early feeding patterns of their young child.

A 24-hour dietary recall was conducted with 49 mothers from the six communities who also reported on the dietary intake for their children under two years (n = 25) and two years and over (n = 40). The 24-hour dietary intake was conducted on two consecutive days for each individual with the assistance of a translator. Several foods (such as cassava, banana, etc.) with known weights and local utensils (cups, plates and *pinig* [bowl for drinking]) provided by the mothers were used as references for quantifying food intake and a food scale with precision to 1 gram was also used to assist assessing portion sizes (Roche *et al.*, 2007, 2008). Mothers reported food consumed for themselves and for their children.

A questionnaire was applied to each of the mothers to explore the frequency of consuming the key list of 34 foods by 48 mothers and 32 children under two years of age. These foods were explored for "daily", "weekly", "monthly" or "rarely" or "never used".

Heights and weights of all 48 mothers, 32 children under two years and 39 children over two years were measured as described elsewhere (Roche *et al.*, 2007) using standard methodology (WHO, 1995). Height was measured using a vertical measuring board and recumbent length for children under two years using a rigid stadiometer accurate to 0.1 cm. Weight was measured using a level and digital Salter bathroom scale and for children under two years of age on hanging scales accurate to 100 grams. Body mass index (BMI) was calculated for the adults and Z-scores relative to international reference data for the children (NCHS, 1977).

Results and discussion

General description of the food system

The land cultivated by the families consulted with in this study was dedicated mainly to the production of cassava, banana, peanuts, maize and cacao. In most cases, families had mixed orchards and/or mixed the larger crops with others of less importance. The indigenous vocation was for polycultivation, a system that better adapts to the reality of the rain forests and its soils. Other plants grown included sugar cane, rice, coffee, papaya, citric fruits, *achiote*, *pituca*, pineapple, *sacha* *papa*, sweet potato, *tumbo*, red pepper, medicinal plants such as *sangre de grado*, *piri piri*, *ajengibre*, *hierba luisa*, *sacha* garlic, and aromatic plants such as *sacha* coriander. New fruit trees were being cultivated including *arazá*, *carambola*, *aguaje* and *pijuayo*. In past years there has been considerable production of cacao in Cenepa. Production diminished due to fungal disease and lack of technical management. Organic coffee was being cultivated in the higher part of the Cenepa.

The majority of native families raised hens, turkeys, ducks, guinea pigs, and pigs; these last two were raised only in some communities and on a small scale. Animals were raised for family consumption as well as for monetary income by their sale. Recently, private and public institutions have started fish farms and poultry-raising. In both cases, the technology available for these ventures was precarious, although efforts were being made to follow up on the feeding and sanitary aspects, as well as providing technical training. Frequent diseases, affecting the raising of poultry, have been reported. Further, many animals were lost through attacks by wild animals. The women traditionally cultivated the fields – although recently this was limited to cassava and banana – and raising small animals near their homes.

Traditionally the Awajun men dedicated a great part of their time to hunting. The preferred mammals were the *sajino*, *hungana*, American tapir (*sachavaca*), deer, *tigrillo* and *otorongo*. Less frequently hunted animals included *ronsoco*, *achuni*, *añuje,* armadillo, and different kinds of monkeys and birds. Over-hunting has diminished the number of animals populating traditional hunting grounds. The products obtained from hunting (meat, leather, feathers, teeth and bones) were used for nutritional, artisanal, medicinal and witchcraft use. Contact with non-native groups has led to the commercialization of some of these products – especially skins, snake venom and meat (to a lesser extent).

More than 150 varieties of fish were identified – constituting a major source of the animal products available to this population – along with a number of other aquatic animals, such as snails, shrimps, crabs, frogs, *sábalo*, *palometa*, *liza*, *doncella*, *boquichico*, *corvina*, *yahuarachi*, Hungarian ray, *fasaco*, among others. Fish was used for family consumption. However, there was less fishing (traditionally done by the men) as there were fewer fish resulting from indiscriminate fishing and contamination of the river because of mining activity in the hills of the Cordillera del Cóndor as described for other Amazon populations (Passos *et al.*, 2003).

Our study showed that it was women who mostly collected the wild fruits from palms and other trees (such as the *uvilla*). They also gathered shrubs, as well as the sprouts of palms, stems, cortex and resins. Edible larvae (*suris*) and other insects were collected for food. More recently however, with the over-harvesting of fruit and fruits trees including palms, the collection of several of these foods has diminished.

Cassava and banana constituted the basis of the food of the Awajun population, supplemented with small portions of meat, and sometimes a little fish. The preparation of food was a women's activity, and foods were prepared most usually by roasting and boiling. *Masato*, a drink prepared from cassava by the women, was an important food, which could be consumed either fermented or unfermented and contributed a high proportion of energy to the diet. Meat and fish were generally smoked or kept dried with salt and wrapped with leaves, or placed directly over the wood fire. The slow drying and smoking allowed the meats to be kept for relatively long periods. Owing to the contact with urban culture, feeding habits modified and new foods purchased from outside traders who sold their produce through the few small, local shops, although in relatively very small quantities. These included sugar, rice, canned fish, canned milk, pasta, onions, oats, cakes, biscuits and bread among others.

During the research period the government offered food programmes through the Ministry of Women's Affairs (Programa Nacional de Asistencia Alimentaria [PRONAA]) providing rice, beans, oil and tuna fish. The municipal "Glass of Milk" programme provided children with milk and sweetened oats, although irregularly.

There was little commerce in the area, mostly due to the lack of surplus production and the high cost of transport required to take produce to main population centres. The communities of the Alto Cenepa did not trade their products; those of Bajo Cenepa sold small volumes of banana and wood outside of the area, transported by boat; and Middle and Bajo Cenepa sold products such as banana, cassava, hens and small birds to larger population centres, such as Huampami and Kusu Kubaim. The main consumers of these latter products, although on a small scale, were government officials, teachers and the military located in the area.

List of foods

A total of 223 foods were identified within the food system of the Awajun, the majority having local Awajun names. Many of the foods did not have Spanish names: thus it was difficult to find equivalent English names. This was reported on previously (Hauamán-Espino and Valladeres, 2006), where 100 currently used foods were listed. The full list of Awajun foods and their nutritional composition where known, was given to ODECOFROC and each of the participating communities and can be viewed at www.mcgill.ca/ cine/resources/data/

The complete list of Awajun food species is presented in Table 4.2; in Table 4.3, a shortlist of unique foods is presented with nutrient composition. Four foods/preparations for energy and macronutrient content were analysed. Foods selected included a green leaf (*ugkush*), seed (*macambo*) and an animal source food (*suri*), potentially rich sources of nutrients, and the community also wanted to know the nutritional composition of their staple drink, *masato*. Of note is the nutritional value of *suri*, which is an important source of nutrients, although not as high as edible worms reported elsewhere in Latin America (Paoletti *et al.*, 2003; Paoletti *et al.*, 2000).

Scientific names and published nutritional composition were found for only 82 of the foods. Among these foods, 34 were mentioned by Awajun Elders as being popular in the past, but no longer in use at the time of this study. They belong to the following groups: animals (10), birds (10), fruits (8), vegetables (1) and tubers (5). A significant reason why these foods were not used as frequently as before, or were no longer consumed, was that they were much further away in the wild hill country, particularly the animals and birds. Also, as the Awajun lived in larger communities, there was over-hunting and harvesting of several animals and plants, while some fruits and vegetables were no longer being planted and harvested.

Locally produced food was bought and sold between families and communities when harvested. Only 12 of the total foods were listed as being bought from the local village shops – these are not local, but industrially produced: rice, noodles, sugar, salt, oil, milk (evaporated and dried), tinned tuna fish, eggs, soda, cookies and sweets. In general, there was a lack of commercialization in the area, as well as low cash resources among the Awajun population. As such, the community population rarely, if ever, went to a market or local urban centre to buy food.

There were also several government assistance programmes that brought donated industrialized foods into the area. These included rice, oil, beans, tinned tuna, tinned salmon, evaporated milk and sugared oats. They were donated through PRONAA and the “Glass of Milk” programme.

Scientific identification and analyses

To help complement the scientific identification, 40 plants with Awajun names were selected for identification, of which 25 were identified by a botanist.

Key micronutrient-rich traditional foods

From the 223 foods listed, 34 were selected as potentially micronutrient-rich foods for further exploration, with a view to selecting foods for promotion in an intervention to improve the nutritional intake of the population, particularly women and children’s (Table 4.4). Foods were selected from the different food groups and chosen on the basis of (a) frequency of mention, (b) probable micronutrient content and potential for making a contribution to nutrition of the population, (c) mentioned as being liked by the population, and (d) availability during different seasons. A few less-frequently used foods with possible potential for increased use were included.

Table 4.2 Awajun traditional foods

	Scientific name	English / common name	Local name	Spanish name	Seasonality
	Vegetables				
1	*Arachis hypogaea*	Peanut	duse	mani crudo perado, con pelicul	October–January
2	*Astrocaryum chambira*	Green leafy vegetables	datsatsam	verdura verde	January–December
3	*Astrocaryum* sp.	–	uwan	huicungo	January–December
4	*Bactris gasipaes*	Peach palm/pewa nut	uyái	pijuayo e.p.	February–April
5	*Caladium bicolor*	–	manchup	manchup	January–December
6	*Capsicum annuum*, *Capsicum frutescens*	Chili pepper	jima	ají	December–February
7	*Caryodedron orinocensis*	Stilt palm	shimpi	palmera	January–December
8	*Cucurbita maxima*	Squash	yuwí	zapallo	January–December
9	*Cyclanthera pedata*	Kaikua	caigua	–	January–December
10	*Euterpe precatoria*	–	yayu, sake	huasai	January–December
11	*Lycopersicon esculentum*	Tomato	tomatillo	tomate	–
12	*Manihot esculenta*	Manioc leaves	namag/mamá duke	hojas de yucca	January–December
13	*Piper* sp.	Green leafy vegetables	ugkush (col de monte)	verdura verde	January–December
14	*Philodendron* sp.	Green leafy vegetables	eep (col de monte)	verdura verde	January–December
15	*Phytelephas* sp.	Tagua palm	tintuk	–	January–December
16	*Socratea exorrhiza*	–	shiim (chonta)	–	January–December
17	*Xanthosoma* sp.	–	tunka	tuka	January–December
18	*Xanthosoma* spp.	Cocoyam	sanku	huitina	January–December
19	*Zea mays*	Corn	shashak shaa	maiz	–
20	–	Kupat	–	–	January–December
21	–	Ungurahui	–	–	–
22	–	A flower	sonat	sonat (flor)	–
23	–	Mushrooms	essem	hongos	–
24	–	Palm heart	iju	chonta e.p.	–
25			tsemantsem	tsemantsem	
	Fruits				
1	*Ananas comosus*	Pineapple	pina	pina e.p.	October–December
2	*Artocarpus altilis*	Breadfruit	kistian pitu	pan de árbol del monte	February–March
3	*Astrocaryum chambira*	Chambira palm	batae	chambira	February–April
4	*Theobroma bicolor*	–	papai, wakam/wakampe	papaya e.p., macambo/ semilla de macambo	January–December
5	*Caryodendron orinocensis* (2 var.)	–	naam	sachamaní	December–March
6	*Caryodendron orinocensis*	Stilt palm	shimpi	–	January–March
7	*Citrus limon*	Lemon	yumung	limon	January–April
8	*Citrus sinensis*	Orange	najan	naranja	January–May
9	*Clavija* sp. (2 var.)	–	kunakip, yampak	–	January–February
10	*Cocos nucifera*	Coconut water	–	coco, agua de	–
11	*Couma macrocarpa*	Milk tree	duam	leche caspi	February–April

Continued

Table 4.2 *(continued)* Awajun traditional foods

	Scientific name	English / common name	Local name	Spanish name	Seasonality
12	*Fabaceae*	–	dapujuk	–	January–March
13	*Grias peruviana*	–	apai	sachamango	March–May
14	*Herrania mariae*	Wild chocolate	kushikan	huacarapona	January–April
15	*Inga nobilis*	Inga	wampushik	inga	January–March
16	*Mauritia flexuosa*	Mauritia palm	achu	aguaje	September–May
17	*Moraceae*	–	shagkuina	–	–
18	*Musa balbisiana* (2 var.)	Banana	pantam, seetash	plátano	January–December
19	*Musa* sp. (3 var.)	Banana, Guinea banana	pantam, guino	plátano de seda, plátano de isla, plátano guineo (grano de oro)	January–December
20	*Oenocarpus bataua*	Bataua palm, pataua palm	ungurahui	palma seje (Venezuela)	February–April
21	*Passiflora ligularis*	Passion fruit	munchi	granadilla	January–June
22	*Persea americana*	Avocado	kai	palta	September–November
23	*Phytelephas* sp.	Taqua palm	chapi	yarina	–
24	*Pouteria sapota*	Sapote	taperiwa	guanabana	–
25	*Pseudolmedia laevigata*	–	chipi	–	January–March
26	*Psidium guajava*	Guava	shawi	guayaba	January–April
27	*Renealmia alpinia*	Achira del monte	kumpia	achira del monte	October–March
28	*Rollinia microcarpa*	Custard apple or prickly custard apple	anuna	anona	December–February
29	*Saccharum officinarum*	Sugarcane	pangaat	cana de azucar	January–December
30	*Senecio herreanus*	Gooseberry	shuiña	uvilla	December–February
31	*Sicana odorifera*	Secana	namuk	secana	January–December
32	*Socratea exorrhiza*	–	shiim	–	January–December
33	*Solanum coconilla*	Coconilla	kukush/shiwankush	cocona	–
34	*Solanum* sp.	Cocona	shiwag kukush/kukuch	cocona e.p.	January–December
35	*Theobroma cocao*	Chocolate bean	bakau	coco de cacao	January–December
36	*Theobroma* sp.	–	akagnum	–	January–April
37	–	–	apeich	–	–
38	–	–	arazá	arazá	January–April
39	–	–	caimito	–	December–February
40	–	–	charichoelo	–	–
41	–	–	dack pau	–	–
42	–	–	dupi	–	January–February
43	–	–	inák	chupé	February–March
44	–	–	copal	–	March–April
45	–	–	naranjillo	naranjillo	–
46	–	–	shajimat	–	February–March
47	–	–	supinim	–	June–July
48	–	–	takash pantam	sachaplatano	–
49	–	–	tayutim	kunchai	–

Continued

Table 4.2 *(continued)* **Awajun traditional foods**

	Scientific name	English / common name	Local name	Spanish name	Seasonality
50	–	–	tejesh	–	March
51	–	–	tintuk	–	January–December
52	–	–	tumpu	tumbo	June–July, Oct–Nov
53	–	–	ujunts	–	March–April
54	–	–	wañam painim	–	January–February
	Tubers				
1	*Burseraceae*	–	uju/mun uju	–	January–April
2	*Caladium bicolor*	–	manchup	–	January–December
3	*Colocasia esculenta*	Taro	pituk	pituca o taro	January–December
4	*Dioscorea trifida*	Yam	kégkeg	sachapapa	April–August
5	*Dioscorea* sp. (2 var.)	–	keghegkeg, tsegkup	sachapapa morada	April–August
6	*Ipomoea batatas*	Sweet potato	idauk	camote	January–December
7	*Lepidium peruvianum* Chacon	Maca	maca	maca	–
8	*Manihot esculenta*	Cassava, manioc	máma/ yujumak	yuca	January–December
9	*Maranta arundinacea*	Arrowroot	chiki	maranta	January–December
10	*Pachyrrhizus tuberosus*	Yam bean	ahipa nambauo huacarapona	–	January–December
11	*Xanthosoma* sp.	–	tunka	–	January–December
12	*Xanthosoma* spp.	Coco yam	sanku	huitina o unchucha	January–December
13	–	–	kegkegkee	sachapapa del monte	April–August
14	–	–	kiyam	papachina	January–December
	Fish				
1	*Ancistrus* sp.	–	shuvi	carachama mediano	–
2	*Brycon* sp. (3 var.)	–	kamit, kusea, huampi	paco-gamitana, sávalo (sábalo), sábalo macho	January–December –
3	*Canthopomus* sp.	–	putu	carachama, cashca	–
4	*Cichlasoma* sp.	–	kantash, huapujúsh	bujurque	April–December
5	*Caranx cynodon gibbus*	–	kujancham daí	denton	–
6	*Characiformes caranx*	–	tujún /tsajun	–	January–December
7	*Characiformes caranx*	Pike	champejam	–	January–December
8	*Characiformes charanx moenkhausia*	–	mamayak	pescado mojarra e.p.	January–December
9	*Characiformes mylosoma*	–	paomít	palometa	January–December
10	*Cynodon* sp.	–	huampikus	chambira	January–December
11	*Cyprinodontiformes poecilidos*	Livebearer	yuvi	poecílidos	January–December
12	*Gymnotiformes gymnotid*	–	puepuen	carapo	January–December
13	*Hoplias malabaricus*	–	kunkui	huassaco/fasaco	January–December
14	*Luciocephalus* sp.	–	chuvio	anashi	January–December
15	*Potamotrygon hystrix*	–	kashap	raya	January–December
16	*Prochilodidos leoprinus*	–	katish	pescado lisa e.p.	January–December
17	*Prochilodus* sp.	–	kagka	boquichico fresco	April–December

Continued

Table 4.2 *(continued)* Awajun traditional foods

	Scientific name	English / common name	Local name	Spanish name	Seasonality
18	*Pseudopimelodus* sp.	Catfish	tunké, yutuí	zungaro	January–December
19	*Rivulus* sp.	Livebearer	huásusum	poecílidos	January–December
20	*Roeboides* sp.	–	suyán	oropendola	January–December
21	*Siluriformes astroblepidae*	Catfish (small)	dukum	bagre chico	–
22	*Siluriformes callichtyidos coridoras*	–	sinkijuash	shirue	January–December
23	*Siluriformes cetoposids*	Catfish	baús, bauts	–	January–December
24	*Siluriformes diplomistidos*	–	kigigi	–	January–December
25	*Siluriformes doradidos pseudo-doras*	–	tujushik	cahuara	January–December
26	*Siluriformes loricardididos* (6 var.)	Catfish	kaejam, nankiputu (nanki putu), nayump, pakash, putu, sachem	carachama chiquita, carachama delgado grande, carachama	January–December
27	*Siluriformes loricardididos loricaria*	–	shajam tsutsum	cashca	January–December
28	–	–	sacham	carachama chiquita	–
29	*Siluriformes pimelodids* (3 var.)	Catfish	butta, inkancham/kunchi, kumpoau	mota, bagre, bagre mediano	January–December
30	*Siluriformes pimelodids sorubim*	Catfish	titín	shiripira	January–December
31	–	Fish	namak	pescado bagre e.p.	–
	Shellfish				
1	*Macrobrachius brasiliensi*	Shrimp	majúsh	camarónes frescos e.p.	–
2	*Pelanus laturus*	Crab	ujik	cangrejo	–
3	*Pomacea* sp.	Snail	tsuntusu	caracoles e.p.	–
	Animals				
1	*Alouatta seniculus*	Howler monkey	yakum	mono	–
2	*Ateles* sp.	Spider monkey	washi	mono	–
3	*Callicebus* sp.	Monkey	kuji	mono	January–June
4	*Cavia porcellus*	Guinea pig	utu	cuy	–
5	*Cuniculus paca*	Paca	kashai	majas	February–April
6	*Dasyprocta aguti*	Agouti	kañuk	añuje	January–December
7	*Mazama* sp.	Deer	japa	venado	January–March, September–December
8	*Nasua nasua*	Ringtailed coati	kúshi	achuni	January–December
9	*Sclurus* sp.	Squirrel	waiwásh	ardilla	January–April
10	*Sus scrofa* (2 var.)	Pig, wild pig	kúchi	cerdo, jabali	January–December
11	*Sylvilagus brasiliensis*	Rabbit	wápajush	conejo	January–December
12	*Tapirus terrestris*	Tapir	pabau	sachavaca	January–March
13	*Tayassu pecari*	White lipped peccary	paki	huangana	–
14	*Tayassu tajacu*	Collared peccary	yunkipác	sajino	January–April
15	*Daypus noremcinctus*	Armadillo	shushui	armadillo	June–July
16	–	Animal organs	kuntinu /ampuji	visceras de animales	–

Continued

Table 4.2 *(continued)* Awajun traditional foods

	Scientific name	English / common name	Local name	Spanish name	Seasonality
	Birds				
1	*Aburria aburri*	Wild turkey	huachu	pavo del monte	–
2	*Columba subvinacea* (2 var.)	Wild pigeon/dove	yapagkam/yampis	paloma del monte	–
	Columba sp.	Pigeon/dove (small)	tsabau yampis	paloma chica	–
3	*Cyanocorax violaceous*	Violaceous jay	kijuánchan	–	–
4	*Gallus gallus*	Hen, chicken	atásh	gallina/pollo	January–December
5	*Gallus gallus*	Chicken's egg	atashú nujinji	huevo de gallina	January–December
6	*Icterus* sp.	–	chuwi	oropendola	July
7	*Leptotila rufaxilla*	–	shimpa	–	–
8	*Monasa nigrifrons*	–	tiuju	–	–
9	*Oreotrochilus estella*	Humming bird	jempe	picaflor	–
10	*Penelope jacquacu*	Spix's guan	aunts	pucacungo	–
11	*Psophia crepitans*	Trumpeter	chiwa	trompetero	–
12	*Pyrrhura* sp.	Parakeet	kijus	pericos	–
13	*Ramphastos cuvieri*	Tukan	tsukangá	tucán	July
14	*Steatornis caripensis*	–	tayu	–	–
15	*Tinamus tao*	Partridge, grouse	sekush	perdiz azulada	–
16	*Zenaida asiatica*	Dove	yampis	paloma de la selva	–
17	–	Duck	patu	pato	January–December
18	–	Parrot	kuwau	loro	–
19	–	Parrot	tuwish	loro	January–March
20	–	Partridge, grouse	waga	perdiz	January–March
21	–	Parrot (small)	inkancham	loro chiquito	–
22	–	Partridge, grouse (small)	puush	perdiz chico	–
23	–	Tukan (small)	kejua	tucán chico	–
24	–	Tukan (small)	pinish	tucán chico	–
25	–	Woodpecker (small)	kuintam	carpintero chico	–
26	–	Woodpecker	tatasham	carpintero	–
27	–	–	achayachik	–	–
28	–	–	ayachui	montete	February–March
29	–	–	chikui	–	–
30	–	–	chiwchiwa	–	–
31	–	–	jempekit	–	–
32	–	–	jempemu	–	–
33	–	–	kajuntsan	–	–
34	–	–	kanampus	–	–
35	–	–	kigtachik	–	–
36	–	–	kugchacham	–	–
37	–	–	kunchau	–	–

Continued

Table 4.2 *(continued)* **Awajun traditional foods**

	Scientific name	English / common name	Local name	Spanish name	Seasonality
38	–	–	kúte	–	–
39	–	–	mantset	–	–
40	–	–	pipjuan	–	–
41	–	–	pisumash	–	–
42	–	–	sawake	–	–
43	–	–	semanchuk	–	–
44	–	–	seuk	–	–
45	–	–	shik	–	–
46	–	–	sugka	gallitos de las rocas	–
47	–	–	takaikit	–	–
48	–	–	tawai	–	–
49	–	–	teesh	–	July
50	–	–	timantin	–	–
51	–	–	tugtumpiu	–	–
52	–	–	tuswam	–	–
53	–	–	tuwits	–	–
54	–	–	ugkun	–	–
55	–	–	ushap	–	–
56	–	–	wakants	maracaraco	October–March
57	–	–	yukupau	–	–
	Amphibians and Reptiles				
1	*Colostethus* sp. (2 var.)	Frog	súakaraip	rana	January–December
2	*Podocnemis unifilis*	Yellow-spotted Amazon River turtle	kugkuim	tortuga	January–December
3	*Polychrotidae*	Lizard	nantana	lagarto	January–December
	Insects				
1	*Coleopterus*	Palm larva	bukin	suri/ larva de palma	January–December
2	*Hymenoptera brachygastra*	Wasp larvae	ete téji	huevos de avispa	January–December
3	*Hymenoptera formicidae*	Ant	maya	hormiga del árbol	January–December

e.p. Edible portion.
– No data.

Table 4.3 Macronutrient composition of analysed Awajun foods *(per 100 g fresh weight)*

Food	kcal	kJ	Protein g	CHO g	Fat g	Ash g	Water %
Ugkush (green leaf)	77	322	0.75	14.08	0.99	2.79	81.4
Masato (fermented cassava drink)	35	146	0.04	7.75	0.04	0.61	91.6
Whole *Suri* (insect larvae)	273	1 141	1.40	13.15	21.96	0.92	62.6
Macambo seeds	718	3 001	3.37	34.35	53.7	2.67	5.9

Table 4.4 Shortlist of key foods rich in micronutrients

Scientific Names	***English***	***Awajun***	***Spanish***	***Varieties***	***Edible Portion***
Arachis hypogea	Peanut	duse	maní	6	seed
Bactris gasipaes	Peach palm	uyai	pijuayo	4	fruit
Caladium bicolor	–	manchup	manchup	–	tuber
Carica papaya	Papaya	wakampé jigkañi	semillas de macambo	1	seed
Citrus sinensis	Orange	najag	naranja	1	fruit
Coleopterus sp.	Palm larvae	bukin	suri	–	larvae
Colocasia esculenta	Taro	pituk	pituca	2	tuber
Colostethus sp.	Frog	suakaraip	rana	–	meat
Columba subvinacea	Dove	yampis	paloma del monte	–	meat
Columba subvinacea	Wild pigeon	yapagkam	paloma del monte	–	meat
Cucurbita maxima	Squash	yuwí	zapallo	1	fruit
Gallus gallus	Chicken	atash	pollo	–	meat
Gallus gallus	Chicken’s egg	atashúnujinji	huevo de gallina	–	egg
Grias peruviana	–	apai	sachamango	–	fruit
Hymenoptera brachygastra	Wasp larvae	eté téji	huevos de avispa	–	larvae
Ipomoea batatas	Sweet potato	idauk	camote	3	root
Manihot esculenta	Manioc cassava	mamá / yujumak	yuca	31+	root
Manihot esculenta	Manioc leaves	mamá Duke	hoja de yuca	31+	young leaves
Mauritia peruviana	Mauritia palm	achu	aguaje	1	fruit
Musa balbisiana	Banana	pántam	plátano	17+	fruit
Philodendron sp.	Green vegetables	eep	verdura verde	–	leaves
Phytelepas sp.	Vegetable ivory	chapi	yarina	1	fruit
Piper sp.	Green vegetables	ugkush	verdura verde	–	leaves
Pomacea maculate	Snail	tsuntsu	caracol	–	flesh
Pseudolmedia laevigata	–	chipi	chipi	–	fruit
Solanum coconilla, *S. quitoense, S. flavesceno*	Cocona	kukuch	cocona	7	fruit
Theobroma bicolor	–	wakam	macambo	1	fruit
–	–	tsemantsem	–	–	vegetable
–	Mushrooms	esem	hongos	–	entire
–	Palm heart	iju	chonta	–	entire
–	–	inak	chupé	–	–
–	Pig	kuchi	cerdo	–	meat
–	Fish	namak	pescado bagre e.p.	–	meat
–	Animal organs/viscera	kuntinu Ampuji	visceras de animales	–	flesh

– No data.
e.p. Edible portion.

Patterns of harvest, storage and preparation of the key foods

Awajun women went daily, or every other day, to their fields to obtain food: thus, there was little storage of foods. Fish were regularly caught from the rivers or fish ponds and mostly consumed fresh. They were harvested from the fish farms approximately every three months, but were caught individually at other times. Meats hunted from the wild were preserved; they were most commonly dried with salt and then smoked. There were also some recent initiatives to preserve fruits by making jams at the time of high production, such as with *cocona*.

In general, the form of preparation of foods was simple: boiled, roasted, smoked, raw or in *patarashka* (the food is wrapped in banana leaves and placed over the wood stove). It was rare to find fried foods in the Awajun diet. Foods such as cassava and banana were used to prepare *masato* and *chapo* drinks, respectively. Other drinks were made from fruit juices.

Mothers' and children's preferences for foods

Preferences were explored for the 34 key foods for mothers and children and most were reported as liked by both mothers and children, except for squash and cassava leaf. The mothers also reported that, in contrast to their children, they did not like wasp larvae and that their children did not like the green leafy vegetable *ugkush*.

Table 4.5 Mean and median energy and macronutrient intake by Awajun mothers and children

		Mothers (n=49)	*Children 6 mo to 2 y (n=25)*	*Children 2 to 8 y (n=40)*
Energy kcal/day	Mean	3 738	997	2516
	Median	3 388	864	2416
	sd	±1567	±736	±1039
Energy from animal sources kcal/day	Mean	226	126	156
	Median	205	57	90
	sd	±199	±148	±156
Protein g/day	Mean	58.2	21.8	46.1
	Median	55.8	25.3	39.8
	sd	±27.5	±17.4	±23.8
Protein from animal sources g/day	Mean	23.7	10.4	14.4
	Median	17.4	6.7	10.8
	sd	±20.1	±10.6	±14.3
Fat g/day	Mean	32.9	12.0	27.0
	Median	21.9	10.6	17.9
	sd	±28.6	±11.3	±24.0
Carbohydrate g/day	Mean	823	208	540
	Median	723	164	505
	sd	±359	±160	±225
Fibre g/day	Mean	29.2	6.3	17.7
	Median	28.6	5.2	15.8
	sd	±14.0	±5.3	±7.8

Foods most available nearby

Cassava, banana and *cocona* were the foods most available locally, and sugar cane, sweet potato, pineapple, *sachapapa*, fish, hens, *pituka* and *tuca*, as well as the fruits *sachamango*, *chupé*, *aguaje* and *yarina* were available seasonally.

Dietary evaluations

Estimated dietary intake by 24-hour recall

Intakes of energy and macronutrients were evaluated by two successive dietary recall days. Imputed nutrient values from similar foods were used when needed. Overall, women's intake of local Awajun food formed 93 percent of total dietary energy, with the balance being from purchased food. For children aged 2–12 years, 85 percent came from local Awajun food, with 15 percent from purchased or donated (primarily rice and tuna) food. Table 4.5 shows the mean, median and standard deviation of the intakes for energy and macronutrients for the mothers, children under two years and children over two years.

Mean and median energy intake of mothers was apparently high (3 738 and 3 388 kcal per day, respectively), although only 6 percent of energy came from animal sources; 6.5 percent of energy was from protein and 7.9 percent from fats, indicating that the major source of energy was carbohydrate. The fibre content of the diet was also high (29 g) – however, there was a wide variation. The food preparations that provided most of the energy were boiled foods, followed by roasted foods. The boiled foods were mainly bananas, tubers and roots, including cassava, *sachapapa* and *pituka*. The roasted foods included cassava, banana, *macambo* seeds and fish. The preparations from animal sources that provided most energy were milky drinks and soups – mostly due to the use of chicken or egg in the ingredients.

Twenty-five children between six months and two years old were included in the 24-hour recall for complementary foods (non-breastmilk). Eight children under six months were excluded. Mean energy intake from complementary foods was 997 kcal per day; 12.6 percent of energy came from animal sources, 8.4 percent from protein, and only 10.6 percent from fats, again indicating that the principal source of energy was carbohydrate. Again, the food preparations that provided most of the energy were the boiled foods, mainly banana, and the tubers and roots (cassava, *sachapapa* and *pituka*) followed by milk preparations and cereals such as rice. The preparations providing most energy

Table 4.6 Energy intake of mothers and children by source of foods

		Mothers *(n=49)*	*Children 6 mo to 2 y* *(n=25)*	*Children 2 to 8 y* *(n=40)*
Energy from local sources kcal/day	Mean	3478	780	2138
	Median	3133	549	1942
	sd	±1 567	±611	±1044
Energy from market/donated foods kcal/day	Mean	261	217	379
	Median	106	30	234
	sd	±329	±302	±432
Percent energy from local foods	Mean	92	82*	85
	Median	97	92	90
	sd	±11	±21	±17
Percent energy from market/donated foods	Mean	8.1	17.5*	15.2
	Median	2.8	7.6	9.5
	sd	±10.8	±21.2	±17.3

* Excluding 3 infants exclusively breastfeeding

Table 4.7 Reported frequency of consuming key foods by Awajun mothers and children

Daily	*Weekly*	*Monthly*	*Seldom/never*
Cassava	Eep	Tsemantsen	Cassava leaf
Banana	Ugkush	Palm heart*	Squash
Chupé	Palm heart*	Suri	Manchup
Macambo	Egg	Orange	Sweet potato
Macambo seeds	Fish*	Yarina	Pork
Cocona	Taro	Wasp larvae	Yapagkam
Pijuayo		Chicken	Parrot
Aguaje		Frog	
Sachamango		Fish*	
Peanuts		Viscera	
		Yampis	

* Foods listed as weekly and monthly were mentioned in each by a similar number of respondents.

from animal sources were milk (and milk preparations), and soups (again mainly because of the presence of chicken or egg).

The mean daily energy intake of the 40 children between two and eight years of age was 2 516 kcal, and only 6.2 percent of the energy was provided by animal sources. Only 6.7 percent of energy came from protein and 7.1 percent from fats. The food preparations providing most energy (mainly from animal sources) were very similar to the younger children.

Mean and median total micronutrient intakes for adult women appeared to be adequate although, as mentioned below, there may have been some over-reporting of food intake. The principal source of minerals in the diet was vegetables, while intakes from high bio-available animal sources were low. The lowest intakes of several micronutrients were those of the infants and young children, specifically for iron with a median intake of 4.9 mg/day for children 6–24 months (mean recommended intakes are 9.3–5.8 mg/day depending on age and assuming medium bio-availability) (FAO/WHO, 2002), especially iron from haeme sources (median 0.33 mg/day). Total zinc intake was near to recommended (4.1 mg/day) intakes (median 3.89 mg/day), but zinc from animal sources (median 0.8 mg/day) and calcium (median 134 mg/day) were low (mean recommended intakes for calcium 400–500 mg/day depending on age), although some calcium would be obtained from breast milk by these children.

The foods or food preparations that were most commonly consumed by the mothers and children were cassava, banana and *masato*. Although fermented for normal adult use (and fermented for a longer period of time for celebrations or parties), *masato* was given to the children when freshly prepared and non-alcoholic.

The large variability in reported amounts of food and high intakes of energy obtained through the 24-hour recalls was surprising. Although the women and children were physically active in their daily work routines, these intakes were not consistent with their body weights. A typical meal consisted of the family sharing food from a common plate of banana leaves, and it is believed by the researchers that some mothers may have reported what was served for the family, or did not know how much each of the individual children ate, thus there may have been some over-reporting. This will be verified in future studies.

Sources of food

Table 4.6 shows that a high proportion of the energy of the diet came from locally produced foods and that comparatively little food was from outside sources. This was slightly higher with children, due to the donated "Glass of Milk" programme.

Food frequency

The frequency of consuming the foods in the key list of 34 foods by the mothers and children (under two years of age) is presented in the Table 4.7. The foods are listed under the most commonly reported frequency, whether daily, weekly, monthly or rarely/never. Cassava and banana were consumed daily, as also reported by Huamán-Espino and Valladares (2006); other foods were seasonal.

Infant-feeding practices

All mothers reported breastfeeding their child, and 74 percent reported giving colostrum. Boys and girls were treated equally in this regard. At the time of the interviews, 26 of the 30 children under two years were still being breastfed. Mothers considered the appropriate age for stopping breastfeeding to be around 20 months. Those children who were no longer breastfed had stopped on average at 12 months.

Liquids other than breastmilk, such as unfermented *masato* or *chapo*, were given to the infant during the first few months of life. Thirty-nine percent (n = 12) had received another type of milk in addition to breastmilk. In the majority of cases this was evaporated cow's milk; only one child received an infant formula. The mean age for first giving other milk was eight months.

Physical health assessments: anthropometry

The majority of the mothers (92 percent) had a BMI within the normal range (18.5 to 24.9 kg/m^2); 6 percent were above this range and 2 percent below. However, mean maternal height was low (148.4 cm), similar to that reported elsewhere for the Awajun population (Huamán-Espino and Valladeres, 2006) and other Amazon populations (Santos and Coimbra Junior, 1991). The proportion of children under two years with stunting (growth retardation, length for age <-2 SD) was high (43.8 percent), and continued into the older age group as shown in Table 4.8, similar to that reported elsewhere (Huamán-Espino and Valladares, 2006, and Buitrón and Hurtig and San Sebastian, 2004). A smaller proportion of children showed low weight for age (<-2 SD), although this is also higher than the national average. Although there were no children over two years with acute malnutrition (weight for height <-2 SD), 25 percent of children under two years showed undernutrition.

Table 4.8 Indices of Awajun nutritional status for children under 2 years and 2–8 years of age

		Children < 2 years (n=32)	*Children 2 to 8 years (n=32)*
Z-score height/age	Mean	-1.93	-2.20
	sd	1.04	1.12
Z-score weight/age	Mean	-1.01	-1.34
	sd	1.13	0.81
Z-score weight/height	Mean	0.37	0.01
	sd	1.05	0.67
Percent global malnutrition (<-2sd weight for age)		15.6	23.1

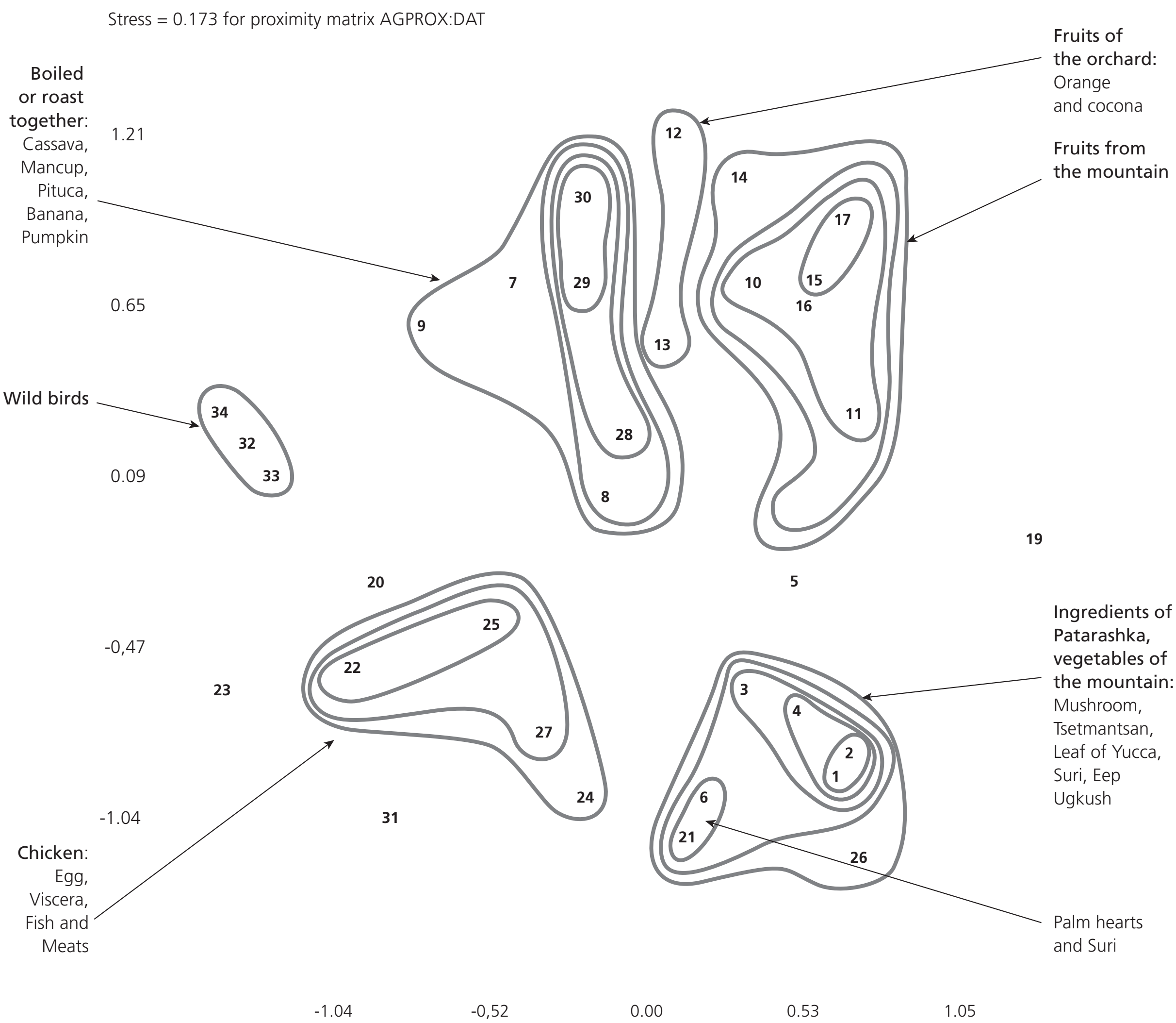
Qualitative information

Pile sorts

Mothers' perceptions of food groups were explored through a pile sort exercise. A diagrammatic representation of this is shown in Figure 4.2.

In this exercise, the main reasons mothers gave for grouping the foods were: (1) how the foods are prepared and which foods are prepared together; (2) the source of the food, for example whether from the wild or whether they grow together; (3) the perceived value of the food; and (4) good taste of the food. The principal food attributes as perceived for young children by the mothers were in relation to their benefit or otherwise for the child, the child's preferences, and source and use of the food. Mothers commented that different foods "are good for growth and development of the body so that the child is not weak", "the food tastes good, it is smooth", "it is eaten daily", "it is boiled or cooked in *patarashka*", "it can harm the child", "it comes from the wild" and "it was used by our ancestors".

Figure 4.2 Multiple dimensional scaling and clustering of foods by pile sort



Legend: **1.** Eep, **2.** Ugkush, **3.** Leaf of Cassava, **4.** Tsemantsan, **5.** Mushroom, **6.** Palm hearts, **7.** Pumpkin, **8.** Cassava, **9.** Banana, **10.** Chupé, **11.** Macambo, **12.** Orange, **13.** Cocona, **14.** Pijuayo, **15.** Aguaje, **16.** Sachamango, **17.** Yarina, **18.** Seed of Macambo, **19.** Peanut, **20.** Pig, **21.** Suri, **22.** Chicken, **23.** Frog, **24.** Fish, **25.** Egg of hen, **26.** Snail, **27.** Viscera of animals, **28.** Pituka, **29.** Manchup, **30.** Sweet potatoe, **31.** Egg of wasp, **32.** Yampis, **33.** Yapagka, **34.** Chipi.

Conclusion

The major dietary sources of the Awajun population of Cenepa were the locally produced, collected or hunted foods (a wide variety) that they traditionally had access to. However, through changes in community living, farming, hunting and collecting patterns not all of these foods were currently available (Huamán-Espino, 2006). The major sources of energy in the diet were the staples: cassava and banana. Intake of animal source foods, particularly meat and fish, was seasonal, but generally low and infrequent and depended on availability. The consumption of vegetables, seeds and fruits was varied and seasonal. The perceptions towards micronutrient-rich foods were mostly very favourable. The main limitation was infrequent consumption because of availability, replacement by government-donated foods and the small amounts consumed, especially by young children. Infectious diseases and parasites were predominant health problems among this population, and there was a high prevalence of stunting among children.

As a result of this exploration potential nutrient-rich foods have emerged that can be used for intervention to increase both production and consumption, especially for women and young children. Using this understanding of the traditional food system of the Awajun population of Bajo Cenepa, the research group designed interventions to enhance the health, nutrition and well-being of the participating communities through the promotion of key aspects of the traditional food system and culture, working with the community organizations, as well as health and nutrition promoters. A study with the Tsunamé in the Bolivian Amazon indicated that foods high in animal products, access to foraging technology and traditional knowledge of medicinal plants were related to better anthropometric indices of the population (Godoy *et al.*, 2005). The selection of the food-based interventions with the Awajun incorporated these elements. The proposed interventions focused on three principal areas:

1. **Production:** Increase the accessibility of the communities to traditional foods, emphasizing those traditional foods that have high nutritional values. Enhance women's role in food production activities to increase the variety of foods through the collecting and planting of traditional fruits seeds and palms, thus contributing to land protection (and possibly reducing the effects of contamination in fish) (Passos *et al.*, 2003), as well as raising more small animals including *suri* and taking an active role in the fish farms. Involve school children in projects of planting seeds in their schools and learning about the value of traditional foods to reduce the loss of this traditional knowledge among young people.
2. **Education:** Increase knowledge regarding the nutritional value and perceptions towards the importance of, and promotion of, traditional foods in the communities, particularly with school children using the information gained from the qualitative explorations.
3. **Participation and use:** Increase the use of a wide variety of traditional foods through incorporation into food preparations, recipes and diets of the family with special attention to young children to benefit their nutrition.

The information gained from this study, although specific to the Awajun of Bajo Cenepa, contributes to the scarce information available describing the traditional foods and dietary intake of Indigenous Peoples living in the Amazon rain forest. Although differences in food varieties and diet have been reported between different Amazon populations (Milton, 1991), this methodology and its results can contribute to the development of appropriate interventions to preserve the rich traditional food culture and benefit the nutritional and health situation of these populations, who are currently experiencing critical changes in their nutrition and environment ●

Acknowledgements

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Chapter 5

Ingano traditional food and health: Phase 1, 2004–2005

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Figure 5.1

PARTICIPATING INGANO COMMUNITIES
Department of Caquetá, Colombia

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library
**www.maplandia.com/columbia/caqueta*

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> "Let's return to our food, our life and our tradition. With our food, we will improve our health, will recover our culture, and will take care of the natural world. We need our plants and our jungle in order to have strength and to live better."

Eva Yela, Ingano community member

Abstract

This chapter presents the results of a study on the ethnonutrition of the Ingano people of the Colombian Amazon. The study was carried out by Colombian, American and Canadian scientists working in close collaboration with the Inganos themselves.

The Inganos are a tribe of Amerindians living in the western-most Colombian Amazon, primarily in the state of Caquetá. Like most Indigenous Peoples, their contact with the outside world has had a serious (and primarily negative) impact on their diet. Particularly serious factors causing the decline in the quality of their nutritional input includes acculturation (particularly with the degradation of local knowledge of, and pride in, traditional agricultural practices) and access to low-quality Western foods (especially carbonated drinks and refined flour) – factors common to many of the indigenous studies carried out by the Center for Indigenous Peoples' Nutrition and Environment (CINE) and presented in this volume. Factors relatively unique to the Colombian example are the degree of deforestation, the ongoing political violence, and the levels of water contamination due to byproducts of the local cocaine trade.

The study focuses at all stages on the process of maximizing community involvement. Representatives of every age group participated, from Elders – born prior to colonial contact – to newborn infants. Prior consultation, consensus decision-making, and human rights issues were integral cornerstones of the study.

The study documented – for the first time ever – the complexity of the original Ingano diet: over 160 types of food, ranging from roots to insects to palm tree products. Pre-contact health status is assumed to have been better than the current situation in terms of diversity of foods, although precise data on health status were not available. Eight items from the traditional diet were deemed necessary for maintaining and improving local health: (1) *milpesos* palm, (2) *yoco liana*, (3) *cayamba* mushroom, (4) bitter cane, (5) beetle larvae, (6) *churo* snail, (7) *cucha* fish and (8) the *cimarron* herb. By using local Ingano knowledge and working closely with Inga communities to better understand traditional diet and current nutritional deficits and needs, this study hopes to contribute positively to Ingano health and well-being.

Introduction

In the western Colombian Amazon, a region of exceptionally high biological diversity, live several indigenous tribes who have expertise in traditional medicine, medicinal plants, and the art of shamanism since pre-conquest times. Their traditional system of resource management entails slash and burn agriculture – primarily based on manioc (a form of cassava), corn and several varieties of fruit trees – hunting, fishing, and harvesting of wild forest products. Their cosmovision, connected intimately with the natural world, is closely aligned with their ceremonies and the consumption of their sacred plant – *yagé*, or *ayahuasca* – that enables them to communicate with their spiritual world and helps determine their social order, environmental ethics and holistic health management system.

For geographic and historic reasons, these groups (referred to by anthropologists as the "*yagé* culture") have been able to preserve their traditions and their traditional systems of production and nutrition better than many others in lowland Amazonia. Nevertheless, during the last hundred years, the religious missions, the increased presence of the state and the extractive economy of quinine, rubber, gold and petroleum, the indiscriminate felling of the forest, plus the recent expanded cultivation of illicit crops and increased presence of armed forces, have produced a demographic and cultural debacle, with loss of indigenous territories, destruction of environment, and marked changes in Ingano customs. All of this has almost led to their physical and cultural extinction and has given rise to illness and malnutrition, in addition to serious damage to their cosmovision and their traditional medicine.

Among these tribes are the Inganos, fragmented and scattered among three Colombian provinces who, since 1986, have been united within the organization known as the Association of Indigenous Communities (Tandachiridu Inganokuna), and who have written a "Plan de Vida" ("Life Plan") that proposes innovative solutions to the challenges of cultural preservation and the conservation of their territories and environment. With the support of NGOs like the Amazon Conservation Team (Amazon Conservation Team, Washington DC, 2004), these tribespeople have developed successful programmes of ethno-education, territorial recovery, environmental conservation, practice and perpetuation of traditional medicine, and sustainable agricultural production, among others.

Historically, the Inganos have been recognized as a relatively healthy group, with a long life expectancy. Current health problems are derived from recent effects of colonization, the loss of territories, the decrease in protein sources, the acculturation and loss of traditional medicine and the changes in eating habits. The reduction of their territories has resulted in diminished access to wild foods such as meats, fish and fruits. One of their most important medicinal species – *yoco* (*Paullinia yoco*) – is valued as a stimulant, a food and a medicine. *Yoco* has traditionally been used by the Inganos and is now in danger of eminent extinction – leading to increased reliance on non-traditional foodstuffs that cause health problems. Social "development" projects, such as cattle ranching and intense agriculture, have caused more problems than they have solved. The acculturation that comes with schools, health centres and publicity in mass communication media has worsened the eating habits of the youth, who abandon traditional foods to embrace processed food, which is more expensive, less nutritional and often harmful to their health.

This case study in Colombia (Figure 5.1) has become integrated into the Life Plan of the Association of Indigenous Communities in the Amazon district, and has four fundamental pillars: (1) the ethno-education programme of the local Yachaicury School, with the indigenous youths implementing a traditional food recovery programme to improve nutrition and health; (2) a biological resource and food supply security programme which relies on the indigenous agro-ecological promoters who work toward the recovery of traditional seeds and the development of productive farms; (3) the traditional medicine programme in which various shamans from several ethnic groups oversee the protection, defence and recovery of their medicine and the use of medicinal plants; and (4) the environmental conservation programme, essential since the Association partnered with the Colombian government to establish the country's first protected area for biocultural conservation, the Indi Wasi National Park. Therefore, the CINE programme with which we are associated is very much in line with the Indians' stated intention to taking charge of the cultural and environmental destiny based primarily on indigenous wisdom and traditions.

Description of Ingano research site and Indigenous People

Geographic and environmental characteristics

Southern-most Colombia at the eastern slopes of the eastern-most Andean chain is the area inhabited by the tribes in this study. This region is located between 150 and 500 m above sea level. Because it is located on the equator, there are no significant seasonal differences in solar radiation, which means that the variation in average monthly temperatures is minimal. Seasonality in this region is affected and defined by changes in precipitation periods.

The piedmont region is greatly influenced by pluvial cycle peaks, which have caused serious avalanches over time. Showers of more than 100 mm in 24 hours are actually frequent (Mejía, 1993). Average precipitation varies between 3 500 mm/year and 4 300 mm/year. The months with the highest precipitation levels are April, May, June and July. Those with lower precipitation levels are December, January and February. Moderate precipitation can be observed during March, August, September, October and November. Relative humidity oscillates between 64 percent and 93 percent (Agenda Unitaria del Caquetá, 2002; Lozano *et al.*, 2001).

Soils are quickly eroding because of agricultural exploitation. Another related problem is illicit crop production, involving extensive use of agrochemicals. Generally speaking, there are two types of soils: 1) those found in the high plains of humid or very humid weather (haplorthox and dystropepts); and 2) those found in zones of very humid and pluvial weather, with plain or undulated relief, well or poorly drained (fluvaquents, tropaquepts) (IGAC, 1986).

According to the morphology and relief of the eastern chain's eastern slope, it is possible to divide the region into sectors with respect to the vertical distribution of the slopes. Schematically, it can be said that in high-mountain areas vertical slopes are very cragged, gradually becoming less pronounced towards lower areas. Below are plains with slopes containing desiccated or elevated terraces. The piedmont belongs to the transition area between steep slopes and plains. The transition between the Amazonian lowlands to the east, and the Andes mountain chain at the west, characterizes this region. When grouping the distribution of the slopes according to their altitude, three elevation ranges were established. Flat areas are most common below 400 m above sea level. A transition can be observed between 400 and 900 m, where both gentle and pronounced slopes are found, while steep slopes predominate over 900 m above sea level (Sarmiento and Alzate, 2004). In addition to these precipitation characteristics, there are some erosion problems caused by loss of vegetable layer, high temperatures and precipitation levels that cause accelerated loss of soil nutrients.

As for water quality, contamination is now common. As streams run through populated areas, quality considerably decreases for there is no adequate treatment for domestic and agricultural residues. Many water sources have been diminished or even dried up by erosion, and others disappear during months with low precipitation. For this reason, availability of potable water is a growing problem.

The fumigation of coca crops has also become a serious problem. The sprayed pesticides fall onto grazing pastures or farmlands. When this happens in mature crops – especially manioc and banana – inhabitants harvest and consume them rapidly to avoid their loss, even if that means ingesting toxic chemicals. Another factor that considerably reduces water quality is the way in which cocasa (cocaine processing waste) is discarded – because this is released into the water supply, rivers and streams become toxic.

There are no fixed pollution sources in the area. Agricultural and livestock activities are based on the periodic burning of pastures during low precipitation months. This common activity reaches considerable proportions, although there are no detailed analyses of the phenomenon. The impact of acid rain is considered to be low or null, for cloudy masses are formed in the Amazon where emissions are not toxic enough. However, there are no studies that can offer precise data on the level of rain contamination.

According to the general ecosystem map (Márquez, 2003), this region marks the transition between lowland humid forests, submontane forests and, finally, mountains and high mountains. Below 1 000 m above sea level, lowland humid forests are characterized by high average temperatures and pluvial indexes above 1 500 mm/year, with a high canopy that varies between 20 and 50 m. Between 1 000 and 2 000 m above sea level, the submontane forests include elements of the ecosystems located above and beneath them. This ecosystem is characterized by both high humidity and pluvial levels, for it is located just where cloudy masses are charged with water and collide with the mountains along their way west through the Amazon. Canopies have an average height of 35 m. According to studies carried out on this region, satellite images can help to establish the increment on deforestation, gracing lands or naked soils rates in these forests (Sarmiento and Alzate, 2004).

Deforestation started during the 1940s when people from other regions in the country began to colonize the area. According to the inhabitants, during that time forests were continuous, but extensive livestock activities during the subsequent decades turned the forests into pastures. Today, plains and savannas have also been turned into pastures. In smaller farms, pastures share the area with banana and manioc crops. Deforestation has also increased near the mountains during the last years because of the arrival of additional peasants seeking land to cultivate coca.

These activities have all but exterminated the wild animals that previously constituted the indigenous communities' main source of proteins. Plant species important for traditional medicine have also been diminished.

Caquetá: Departmental profile

Rural areas in the Department of Caquetá are suffering from overpopulation and low income because of the influx of landless peasants fleeing violence in other parts of the country. This regrettable situation has forced people living in rural areas to become involved in illicit alternatives to generate incomes. Of the 5 million acres surveyed by the Department, 99 percent were used for illicit crops and stockbreeding (Aguirre, 2004).

The main crops of Caquetá are rice, beans, corn, soy, cocoa, *cocona*, *chontaduro*, *lulo*, mandarin oranges, African oil palm, pineapple, manioc, banana and sugarcane. The acre yield for all these crops is relatively low. As for cattle rearing, studies show a considerable deficiency, with low milk and meat production. Deficiencies in roads and telecommunications infrastructure also exacerbate this problem, as they hinder contact and exchange between market centres as well as increasing the inputs and production costs.

Facing this critical situation, there are insufficient financial resources to invest in technology transfer and technical assistance. Some regional and national institutions have developed and disseminated technology for sustainable forestry and agricultural extension. However, because of the lack of resources and adequate agricultural policies, this technology has not yet been consistently developed or applied. This issue has led to depopulation of some rural areas and diminution of the agricultural business profitability, explained by the evident increase of the price of inputs, such as labour. In addition, the social situation of the country strongly affects that of the departmental rural areas, for abandonment of the countryside further aggravates the original problem (Aguirre, 2004).

Caquetá Department is part of the Amazon basin. Virgin forests exist on nearly 60 percent of this territory, mostly placed on the eastern slope of the eastern Andes where the headwaters of the Caquetá river – one of the major tributaries of the Amazon – are located. Nearly 70 percent of Caquetá's territory is governed by laws enforcing protection or special management of its natural resources (Aguirre, 2004), but these are poorly enforced.

The General Social Security Health System seeks to provide social protection to the most vulnerable part of the population and assure that they receive appropriate healthcare and access to basic services. However, this department's healthcare goals have never been met fully. In fact, many reserves and settlements do not have basic health services. Caquetá's inhabitants generally poor health situation is, in general terms, the result of several factors: fast urbanization accelerated by displacement, presence of illicit crops such as coca, and armed conflict. Poverty is severe, and there is low insurance coverage because of scarce economic resources. Therefore, healthcare services are inadequate for the population. The department has additionally identified the following problems: high maternal and infant morbidity rates (one of the highest in the country) resulting from difficulties to access prenatal care; lack of safe delivery programmes and lack of monitoring

Table 5.1 Most common Ingano botanical and faunal resources from the forest

Common name	*Scientific name*	*Family*	*Uses*
Botanical resources			
Palma Guajo	*Attalea* sp.	Palmaceae	Food
Palma mil pesos	*Jessenia bataua*	Palmaceae	Food (edible oil)
Balso	*Ochroma lagopus*	Bombacaceae	Timber
Bilibil	*Guarea Trichiloides*	Meliaceae	Timber
Carbonero	*Albizzia carbonaría*	Mimosaceae	Timber
Fono	*Schweilera* sp.	Lecythidaceae	Timber
Árbol del Pan	*Arthocarpus comunis*	Moraceae	Fruit and timber
Cacao de monte	*Theobroma cacao*	Stherculiaceae	Fruit and timber
Cachimbo	*Eritrina glauca*	Fabaceae	Ornamental and timber
Cobre	*Apuleia* sp.	Caesalpinaceae	Ornamental and timber
Nacedero	*Eufhorbia* sp.	Eufhorbiaceae	Ornamental and living fence
Matarratón	*Glirisida sepium*	Fabaceae	Medicine and fodder
Yarumo	*Cecropia* sp.	Moraceae	Protector
Caucho	*Ficus* sp.	Moraceae	Raw material
Sangre toro	*Virola theidora*	Myristicaceae	–
Faunal resources			
Ayumara	*Hoplias malabaricus*	Erythrinidae	Meat
Bocachico	*Curimata spilura*	Curimatidae	Meat
Hoatzin	*Opisthocomus hoatzin*	Opisthocomidae	Meat
Mojarra o Jacho	*Eaquidens* sp.	Cichlidae	Meat
Peccary	*Tayassu tajacu*	Tayassuidae	Meat
Sardina	*Astyanax* sp.	Characidae	Meat
Spectacled caiman	*Caimán cocodrilus*	Crocodylidae	Meat
Tapir	*Tapirus terrestres*	Tapiridae	Meat
Paca	*Agouti paca*	–	Meat, medicinal
Armadillo	*Dasypsus novemcinctus*	Dasypodidae	Meat, medicinal. Ornamental
Panguana	*Cryptorellus undalutus*	Tinamidae	Pet and meat
Paujil	*Mutum salvini*	–	Pet and meat
Red handed tamarin	*Saguinuisniigrcollis*	–	Pet and meat

– No data.

of children's growth and development; and lack of coordinated policies that ensure suitable food for pregnant women and children under five years of age. In addition, high incidence and presence of pathologies related to poor water quality are aggravated by weather conditions and primitive basic drainage infrastructure. With regard to education, average lower school enrollment and graduation is under 70 percent, while middle school coverage is less than 15 percent (Aguirre, 2004).

Displaced populations caught in the middle of the armed conflict, or whose lands have been affected by fumigation of illicit crops, presents still another challenge. Human rights violations because of the ongoing conflict compound these challenges. The Social Solidarity Network of Caquetá lists almost 7 927 displaced families or 38 000 displaced people (Aguirre, 2004).

Since the creation of the 1991 Constitution, indigenous communities have their own legislation, which allows them to ensure the existence and proper implementation of their traditional socio-political organization. However, communities are not fully capable of undertaking these processes and therefore protecting their culture and traditions. Lacking effective voice capable of dealing with the government and the outside world in general, these communities continue to be isolated and receive little support for their programmes and activities.

Caquetá is not properly covered by aqueduct or adequate sewer systems, especially in rural areas, and this is one of the most significant causes of morbidity, gastrointestinal and diarrhoeal diseases. Aqueduct distribution networks have a 25 percent deficit in the urban area, and 60 percent in the rural area. "Department municipalities do not have an efficient system that allows them to properly dispose of solid residues. Although most of this work (62.5 percent) is carried out through garbage collection, there are no adequate sanitary dump stations, but dumps with no kind of control or respect for environmental protection laws" (Aguirre, 2004).

The San Jose del Fragua Municipality traditionally belongs to the Ingano people, who arrived from Puerto Limon and Mocoa escaping Catholic missions and colonization. The municipality was officially created in 1985, although it had been established as a town as early as 1959 (Parra, 2004). The municipality is located in eastern Caquetá, 37.28 miles south of Florencia. It covers 76 367 square miles, 540 m above sea level. Its average temperature is 27 °C, with relative humidity of 87 percent. Average precipitation is 3 500 mm a year. Yurayaco is located at 297 m above sea level. The most important agricultural products are banana, sugarcane, pineapple and corn. Other significant products are rubber, cocoa, *araza*, *cocona*, *copoazu*, *chontaduro*, *caimarona* grape, coffee and *borojo* (Parra, 2004).

The most common botanical and faunal resources from the forest (Parra, 2004) are shown in Table 5.1.

Seven watersheds are found within the municipality's territory, most originating in the mountains. These rivers all flow into the Amazon. They are rich in sediment and vegetable material. Deforestation also contributes to sediments entering the rivers. Because of the steepness of slopes, these rivers have a strong current (Parra, 2004).

As for health care, traditional indigenous medicine is widely accepted and practised. However, only 42 percent of Ingano families receive healthcare aid. Typically, rural areas have the lowest access to western healthcare. Common diseases in Caquetá include malaria, dengue, yellow fever, trypanosomiasis, schistosomiasis, oncocercosis and leishmaniasis. Diarrhoeal diseases and respiratory infections also present especially high rates. Unfortunately, tuberculosis and some diseases that could be forestalled through immunization are present. Chronic non-transmissible diseases are not among the most critical contributors to morbidity or mortality rates, but their incidence has been increasing lately (PAHO, 1994).

Besides medical and dental assistance, the Departmental government provides some promotion and prevention activities, including the Extended Immunization Plan as required by national law. However, the indigenous populations receive even less of this attention than other inhabitants of Caquetá.

Ingano people

Ingano indigenous communities in Caquetá are organized into cabildos – the community's maximum authority – that elect a governor as well as a mayor, sheriff or constable, secretary, treasurers and other necessary officers. These posts are elected by popular vote at indigenous assemblies:

> The Ingano come from several indigenous ethnos: the migratory groups living in the Colombian Amazonian piedmont come from the Peruvian and Ecuadorean Amazon; those inhabiting the lower Putumayo, known as Mocoas; and some are the last survivors of the Andakies, fighting people that never surrendered to the Spanish conquerors.
>
> The most important settlement is located in Sibundoy Valley, located near the upper Putumayo River at 2 200 m over sea level. They also inhabit some rural territories in the Departments of Putumayo, Caquetá and Cauca. However, their

migratory spirit has led them to some of the big cities of Colombia and neighboring countries. Over the last few years, they have experienced a great demographic recovery, and up to this moment 35 000 Ingano people are estimated to live throughout the country.

The Ingano people speak the Inga language, a linguistic form of Quechua. There is no exact information about their Mocoas and Andakies ancestors' original dialect. With the latest colonization movement at the beginning of the last century and the presence of Capuchin missionaries, Ingano people were isolated and fragmented into five groups: a) those inhabiting at Sibundoy Valley, b) those at the neighboring regions of Mocoa, Bajo Putumayo, c) those living in the Bota Caucana, d) those at the region of el Fragua in Caquetá, and e) those who have migrated to villages in Nariño, Valle, Amazon, or to the big cities. This is the reason why the Ingano people are represented by several political organizations: Musu Runacua, OZIP and the Asociación de Cabildos del Valle de Sibundoy in Putumayo, Zonal de la Baja Bota Caucana in Cauca Department, and Tanda Chiridu Inganokuna in Caquetá.

Besides their demographic recovery, the Inganos have managed to consolidate more than 18 reservations properly acknowledged by the state. Although these territories are relatively small, they are distributed throughout the immense geography of the Amazon piedmont.

There are two main groups of Ingano people: the largest group, inhabiting the highlands, which incorrectly led them to be anthropologically classified as "High Andes" people; the other group inhabits the lowlands. The geographic diversity has also made the cultural variety extremely significant, although both groups share language, traditions, and especially traditional medicine like the use of medicinal plants.

(UMIYAC, 1999)

Geographically, these communities are located at the western part of the Department. The territory is close to Cauca and Putumayo Departments, only divided by the Caquetá and Fragua River that runs through the lower part of the Bota Caucana:

> The territorial occupation of the indigenous settlements exemplifies how the community uses their land, for the Ingano people need the entire territory for their sustenance and recreation. Each family daily uses basic elements of the surroundings to survive and satisfy their needs. Each year, these communities occupy around 4.94 acres for cultivation, using a rotating cropping system in permanent crop areas.
>
> One of the most important cultural expressions of the Inganos is the "Calusturinda", carnival or party in honour of the rainbow. This carnival takes place during mid-February or beginnings of March, and it is considered the most important popular event of the year. It is also called Atun Puncha, or "big day", and represents for the Ingano people the beginning of the year, joy, reconciliation, and the return of those who had left. Special dancing events take place during this festivity. People drink chicha [corn beer] and sing. Typical costumes are colourful and there are lots of games and music. As for religious traditions, the most important rite is drinking Ambi Huasca or Yagé. This drink is obtained from the plant called [ayahuasca], and it is sacred and medicinal for the Ingano people.
>
> *(Parra, 2004)*

Colombian nutritional condition

According to statistics presented by UNICEF-Colombia, in terms of global malnutrition (weight/age), 10 percent of the country's population suffered from severe malnutrition or was below two standard deviations during 1990. This percentage went down to 8.4 percent in 1995 and to 6.7 percent in 2000. On the other hand, 21 percent of the population was found to suffer from chronic malnutrition (height/age) during 1990, 15 percent in 1995 and 13.5 percent in 2000. As for acute malnutrition (weight/age), there are no records for 1990, but 1.4 percent was reported for 1995, and 0.8 percent for 2000.

UNICEF also declared Colombia free of iodine deficiencies in 1998, after establishing the presence of iodated salt in 91 percent of families, and just 7 percent of level I goitre, representing a very low risk for school-going age children. In Colombia, all wheat flour produced within the country must be fortified with iron, vitamin B_1, vitamin B_2, niacin and folic acid. With regard to anaemia, 25 percent of children under five years presented less than 11 g/dl haemoglobin in 1995, with those under two years of age being the most affected. The same percentage was recorded for groups of women of reproductive age, with the percentage increasing to 43 percent in gestating women (UNICEF-Colombia, n.d.).

These figures show an improvement in nutrition. However, rural areas located far from municipality administrative centres, such as in Caquetá where many Inganos live, do not receive adequate attention or services generally present the lowest of all health and nutrition indexes.

Many of the positive changes observed in nutrition indexes are attributed to the National Nutrition Plan developed in Colombia for the period 1999 to 2005. Nevertheless, the important gap between different areas of the country cannot be ignored. The Caquetá Department, for example, has the second highest malnutrition figures in the country (UNICEF-Colombia, n.d.).

According to UNICEF:

> ... death risk among children under five is extremely high, as well as the possibility that their adequate development suffers serious limitations. Many of today's undernourished children did not receive the benefits of breast milk, or belong to families who have been displaced by the armed conflict. Women in these families are often undernourished, incapable of hygienically caring for their babies, or otherwise attending to their children. The Pacific Coast region has the highest figures of children under five suffering from chronic malnutrition. In this region, for the year 2000, only 12 percent of women were exclusively breastfeeding their children during the first six months. This fact reveals that cultural practices established by industries producing baby food products during the 1960s or 1970s are very hard to change.
>
> *(UNICEF-Colombia, 2007)*

Methodology

We discussed, modified and signed with the indigenous leaders the collective consent that was drafted by the Centre for Indigenous Peoples' Nutrition and Environment (CINE): prior consultation, consensus decision-making and the protection of their rights as indigenous communities were guaranteed. For the Inganos, the project was not considered research, but rather an instrument to improve and implement their Life Plan and to help them move towards cultural, environmental, productive, and community health recovery. Because of the civil conflict in Colombia that has its epicentre in Caquetá and Putumayo, the project strategy must be one of gradual extension and replication on the part of the indigenous groups. On the other hand, the Inganos do not recognize divisions between shamanism, health, diet, plants and nature. Therefore, the project was viewed as integrating all these issues in a holistic manner.

Given the prior instances of exploitation and of abuse of intellectual property, the Inganos do not approve of the collection of blood samples and subsequent medical laboratory analysis. It is the opinion of the indigenous leaders that these types of projects should result in better conditions for access to food and food availability than in diagnoses and documents. Initially, the expected project's development was hindered by the occasional political difficulties that took place in the area, obstructing access to the Ingano region.

An interdisciplinary research team was created for the project, Nutrición y Alimentos Tradicionales (Traditional Foods and Nutrition), which began its activities on 1 May 2004. The project was developed with the communities belonging to the Asociación de Cabildos Tandachiridu Inganokuna (Tandachiridu Inganokuna Indigenous Cabildos Association). Participating reservations included Yurayaco, Brisas, San Miguel, Niñeras and Cosumbe, all in the Department of Caquetá. The participating communities with which the group had established a previous relationship signed a collaboration letter at the beginning of the project. The participation of each member was subsequently established, presented and discussed.

Table 5.2 Ingano traditional food list *(160 species/varieties)*

	Scientific name	English/common name	Local name	Spanish name
	Vegetables, Tubers and Tree			
1	*Allium* sp.	Onion	cebolla	–
2	*Begonia plebeja*	–	caña (caña agria)	singo
3	*Capsicum annuum*	Chili pepper	cjí	aji
4	*Carludovica palmata*	Palm tree greens	cogollo de iraca	–
5	*Carludovica palmata*	Panama hat plant	cogollo de bombona (bombona)	–
6	*Chrysophyllum mexicanum*	Star apple	–	
7	*Cucumis sativus*	Cucumber	pepino	–
8	*Dioscorea alata*	Yam	name	–
9	*Eryngium foetidum*	Cilantro	cilantro cimarrón	–
10	*Guilielma gasipaes* (2 var.)	Peach palm	chontadura, chotaduro	chontadura bagre, chontaduro
11	*Ipomoea batatas*	Sweet potato	batata	–
12	*Lycopersicon esculentum*	Tomato	tomate	–
13	*Manihot esculenta*	Yucca greens	cogollo de yuca	cogollo de rumo
14	*Manihot esculenta*	Cassava, Yucca, Manioc	yuca	
15	*Oenocarpus bataua*	Ungurahui (Fruit and Palm tree)	milpes (palma de milpes- seje)	milpes
16	*Oenocarpus bataua*	Milpes milk	leche de milpes	milpes
17	*Paullinia yoco*	Yoco vigne	yoco	–
18	*Phaseolus vulgaris*	Kidney bean	fríjol	fríjol
19	*Pouteria* sp.	Palm tree variety	caimo	–
20	*Sechium edule*	Chayote	yota	yota
21	*Zea mays*	Corn	maíz	sara
22	–	–	nina waska	–
23	–	–	bore	bore
24	–	–	guansoco	–
25	–	–	tintero	–
26	–	–	mereñe	–
	Fruits			
1	*Allium sativum*	Garlic	ajo	ajo
2	*Ananas comosus*	Pineapple	piña	piña
3	*Annona cherimolia*	Custard apple	chirimoya	custard apple
4	*Annona muricata*	Soursop	guanábana	guanábana
5	*Pachira aquatica*	Brazil nut	castaño	–
6	*Carica papaya*	Papaya	papaya	papaya
7	*Pourouma cecropiifolia*	Amazon tree-grape	uva caimarona	caimarona
8	*Citrus sinensis*	Orange	naranja	naranja
9	*Citrus limon*	Lemon	limón	limón
10	*Cocos nucifera*	Coconut	coco	coco
11	*Syagrus* sp.	Coconut (Wild)	coco silvestre	syagrus

Continued

Table 5.2 *(continued)* **Ingano traditional food list** *(160 species/varieties)*

	Scientific name	English/common name	Local name	Spanish name
12	*Eugenia stipitata*	Araza	arazá	arazá (wild guava)
13	*Inga feuillei*	Pacay	–	–
14	*Matisia cordata*	Sapote	zapote	zapote chupa chupa
15	*Musa regia*	Plantain	plátano	plátano
16	*Musa sapientum*	Banana	banano	bando
17	*Musa* sp. (4 var.)	Plantain variety	chiro, pilipita, pildoro, guineo real	platano pilipita
18	*Psidium guajava*	Guava	guayaba	guayaba
19	*Passiflora multiflora*	Giant granadilla	badea	–
20	*Passiflora edulis, Passiflora edulis f. flavicarpa* if yellow	Passion fruit, purple, yellow	maracuyá	maracuyá
21	*Persea Americana*	Avocado	aguacate	aguacate
22	*Rheedia madruno*	Madrono	madroña	–
23	*Theobroma bicolor*	Peruvian cacao, Tiger cocoa, Wild cacao`	cacao maraco	–
24	*Theobroma cacao*	Cacao	cacao	–
25	*Theobroma subincanum*	Wild cacao	cacao silvestre	–
26	–	–	pomo	pomo
	Animals			
1	*Alouatta seniculus*	Red howler monkey	cotudo, koto	mono cotudo, mono bombo
2	*Cabassous unicintus*	Armadillo	matiguaja, chichico, gurre	armadillo rabo de trapo
3	*Cabassous unicintus* and *Geochelone carbonaria*	Armadillo and red-footed tortoise blood	sangre de gurre y morrocoy	sangre o claros
4	*Cebuella pygmaea*	Pygmy marmoset	chichico	mico titi - leoncito
5	*Cebus albifrons*	With-fronted capuchin	yura chichikú	mico blanco
6	*Cebus apella*	Brown capuchin	comendero	mico maicero
7	*Chiropotes satanas*	Black bearded saki	viraño	cucus conejo
8	*Crocodilus fuscus*	Spectacled caiman	babilla	babilla
9	*Cuniculus paca*	Spotted cavy	yulo	boruga
10	*Dasyprocta fuliginosa*	Black agouti	guara	atun conejo
11	*Didelphis albiventris*	White-eared opossum	raposa	chucha
12	*Geochelone carbonaria*	Red-foot tortoise	sacha testuja	morrocoy
13	*Iguana iguana*	Iguana	iguana	iguana
14	*Lagothrix logothricha*	Wooly monkey	churuco	mono
15	*Lagothrix* sp.	Big monkey	churuco grande	mono atun
16	*Mazama americana*	Red brocket	atun taruka	venado grande
17	*Mazama rufina*	Little red brocket	uchipa taruka	venado pequeño
18	*Mazama* sp.	Deer	taruka	venado
19	*Myoprocta pratti*	Green acouchy	tintin	titie
20	*Myrmecophaga tridactyla*	Giant anteater	oso caballuno	oso caballuno
21	*Nasua brasiliensis*	Coatimundi	cusumbe	cusumbe

Continued

Table 5.2 *(continued)* **Ingano traditional food list** *(160 species/varieties)*

	Scientific name	English/common name	Local name	Spanish name
22	*Pitechia monachus*	Monk saki	oso mono	mico volador
23	*Podocnemis expansa*	Side neck turtle	charapa	tortuga
24	*Potos flavus*	Kinkajou	tuta mono	perro de monte
25	*Saguinus inustus*	Mottled-faced tamarin	yana chichikú	mico negro
26	*Saimiri sciureus*	Squirrel monkey	caspi cara chichico	mico pielroja - mono ardilla
27	*Sciuridae*	Squirrel	callambero	ardilla
28	*Sciurus igniventris*	Northern Amazonian red squirrel	ardita	ardilla colorada amazónica
29	*Spermophilus adocetus*	Tropical ground squirrel	sirindango	sirindango
30	*Tamandua tetradactyla*	Anteater	chucha jueniko	oso hormiguero
31	*Tapirus terrestris*	Tapir	danta	Dant
32	*Tayassu tajacu*	Collared peccary	boruga cerrillo	cerrillo
33	–	Animal viscera	menudencia	visceras
34	–	–	maisero	comendero
35	–	–	marimba	blas
36	–	–	sicse	–
	Fish			
1	*Aequidens latifrons*	Ray-finned fish	mojarra	contacuro
2	*Alectis ciliaris*	Ray-finned fish variety	zapatero	–
3	*Brachyplatystoma flavicans*	Long whiskered catfish	dorada	–
4	*Brycon* spp.	Sábalo	sábalo	sasidina
5	*Cetopsis coecutiens*	Ray-finned fish variety	pege ciego	puño ñave
6	*Gasterosteus aculeatus*	Three-spined stickleback	espinoso	–
7	*Geophagus steindachneri*	Redhump eartheater	jachos	–
8	*Harengula thrissina*	Pacific flatiron herring	sardina	–
9	*Hoplias malabaricus*	Trahira	denton, mojoso	kirosapa
10	*Megalonema platycephalum*	Long whiskered catfish	barbudo	wira barbudo
11	*Menticirrhus panamensis*	Ray finned fish	botello	
12	*Panaque nigrolineatus*	–	cucha real	caraguaja
13	*Prochilodus nigricans*	Black prochilodus	bocachico	chalua
14	*Pseudancistrus* sp.	–	cucha pequeña	chiki caqui
15	*Pseudoplatystoma fasciatum* (2 var.)	Barred sorubim, Tiger catfish	pintadillo	Pintadillo, pintadillo bagre
16	*Pseudoplatystoma filamentosum*	–	cheo	pintadillo chalua (pintadillo rayado)
17	*Pseudoplatystoma tigrinum*	Long-whiskered catfish	tigre bagre	tigre bagre
18	*Sardinella aurita*	Round sardinella	sabala dorada grande	sardina dorada atun
19	–	–	cucha	caraguaja
20	–	–	corbao	corcobao
21	–	–	cucha burro	caraguaja
22	–	–	cuchineja	–

Continued

Table 5.2 *(continued)* **Ingano traditional food list** *(160 species/varieties)*

	Scientific name	English/common name	Local name	Spanish name
23	–	–	dentun real	pita chalua
24	–	–	fauton	hachacabo
25	–	–	pescado	chaiwa
26	–	–	saino	sacha kuchi
27	–	–	sambica	chalua sambica
28	–	–	tusa	karauaja
29	–	–	domesalla	–
30	–	–	guaraja	rina ñagui
31	–	–	mojiño	–
32	–	–	puka chupa	–
33	–	–	puño	latiran
34	–	–	rabicolorado	puca chupa
35	–	–	rabinegra	–
36	–	–	sabaleta	–
37	–	–	corbao	corcobao
	Birds			
1	*Anseranatidae* (general)	Duck	pato	pato
2	*Brosimum utile*	Sande	panguana	panguana
3	*Cheirodon axelrodi*	Cardinal	cardenal	yabuar pisco
4	*Columba* spp.	Pigeon	torcasa	puca tostolita
5	*Cracidae* (4 var.)	Guan	pava cuyuya, pava taro, pajuil colorado, pajuil negro	yura pava, puka pava, resador, pajuil yana
6	*Icteridae*	–	muchilero	muchilero
7	*Melleagris* sp.	Turkey	pavo	puca pavo
8	*Penelope purpurascens*	Crested guan	pava	pava
9	*Phasianidae*	Large partridge	gallineta, Gallineta de monte	atún perdiz, atun pisdez
10	*Psittaciformes*	Parrot	loro	orito
11	*Ramphastus ambiguus*	Crimpson rumped tucanet	picon	tucan
12	*Thraupis* sp.	Blue bird	azulejo	pali piso
13	*Psaricolius angustifrons*	Blood of black-billed oropendola	sangre de muchilero	oropéndola
14	–	Parakeet	perico	koleguiro, colejero
15	–	–	rapiño	pisco gavilán
16	–	–	chilanga	–
17	–	Bird	pisco	–
18	–	–	pitojai	sillo picho
	Insects			
1	*Atta* spp.	Leaf cutting ant	hormiga arriera	–
2	*Atta* sp.	Ant	hormiga	arriera
3	*Coleoptera*	Beetle	mojojoy	kuru
4	*Pomacea maculate*	Snail	caracol	churo

Continued

Table 5.2 *(continued)* **Ingano traditional food list** *(160 species/varieties)*

	Scientific name	*English/common name*	*Local name*	*Spanish name*
	Drinks			
1		Fermented banana/plantain drink	chicha ó anduche	–
	Miscellaneous			
1	*Auricularia auricula*	Ear fungus (mushroom)	cayamba	oreja de palo
2	–	Edible mushroom	cayamba	oreja de palo
3	–	Mushroom	callamba	–
4	–	Frog	guanvoy	–

– No data.

The collaboration agreement and general consent were adjusted to the communities' expectations and signed. A training workshop followed, which focused on the development and management of survey instruments: data format, surveys, anthropometric analysis and community workshops.

Research in the community was conducted as outlined in the methodology from CINE (www.mcgill.ca/cine/research/global.pdf). Research activities comprised focus groups to determine species in the traditional food list, and the ways that the Ingano foods are perceived and used. In addition, interviews with 34 women and 8 men, including several shamans, were completed. Twenty-four hour diet recalls were conducted with adults. Anthropometry was conducted on 116 individuals – 43 children (0–12 years) and 73 adolescents/adults (>12 years) – with standard scales and tape measures used in health clinics in the region. Several discussions were held with an additional 20–25 adult Ingano community leaders and health personnel, and existing reports on traditional medicines were reviewed.

Excel formats were used to enter a list of traditional foods to make the information easy to handle and process. Individual interviews with people belonging to the Ingano culture elaborated the food information. Food classification according to traditional attributes or categories was derived from personal interviews. Particularly emphasized were the hot and cold foods, the irritating and soothing foods, and the tonic and purgative foods.

Results

Over 160 types of food were described. Some were varieties of the same species, and, in some cases, parts of the same species were referred to separately. The research on traditional food confirmed the loss of many traditional resources, especially game animals and fish, insects and tubers, roots, seeds and leaves of indigenous plants. These foods have been divided according to the suggestion of focus groups in the following categories: small animals, big animals, traditional animals, traditional furry animals, monkeys, insects, birds, small fish, big fish, traditional fish, palm trees, platanos (varieties of banana), fruits, root foods, other plants, carbohydrates and cereals. This division allowed clarification of some characteristics of the classified species. The availability calendar of most of these foods was not especially significant. Since the communities are located in tropical areas, weather variations are not drastic enough to be distinctive. However, wild species do appear in specific seasons, while those that are grown are available depending on where they are planted. This provides food year round. Table 5.2 records a list of Ingano traditional food, containing 160 species.

Generally, the reason that certain traditional foods remained in the diet has been availability rather than demand, although some traditional Inga foods were also highly appreciated for their nutritional value. Since in many cases foods were wild, information on their

Table 5.3 Nutrient composition of selected Ingano traditional food

Food Items	kcal	Energy kJ	Protein g	CHO g	Fat g	Ash g	Vitamin A RE	Vitamin C mg	Iron mg	Phosphorous mg
Vegetables, Tubers, Trees and Herbs										
Chontaduro[1]	185	773	3.3	–	4.6	–	730	20	0.7	–
Ñame[1]	105	439	2.4	–	0.2	–	0	6	2.4	–
Palma de milpes or Seje[2]	55	230	7.4	37.3	–	–	–	–	–	–
Fruits										
Araza[3]	15	63	0.4	–	0.2	–		20.0	0.60	–
Papaya[1]	30	125	0.5	–	0.1	–	70	75.0	0.30	–
Pina[1]	51	213	0.4	–	0.1	–	0	12.0	0.40	–
Platano[1]	140	585	1.2	–	0.1	–	100	20.0	0.50	–
Zapote[1]	49	205	1.1	–	0.1	–	1 200	20.0	1.40	–
Insects										
Churo[4]	74	309	16.2	–	–	–	–	–	–	112
Hormiga[4]	393	1 643	20.4	4.00	33.0	10.0	–	–	–	–

– No data.
[1] Instituto Colombiano de Bienestar Familiar, 2000.
[2] Diaz and Ávila, 2002.
[3] Corporacion Red Pais Rural, 2007.
[4] Edible LTDA, 2007.

Nutrient composition of selected Ingano traditional food – dry matter basis*

Food Items	Crude protein	Neutral detergent fiber	Acid detergent fiber	Ash (Ethereal extract)	Fat	Calcium	Phosphorous	Magnesium	Zinc	Copper	Iron
	Per 100g basis								Parts per million		
Caña agria	8.5	53.1	41.3	6.2	–	0.22	0.28	0.31	9	5	340
Caracol	65.6	–	–	13.9	3.7	5.31	0.47	0.17	1 270	45	1 833
Cilantro cimarrón	13.5	63.8	65.9	39.1	–	0.50	0.43	0.21	25	28	9 304
Cucha	52.1	–	–	31.0	12.8	2.34	0.47	0.13	269	6	1 792
Milpes	4.0	–	–	6.8	11.4	0.03	0.06	0.03	1	2	61
Mojojoy	28.7	–	–	1.8	64.4	0.02	0.25	0.07	266	9	76
Yoco	8.4	71.5	69.2	3.1	2.0	0.50	0.36	0.12	14	5	389

* Laboratorio de Nutricion, Departmento de Ciencias de la Produccion Animal, Faculted de Medicina Veterinaria Yde Zootecnia, Universidad Nacional de Colombia 2005.
– No data.

Table 5.4 Literature values for nutrients in selected Ingano traditional food per 100 g edible portion

Common name
chontaduro / peach palm
Scientific name
***Guilielma gasipaes* Bailey**

General characteristics
Chontaduro is a neotropical palm fruit.

Nutritional characteristics
In 100 g of cooked pulp:
Energy: 185 Kcal
Protein: 3.3 g
Fat: 4.6 g
Iron: 0.7 mg
Vitamin A: 730 RE
Vitamin C: 20 mg

> Instituto Colombiano de Bienestar Familiar (ICBF). 2000. *Tabla de composición de alimentos Colombianos.* Bogota, ICBF.

Common name
mojojoy / palm grub
Scientific name
Rynchophorus palmarum
(Wilson, 1999)

General characteristics
For indigenous groups, insect gathering is one of the most important activities for food acquisition. The most desired species are the larva, or mojojoy, of the seje palm, and the mojojoy of the chontaduro. The lunar cycle determines the gathering of this species, along with the "hand" of the one that brings down the palm.

Nutritional characteristics
In 100g edible portion, smoke dried (Dufour, 1987):
Energy: 661 g
Protein: 24.3 g
Fat: 55.0 g
Ash: 1.0 g

> Dufour, D.L. 1987. Insects as food: a case study from the Northwest Amazon. *American Anthropologist*, New Series. 89(2): 383–397.
> Wilson, D.J. 1999. *Indigenous South Americans of the past and present: an ecological perspective.* Boulder, Westview Press.

Common name
milpes / bataua
Scientific name
Oenocarpus bataua

General characteristics
Seje palm is of great importance in the traditional food system of many Indigenous Peoples in Colombia and South America because its fruits can be harvested all year long. Among these communities this species is used as raw material to create or prepare multiple products: medicines, oil, chichi and milk (Balick and Anderson, 1986).

Nutritional characteristics
Oil extracted from this palm is similar to olive oil. The main difference between these two is that this palm oil has three times less linoleic acid than olive oil.
In the Amazonian region, milk obtained through a maceration process of the flesh of the palm is consumed very widely. The milk's protein content is comparable to that from an animal as well as to the majority of the grains and leguminous; the biological value of this protein is similar to that of the casein. The "milk" of the seje is comparable to the human one in its content of fat, proteins and carbohydrates – its caloric content provides 55.3 % of calories of the oils, 7.41 % of protein and 37.3 % of carbohydrates (Dìaz y Ávila, 2002).
The nutritional value of this milk is (Dìaz y Ávila, 2002):
Calories: 55.3%
Protein: 7.41%
Carbohydrates: 37.3%
The nutritional value in 100 g of fruit is (1):
Protein: 8 g
Fat: 12 g
Fiber: 15
And in pulp – husk:
Protein: 4 g
Fat: 28 g
Fiber: 3 g

> Balick, M.J. & Anderson, A.B. 1986. *Dry matter allocation in* Jessenia bataua *(Palmae)*. *Acta Amazonica.* 16(17): 135. Cali, Centro Internacional de Agricultura Tropical.
> Diaz, J.A. & Avila, L.M. 2002. *Sondeo del mercado mundial de Aceite de Seje (Oenocarpus bataua).* Bogota, Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. 18 pp (available at www.minambiente.gov.co/viceministerios/ambiente/mercados_verdes/INFO%20SECTORIAL/Sondeo%20del%20Mercado%20de%20Seje.pdf).
> Rios, H.A. 1997. *Proceso de Germinación, transplante y características del Fruto de la Palma de Milpesos Jessenia Batua*. Cartilla No. 2. Quibdo, Ministerio de Agricultura-Universidad Tecnológica del Choco.

Common name
zapote
Scientific name
Matisia cordata

General characteristics
Fruit belonging to the third group of food according to the alimentary guides for Colombian population. It is fleshy, with little pulp, accompanied by a seed that occupies most of its weight. It is produced in warm areas and is harvested twice a year.

Nutritional characteristics
In 100 g of pulp without seeds:
Energy: 49 Kcal
Protein: 1.1 g
Fat: 0.1 g
Iron: 1.4 mg
Vitamin A: 1200 RE
Vitamin C: 20 mg

> Instituto Colombiano de Bienestar Familiar (ICBF). 2000. *Tabla de composición de alimentos Colombianos.* Bogota, ICBF.

Common name
papaya
Scientific name
Carica papaya L.

General characteristics
Fruit belonging to the third group of foods, according to the alimentary guides of the Colombian population. Considered an excellent laxative, rich in vitamins and fiber.

Nutritional characteristics
This fruit, known to be laxative, has seeds with medicinal properties.
In 100 g of pulp:
Energy: 30 Kcal
Protein: 0.5 g
Fat: 0.1 g
Iron: 0.3 g
Vitamin A: 70 RE
Vitamin C: 75 mg

> Instituto Colombiano de Bienestar Familiar (ICBF). 2000. *Tabla de composición de alimentos Colombianos*. Bogota, ICBF.

Common name
ñame / yam
Scientific name
Dioscorea alata L.

General characteristics
Tuber belonging to the first group of foods, according to the alimentary guides of the Colombian population. A rich source of carbohydrates.

Nutritional characteristics
In 100 g:
Energy: 105 Kcal
Protein: 2.4 g
Fat: 0.2 g
Iron: 2.4 g
Vitamin A: 0 RE
Vitamin C: 6 mg

> Instituto Colombiano de Bienestar Familiar (ICBF). 2000. *Tabla de composición de alimentos Colombianos.* Bogota, ICBF.

Continued

Table 5.4 *(continued)* Literature values for nutrients in selected Ingano traditional food per 100 g edible portion

Common name
piña / pineapple
Scientific name
***Ananas comosus* L. Merril**

General characteristics
Fruit belonging to the third group of foods according to the alimentary guides of the Colombian population. Pineapple aids digestion and has laxative properties as well.

Nutritional characteristics
In 100 g of pulp:
Energy: 51 Kcal
Protein: 0.4 g
Fat: 0.1 g
Iron: 0.4 g
Vitamin A: 0 RE
Vitamin C: 12 mg

> **Instituto Colombiano de Bienestar Familiar (ICBF).** 2000. *Tabla de composición de alimentos Colombianos.* Bogota, ICBF.

Common name
platano / plantain
Scientific name
Musa regia L.

General characteristics
Tuber belonging to the first group of foods according to the alimentary guides of the Colombian population. Especially used for child nourishment through products made of plantain flour.

Nutritional characteristics
In 100 g of pulp:
Energy: 140 Kcal
Protein: 1.2 g
Fat: 0.1 g
Iron: 0.5 g
Vitamin A: 100 RE
Vitamin C: 20 mg

> **Instituto Colombiano de Bienestar Familiar (ICBF).** 2000. *Tabla de composición de alimentos Colombianos.* Bogota, ICBF.

Common name
caña agria
Scientific name
***Begonia plebeja* Liebm.**

General characteristics
This plant has an edible stem. It is consumed fresh; in some cases with nothing but salt. The caña agria is an herb with its stem covered in down. Its leaves are large, measuring from 7 cm (2.76 in) to 20 cm (7.87 in) long. Its flowers are white or pale rose, and the fruit is an elongated capsule of about 12 mm (0.47 in), with uneven wings. One is wider and longer than the other.

> **Instituto Nacional de Ecología.** *VII. Tallo-Kuyé o Pistá.* México (available at www.ine.gob.mx/ueajei/publicaciones/libros/274/vll.html).
> **Eulàlia Garcia Franquesa (AAMZB) & Jordi Pascual Sala (MUSAS).** *Llistat de plantes autoctones I els seus usos medicinals* (available at www.bcn.es/museuciencies_fitxers/imatges/ImatgeNoticia187.pdf).
> **Chavarría, F., Espinoza, R., Guadamuz, A., Perez, D. y Masís, A.** 1998. *Species page de Begonia plebeja* (Begoniaceae).
> **Area de Conservación Guanacaste, Costa Rica.** *Species Home Pages* (available at www.acguanacaste.ac.cr).

Common name
araza / wild guava
Scientific name
***Eugenia stipitata* Mc Vaugh**

General characteristics
One of the most distinctive Amazonian wild fruits is the araza, noted for its exquisite aroma and bitter taste. The araza is used to prepare juices, sweets, marmalades, yogurts, and cakes. It can also be used for perfume production due to its scent.
The plant's yield and pulp percentage is high – 34 934 Kg (77 000 lb approx.) of fruit /Ha; 81% compared to others such as caimito – 204 kg (450 lb) – of fruit /Ha; 59%, and camu-camu 933 kg (2056 lb) of fruit/Ha; 62%, respectively. Most part of the production grows wild.

Nutritional characteristics
In 100 g of pulp:
Energy: 15 Kcal
Protein: 0.4 g
Fiber: 0.3 g
Fat: 0.2 g
Vitamin C: 20 mg
Iron: 0.6 mg

> **Escobar, A., C.J. & Zuluaga, P., J.J.** 1998. *El Cultivo de Arazá.* Servicio Nacional de Aprendizaje (SENA), Regional Amazonía, Florencia-Caqueta, Corporación Colombiana de Investigaciones Agropecuarias (CORPOICA).

Common name
yoco
Scientific name
***Paullinia yoco* Schultes**

General characteristics
This plant is native to the northwest Amazon and is valued as both a stimulant and a medicine Traditionally, it has been valued as a stimulant by the Indigenous Peoples at the southeast of Colombia, Ecuador and Peru. The stem, mixed with cold water, produces a mixture of chocolate-like colour. The Putumayo Indians consume this at dawn, and usually eat nothing more until noon. After consuming just one or two cups, representing approximately 100g of the extracted material, hunger disappears for at least 3 hours, while muscles continue to be stimulated.
Reported to be antipyretic, purgative, stimulant and tonic, yoco is used by villagers to treat dysentery, fever, malaria and stomach ache. Among the Putumayo people, this plant is also used in higher doses to treat malaria fever and biliary disorders.

Etnobotanic and etnomedical information:
In the western Amazon of Colombia, in Ecuador and northern Peru, many tribes use yoco daily as stimulant and occasionally to treat fever. Although it is not food, this is a plant that makes op part of the indigenous diet. Because it is known only from the wild, deforestation and over-harvesting are endangering the plant.
The Kofans, Sionas, Ingano, Koreguajes and Secoyas scrape the bark of the stems and macerate them in cold water to ease hunger and fatigue. According to García-Barriga (1992), the traditional preparation entails taking well-formed stems and cutting them into pieces from 40 cm to 50 cm long (approximately 15 to 16 in). They clean the external bark and then scrape it, obtaining shavings equivalent to approximately 10 cm (4 in) of the liana. This amount corresponds to an approximate dose of 5g of bark. They then place the shavings in cold water and, using their hands, rub them together until the water turns milky. After straining out the bark, the beverage is then ready to be consumed. This drink has a milky reddish color and is astringent and sour.
Indigenous Peoples of the Ingano-Kamsá community in Colombia believe that yoco can also be used to treat sexual impotence, weakness and "mala hora" (the "bad hour"). (Urrea and Barreras, 1989). Among the Sionas and Kofans of the Ecuadorian Amazon, this plant is used as a stimulant, to treat malaria, and to treat most fevers in general (Lescure, 1987). Amazon peoples employ several different emetic plants including the ***Paullinia emetica***. This effect is due to the saponin content of the plant (Schultes, 1987).

Nutritional characteristics
There is no available data on its nutritional structure, but its components classify it as a medicinal plant, since the main component is caffeine (12%), mineral matter and diverse alkaloids.

> **EcoAldea.** (available at www.ecoaldea.com/).

Continued

Table 5.4 *(continued)* **Literature values for nutrients in selected Ingano traditional food per 100 g edible portion**

> **Siamazonia** (Sistema de Información de la Biológica y Ambiental de la Amazonía Peruana). (available at www.siamazonia.org.pe/archivos/publicaciones/amazonia/libros/44/texto04.htm).

> **García-Barriga, H.** 1992. *Flora medicinal de Colombia: botánica médica.* Santafé de Bogotá: Tercer Mundo Vol II, p. 149.

> **Lescure, J.P., Balslev, H., & Gallegos, R.A.** 1987. *Plantas útiles de la Amazonia ecuatoriana: un inventario crítico de los datos disponibles en Quito.* Quito, Office de la Recherché Scientifique et Technique Outre-Mer en la Pontificia Universidad Católica del Ecuador.

> **Schultes, R.E., & Hofmann, A.** 1987. *Plants of the Gods: origins of hallucinogenic use.* New York, Van der Marck Editions.

> **Urrea, F., & Barreras, R.** 1989. *Remedios botánicos y modelo etnomédico en el curanderismo ingano-kamsá. Curandismo.* Serie Memorias de Eventos Científicos. Bogotá. 1: 235–274.

Common name
hormiga / ant
Scientific name
Atta* sp. *sexdens/cephalotes

General characteristics
Collected year round, *Atta* sp. are leaf-cutting ants of great importance in the North West Amazonia diet. The winged reproductives or alates, and large-headed soldiers are the largest of the species and some of the largest ants known (Dufour, 1987; Ruddle, 1973).

Nutritional caracteristics
In 100 g edible portion (Durfour, 1987; Durfour, 1988):

Atta sexdens:
Protein: 39.7 g
Fat: 34.7 g
Ash: 1.6 g
Fiber: 7.4 g
Water: 6.1 g
Energy: 628 kcal
Atta cephalotes:
Protein: 48.1 g
Fat: 25.8 g
Ash: 2.3 g
Energy: 580 kcal
Water: 6.9 g

> **Dufour, D.L.** 1987. Insects as food: a case study from the Northwest Amazon. *American Anthropologist, New Series* 89(2): 383–397

> **Dufour, D.L.** 1988. The composition of some foods used in Northwest Amazonia. *Interciencia.* 13(2): 85.

> **Ruddle, K.** 1973. The human use of insects: examples from Yukpa. *Biotropica*. 5(2): 94–101

Common name
churo
Scientific name
Pomacea maculata

Nutritional characteristics
The edible percentage of churo is approximately 50%.
Nutritional composition in 100 g of edible portion:
Energy: 74.3 Kcal
Protein: 16.2 g
Calcium: 36 mg
Phosphorus: 112 mg

> **Siamazonia** (Sistema de Información de la Biológica y Ambiental de la Amazonía Peruana). (available at www.siamazonia.org.pe/archivos/publicaciones/amazonia/libros/44/texto04.htm).

nutritional value was difficult to acquire. It appears reasonable to consider that the good health attributed to these indigenous populations prior to contact has to (in part, at least) be strongly related to traditional diet, which has been disrupted by contact with the outside world.

Primary meat processing and storage techniques were salting and smoking. Many of the listed foods were only eaten fresh; food gathering among the Inganos was carried out on a daily basis, and most of these foods were consumed relatively quickly.

For food-analysis sampling, priority was given to those with potentially high nutritional value. Of the 19 foods chosen for additional analysis, we learned both from the literature and the lab that the following species are nutritionally important and need to be a part of the current and future diet:

1 *Caña agria*: bitter cane employed in the preparation of refreshing drinks.
2 *Cayamba*: large and tasty edible mushroom.
3 *Churo*: edible riverside snail.
4 *Cimarrón*: edible and medicinal herb.
5 *Cucha*: edible fish.
6 *Milpesos*: Palm tree fruit used for consumption and for edible oil.
7 *Mojojoy*: edible beetle larva from fallen palm trunks.
8 *Yoco*: liana used to prepare stimulating beverage.

Some elements of important traditional foods are presented in Table 5.3. Samples were sought for laboratory analysis of nutrients of *yoco*, *cucha*, *caracol*, *mojojoy*, *cilantro*, *cimarron*, *caña agria* and *milpes*. Samples were gathered at San Miguel del Fragua, at a height of 540 metres above sea level, by Fabio Quevedo in February 2005, following all the technical specifications suggested by the laboratory. Table 5.3 presents laboratory results in dry weight of these food items.

A literature search of nutrient values of selected key Ingano food species was conducted, and results are presented in Table 5.4. The need for further work on nutrient composition of Ingano food samples is evident from the lack of published data.

Qualitative aspects of Ingano traditional food importance

The characteristics of traditional foods were agreed in the groups. Following the selection of attributes, the same foods were used to derive a taste-appreciation score for children and adults on a 5-point scale. Table 5.5 reports the average scores for each food. With this information it was then possible to summarize attributes of each of the foods (Table 5.6).

It is clear that these foods were well accepted and that both children and adults enjoyed them. In some cases, the taste of certain items may not have been very pleasant, but their importance to the community was considerable.

Nutrition of infants, children and adults

Interviews conducted with mothers about the nutrition history of infants revealed that breastfeeding was prevalent with cessation from 3–24 months. Complementary food was given early in life. Many children were already taking complementary foods after the first month, and almost all of them had these foods after the fourth month. Milk formula and supplements were used rarely. Complementary food in the infant diet was initiated gradually, generally well accepted and did not produce any health problems.

In the 24-hour dietary surveys, it was found that food diversity was good but somewhat limited because of the scarcity of food resources (including traditional foods) obtained from the surroundings. Also important were the financial difficulties limiting access to other high-quality foods from markets. Using dietary recalls to understand the significance of market food sources, the percentage of dietary energy from both traditional food and market sources was calculated (Table 5.7). Of total daily dietary energy, 58 percent of children's diets and 47 percent of women's diets comprised traditional Ingano food.

Results of the anthropometry assessment of Inganos are given in Table 5.8. It can be seen that the population represented the early stages of the nutrition transition where most children are normal in their height and weight, but that underweight (low weight-for-height) and stunting (low height-for-age) are present, and there was little childhood overweight or obesity. At the same time, the incidence of overweight and obese adults was evident.

Table 5.5 Mean taste scores for selected Ingano traditional foods *(Range of possible scores: 1–5)*

Traditional food name	*Child score (n=25)*	*Adult score (n=21)*
Ají	3.0	4.8
Arazá	4.8	4.9
Bombona	4.2	4.3
Caña agria	2.7	3.8
Cayamba	4.1	4.3
Churo	3.7	4.3
Cimarrón	5.0	5.0
Cucha	5.0	5.0
Hormiga	4.7	5.0
Milpes	5.0	5.0
Mojojoy	3.8	4.2
Ñame	4.6	4.8
Nina waska	2.9	4.1
Papaya	5.0	5.0
Piña	5.0	5.0
Plátano	5.0	5.0
Yoco	2.0	3.4
Zapote	4.6	4.8

Summary of the current situation

The research has shown that at the time of the research an impressive diversity of traditional food resources from the local environment were known and consumed by Ingano families. While commercial food was encroaching, the majority of dietary energy was still derived from traditional Ingano food. These local resources were highly regarded by adults and children alike for their many attributes. Environmental concerns for the local food-producing areas are significant.

A meeting was held with project personnel to evaluate the project's development, executed activities and participation of the work group, as well as to establish the expectations for the future. During this

Table 5.6 Summary of attributes by Inganos for key Ingano traditional foods

Traditional food name	*Attributes*
Ají	Its use is a tradition. It's good and improves food taste. It is also used as a medicine.
Arazá	Provides vitamins. It's very nutritious and healthy and prevents diseases.
Bombona	Very nutritious, has vitamins, improves growth and is very filling.
Caña Agria	Medicinal. Used as purge and to treat diarrhea and stomach sourness. Very refreshing.
Cayamba	Nutritious. Improves growth. Provides vitamins, proteins and energy and fills up.
Chontaduro	Provides proteins and vitamins. Refreshing. Improves digestion because of its fiber. Fills up and satisfies. Improves health and digestion, is nutritious and tasty.
Churo	Nutritious. Improves growth and body support. Has proteins.
Cimarrón	Used to treat hepatitis. Improves food taste. Very nutritious, strengthens immune defenses.
Cucha	Nutritious, improves growth. Provides phosphorus, vitamins, proteins and calcium, therefore strengthening teeth and bones. Used to treat malnutrition.
Hormiga	Nutritious. Improves growth. Very popular. Strengthens immune defenses, provides proteins, vitamins and minerals.
Milpés	Has vitamins, proteins, fiber and phosphorus. Its milk is very nutritious. It's energetic, improves growth and fattens. It improves health and is used to treat cough.
Mojojoy	Medicine for pulmonary affections. Nutritious, improves growth. Its fat helps preventing pulmonary problems. It has proteins, vitamins and minerals.
Ñame	Very filling and satisfies. Generates energy, improves growth and good physical development and fattens. Provides calories, energies and strength.
Ninan Waska	Medicinal. Used to treat fever. Very refreshing.
Papaya	Improves digestion, prevents constipation. Has vitamins, calories and minerals. Very nutritious.
Piña	Provides vitamins, minerals and fiber. Is very nutritious and refreshing and tasty.
Plátano	Very nutritious. Provides calories, proteins and potassium. It fattens, improves growth, and it's satisfying. Staple food.
Yoco	Medicinal. Used as purge, laxative, and to treat cough. Generates energy.
Zapote	Very nutritious provides vitamin and is very filling.

meeting, the group commented on several matters of the investigation conducted and concluded that the community had gained awareness about the loss of certain cultural aspects and people were starting to give importance to the products included in the diet. Generally speaking, the support offered by the Inganos to this project in the first months of work was good. The visits carried out were well received by the community. For members of the community, the experience of just remembering the traditional names of their food products was extremely enriching, and allowed them to learn and exchange knowledge. Since the topic was interesting, the work was easily done, especially because Elders like to share this information, although they are always cautious when doing so to protect their traditional knowledge. Indigenous authorities were also supportive and made it easy to access the communities and to carry out individual and group activities.

Table 5.7 Percentage of energy from traditional and market foods

Food groups	*Children*	*Women*
Traditional	58	47
Market (imported)	42	53

Problems the group encountered were also discussed during the meeting. One topic was the rejection and wariness that domiciliary visits and surveys sometimes caused. The reason for this reaction was that many members of the community were not aware of the overall purpose of the research and the benefits it

Table 5.8 Nutritional status by age group

Age groups	***Prevalence*** *(percentage)*
3–6 years old (n = 13)	
Underweight	19.1
Stunted	21.8
Wasted	2.2
Overweight	0.0
Obese	4.3
7–12 years old (n = 16)	
Underweight	21.3
Stunted	38.4
Wasted	1.6
Overweight	0.0
Obese	1.6
Women BMI (n = 39)	
< 25 (normal)	89.2
25–29.9 (overweight)	8.1
≥ 30 (obese)	2.7
Men BMI (n = 34)	
< 25 (normal)	96.6
25–29.9 (overweight)	3.4
≥ 30 (obese)	0.0

would potentially mean to them. Some didn't want to participate because they believed the project was only trying to obtain information that depreciated indigenous groups.

The community work group as a whole considered that this project had gathered information that is of great importance if the traditional elements are to be rescued, in order to make the community more independent from external markets, when it comes to health and nutrition.

Looking to the future of the project

Project participants involved in evaluation meetings suggested that all activities should be carried out with the support of community leaders. In this way, acceptance and understanding of this project and its objectives can be assured. Another suggestion was to share project methods with all Ingano communities in the region.

Community work must try to involve everyone: Elders, women, adults, young people and children. It is also necessary to create campaigns designed to promote the protection of the resources the community already has, as well as trying to recover what has been lost or damaged. This is only possible by creating awareness (especially among young people) and improving technical management of crops and wild species.

Nineteen Ingano traditional foods were chosen for promotion and recovery for the following reasons:

- Traditional: foods that were part of the traditional diet.
- Nutritive: foods known for their nutritive value (protein, polyunsaturated fats and important micronutrients).
- Necessary: foods that have not been replaced or that serve a fundamental role in the cosmovision of the culture.
- Available: foods that are easy to obtain.
- Enjoyable: foods that will be eaten and enjoyed by the communities.
- Affordable: foods that are inexpensive to obtain.

Ingano representatives who attended planning sessions requested that: (1) crops of the ancestral foods be cultivated, (2) an environmental protection plan for the ecosystems required to maintain these food resources be designed, (3) support or subsidy be offered toward the acquisition of the crops obtained from the gardens maintained in the traditional agriculture programme, (4) a Nutritional and Epidemiological Monitoring System to monitor the condition of the participating population, and (5) a programme be established to promote the consumption of traditional food. These measures should be included in the education offered to the indigenous persons in the Yachaicury School so that they may serve as "multipliers" of this information, beyond the activity in community workshops carried out by the promoters and the professional team.

Discussion

One of the characteristics of the crisis the world is currently undergoing is the loss of diversity, both biological and cultural. With this loss, threats to shamanism

– a belief system central to the well-being of many indigenous groups – can be seen. This is important for a world that seems to have lost the way in its effort to maintain health and respect the natural world.

The problems our societies are currently facing result from a tendency to homogenize culture (underestimating the traditional values of peasant groups and Indigenous Peoples). We face crises in health services management, serious contamination problems and dramatic loss of biodiversity. Also damaging is the reductionist perspective of scientific thought, and in ethical terms, the secularization of human culture.

To overcome these problems, a long-term social transformation is required. First of all, it is important to strengthen the scientific and technological advances accomplished during the twenty-first century, the creation of new paradigms, and incorporation of new scientific perspectives regarding the world and humans who live in it. The growing awareness on the "environmental problem" has encouraged a search for urgent solutions. After its timid appearance with the ecologic movements of the 1970s, this awareness first evolved into an "ecodevelopment" proposal (UNEP, 1972) and finally into the concept of "sustainable development", which is understood as the development that satisfies the needs of the present generation without compromising the capacity of future generations to satisfy their own needs (United Nations, 2002). This concept is still in force, despite the conceptual divergences and conflicts of interests that surround it.

Sustainable development policies have followed four main lines: 1) preservation and/or recovery of ecosystems and flora and fauna diversity in several regions of the world; 2) application of economic models that encourage a decrease on the economic growth; 3) creation of new technologies considered as soft, clear or less contaminant; and 4) control of demographic growth.

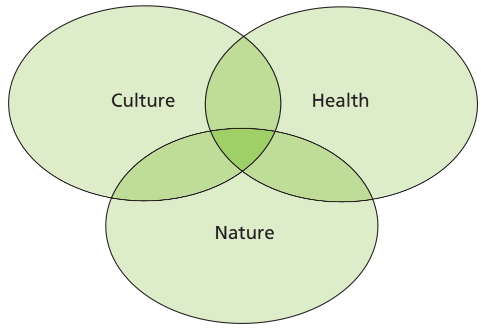
Thus, the following question arises: would Indigenous Peoples prefer to disappear as a culture if they lose the sense of collective property and/or their shamanic systems? Shamanism cannot be strictly defined as medicine, although healing is its main objective. Strange ceremonies and rituals, chants and dances, colourful outfits, perfuming with incense and invocations are part of the shamanic world. The shamanic functions are characterized by a deep sense of the sacred, great wisdom regarding nature, utilization of trance-inducing techniques, and a strong belief in other worlds; it also implies consumption of plants that are regarded as sacred (wrongly called hallucinogenic), and a vast knowledge on the medicinal properties of plants. For the Western world, the shamanic universe remains strange and mysterious (UMIYAC, 1999).

The pillar of the indigenous culture and its productive systems is shamanism. In those groups where the shaman disappears or loses his authority, and the traditional medicine man loses validity, extinction and acculturation are more serious and immediate. That is why any social, environmental, cultural, economic or politic development project should start by strengthening the shamanic institution and the traditional medicine system. The indigenous culture highly depends upon the survival of shamanism. Therefore, – and this should be considered by all bioprospecting programmes – strengthening of the shamanic institution is paramount to the conservation of cultural diversity. Actions that seek to preserve traditional societies are crucial:

> It is necessary to value and protect cultural diversity, because of the alarming current diminishment of the little adaptative social forms still existing. To lose and destroy civilizing systems implies losing unique models of social, political, economic, and linguistic organization, as well as intellectual, scientific, artistic and philosophic expressions… Cultural diversity is as important as biologic diversity: they both guarantee the wealth of life forms… Cultural pluralism is paramount to a biosocial evolution that optimizes all life forms and cultural creativity… Cultural diversity increases all human creativities in order to achieve different forms of collective coexistence.
>
> *(Barón* et al.*, 1995)*

Environmental conservation policies face the conflict of focusing either on biologic or cultural conservation. There are very few experiences that integrate both concepts. For indigenous traditional medicine, health implies harmony or equilibrium of reality. The human

Figure 5.2 **Relationship between culture, nature and health**



being is not just a body, but also thoughts, memories, emotions and spirituality. This harmony also refers to social relationships: family, neighbourhood, community; and finally, it also means harmony between and within nature, harmony among vegetables, animals, the invisible beings and sacred places. It could be stated then that the concept of health within the indigenous traditional medicine focuses on the triad *person-society-nature* that greatly exceeds the current definition of modern medicine.

The Western perspective typically refers only to the extrinsic values, while the indigenous perspective refers to intrinsic values. Both the orthodox approach of modern economics and the environmentalist discourse refer to the concept of development. Progressive economic growth or sustainable development always implies "development". The modern economic model seeks to measure development through an indicator known as Unsatisfied Basic Needs (UBN),[2] which – through a series of complex calculations – includes categories of material character: housing, access to public services, transportation, formal education level, consumption capacity (electrical household appliances and luxury goods), among others (UNDP, 1996). But the UBN does not consider other "unsatisfied basic needs" that might be intangible but not because of that, less important. We're talking about health, joy, production methods, access to formal and informal education systems, capacity to develop the need of transcendence and finding the meaning of life.

The Indigenous Peoples have managed to remember that "life" is not just about consumption, welfare and acquisition of material goods. Their cosmovision, their way of life with a collective property perspective, and their easy access to other awareness levels that bring a transcendence feeling are lessons that should not be forgotten at the moment of negotiating or establishing the concept of development.

Culture, nature and health

To understand the indigenous analysis of reality, the perspective Culture-Nature-Health can be utilized (Figure 5.2) (Zuluaga, 1998).

Culture here refers to cosmovisions, production methods, form of social relationships and the interpretation of daily reality. Nature refers to natural resources, defined as the vegetable, animal and mineral kingdom by the western culture, and as "mother earth" – a more global concept – by the Indigenous Peoples. However, to understand the interrelationship between the three concepts, one cannot fragment the analysis into independent categories.

In this perspective, culture is studied by social sciences, nature by biological sciences, and health by health sciences. There is still missing an interdisciplinary science that considers these aspects as a whole and not as the arithmetic sum of each discipline, not only when dealing with the indigenous reality, but with reality at any level.

There are four interstices among the three circles. It is precisely in those spaces where new reflection and work strategies for environmental, social and health projects can be found:

1. **Relationship health-nature:** This firstly refers to nature's health or health of the ecosystems, meaning the state of biologic resources. It secondly refers to the important role that environment plays on the matter of human health. Water and air quality, availability of fertile soils to guarantee food security,

2 The UBN is used by entities as the World Bank, the International Monetary Fund and the Ministries of Treasury and National Planning in most countries of the Third World.

accumulation of rubbish and toxic residues, contamination with nuclear radiation, etc., are factors that directly affect health conditions. Recent World Health Organization (WHO) documents have justly concluded "the planet is sick", and the opening to new health policies state: "Our planet, our health" (WHO Commission on Health and Environment, 1992). Finally, there is a close relationship between health and nature, established through more reliance on traditional medicinal plants. Indigenous shamans and traditional medicine men and women are masters of these medicinal plants. And these sacred plants play an essential role in cultural maintenance and well-being.

2. **Relationship nature-culture:** Although biology also refers to culture when talking about animal behaviour – well known by shamans – this category must be considered with respect to nature and human culture. This is how cultural ecology starts to discover the important role of environment and resource availability in the development of cultural, ethic and power manifestations of human societies. It is surprising to examine the origin rites of many tribal peoples, who consider the domestication of a plant the genesis of their society; that is the case of the Maya people, who consider themselves to be "sons of corn", or of several Amazon peoples that call themselves "sons of yuca", etc. Ethnobiology is precisely the discipline which seeks to study the interrelationship between nature and human culture in its different branches (ethnobotanics, ethnoecology, etc.),
3. **Relationship culture-health:** Traditional medicine is understood as the medicine system used by indigenous or peasant communities to manage health and sickness. Contrary to modern medicine and psychiatry, traditional medicine considers illnesses to be more than body or mind problems; they also include work or marital difficulties, bad luck in hunting and fishing activities, or bad relationships with others.
4. **Relationship health-nature-culture:** Western scientific thinking and its several disciplines still lack a science able to approach the integrality of the three relationships, but authentic shamanic systems can teach us about this integration of concepts. We have to accept our condition of listeners and apprentices of the indigenous Elders' wisdom, and listen to what they have to explain about a reality that does not admit differences between culture, nature and health.

For centuries, Indigenous Peoples have managed to obtain from the forests satisfaction for all of their needs – including culture and spirituality – without destroying these ecosystems. This type of intervention has been called "anthropogenic forest" or "humanized forest" (Correa, 1993). The process of "humanization" of the forest has been led by the Elders of communities. Availability of sacred, stimulant and medicinal plants, the overlapping of natural resources with "invisible people", the establishment of annual calendars based on ecologic events characteristic of the forest, the ethic codes for fishing, hunting and gathering of wild fruits, and a frugal use that guarantees resource sustainability – among others – are characteristic elements of shamanism for territorial ordering and sustainable use of resources.

> Each culture, within its process of historic development, has identified different ways to face fundamental problems… As for the specific problem of sickness, we can identify very particular categories, models, ideas, practices, etc., that depend on the cosmovision, social and economic history and geographic conditions – nature – of each culture. That's why the answer to those problems is not necessarily identical or valid for every culture.
>
> *(PAHO, 1995)*

On the other hand, it is also evident that younger indigenous generations, due to their more frequent contact with modern society, are leaving aside or failing to learn many of their traditions and production systems. Acculturation, as a result of governments' influences and classic models of western development, is a common phenomenon among all Indigenous Peoples.

It is necessary to recover, cultivate and protect the food and medicinal resources: germplasm banks, botanic gardens, house gardens and greenhouses can be used to reinforce species propagation. At the same time, we need to protect cultural memory that strengthens traditional medicine. Dialogue is necessary among medicine men and women, midwives, and herbalists in order to transmit traditional values and techniques to younger generations ●

Acknowledgements

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Chapter 6

Documentation of the traditional food system of Pohnpei

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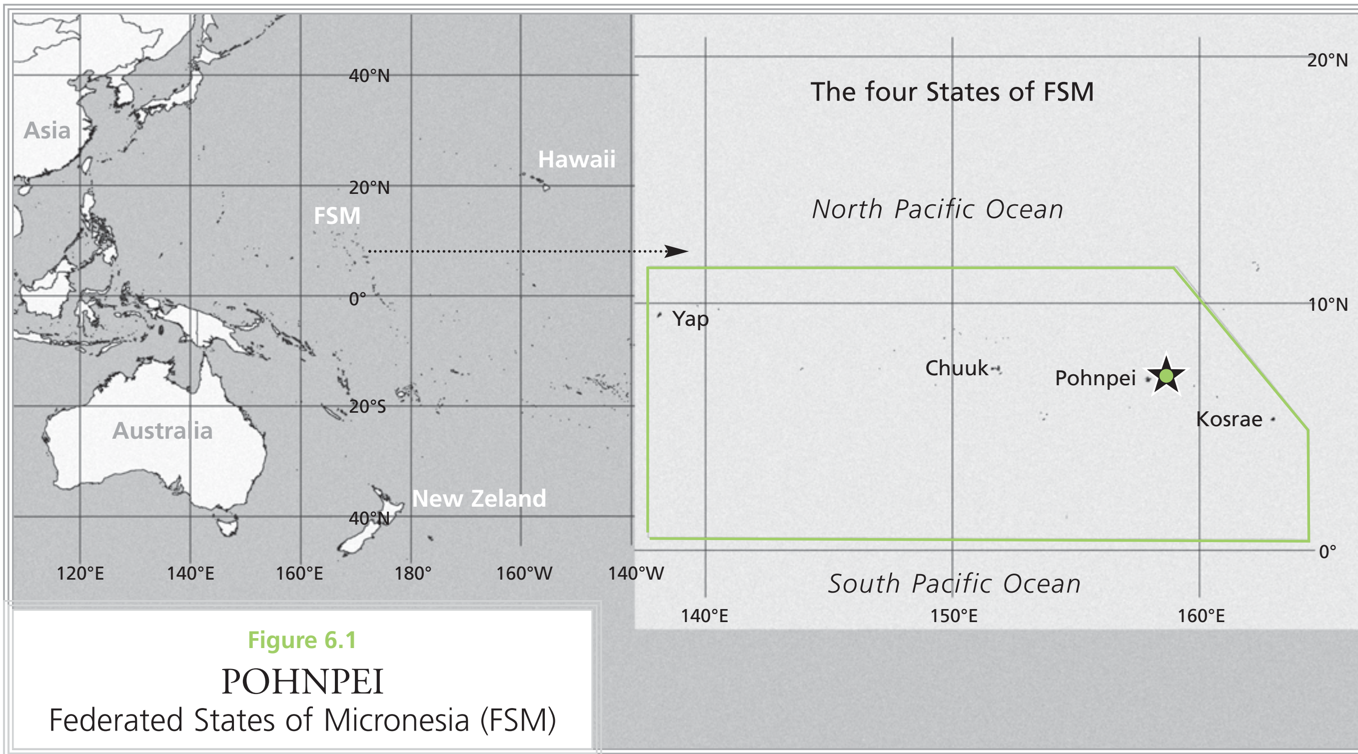

Figure 6.1

POHNPEI

Federated States of Micronesia (FSM)

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.

1
Island Food Community of Pohnpei (IFCP), Pohnpei, FSM

2
Pohnpei Agriculture of the Office of Economic Affairs, Pohnpei, FSM

3
Peace Corps Micronesia, Pohnpei, FSM

4
Community of Mand, Pohnpei, FSM

5
Pohnpei Department of Health, Pohnpei, FSM

6
College of Micronesia (COM)-FSM, Pohnpei, FSM

7
Pohnpei Department of Land and Natural Resources and Historic Preservation Office, Pohnpei, FSM

8
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> "God made us to eat our own foods. We need to go local!"
>
> **Pohnpei community leader**

Abstract

The Pohnpei case study presented here, is centred in the Mand community of Pohnpei, Federated States of Micronesia in the Western Pacific Ocean. The study aims were to document the Pohnpei traditional food system and test the Centre for Indigenous Peoples' Nutrition and Environment's methodology, using a participatory, multiple-methodology, ethnographic approach.

There was a great diversity of local foods (381 items), but use of the traditional food system has declined. Local foods provided 27 percent of the energy and 38 percent of the protein consumed by adults (compared to 16 percent of energy, 27 percent of protein for children), while the rest came from imported foods, many which are of nutritionally inferior value. Few participants met the vitamin A and C recommended intakes. Seventy percent of women and 60 percent of men were overweight or obese in all age groups except for the men in the 15–19-year-old age group in which most were of normal weight. Of the participants 40 years and older, 63 percent of women and 58 percent of men had abnormal blood sugar levels (fasting blood sugar ≥126 mg/dl) and were, thus, either diabetic or at risk of diabetes. Stunting, vitamin A deficiency and dental decay among children were serious problems. Intervention activities for increasing local food production and consumption were set in place.

The study raised great community interest and signs of positive project impact have already been recorded. It is likely that a similar approach may be valuable in other Pacific islands.

Introduction

Preparations for participatory research in the community

In early 2005, the Island Food Community of Pohnpei (IFCP) was invited to join the Centre for Indigenous Peoples' Nutrition and Environment (CINE) Food Systems for Health Program as the twelfth case study, representing the Oceania region (Kuhnlein *et al.*, 2006).

In mid-January 2005, partner agencies, including the Pohnpei Department of Health, became involved and discussed the selection of the target community. The criteria were: rural community, population of 500 to 1 000, accessibility and willingness to participate in a three- to four-month survey, followed by a two-year intervention. Three villages were suggested, and Mand was chosen, as it fit the criteria most closely and partner agencies had project officers available there with community links.

Initially, community members were sceptical about the project, but they gave full support after learning more. The Governor's Office concurred with the research project, and assistance was provided by Professor Kuhnlein during a visit to Pohnpei (5–11 March 2005). A research agreement was signed with these research aims:

- To understand the traditional food resources of the community in order to improve health, and to conduct and evaluate a health improvement programme using traditional food resources.
- To include Pohnpei traditional food system data and establish the link to improved health status as a consequence of greater traditional food consumption, as part of a 12-case study programme with CINE to demonstrate that traditional food resources of Indigenous Peoples around the world should be protected.
- To prepare a 20-minute DVD on issues related to Pohnpei traditional food.

A consent form presenting the study purposes was developed for obtaining verbal consent for participation in the study (including interviews and photographs). Interviewers were trained on research methods and procedures, including data confidentiality.

Overall description of case study research site and Indigenous People

Geographic and environmental characteristics

Pohnpei is one of the four states of the Federated States of Micronesia, a developing country located in the western Pacific Ocean (Figure 6.1). The Federated States of Micronesia, including also Chuuk, Yap, and Kosrae, consists of 607 islands (volcanic and atoll)[3] spread over a million square miles of water.

Pohnpei State comprises the main island of Pohnpei and five outer atoll island groups: Mwoakilloa and Pingelap (located east of Pohnpei), and Sapwuafik, Nukuoro and Kapingamarangi (located south). Pohnpei Island lies at 6° 55' north latitude and 158° 15' east longitude.

Pohnpei Island has rugged mountains, verdant tropical plants with year-round heavy rainfall (250–500 cm annually in populated areas) and high temperatures (annual average 27 °C). In general, agricultural resources are adequate throughout Pohnpei (and the Federated States of Micronesia), with atolls generally having poorer soils and less rainfall than volcanic islands. Subsistence farming and fishing are the primary domestic economic activities (CIA, 2006).

Demographic characteristics

The Federated States of Micronesia's population is approximately 107 000, with that of Pohnpei State being 34 500 (FSM, 2002). Pohnpei's total land area is 355 sq km. Historically, the Federated States of Micronesia was colonized from 1885 to 1945 by three foreign powers: Spain, Germany and Japan, respectively. After 1945, the islands making up what is now the Federated States of Micronesia came under United States administration as part of the Trust Territories of the Pacific Islands (TTPI).

In 1986, the Federated States of Micronesia became independent, along with the 15-year Compact of Free Association with the United States through which substantial funds were provided.[4] The close relationship with the United States was maintained by the signing of a second Compact in 2004, which will end in 2023 (CIA, 2006). These formal agreements have generated most of the funds of the nation's economy, including a large public sector employment (Drew, Alavalapati and Nair, 2004). As to poverty, lack of food is not a problem in Pohnpei, but it is estimated that 29.5 percent of the population falls below the poverty level – the definition of poverty includes low access to adequate medical services, education, and clean water (Abbott, 2004).

As the second Compact provides less funding for state and national governments than previously, the public sector is presently being downsized, thus providing lower incomes for Pohnpei and the rest of the Federated States of Micronesia. It is expected that agriculture will be taking on a more important role in household food and income production in the future (Drew, Alavalapati and Nair, 2004). Although there are limited data on the level of remittances sent to Pohnpei by family members, there are increasing numbers of Pohnpeians working overseas, mainly in the United States of America (Hezel, 2006).

Mand, the target village of this study, consists of a group of Pingelapese people who maintain their distinct language and culture (Damas, 1994). Mand is located in rural Madolenihmw, one of the five municipalities of Pohnpei on the main island. In the 2000 census (FSM, 2002), Mand had a population of 462 residents and it is estimated that the population in 2005 was over 500.

Cultural characteristics

Pohnpei Island is the largest of the state's six major island groups. Pohnpeian and English are the state languages (Rehg and Sohl, 1979). However, Pohnpei's atolls have distinct languages and culture. Pohnpei has a great mixture of cultures and ethnicities and it is the

[3] An atoll is a ring-shaped low-lying coral island or group of islands, often consisting of only a narrow strip of land with seawater on both sides, circling a lagoon. Atoll island climates are considered among the harshest in the world because of the poor rainfall and poor soils.

[4] Exclusive military access is provided to the United States of America as a part of the agreement of the Compacts.

seat of the Federated States of Micronesia National Government where English is the official language. Due to overcrowding on Pingelap atoll, land was obtained in the early 1950s from the leader of Madolenihmw Municipality of Pohnpei. The first group of 60 Pingelapese settlers arrived in Mand in 1954. Although around half of Pohnpei State's people are Catholic, most people in Mand are Protestant and there is one main church in the village, with a well-built community hall adjacent to that church. There is also a Mormon church in the village and a few residents are followers of the Bahai faith. The village has a small school with classes up to the fourth grade. This is located next to the traditional meeting house (*nahs*) – an open-air structure used for informal and formal meetings. More advanced primary and secondary schooling can be obtained in a nearby village, and there is a community college at the College of Micronesia (COM)-FSM Pohnpei Campus in Kolonia, the town centre of Pohnpei and another at the COM-FSM National Campus in Palakir, an area near Kolonia.

General description of the food system

In Pohnpei, there is great plant diversity (Adam, Balick and Lee, 2003) and many varieties and cultivars[5] for the staple food crops, including 55 banana, 133 breadfruit and 171 yam cultivar names (Raynor, 1991). Almost all production is through the agroforestry system, which consists of multi-storied gardens of trees and shrubs grown among annual and perennial crops and, often, domestic animals. Pohnpei also has a wealth of seafood: 1 196 species of edible fish and 4 species of inedible fish (Ashby, 1993). However, there has been a decline of traditional agriculture and local food use in recent years, owing to a complex set of factors including changing lifestyles, inconsistent external and internal government policies for supporting indigenous food crops, increased available cash, and food aid programmes (Hezel, 2001; Englberger *et al.*, 2003a). There is concern about the loss of traditional knowledge. Despite this, there is still a considerable reliance on local foods and still a wealth of traditional knowledge relating to local foods (Corsi, 2004).

Mand is reached from the town centre of Pohnpei, Kolonia, by a 40-minute drive on a paved road. The village is located along a river, featuring a waterfall directly behind the settlement. The lands surrounding the village consist of rich soils on which a variety of crops are grown. There is no distinct rainy season, although there are distinct seasons for the harvest of the two main staple foods (breadfruit and yam).

The village has no direct access to the sea, but is within walking distance of it. Many people fish on a regular basis; some of the catch is consumed by fishermen and the rest is sold. Agriculture is carried out mainly on a subsistence level. There is no established local foods market in Mand, but three small shops sell imported processed food, and major food shopping is done in Kolonia.

Overall health and nutrition status

Nutrition-related disorders, including both micronutrient deficiencies and nutrition-related chronic diseases (i.e. diabetes, cardiovascular disease, and cancer), have become serious health problems of epidemic proportion in Pohnpei and FSM (Elymore *et al.*, 1989; Coyne, 2000; Pohnpei STEPS, 2002; Englberger, Marks and Fitzgerald, 2003).

Writings from earlier in the twentieth century indicate little evidence of malnutrition. A United States Navy study after World War II noted an almost complete absence of obesity in Pohnpei; physiques were described as lean, and diabetes was unusual (Hezel, 2004; Richard, 1957). However, now over half of the Pohnpei pre-school children have vitamin A deficiency and a third may be anaemic (Auerbach, 1994; Yamamura *et al.*, 2004). There are high levels of stunting among children (Elymore *et al.*, 1989). Approximately one-third of Pohnpei adult women are overweight in every age group (Elymore *et al.*, 1989; Pohnpei STEPS, 2002). Around 20 percent of 45–55 year old Pohnpeians have diabetes (Hezel, 2004; Pohnpei STEPS, 2002).

Present-day dietary disorders appear to be the consequences of significant dietary and lifestyle changes,

[5] In this paper cultivars refer to varieties produced upon cultivation.

most of which gathered momentum after the 1970s. The diet has greatly shifted from the consumption of traditional foods[6] towards increased consumption of imported foods, including white rice, flour products, sugar, fatty meats (including turkey tail),[7] and other fatty, salty and sweet processed foods.

Methodology

The data collection took place from May to August 2005 using the CINE methodology with its ethnographic participatory multiple-methodology approach (Kuhnlein *et al.*, 2006; INMU, 2003). The primary research team was composed of ten officers from eight agencies. Team members were first trained on the survey protocol, consent form, interview guides and questionnaire forms. Visits to the community were scheduled for two days per week.

Preparations for the health, dietary and agroforestry assessments

An informal census of the village identified 71 households. Households were then numbered, random numbers were electronically generated and 47 households were randomly selected for the study, aiming at reaching over half of all households. All adult members (aged 15 to 65 years) in the randomly selected households were asked to join the adult health assessment for weight, height, fasting blood sugar and blood pressure measurements, and relevant other information, including physical activity levels and food purchases.

In order to maximize dietary variation, one adult (females were generally targeted) and one child (aged one to ten years) were selected per household for the dietary assessment. The adult was chosen according to best knowledge of foods consumed and knowledge of the child's diet. In cases where there were multiple children in the targeted age group, the youngest child was selected.

6 Local food is the commonly used term in Micronesia and the Pacific for traditional food.
7 Turkey tail is literally the tails of turkey. This item is imported as a frozen product from the United States of America, eaten fried or in other recipes and is generally considered by Pohnpeians as a delicious food.

Methodology for dietary assessments

Two dietary assessment methods, a repeated quantitative 24-hour recall for two non-consecutive days and a seven-day food frequency questionnaire (FFQ), were used in order to better assess the usual diet in Mand. The dietary assessment questionnaires were adapted from forms already developed for FSM (Englberger, 2003; Englberger *et al.*, 2005c), but were further developed to specifically distinguish between imported and locally grown foods. As requested by the interviewers, the forms were in English (to improve precision), but the questions were asked in the vernacular.

All five interviewers spoke Pohnpeian, Pingelapese and English fluently and had ties with the Mand community. Interviewers were involved in developing and pre-testing the questionnaires, aiming at relevant, clear and culturally appropriate questions. Each completed questionnaire was reviewed for detecting omissions or inconsistencies. The interviewers alternated so that the second 24-hour recall for a household was administered by a different interviewer in order to reduce interviewer bias.

A standardized 24-hour recall protocol was followed, describing amounts eaten (standard cups, spoons, pieces), cooking methods, maturity of food crops (i.e. banana, breadfruit), brand names and recipes. For bananas – which can be identified by cultivar name and which vary greatly by carotenoid content – the names of the cultivars consumed were recorded in order to increase the accuracy of the dietary assessment. A standard portion size list previously used in the Federated States of Micronesia (Englberger, 2003; Englberger *et al.*, 2005c) was adopted, as the foods were similar to those in Mand. Actual foods and utensils (tablespoon and teaspoons) were used during interviews to help the participant describe the foods and amounts consumed and to serve as memory aids. Efforts were made to determine any fortified foods and to ensure that consumption of these would be correctly entered into the dietary analysis.

Data of the 24-hour recall were entered into the FoodWorks software, grouping foods as local or imported and analysing for energy, protein, fat, ß-carotene equivalents, vitamin A and vitamin C. There were no missing nutrient values for food consumed. The food composition table was augmented using data of ß-carotene equivalents or vitamin A determined in the ongoing food composition study, as well as some local recipes. A focus was placed on vitamins A and C because of previously identified problems and concern about low consumption of fresh foods. Information was collected on lactation among participants, but not on pregnancy status, due to sensitivity and lack of confirmation about this in some cases. Individual means of the two days' intake were calculated and entered into Excel computer software. Group means were calculated separately for the mothers and children.

The seven-day FFQ provided a qualitative assessment of food intake over seven days.[8] Thirty-seven foods and other items were included, including alcoholic beverages,[9] local *sakau* drink (kava),[10] betel nut and tobacco. In addition to these 37 items, there were over 200 sub-items, which helped the interviewers in probing and provided further information. Interviewers circled these if the item had been consumed at least once. Some food terms including local cultivars with no English name were presented in the local language for improving clarity. Excel computer software was used for the analysis.

A further questionnaire on activity levels and topics relating to diet and health was developed and administered. An infant-feeding survey was carried out later in the study period in order to provide specific information on breastfeeding practices and complementary feeding.

Methodology for health data assessments

Community members were encouraged to participate in the fasting blood sugar (FBS) study in order to know their status relating to diabetes. The study was offered free of charge and at a site in the village to facilitate participation. It was explained to all individuals that a fully fasted condition was required for the test.

When participants arrived at the survey spot in early morning, they were registered, measured for weight and height and asked if they had previously taken a FBS measurement and whether they already had diabetes. Weights were taken using electronic scales (Seca Model 890), while wearing light clothing. Height was measured by using a microtoise. Waist circumference was measured at the narrowest point (at the navel or slightly above). Standard methods were used for measuring blood pressure and FBS using the Accu-check mobile instrument. Participants were asked to sit five minutes prior to the blood pressure check (repeating for cases outside normal ranges), and were excluded for the FBS check if they had consumed food or a beverage after midnight.

For assessing the vitamin A status in the community, an arrangement was made for partnering with a hepatitis B study conducted by the Centers for Disease Control and Prevention (CDC) so that a portion of the blood sample of the children and their mothers/caretakers could also be analysed for serum retinol. The analyses were performed at the CDC, in a United Nations Children's Fund East Asia and Pacific Regional Office-supported project. Serum vitamin A was measured using high-performance liquid chromatography and UV-visible detection. Specimens were also tested for C-reactive protein (CRP), a measure for infection, using immunoturbidimetry and the QuikRead®101 CRP instrument. As infection is known to lower serum retinol (Thurnham *et al.*, 2003), cases with high CRP (≥5 mg/L) were excluded from the study in order not to overestimate the prevalence of vitamin A deficiency in the sample. Quality-control protocols included internal (three levels of quality control pools in each assay) and external quality assurance (participation in the National Institutes of Standards and Technology and College of American Pathologists quality assurance programme).

8 For each item, the participant was asked, "How many days in the last seven days did you consume (the item)?" Participants were also asked for the number of times that rice was generally eaten each day.

9 Although alcoholic beverages are illegal in the municipality of Madolenihmw where Mand is located, they are still consumed and include hard alcohol, imported beer and some locally made alcoholic beverages. However, these are unacceptable by the Protestant church community in Mand and are commonly consumed mainly by the youth.

10 *Sakau* is a non-alcoholic drink prepared from the freshly pounded roots of the *Piper methysticum* plant. The psychoactive substances are kavalactones, which produce a mildly euphoric anxiety-reducing feeling along with muscle relaxation. It has cultural importance and is frequently consumed by native Pohnpeians.

Table 6.1 Summary of fieldwork and project activities May to August 2005

Survey on traditional food system	
Literature search/related papers	24
In-depth interviews (5 interviewers)	33
Pile sort interviews	7
Informal focus group discussions	29
Total attendance at the 29 meetings	***578***
Market and agroforestry survey	
Markets surveyed: Mand/Kolonia	3
Agroforestry study interviews	43
Photographic documentation	
Folders categorized by topic	10
Photographs selected	297
Health study – random selection of 47 households (hh)	
Adult weight/height/BMI: Random survey	
Males	82
Females	85
Adult weight/height/BMI: Volunteers	
Males	13
Females	17
Children <15 y weight/height	
Males	53
Females	43
Serum retinol analysis	
Children	44
Female caretakers	20
Fasting blood sugar	
Males	84
Females	85
Blood pressure	
Males	84
Females	85
Dental screening, children 1–14 y	
Males	49
Females	36
Dietary assessment – random selection of 47 hh	
7-day FFQ	
Adults (one per hh)	47
24-hour recalls: 2 non-consecutive days	
Children (one per hh)	27
Female Adults (one per hh)	44
Infant feeding study	10
Survey of factors related to the nutrition/health behaviours and issues	
Interviews	46
Food sample collection for analysis and identification	
Food samples for analysis of carotenoid and fiber content	40

Results and discussion

Table 6.1 presents a summary of the project activities. Developing the Mand map (Figure 6.2) was an important initial activity. The waterfall, river, road, community hall, sports ground, two churches, three small shops, school, traditional meeting house, graveyard and individual households were featured.

Health-related socio-economic indicators

Of the randomly selected households, one member per household[11] was asked about certain aspects relating to food consumption, income, food purchase and food preparation.

Most Mand families (80 percent) had at least one family member with salaried employment (government or private sector). However, there were families who lived mostly by subsistence. Idleness and over-dependence of unemployed family members on those with salaried employment were self-reported problems in the community.

Electricity and telephones were available in the community. However, at the time of the survey, a few households had no electricity and only about a third had telephones. Housing varied greatly, from small wood structures to larger concrete-based houses. A problem identified during the survey was that not all families had a toilet. Waste disposal was a problem and families often used the river as a waste disposal system, causing problems with villages below Mand. A health problem in Mand, which has arisen from time to time, was that of leptospirosis – a serious bacterial disease related to water contamination. Mand Community is also one of the areas in Pohnpei with a problem of leprosy, which is related to poverty, poor housing and over-crowding.

As to the proportion of income spent on food, 72 percent of the households reported were spending half or more of their income on food (despite the rural location of Mand and ready availability of land with

[11] The respondents included 44 females and 2 males, selected according to familiarity with family diets.

good agricultural potential); 17 percent said that they spent less than half of their income on food and the rest reported lack of knowledge on this. Cooking was mostly done by kerosene cookers, open-fire cooking, or with a traditional earth oven. Food preparation was done mainly by the women although male members of the household also helped. Both the respondent and others in the household carried out the food purchasing.

Similar to the larger Pohnpei population, most Mand families' cash income was important for obtaining daily food. The price of local foods was much higher than imported staples (rice at US$0.30 per pound versus breadfruit at US$0.50 per pound), with local food prices including peels and inedible parts making the cost per pound of edible food even greater.

Mand traditional food list

In total, 381 local food items (including distinct cultivars of food crops and many species of fish) were identified (Table 6.2). A list of 240 distinct species is given in Table 6.3. The names in both local languages, Pohnpeian and Pingelapese, were specified for each item, in addition to the English and scientific names. The community asked to include some crops that are not presently growing in Mand, but which grew nearby (e.g. avocado), since the community planned now to start cultivating them. Some foods (e.g. freshwater eel and several types of sea cucumber) eaten by some Pohnpeians, but not by Mand people, were removed from the list.

Free listing, key informant interviews (including house-to-house visits), semi-structured interview guides and informal focus group discussions were used to determine the foods of Mand and selected parameters. To help develop the Mand food list, a literature search was conducted and data collated in order to construct a list of foods potentially available (Adam, Balick and Lee, 2003; Ashby, 1993; Bascom, 1965; Damas, 1994; Merlin *et al.*, 1992; Pollock, 1992; Ragone, Lorence and Flynn, 2001; Ram, 1994; Raynor, 1991; Rehg and Sohl, 1979; Sacks, 1996; Sasuke, 1953; St John, 1948). After collating these data, the most important descriptors were selected and the food items were ordered in two separate databases according to commonly used food groups.

Figure 6.2 **Mand map**

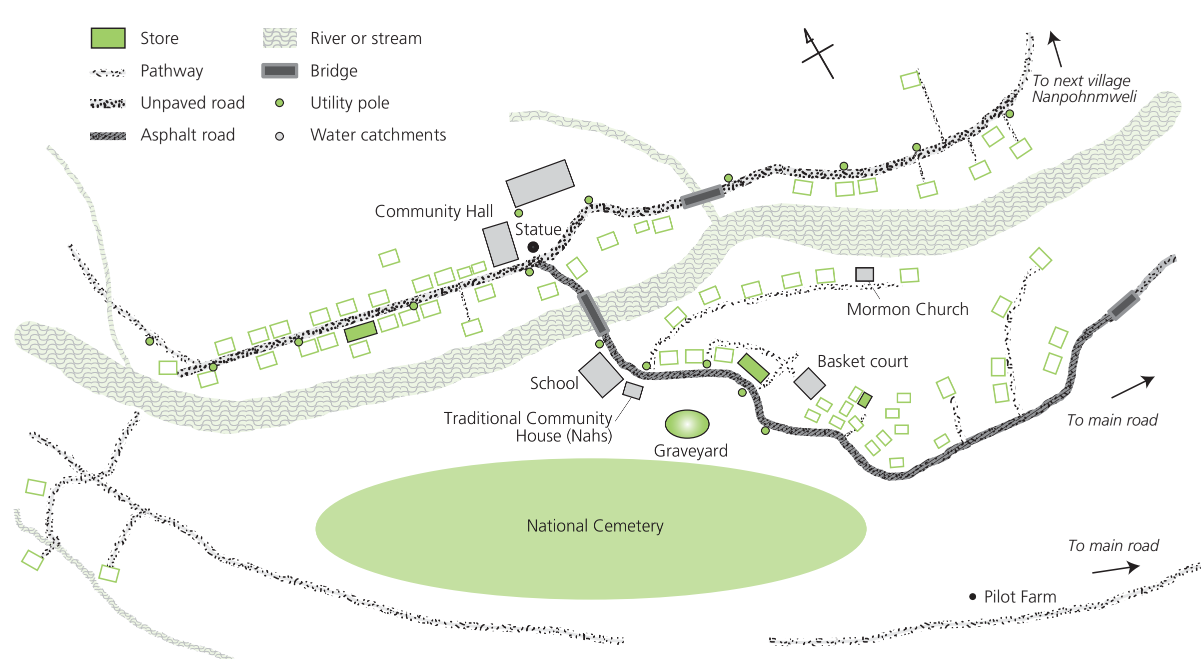

Table 6.2 Summary of the Mand traditional food list

Food list items	*Number of food items**
Starchy staples	
Arrowroot	1
Banana/cultivars	26
Breadfruit/cultivars	15
Jackfruit	1
Sweet potato/cultivars	6
Tapioca/cultivars	9
Taro, *Alocasia*/cultivars	2
Taro, *Colocasia*/cultivars	5
Taro, *Cyrtosperma*/cultivars	12
Taro, *Xanthosoma*/cultivars	2
Yam/cultivars	42
Palms	
Coconut/cultivar, *Cocos nucifera*	6
Mountain palm, *Clinostigma ponapensis*	1
Oil palm, *Elaesis guineensis*	1
Palm, *Ptychosperma* spp.	1
Nuts	
Chestnut	1
Indian almond	1
Red bead	1
Fruits (excluding bananas and pandanus)	23
Pandanus/cultivars	13
Citrus/cultivars	3
Vegetables	25
Herbs (basil, garlic vine, lemon grass)	3
Spice (pepper, ginger, turmeric)	3
Local drink: native cinnamon	1
Local drink: hibiscus flower	1
Local drink: *sakau* cultivars**	2
Fish	127
Shellfish	13
Crab	4
Shrimp	2
Sea cucumber	2
Turtle	2
Other seafood (octopus, squid, lobster)	3
Bird	15
Pig and other animal (carabao, cow, deer, dog, goat)	6
Total	**381**

* The term "items" in this table refers both to species and cultivars.
** *Sakau*, known also as kava, is a non-alcoholic drink prepared from the roots of *Piper methysticum*; its psychoactive substances promote reduction of anxiety and muscle relaxation.

One database (Englberger *et al.*, 2005d) was constructed for the food items categorized by species and identified by Pohnpei, Pingelap, English and scientific names. Data provided on each of these foods included: parts used, cultivated or wild, if seasonal, whether marketed and whether a photograph or sketch was available. A second database was constructed to describe specific cultivars. Data provided on each of these foods included: availability, growth, nutrient content (if well known), acceptability and priority for promotion. All descriptions were checked using repeated key informant interviews and informal focus group discussions. The complete set of data collected on these foods is presented by Englberger *et al.* (2005d).

Group meetings of the Mand Community Working Group were initiated in mid-May 2005, since it was determined that a group consensus was needed to finalize many of the food item names and information describing those specific food items. These meetings became multi-purpose in nature, collecting information, providing training and planning intervention activities. The meetings also served as a way for sharing and photographing traditional food dishes and the person preparing it, collecting information for local newspaper articles and acknowledging those community members active in the project. Posters with photographs of fish (US Fish and Wildlife Services/FSM DNR, 1983a, 1983b), shellfish (Ministry of Fisheries, Government of Tonga, 1997), and birds (FSM National Government, n.d., a, b) provided the Mand Community Working Group with a basis for discussing animal food items. Detailed discussions were held to document local names and characteristics. A local fish expert assisted in identifying species by scientific name, using available literature (Kobayashi, 1994; Masuda *et al.*, n.d.; Okamoto, 1988a, 1988b; Takashi, 1994).

As giant swamp taro and pandanus were important foods for Pingelap, a careful review was made of the cultivars grown on Pingelap (Damas, 1994; St John, 1948; Englberger *et al.*, 2005a). Also, photographs of Mwoakilloa pandanus (Englberger *et al.*, 2004) were shown to informants in order to help identify and characterize Pingelap cultivars that were introduced to Mand, or which may still be introduced.

Table 6.3 Pohnpei traditional food list

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
	Starchy staples							
1	*Alocasia macrorrhiza* (2 var.)	*Alocasia* taro	ohd	wod	corm	no	no	W
2	*Artocarpus altilis/mariannensis* (15 var.)	breadfruit	mahi	mei	fruit, nut	yes	yes	C
3	*Artocarpus heterophyllus*	jackfruit	jackfruit	–	fruit	yes	no	C
4	*Colocasia esculenta* (5 var.)	*Colocasia* taro	sawa	sewa	corm, leaves	no	yes	C, W
5	*Cyrtosperma chamissonis* (12 var.)	giant swamp taro	mwahng	mweiang	corm	no	yes	C
6	*Dioscorea* spp. (42 var.)	yam	kehp	kehp	tuber	yes	yes	C, W
7	*Ipomea batatas* (6 var.)	sweet potato	pedehde	pidehde	corm, leaves	no	yes	C
8	*Manihot esculenta* (9 var.)	tapioca	kehp tuhke	dapiohka	cassava, tuber	no	yes	C
9	*Musa* spp. (26 var.)	banana	uht	wis	stem, bud	no	yes	C, W
10	*Tacca leontopetaloides*	arrowroot	mwekimwek	mwekemwek	tuber	no	no	C, W
11	*Xanthosoma sagittifolium* (2 var.)	*Xanthosoma* taro	sawahn awai	sewah seipen	corm	no	yes	C
	Coconut and other palms							
1	*Clinostigma ponapensis*	mountain palm	kotop	kedei	heart	no	no	W
2	*Cocos nucifera* (6 var.)	coconut	nih	ni	nut, juice, husk, embryo, inflorescence, heart	no	yes	C, W
3	*Elaeis guineensis*	oil palm	apwuraiasi, nihn aprika	apwuraiasi	meat embryo	yes	no	W
4	*Ptychosperma* spp.	palm	kedei	kedei	heart	no	no	W
	Fruits and nuts							
1	*Adenanthera pavoniva*	red bead	kaikes	kaikes	nut	yes	no	W
2	*Ananas comosus*	pineapple	pweinaper	pweiniper	fruit	yes	yes	C
3	*Annona muricata*	soursop	sei	sei	fruit	yes	yes	W
4	*Averrhoa carambola*	carambola, star fruit	ansu	ansu	fruit	yes	yes	C, W
5	*Carica papaya*	papaya	memiap	keiniap	fruit, seed	no	yes	C, W
6	*Chrysophyllum cainito*	star apple	star apple	–	fruit	yes	no	C
7	*Citrullis vulgaris*	watermelon	sihka	wedamelon	fruit	no	yes	C
8	*Citrus aurantifolia* (3 var.)	citrus	karer, peren	karer	fruit, leaves	yes	yes	C, W
9	*Crataeva speciosa*	garlic pear	apus, apuch	–	fruit	yes	no	C
10	*Eugenia jambos*	rose apple, bell apple	apel en wai, apeltik	apolsikisik	fruit	yes	yes	C
11	*Eugenia stelechantha*	jungle apple	kirekinwel	apol in wai	fruit	na	no	W
12	*Ficus tinctoria*	native fig	nin	nin	berry	yes	no	W
13	*Inocarpus fagifer*	chestnut	mworopw	mwerepw (kirek)	nut	yes	no	C, W

Continued

Table 6.3 *(continued)* **Pohnpei traditional food list**

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
14	*Mangifera indica*	mango	kehngid	kehngid	fruit	yes	yes	C, W
15	*Morinda citrifolia*	Indian mulberry, noni	weipwul	uhpwul	fruit, leaves	no	yes	W
16	*Nephelium lappaceum*	rambutan	rambutan	–	fruit	yes	no	C
17	*Pandanus tectorius* (13 var.)	pandanus fruit	kipar, deipw	kipar	fruit, seed	yes	yes	C, W
18	*Pangium edule*	false durian	duhrien (false)	duhrien (false)	fruit	yes	no	W
19	*Passiflora edulis*	giant passion fruit	pwompwompw en wai	pwompwompw	fruit	yes	no	C
20	*Passiflora foetida*	passion fruit	pwompwompw	pwompwompw	fruit	yes	no	W
21	*Persea Americana*	avocado	apakahdo	–	fruit	yes	yes	C
22	*Pouteria campechiana*	canistel, egg fruit	kanisutel	–	fruit	na	no	C
23	*Psidium guajava*	guava	kuahpa	kuahpa	fruit	yes	no	C, W
24	*Saccharum officinarum*	sugar cane	sehu	seu	stem	no	yes	C
25	*Spondias dulcis*	golden apple, Polynesian plum	doismango	–	fruit	yes	no	W
26	*Syzygium malaccensis*	mountain apple, Malay apple	apel en pohnpei	apol in pohnpei	fruit	yes	yes	C, W
27	*Terminalia catappa*	Indian almond	dipwoapw	dipwopw	nut	yes	no	C, W
28	*Theobroma cacao*	cocoa fruit	kakau	kekau	fruit	yes	no	C
	Vegetables							
1	*Allium cepa*	spring onion	nengi	nengi	leaves	no	yes	C
2	*Allium schoenoprasum*	leek	nira	lihk	leaves	no	yes	C
3	*Alternanthera sissoo*	Brazilian spinach	spinach	sipinis	leaves	no	no	C
4	*Asplenium nidus*	bird's nest fern	tehnlik	sehlik	leaves	no	no	W
5	*Brassica chinensis*	Chinese cabbage	napa	cabbage	leaves	no	yes	C
6	*Capsicum annuum*	chili pepper	sele	sele	leaves, fruit, stem	no	yes	C, W
7	*Capsicum annuum*	bell pepper	bell pepper	bell pepper	fruit	no	yes	C
8	*Cnidoscolus chayamansa*	chaya	taya	chaya	leaves	no	no	C
9	*Cucumis sativus*	cucumber	kiuhri	kiuhri	fruit	no	yes	C
10	*Cucurbita pepo*	squash, zucchini	iuhnawo	–	fruit	no	yes	C
11	*Cucurbita moschata*	pumpkin	pwengkin	pwengkin	fruit	no	yes	C
12	*Gynura crepioides*	Okinawa spinach	spinat	sipinis	leaves	no	no	C
13	*Hibiscus esculentus*	okra	okira	okra	fruit	no	yes	C
14	*Hibiscus manihot*	leafy green	bele	bele	leaves	no	no	C
15	*Ipomoea aquatica*	kangkong, swamp cabbage	kangkong	kangkong	leaves, stem	no	yes	C, W
16	*Lagenaria siceraria*	bottle gourd, squash	bottle gourd	ungau	fruit	no	yes	C
17	*Lycopersicon esculentum*	tomato	domado	domado	fruit	no	yes	C

Continued

Table 6.3 *(continued)* **Pohnpei traditional food list**

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
18	*Momordica charantia*	bitter gourd	bitter gourd	–	fruit	no	yes	C
19	*Moringa oleifera*	drumstick, moringay	drumstick	–	leaves	no	no	C
20	*Ocimum basilicum*	basil	basil	kediring	leaves	no	no	C
21	*Psophocarpus tetragonolobus*	winged bean	winged bean	–	leaves, fruit	no	no	C
22	*Raphanus sativus*	Oriental radish	daikon	daikon	root, leaves	no	yes	C
23	*Sauropus androgynus*	sweetleaf bush	katuk	katuk	leaves	no	no	C
24	*Solanum melongena*	eggplant	nasupi	eggplant	fruit	no	yes	C
25	*Vigna sesquipedalis*	beans	pihns	pihns	legumes	no	yes	C
	Other plants: drinks/spices							
1	*Cinnamomus carolinense*	native cinnamon	madeu	madeu	bark	no	yes	C, W
2	*Curcuma longa*	turmeric	kisinioang	oang	root, leaves	no	no	C, W
3	*Cymbopogon citratus*	lemon grass	lemon grass	saineroil	leaves	no	no	C
4	*Hibiscus rosa-sinensis*	hibiscus	keleu en wai	keleu in wai	ornamental flowers	no	no	C
5	*Ocimum basilicum*	basil	kadiring, basil	kediring	leaves	no	no	C
6	*Piper methysticum* (2 var.)	kava	sakau	sekau	root	no	yes	C
7	*Piper nigrum*	pepper corns	pepper en pohnpei	pepper in pohnpei		no	yes	C
8	*Zingiber officinale*	ginger	sinter	sinter	root	no	no	C
9	*Mansoa alliacea*	garlic vine	garlic vine	garlic vine	leaves	no	no	C
	Fish							
1	*Abudefdus sordidus*	black-spot sergeant	peikopw	peikopw	–	no	yes	W
2	*Acanthocybium solandri*	wahoo	ahl	ahl	–	no	yes	W
3	*Acanthurus gahhm*	surgeonfish	tamwarok	koahlau	–	no	yes	W
4	*Acanthurus lineatus*	bluebanded surgeonfish	wakapw	pilehn	–	no	yes	W
5	*Acanthurus triostegus*	convict tang	letepwel	koalau	–	no	yes	W
6	*Acanthurus xanthopterus*	yellowfin surgeonfish	pakas	pekas	–	no	yes	W
7	*Acanturus guttatus*	white-spotted surgeonfish	parapar en lik	parapar	–	no	yes	W
8	*Aphareus rutilans*	silvermouth, lehi	lol imwin pwadaik toantoal	lol	–	no	yes	W
9	*Bolbometopon muricatus* (2 var.)	humphead parrotfish	kemeik, tamwais	kemeik	–	no	yes	W
10	*Caranx ignobilis*	giant trevally	oarong pil	arong	–	no	yes	W
11	*Caranx melampygus*	bluefin trevally	oarongen	arong	–	no	yes	W
12	*Caranx sexfasciatus* (2 var.)	bigeye trevally, jack fish	oarong maswelek, oarongenpwong	masepwelepwel, arong	–	no	yes	W
13	*Carassius auratus*	small fresh water fish	palaiau	palaiau	–	no	yes	W

Continued

Table 6.3 *(continued)* **Pohnpei traditional food list**

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
14	*Carcharhinus amblyrhinchos*	gray reef shark	pakoahn nan madau	pakoa	–	no	no	W
15	*Carcharhinus melanopterus*	blacktip reef shark	pelenges	pelenges	–	no	no	W
16	*Cephalopholis argus* (2 var.)	bass-grouper, peacock grouper	mwoalusulus, mwoalus	kali	–	no	yes	W
17	*Cephalopholis miniata*	coral grouper	mwoalusulus weitahta	soakohar	–	no	yes	W
18	*Cetoscarus bicolor*	bicolor parrotfish	weleir	kidi	–	no	yes	W
19	*Chaetodon auriga*	butterfly fish	lierpwater	lidenpwares	–	no	yes	W
20	*Chanos chanos*	milkfish	kih	lahd	–	no	yes	W
21	*Cheilinus trilobatus*	tripletail wrasse	poros	poros en merer	–	no	yes	W
22	*Cheilinus undulatus* (2 var.)	humphead wrasse	merer, pahini poken	merer	–	no	yes	W
23	*Coryphaena hippurus*	mahimahi, dolphin fish	kohko	soapoahr	–	no	yes	W
24	*Ctenochaetus striatus*	striped bristletooth	doarop	doarop	–	no	yes	W
25	*Echidna polyzona*	salt water eel	lapwed	rap	–	no	yes	W
26	*Elagatis bipinnulatus*	rainbow runner	mwunseik	mwahseik	–	no	yes	W
27	*Epibulus insidiator*	slingsaw wrasse	malekelek	nein lipehden	–	no	yes	W
28	*Epinephelus coeruleopunctatus* (2 var.)	snowy grouper sammenip	mwanger en nanipil,	widir	–	no	yes	W
29	*Epinephelus fasciatus*	black-tipped grouper	senser	widir	–	no	yes	W
30	*Epinephelus macrospilos*	black-spotted grouper	mwanger pwet	widir	–	no	yes	W
31	*Epinephelus malabaricus*	giant grouper	mwanger ripwiripw	deiahwe	–	no	yes	W
32	*Epinephelus merra*	honeycomb grouper	widir en pohn mad	kahlenwo	–	no	yes	W
33	*Epinephelus morrhua*	narrow curve-banded grouper	kilo en pohnwol	lol	–	no	yes	W
34	*Epinephelus polyphekadion*	marbled grouper	mwanger en nannamw	widir	–	no	yes	W
35	*Epinephelus septemfasciatus*	seven-banded grouper	maud, deiahwe	widir lap	–	no	yes	W
36	*Etelis carbunculus*	ehu	lol, loi	lol	–	no	yes	W
37	*Etelis coruscans*	onaga	lol maswalek	lol	–	no	yes	W
38	*Euthynnus affinis*	kawakawa	sidaudau	sidaudau	–	no	yes	W
39	*Gerres abbreviatus*	silverfish	kasapal	kesepal	–	no	yes	W
40	*Gerres oyena*	oyena mojarra	mwomwin leng	kesepal	–	no	yes	W
41	*Grammatorcynus bilineatus*	double-lined mackerel	kapou	pweir	–	no	yes	W
42	*Gymnosarda unicolor* (2 var.)	dogtuna, dogtooth tuna	manguro, sileu	ail	–	no	yes	W
43	*Gymnothorax javanicus*	moray eel	lapwed ehn nam	siloangoaloang	–	no	yes	W
44	*Hemiramphus guoyi*	half beak	pwuwas	–	–	no	yes	W
45	*Hipposcarus longiceps*	Pacific longnose parrotfish	mwomw mei	arere	–	no	yes	W

Continued

Table 6.3 *(continued)* **Pohnpei traditional food list**

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
46	*Hirundichthys oxycephalus*	flying fish	mwahmw pihr	menger	–	no	yes	W
47	*Istiophorus platypterus*	sailfish	dekilahr sike tehlap powe	dekilahr serek	–	no	yes	W
48	*Katsuwonus pelamis*	skipjack tuna	kasuwo	lesapwil	–	no	yes	W
49	*Kyphosus cinerascens*	highfin rudderfish	keriker, kertakai, kerilel	limwilimw, leseneke	–	no	yes	W
50	*Leiognathus equulus*	common slipmouth	sengiseng	sengiseng	–	no	yes	W
51	*Lethrinus harak*	blackspot emperor	samwei pwet	samwei	–	no	yes	W
52	*Lethrinus kallopterus*	orangefin emperor	ikiepw	ewih rar	–	no	yes	W
53	*Lethrinus lentjan*	snapper	medi	medi	–	no	yes	W
54	*Lethrinus microdon*	white snapper	kadek	samwei	–	no	yes	W
55	*Lethrinus ramak*	yellowstripe emperor	samwein pohn rar	samwei rar	–	no	yes	W
56	*Lethrinus xanthochilus*	yellowlip emperor	moadi	medi	–	no	yes	W
57	*Liza vaigiensis*	yellowtail mullet	ikimweni	kepase	–	no	yes	W
58	*Lutjanus argentimaculatus*	river snapper	asimel	asimel	–	no	yes	W
59	*Lutjanus bohar*	red snapper	kihr, kihr en eiwel	kehu	–	no	yes	W
60	*Lutjanus fulvus*	flametail snapper	ikem	ikem	–	no	yes	W
61	*Lutjanus gibbus*	humpback snapper	pwahlahl	pwahlahl	–	no	yes	W
62	*Lutjanus kasmira*	snapper	tehnseu	samwei	–	no	yes	W
63	*Lutjanus monostigmus*	onespot snapper	pwehu	inahme	–	no	yes	W
64	*Lutjanus rivulatus* (2 var.)	scribbled snapper	ikem en asimel, kihrsal	asimel, kihr	–	no	yes	W
65	*Lutjanus semicinctus*	half-barred snapper	inahme	pwehu	–	no	yes	W
66	*Makaira nigricans*	Pacific blue marlin	dekilahr	dekilahr	–	no	yes	W
67	*Monotaxis grandoculus*	bigeye emperor	masokod	masamas	–	no	yes	W
68	*Mulloides flavolineatus*	yellowstripe goatfish	dingmoa	epil	–	no	yes	W
69	*Myripristis berndti*	bigscale soldierfish	mwuhn weitahta	medeu	–	no	yes	W
70	*Naso lituratus*	orangespine unicornfish	pwulangkin	pwilaksoal	–	no	yes	W
71	*Naso unicornis* (2 var.)	bluespine unicornfish	pwilak, pwulak	pwilakemei, pwulak	–	no	yes	W
72	*Naso vlamingii*	bignose unicornfish	kitik	monomon	–	no	yes	W
73	*Ophiocara porocephala*	mangrove swamp fish	sopwou	sopwou	–	no	yes	W
74	*Ostracion cubicus*	cube trunkfish	kohpwa	kohpwa	–	no	yes	W
75	*Paraglyphidodon melas*	damsel fish	toik	soik	–	no	yes	W
76	*Parupeneus barberinus*	dash-and-dot goatfish	mwomw pohn mwei toal ni pwadaike	mwedel	–	no	yes	W
77	*Parupeneus cyclostomus* (2 var.)	goatfish	mwomwalis, mwompwon	mwedel, mwompwon	–	no	yes	W

Continued

Table 6.3 *(continued)* **Pohnpei traditional food list**

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
78	*Parupeneus indicus*	goatfish	iomo	mwedel	–	no	yes	W
79	*Plectorhinchus chaetodonoides*	harlequin sweetlips	koahng, kehng	koil, dehn	–	no	yes	W
80	*Plectorhinchus goldmanni*	goldman's sweetlips	koahng, kehng	koil, dehn	–	no	yes	W
81	*Plectorhinchus obscurus*	giant sweetlips	koahng, kehng	kakarpil	–	no	yes	W
82	*Plectorhinchus orientalis*	oriental sweetlips	koahng, kehng	koil, dehn	–	no	yes	W
83	*Plectorhinchus picus*	spotted sweetlips	koahng mweimwei	dehn	–	no	yes	W
84	*Plectorhynchus celebicus*	sweetlips porgy	kakerepil, koail	koil	–	no	yes	W
85	*Plectropomus areolatus* (2 var.)	giant coral trout	ewen sawi, oawen sawi	sawi	–	no	yes	W
86	*Plectropomus laevis*	saddleback grouper	oawen sawi	sawi	–	no	yes	W
87	*Pristipomoides argyrogrammicus*	blueline gindai	mesarar	kihr	–	no	yes	W
88	*Rhinecanthus aculeatus* (2 var.)	triggerfish	lioli, pwuhpw	liolu, pwupw	–	no	yes	W
89	*Ruvettus pretiosus*	castor-oil fish	deikenipeng	deikenepeng	–	no	yes	W
90	*Sargocentron spiniferum*	long-jawed squirrelfish	sara sike weitahta	sera	–	no	yes	W
91	*Sargocentron tiere*	blue-lined squirrelfish	sara weitahta	sehwod wahu	–	no	yes	W
92	*Scarus frontalis*	tan-faced parrotfish	mahu toal	mahulik	–	no	yes	W
93	*Scarus ghobban*	blue-barred parrotfish	lidoin mahu	senidinid	–	no	yes	W
94	*Scarus gibbus*	gibbus parrotfish	mahulik	mahu soal	–	no	yes	W
95	*Scarus rubroviolaceus* (2 var.)	parrotfish type, redlip parrotfish	lidoi, mahu pwur	lioel, mahu	–	no	yes	W
96	*Scomberoides lysan*	leatherback	sarduwa	saraduwa	–	no	yes	W
97	*Selar crumenophthalmus*	bigeye scad	pedihdi	pedihdi	–	no	yes	W
98	*Seriola dumerili*	greater amberjack	arong seik	mwahseik	–	no	yes	W
99	*Siganus argenteus*	forktail rabbitfish	umwule	mwomwene	–	no	yes	W
100	*Siganus doliatus*	rabbitfish	pwerinmwomw	mehlau	–	no	yes	W
101	*Siganus puellus*	rabbitfish	mahr	mahr	–	no	yes	W
102	*Siganus punctatus*	gold-spotted rabbitfish	palapal	palapal	–	no	yes	W
103	*Siganus* spp.	forktail rabbitfish	ilek	ilek	–	no	yes	W
104	*Siganus vulpinus*	rabbitfish	kompani	palapl ongong	–	no	yes	W
105	*Sphyraena barracuda*	great barracuda	suhre, sarau	suhre	–	no	yes	W
106	*Sphyraena genie*	blackfin barracuda	sarau	sarau	–	no	yes	W
107	*Thunnus albacares*	yellowfin tuna	karangahp	pweipwei	–	no	yes	W
108	*Triaenodon obesus*	whitetip reef shark	pakoa	pakoa	–	no	yes	W
109	*Valamugil seheli*	bluespot mullet	ahpako, ah	ah	–	no	yes	W

Continued

Table 6.3 *(continued)* **Pohnpei traditional food list**

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
110	*Variola albimarginata*	whitemargin lyretail grouper	sawi pwiliet	sawi pwiliet	–	no	yes	W
111	–	–	mwahmw	mwomw	–	no	yes	W
112	–	–	katik	–	–	no	yes	W
113	–	–	lisap	–	–	no	yes	W
114	–	–	parakus	–	–	no	yes	W
115	–	–	pidekilik	–	–	no	yes	W
	Other seafood						no	
1	*Anadara antiquata*	shellfish, antique ark	lipwei	lipwei	–	no	yes	W
2	*Brachycerus latro*	coconut crab	emp	epup	–	no	yes	W
3	*Chelonia mydas*	green turtle	kalahp (wehi)	kalahp (wei)	meat, eggs	no	yes	W
4	*Eretmochelys imbricata*	hawksbill turtle	sapwake (wehi)	sapwake (wei)	meat, eggs	no	yes	W
5	*Gafrarjum tumidum*	shellfish	kemei	–	–	no	yes	W
6	*Geocarcordea natalis*	red crab, 2-3 types	pworu	rokumw	–	no	yes	W
7	*Hippopus hippopus*	shellfish, giant clam	pahsu	pahsu	–	no	yes	W
8	*Lambis lambis*	shellfish	lahg	leiang	–	no	yes	W
9	*Matapenaeus moyebi*	shrimp, female	likedepw	likedepw	–	no	yes	W
10	*Octopus aculaetus*	octopus	kihs	kihs	–	no	yes	W
11	*Palaemon serrifer*	freshwater shrimp	lur	lur	–	no	yes	W
12	*Panilurus* spp.	lobster	uhrena	wirehna	–	no	yes	W
13	*Scylla serrata*	mangrove crab	elimoang	elimoang	–	no	yes	W
14	*Sepiodenthis lessoni*	squid	nuhd	nuhd	–	no	yes	W
15	*Sticopus japonicus*	sea cucumber variety	loangon	loangon	–	no	yes	W
16	*Tridacna maxima*	shellfish, clam	sile	sile	–	no	yes	W
17	*Trochus niloticus*	shellfish, trochus	sumwumw	deakasingai	–	no	yes	W
18	*Turbo argyrostomus*	shellfish	komis	komis	–	no	yes	W
19	*Turbo petholatus*	shellfish	kalemwei	–	–	no	yes	W
20	–	crab (small, black)	masaht	mesahs	–	no	yes	W
21	–	sea cucumber variety	werer	werer	–	no	yes	W
22	–	shellfish	–	kaidad	–	no	no	W
23	–	shellfish	–	ikoaroas	–	no	no	W
24	–	shellfish, black	lingkorot	ihkoaroahs	–	no	yes	W

Continued

Table 6.3 *(continued)* Pohnpei traditional food list

	Scientific name	English/common name	Pohnpei name	Pingelap name	Part(s) used	Seasonality	Marketed	Source
25	–	shellfish	lisap	lisap	–	no	yes	W
26	–	shellfish	kataur	–	–	no	yes	W
	Meat						no	
1	*Bos taurus*	cattle	kou	kou	–	no	yes	D
2	*Bubalus bubalis*	carabao, water buffalo	karapahu	kerebahu	–	no	yes	D
3	*Canis familiaris*	dog	kidi	kidi	–	no	yes	D
4	*Capra hircus*	goat	kout	kuhs	–	no	yes	D
5	*Cervu elaphus*	deer	tie	sie	–	no	yes	W
6	*Sus scrofa*	pig	pwihk	koaso (pwihk)		no	yes	D
	Birds						no	
1	*Anous stolidus*	brown noddy tern (big)	paret	dopwohk	–	no	no	W
2	*Anous stolidus*	brown noddy tern (small)	paret (atet)	rehn	–	no	no	W
3	*Aplonis opaca*	Micronesian starling	siohk	sioahk	–	no	yes	W
4	*Aythya fuligula*	duck	tehk	deki	meat, eggs	no	no	D
5	*Ducula oceanica*	pigeon	mwuroi	mwuroi	–	no	yes	W
6	*Egretta sacra*	Pacific reef heron	kewelik	kulap	–	no	no	D, W
7	*Fregata minor*	great frigate bird	kasap	kesap	–	no	no	D, W
8	*Gallicolumba kubaryi*	Caroline Islands ground dove	peluhs	peluhs	–	no	no	W
9	*Gallus domesticus*	chicken	malek	malek	meat, eggs	no	yes	W
10	*Gallus domesticus*	jungle fowl	malek en wel	malek in wel	–	no	yes	D, W
11	*Gygis alba*	fairy tern	kahke	keake	–	no	no	W
12	*Myzomela rubratra*	Micronesian honeyeater	pwiliet	pwilied	–	no	no	W
13	*Phaethon lepturus*	white-tailed tropic bird	sihk	sik	–	no	no	W
14	*Ptilinopus porphyraceus*	crimson crowned fruit dove	kiniwed	kiniwed	–	no	no	W
15	*Sula sula*	booby, red-footed; + others	kupwur	kupwur	–	no	no	W

– No data.
C Cultivated.
W Wild.
D Domesticated.

Table 6.4 Flesh colour and carotenoid, vitamin and mineral content of selected Pohnpei traditional foods and common imported foods *(per 100 g edible portion)*

Food Items	*Flesh color*	*ß-carotene*	*α-carotene*	*ß-crypto-xanthin*	*ß-carotene equivalents*[2]	*RE*[3]	*RAE*[4]	*Lutein*	*Zeaxanthin*	*Total carotenoids*	*Riboflavin*	*Zinc*	*Iron*
		µg	*µg*	*µg*	*µg*	*µg*	*µg*	*µg*	*µg*	*µg*	*mg*	*mg*	*mg*
Banana													
Utin lap, raw	Orange	6 360	1 472	*	7 096	1 183	591	40	10	5 370	1.76	–	–
Karat, raw	Yellow-orange	2 230	455	30.0	2 473	412	206	1 130	137	4 320	14.30	0.3	0.2
Utin Menihle, raw	White	30	20	*	40	7	3	230	*	290	0.47	–	–
Giant Swamp Taro[1]													
Mwahng Tekatek Weitahta, cooked	Yellow	4 486	*	*	4 486	748	374	1 548	*	–	–	63.0[5]	0.2
Mwahng en Wel, cooked	Yellow	2 930	2040	*	3 950	658	329	130	<10	2940	–	36.0[5]	3.2
Breadfruit[1]													
Mei Kole, ripe, cooked	Yellow	868	142	–	939	157	78	750	70	1260	–	–	–
Mei Uhpw, ripe, cooked	Cream	154	<5	–	157	26	13	310	<10	470	–	–	–
Pandanus													
Unidentified variety, ripe, raw	Orange	270	30	–	285	48	24	350	370	5 340	–	–	–
Rice													
White, cooked	White	0	0	–	0	0	0	0	0	0	0.01	0.6	0.3
Flour, wheat													
White, plain	White	0	0	–	0	0	0	0	0	0	0.03	0.6	1.3
Sugar													
White	White	0	0	–	0	0	0	0	0	0	0	0	T

– No data.
* Below detection limits.
T Trace.
1 The cooked giant swamp taro samples were boiled 30–40 min peeled with pot covered and breadfruit samples were boiled 10 minutes with pot covered.
2 ß-carotene equivalents (content of ß-carotene plus half the content of α-carotene and ß-cryptoxanthin).
3 Retinol Equivalents (conversion factor 6:1 from ß-carotene equivalents to RE).
4 Retinol Activity Equivalents (conversion factor 12:1 from ß-carotene equivalents to RAE).
5 Taro sample collection and analyses were repeated to detect any zinc contamination, but high levels were found twice. Further studies are planned.

References: Englberger *et al.*, 2003b,c,d; Englberger *et al.*, 2005a; Englberger *et al.*, 2006; and Dignan *et al.*, 2004.

Notes: All analyses used state-of-the art techniques, including high performance liquid chromatography (HPLC) carried out from the year 2000 to 2005.Results present means of duplicate analyses by different laboratories on multiple composite samples. All samples were collected from Pohnpei Banana, breadfruit, and pandanus samples were fully ripe and the giant swamp taro samples (a root crop that does not ripen) were at the mature stage. The white rice, wheat flour and sugar are major imported dietary food items.

Laboratories: Institute of Applied Sciences/University of the South Pacific, Suva, Fiji; DSM Nutritional Products, Basel, Switzerland; University of Adelaide, Glen Osmond, Australia.

Table 6.5 Key micronutrient-rich traditional foods ranked by the Mand Community Working Group in order of importance for promotion based on nutrient content

Rank	Food item by English, Pohnpei, and Pingelap names
1	Yellow-fleshed giant swamp taro (mwahng, mweiang) cultivars
2	Yellow-fleshed banana (uht, wis) cultivars
3	Seeded breadfruit (mahi, mei): Meikole, Meipa
4	Smooth-skinned breadfruit (mahi, mei) cultivars
5	Rough-skinned breadfruit (mahi, mei) cultivars
6	Yam cultivar, Kehp Pwetpwet or Kororo
7	Yam cultivar, Kehp Toantoal or Kehp Soar
8	Green leafy vegetables: chaya, pele, katuk
9	Green leafy vegetables: kangkong, spinach, cabbage
10	Chestnut (mworopw)
11	Papaya (memiap, keiniap)
12	Pineapple (pweinaper, pweiniper)
13	Mango (kehngid), mountain apple (apel en pohnpei)
14	Soursop (sei)
15	Calamansi citrus (karertik)
16	Guava (kuahpa)
17	Reef fish (mwahmw, mwomw)
18	Ocean fish (mwahmw, mwomw)
19	Skipjack tuna fish liver
20	Drinking coconut (nih, ni)

Scientific identification and/or composition analysis of selected species

Photographs and descriptions of some food crops not identified by English and scientific names were emailed to two regional networks, Pestnet and the Secretariat of the Pacific Community (SPC) Pacific Agricultural Plant Genetic Resource Network. This and consulting photograph collections of Pacific island foods assisted in the identification of species.

A series of ongoing assessments of Pohnpei foods (Englberger *et al.*, 2003b, 2003c, 2003d; Englberger *et al.*, 2006; Shovic and Whistler, 2001) have identified banana cultivars with the highest levels of ß-carotene[12] in the world (Table 6.4). Karat banana, unique for its erect bunch, fat-shaped finger, and yellow/orange flesh colour has captured international attention (Coghlan, 2004; Kuhnlein, 2004; Radford, 2004). In 2005, Karat was named the Pohnpei State Banana and was featured on postage stamps. As many of the local foods and food cultivars of Pohnpei have not yet been assessed for nutrient content (Englberger *et al.*, 2005b), regional data or data from previous studies of nearby regions were also consulted for providing insight on nutritional value (FAO, 2004; Murai, Pen and Miller, 1958). Many giant swamp taro and pandanus varieties have also been identified as rich in provitamin A carotenoids[13] and minerals, including zinc, iron, and calcium (Englberger *et al.*, 2003b, 2003c). A general characteristic of these carotenoid-rich foods is a deep yellow or orange colouration of the edible flesh, which is visually recognizable. This provides a meaningful way of communicating about nutrient content to members in the community and selecting the most nutritious foods and cultivars for the greatest health benefits.

List of key micronutrient-rich traditional foods

Table 6.5 presents the 20 key micronutrient-rich foods agreed upon by the Mand Community Working Group. Primarily the nutrients vitamin A and vitamin C were considered. Yellow-fleshed giant swamp taro and banana cultivars were ranked as the most important to promote. Seeded breadfruit, formerly an important Pingelapese food, but little used today, was also selected for promotion. Some foods that have not been traditionally eaten (greens), but which grow easily in Mand and are nutrient-rich, were included in the list.

Patterns of harvest, storage and preparation of key traditional foods

The harvest patterns were uniform throughout Pohnpei Island. The main breadfruit season was from May to August, peaking in July, with a minor season from

12 ß-carotene is the most important of the provitamin A carotenoids contributing to vitamin A status.

13 In contrast to these locally grown foods, rice, a commonly consumed food, contains no provitamin A carotenoids.

Table 6.6 Selected local foods by order of like/use/ease of growing and order of priority for promotion ranked by the Mand Community Working Group

Order of like/consumption/ease of growing		Order of priority for promotion	
Banana (uht, wis)			
1	Taiwang	1	Utin lap, Utimwas
2	Sendohki (Kudud)	2	Karat
3	Karat	3	Akadahn, Akadahn Weitahta
4	Akadahn, Akadahn Weitahta	4	Karat en lap, Taiwang
5	Utin lap, Utimwas	5	Sendohki (Kudud)
6	Mangat, Ihpali	6	Mangat, Ihpali
7	Karat en lap		
Giant swamp taro (mwahng, mweiang)			
1	Mweiang Pwiliet	1	Smihden
2	Sounpwong Weneu	2	Mweiang Seria
3	Mweiang Saleng Walek	3	Nein Sehm
4	Mweiang Tekatek	4	Nein Silingden
5	Smihden	5	Nein Aikem
6	Mweiang Seria	6	Nein Pisep
7	Nein Sehm	7	Mweiang Pwiliet
8	Nein Silingden	8	Mweiang Saleng Walek
9	Nein Aikem	9	Mweiang Tekatek
10	Nein Pisep	10	Sounpwong Weneu
Taro, *colocasia* (sawa)			
1	Sawa Toal	1	Pasdohra
2	Sawa Weisasa	2	Sawa Mweiang
3	Sawa Mweiang	3	Sawa Toal
4	Sawa Kororo (Pakohr)	4	Sawa Weisasa
5	Pasdohra	5	Saipan
6	Sawa Saipan	6	Sawahn Hawaii
7	Sawahn Hawaii	7	Sawa Kororo (Pakohr)

Order of like/consumption/ease of growing		Order of priority for promotion	
Nut			
1	Chestnut (mworopw)	1	Chestnut (mworopw)
2	Indian almond (dipwopw)	2	Indian almond (dipwopw)
3	Red bead (kaikes)	3	Red bead (kaikes)
Vegetable			
1	Cabbage	1	Kang kong (se kang kong)
2	Chaya leaves (se chaya)	2	Chaya leaves (se chaya), katuk (se katuk)
3	Pele leaves (se pele)	3	Pele leaves (se pele)
4	Spinach (se spinis)	4	Spinach (se spinis)
5	Chilli pepper leaves (se sele)	5	Cabbage
6	Kang kong (se kang kong)	6	Chilli pepper leaves (se sele)
7.	Katuk (se katuk)	7	Pumpkin tips (se pwengkin)
8	Pumpkin tips (se pwengkin)	8	Sweet potato leaves (se pedehde)
9	Sweet potato leaves (se pedehde)	9	Taro leaves (se sawa)
10	Taro leaves (se sawa)	10	Tapioca leaves (se dapiohka)
11	Tapioca leaves (se dapiohka)		
Fruit			
1	Papaya (memiap, keiniap)	1	Papaya (memiap, keiniap)
2	Pineapple (pweinaper)	2	Pineapple (pweinaper)
3	Citrus (karer, karertik)	3	Citrus (karer, karertik)
4	Soursop (sei)	4	Soursop (sei)
5	Mango (kehngid)	5	Guava (kuahpa)
6	Mountain apple (apel en ponhpei)	6	Mango (kehngid)
7	Guava (kuahpa)	7	Mountain apple (apel en pohnpei)
8	Rose apple (apel en wai)	8	Rose apple (apel en Wai)
9	Passion fruit (pwompwompw)	9	Passion fruit (pwompwompw)

October to February. The yam season was from September to March, peaking in December. Banana and taro, the other main staple foods, were harvested throughout the year. Many fruits including papaya and citrus were harvested throughout the year, whereas mango and pineapple were seasonal, peaking in June and July. Vegetables were harvested year-round.

The traditional method of storing breadfruit by preserving in earthen pits for making *mahr*[14] was rarely used. However, there was a modernized version of this method, consisting of peeling and coring the breadfruits and storing them in plastic bags and containers. The products were baked and sold in local markets, popular among the older generation. The Pingelapese method of preparing this product of preserved breadfruit *mahr* produced a tasty product[15]

14 Previously in Pohnpei breadfruit was often preserved in a pit with as many as 500 to 1 000 peeled and cored breadfruit placed in the ground for a fermentation process that required about three months. After this time the doughy mass can be kneaded and prepared as bread, which has a cheese-like fermented taste. Preserved breadfruit could be left in the pit for many years. As breadfruit is a seasonal crop, this preservation method provided a supplement to the diet in off seasons and provided food security in times of natural disasters.

15 The sour taste is removed by rinsing the raw preserved *mahr*.

and did not have the strong taste (distasteful to many) of the regular Pohnpeian *mahr*. Cooking was mostly done on kerosene cookers and by open-fire methods. A traditional earth oven (*uhmw*) may be prepared for special events. Boiling and frying were also common cooking methods.

Preferences of families, especially mothers and children within the food list

Key informants first developed the list of little-used or unused foods in Mand, giving an availability score, which was finalized by the Mand Community Working Group. This list was used to help gain a general understanding about the locally grown foods presently consumed. Informants stressed that there were many foods that used to be commonly grown in Mand, but which are now grown to a much lesser extent. This included cultivars of sugar cane and banana (*Karat* and *Utin Iap*) and other staple food crops, fruits and vegetables.

A variety of local foods was ranked according to preferences of taste, consumption, ease of growing and agricultural factors, and then by order of priority for promotion, as agreed upon by group consensus (Table 6.6). The priority for promotion in Table 6.6 is somewhat different from that in Table 6.5. The priorities agreed upon in Table 6.6 included factors of taste preference, consumption and agricultural factors, whereas the priorities agreed upon in Table 6.5 focused on nutrient content.

Dietary evaluation

Quantitative dietary assessment for female adults and young children

Tables 6.7 and 6.8 present the overall results of the 24-hour dietary recall, repeated for two non-consecutive days. Of the 47 households, 47 adults (45 females, 2 males) participated in the seven-day FFQ and 44 female adults (aged 19–68 years) and 27 children (aged 1–10 years) participated in the 24-hour recall. Of these adults (the same for whom FFQ and other data were collected), the education level ranged from two to 13 years of schooling, with a mean of nine years. The number of members per household ranged from 1–11, with a mean of four members. The mean number of children per household was three, ranging from zero to eight. The mean age at which women had their first child was 19 years, ranging from 13 to 36 years of age. Five adult female participants had no children.

Table 6.7 Mean daily intake of selected nutrients by Mand female adults (*n* = 44) and young children (*n* = 27) by local or imported food source in two non-consecutive 24-hour recalls, August 2005

	Energy kcal	*Protein* g	*Fat* g	*Total Vitamin A* µg RE	*Retinol* µg	*ß-carotene* equivalents-µg	*Vitamin C* mg
Female adult intake							
Nutrient intake: local foods	648	43	26	141	78	335	60
Nutrient intake: imported foods	1 796	69	57	82	60	113	6
Total intake: local + imported	2 445	111	83	223	138	448	66
Percent contribution of imported food to total nutrient intake	73%	62%	69%	37%	43%	25%	9%
Child intake							
Nutrient intake: local foods	258	17	9	47	25	190	29
Nutrient intake: imported foods	1 349	45	44	69	40	164	2
Total intake: local + imported	1 608	62	53	116	55	354	31
Percent contribution of imported food to total nutrient intake	84%	73%	83%	59%	73%	46%	6%

Note: This dietary assessment was conducted during the height of the breadfruit season, which contributed thus to greater local food intake.

Table 6.8 Number and percent of Mand female adults (n = 44) and children (n = 27) meeting recommended intakes for protein, vitamin A, and vitamin C in two non-consecutive 24-hour recalls, August 2005

		Protein			*Total Vitamin A*			*Vitamin C*		
		Mean intake	*Meeting RDI*[1]		*Mean intake*	*Meeting RSI*[2]		*Mean intake*	*Meeting RNI*[4]	
	n	*g*	*n*	*(%)*	*µgRE*[3]	*n*	*(%)*	*mg*	*n*	*(%)*
Female adults										
Non-lactating	38	109.7	36	(94.7)	225.2	2	(5.3)	65.7	24	(63.2)
Lactating	6	120.9	6	(100)	203.4	0	(0)	72.0	5	(83.3)
Children										
1–3 years	8	50.7	8	(100)	97.0	0	(0)	45.0	4	(50.0)
4–6 years	11	60.0	11	(100)	105.5	1	(9.1)	26.9	4	(36.4)
7–9 years	5	73.1	5	(100)	153.6	0	(0)	26.5	2	(40.0)
10 years	3	79.8	3	(100)	137.2	0	(0)	16.8	0	(0)

[1] Recommended Dietary Intake; [2] Recommended Safe Intake; [3] Retinol Equivalents; [4] Recommended Nutrient Intake.
References: FAO/WHO/UNU 1985 and WHO/FAO 2002.
Note: For a non-pregnant, non-lactating female 19-60 years of age, the RDI for protein is 45 g (in lactation 61 g), RSI for vitamin A is 500 ug RE (850 RE in lactation), and RNI for C is 45 g (in lactation 70 g). For a child: the RDI for protein for is 13 g (1-3 y), 16-19g (4-6 y), 25 g (7-10 y), RSI for vitamin A is 400 RE (1-3 y), 450 RE (4-6 y), and 500 RE (7-10 y), and RNI for vitamin C is 30 g (1-3 y), 30 mg (4-6 y), and 35 mg (7-10 y).
This dietary assessment was conducted during the height of the breadfruit season, which contributed thus to greater local food intake.

The female adults consumed only 27 percent of their energy and 38 percent of their protein from local food sources, with the rest from imported foods (Table 6.7). The children had an even greater reliance on imported food (16 percent of their energy and 27 percent of protein was from local food). Few reported intakes met the recommended intakes for vitamins A and C (Table 6.8). The non-lactating female adult mean vitamin A intake was very low at 225 Retinol Equivalents (RE) whereas the recommended intake for non-pregnant, non-lactating women is 500 RE (WHO/FAO, 2002). The child mean vitamin A intake ranged from 97 to 154 RE per day, varying by age group, whereas 400–500 RE is the recommended intake for children 1–10 years old. The predominant sources of vitamin A and vitamin C intake were local food. Few imported foods were fortified.

Although individual activity levels were not estimated, it is likely that many individuals consumed energy intakes exceeding their requirements. The average individual energy requirement for a standard reference female weighing 55 kg is estimated at 2 210 kcal (WHO/FAO, 2002), whereas the mean female adult energy intake in Mand was 2 445 kcal. The mean female adult fat intake was 83 g, providing 30.6 percent of total mean energy intake.[16] The child mean fat intake was similar at 29.7 percent of total energy. There was a high female mean adult protein intake, 109 to 120 g/day (Table 6.8), far exceeding estimated requirements, 45 g and 61 g protein per day respectively for non-lactating and lactating females (FAO/WHO/UNU, 1985).

Qualitative dietary assessment for adults

As FFQ responses for the child's diet were similar to those of the adult for the household, only the adult results were analysed. FFQ data revealed that rice was the most commonly consumed food item and was consumed by 100 percent of participants at least once per week and by 95 percent on three or more days. Flour products (mainly ramen noodles and doughnuts) were consumed by 71 percent of participants on three days or more. Of local root crops and starchy fruits, breadfruit (ripe and green unseeded) was the most frequently consumed item (52 percent of participants).[17] White-fleshed banana cultivars were more commonly consumed (36 percent) than the yellow-fleshed banana

[16] Fat intake should supply a minimum of 15 percent of total energy, but should not exceed 30–35 percent (WHO/FAO, 2002).
[17] The seven-day FFQ was administered during the breadfruit season. It is likely that there was a higher consumption of local foods than would have been the case if the survey had been conducted when breadfruit was not available.

cultivars (31 percent), with *Daiwang* (17 percent) and *Sendohki* (8 percent) topping the list of these yellow-fleshed cultivars. Adding sugar to the local staple food, breadfruit, was common (44 percent).

Local fish/seafood was the most commonly consumed source of animal protein (73 percent consuming this item on three days or more), followed by imported fish and seafood (39 percent). Reef fish, local tuna and pork were the most common local animal protein sources. Of imported animal protein food items, canned mackerel and canned tuna were most commonly consumed (59 and 54 percent respectively). The most frequently consumed fat was shortening (reported by 34 percent of the participants), which was of concern because of its high level of trans-fatty acids. Imported vegetable oil was consumed by 29 percent of the participants and local coconut cream by 21 percent.

Vegetables were rarely consumed (30 percent consumed this item on three days or more). Fruits were commonly consumed (89 percent), but mainly in the form of ripe banana. The consumption of imported drinks on three days or more was about the same (41 percent of participants) as consumption of local drinks (40 percent). The most common local drink (63 percent) was coconut water, but imported soft drinks were also common (40 percent). Sugarcane was consumed as a snack by 21 percent of the participants and potato chips were the most common imported snack food.

Although giant swamp taro was described by survey participants as important culturally, only 24 percent had consumed it. Imported turkey tail,[18] normally a common part of the diet in Pohnpei, was not consumed. However, participants explained that the reason for this was that the ship had not arrived and none was available. Imported fat was more commonly consumed than local coconut fat.

No participant reported alcohol consumption; one reported *sakau* drinking (or kava, see footnote 10) on one day. Six participants reported chewing betel nut and seven reported consuming tobacco on mostly a daily basis.

[18] Turkey tail is literally the tail of the turkey (see footnote 7).

As assessed from 24-hour dietary recalls, rice was consumed frequently – on average 1.9 times per day – followed by flour products, banana, breadfruit and giant swamp taro. Of protein items, fish was most frequently consumed throughout the day (1.2 times per day), followed by chicken, pork and tinned meat. Vegetables and fruits were infrequently consumed (0.3 and 0.2 times per day, respectively).

Infant-feeding practices

The Pohnpei State Hospital was awarded "Baby Friendly Status" according to international standards in 2004, and staff members were active in promoting breastfeeding throughout the island. Most women in Pohnpei, including Mand, delivered their babies at this hospital[19] and were encouraged to breastfeed, give colostrum, "exclusively breastfeed"[20] and continue doing so for two years and beyond.

However, there was a common use of breastmilk substitutes in Mand, despite the low incomes of most families. A short questionnaire was administered to mothers/caretakers of ten infants (including a set of twins) in order to better understand infant-feeding practices and attitudes. The children's ages were: one month (n = 1), three months (n = 3), nine months (n = 2), 11 months (n = 1), 13 months (n = 1), 25 months (n = 1) and 26 months (n = 1). Initiation of breastfeeding was universal (100 percent). Seven of the infants were delivered at Pohnpei State Hospital, the twins were delivered at a privately run clinic and one infant was delivered at home in Mand. Of the ten infants, eight were still breastfeeding, including two children over two years old. A caretaker for one of the two infants who was no longer breastfed reported that the mother had stopped because of a colour change in her milk and the baby refusing breastmilk at around three months of age. The other infant was given other milk as the mother claimed that she had ceased to produce milk.

Of the six infants older than six months, four were given their first solid food (*kepeloal*)[21] at six months of

[19] Health officials report that around 90 percent of deliveries in Pohnpei are carried out in Pohnpei State Hospital.
[20] Exclusive breastfeeding refers to giving breastmilk only, not even water, for the first six months.
[21] The term in the Pingelapese language for the first solid food given to an infant is kepeloal.

Table 6.9 Mean Body Mass Index (BMI) of adults and prevalence of overweight and obesity in a randomly selected sample in Mand Community, June/July 2005, by gender and age group (n = 82 males, 85 females)

		Mean BMI	Underweight BMI <18		Normal BMI 18–24.9		Overweight BMI 25–29.9		Obese BMI 30–39.9		Very Obese BMI ≥ 40	
	n		*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Male												
15–19 y	11	24.6	0	(0)	8	(73)	2	(18)	0	(0)	1	(9)
20–29 y	25	27.4	0	(0)	9	(36)	9	(36)	7	(28)	0	(0)
30–39 y	8	29.2	0	(0)	2	(25)	2	(25)	4	(50)	0	(0)
40–49 y	16	27.6	0	(0)	4	(25)	6	(38)	6	(38)	0	(0)
50–59 y	15	30.4	0	(0)	2	(13)	7	(47)	6	(38)	0	(0)
60+ y	7	27.9	0	(0)	0	(0)	5	(71)	1	(14)	1	(14)
Females												
15–19 y	14	28.5	0	(0)	4	(29)	5	(36)	5	(36)	0	(0)
20–29 y	18	30.5	0	(0)	2	(11)	5	(28)	11	(61)	0	(0)
30–39 y	20	33.1	0	(0)	1	(5)	8	(40)	8	(40)	3	(15)
40–49 y	21	33.8	0	(0)	1	(5)	4	(19)	12	(57.1)	4	(19)
50–59 y	8	31.3	0	(0)	0	(0)	4	(50)	3	(38)	1	(13)
60+ y	4	35.9	0	(0)	0	(0)	1	(25)	2	(50)	1	(25)

age, following Pohnpei public health staff and international advice, with one given *kepeloal* at five months and one at seven months. The foods reported as kepeloal for these infants were grated, boiled green banana (n = 3), ripe *karat*[22] (n = 2) and imported cereal (n = 1).

Few mothers followed the internationally advised practice of exclusively breastfeeding. Seven infants were given coconut juice before the age of six months, and five were given water prior to that age. One caretaker reported that a medical officer advised her to give water and coconut juice to her infant younger than six months, contrary to present recommendations. Four infants were fed infant formula; the twins were fed breastmilk and infant formula. *Karat* and other ripe banana, ripe papaya, pumpkin and giant swamp taro were considered to be the five healthiest infant foods. Many changes in attitudes and practices in infant-feeding since 1960 were reported in the study. Imported baby food and imported foods such as bread, flour cooked in water, rice soup, doughnut, ramen and biscuit were more commonly fed compared to the 1960s.

Anthropometry: a window into the nutrition transition

Body Mass Index, overweight and obesity among adults

Table 6.9 presents the results of the Body Mass Index (BMI)[23] data for Mand. Weight and height measurements were taken for 167 adults of the randomly selected households.[24] There were two bed-ridden adults for which height and weight could not be measured.

A high prevalence of overweight[25] and obesity was found in all age groups, particularly among females. Even in the age group 15 to 19 years of age, 71 percent of the females were either overweight or obese. From the 20 to 29 year-old age group and above, over 85 percent of females were either overweight or obese. The mean BMI generally increased with greater age.

[22] *Karat* (a banana cultivar) is a traditional infant food of Pohnpei. See section on scientific identification.
[23] BMI = weight in kg divided by height in meters squared.
[24] Measurements were also taken for 30 additional adults not in the randomly selected households, but these data are not included in the analyses.
[25] Overweight was defined as a BMI >25 and obesity was defined as a BMI >30.

Table 6.10 Nutritional status of Mand children

	Prevalence (%)	
	Male	*Female*
1–5 years old (*n* = 14 male, 8 female)		
Underweight (weight for age)	7	11
Stunted (height for age)	46	12
Wasted (weight for height)	0	0
Overweight	0	0
Obese	0	0
6–10 years old (*n* = 22 male, 27 female)		
Underweight (weight for age)	4	3
Stunted (height for age)	40	55
Wasted (weight for height)	0	0
Overweight	0	0
Obese	0	0
11–14 years old (*n* = 17 male, 7 female)		
Underweight (weight for age)	35	28
Stunted (height for age)	58	28
Wasted (weight for height)	0	0
Overweight	0	0
Obese	0	0

There was a low prevalence of overweight/obesity among males 15 to 19 years of age, but over 60 percent were either overweight or obese in all older age groups.

Informants explained that big body size is often perceived as healthy and attractive. One informant explained, "When I was a child, I remember going from Mand to the big town and seeing that other people there were heavier. We were poor, and so when I saw the heavy people, I thought they were healthy and asked myself what is wrong with me".

Waist circumference measurements among adults

Waist circumferences denoting increased health risks[26] were found among both males and females in all age groups from 20 years of age; in all cases the mean was greater than the cut-off indicating substantially increased health risks (WHO, 1997). The greatest mean waist circumferences were among individuals in the 40 to 59 year-old age groups (from 103 to 105 cm for males, and from 103 to 114 cm for females).

Blood pressure measurements among adults

Among younger adults, mean blood pressures were within normal range (WHO, 1997).[27] However, mean blood pressure increased with age and was greater than optimal, for both males and females over 40 years of age. Some borderline and definite hypertension (high blood pressure) cases were identified in people who had not previously known that they might have this problem. Of the participants of 40 years and older (40 males and 33 females), three males (7.5 percent) and two females (6 percent) had borderline hypertension, and five males (12.5 percent) and two females (12.5 percent) had definite hypertension. All cases were referred for further medical checks.

Anthropometry among children

A purposive sample of 96 children aged 1–14 years old was measured for weight and height and birthdates were recorded. Epi-Info 6.04 software was used for analysis. Standard cut-offs for assessing protein-energy malnutrition[28] (WHO, 1995) were used. With all ages combined, 48.1 percent of males and 42.9 percent of females were classified as stunted (low height for age), indicating a serious long-term nutrition problem; 15.1 percent of males and 9.3 percent of females were underweight, and none were wasted. Table 6.10 describes the nutritional status of children surveyed.

Other health measures

Fasting blood sugar (FBS) and abnormal FBS levels among adults

Table 6.11 presents the results of the FBS measurements and highlights abnormal FBS levels (≥126 mg/dl),[29]

26 The cut-offs used for waist circumference with substantially increased health risks were: >88 cm (females) and >102 cm (males).

27 Guidelines used were: optimal <120/80 (systolic/diastolic); normal/high 130–139/85–89 (systolic/diastolic); borderline hypertension 140–159/90–94 (systolic/diastolic); and definite hypertension ≥160/95 (systolic/diastolic).

28 Two standard deviations (SD or Z-score) below the National Center for Health Statistics (NCHS) median values for height for age, weight for age, and weight for height.

29 Levels of FBS were classified as: normal <126 mg/dl, and abnormal ≥126 mg/dl (American Diabetic Association 2003).

Table 6.11 Fasting Blood Sugar (FBS) in randomly selected sample in Mand Community, June–July 2005 (*n* = 73 males, 74 females)

		Mean FBS		Minimum FBS	Maximum FBS	Normal range		Abnormal range[1]		New cases (total=37)
	n	*mg/dl*	*(sd)*	*mg/dl*	*mg/dl*	*n*	*(%)*	*n*	*(%)*	
Males										
15–19 y	9	105	(13)	91	108	8	(89)	1	(11)	1
20–29 y	21	112	(24)	87	180	17	(81)	4	(19)	4
30–39 y	7	13	(38)	95	192	3	(43)	4	(57)	4
40–49 y	15	149	(102)	26	418	9	(60)	6	(40)	6
50–59 y	12	178	(56)	110	303	4	(33)	8	(67)	4
60+ y	9	191	(87)	101	500+	2	(22)	7	(77)	1
Females										
15–19 y	9	94	(15)	84	130	8	(89)	1	(11)	1
20–29 y	16	117	(35)	86	196	12	(75)	4	(25)	4
30–39 y	19	119	(38)	86	258	14	(74)	5	(26)	5
40–49 y	19	232	(124)	103	436	7	(37)	12	(63)	4
50–59 y	7	246	(143)	107	436	3	(43)	4	(57)	1
60+ y	4	172	(95)	113	313	1	(25)	3	(75)	2

1 Abnormal FBS defined as ≥126 mg/d.

reflecting either diabetes or those at risk for diabetes. Of 73 males and 74 females of the randomly selected households, a total of 37 new cases of diabetes or at risk cases were identified, exclusive of volunteers.[30] The mean FBS levels increased with age: from a mean of 94 mg/dl for females 15 to 19 years and 105 mg/dl for males 15 to 19 years up to means of 172 mg/dl for females over 60 years and 191 mg/dl for males over 60 years. In one case, the fasting blood sugar level was greater than the capacity of the instrument (>500 mg/dl). Of the participants 40 years and older, 63 percent of women and 58 percent of men had abnormal fasting blood sugar levels. All participants with abnormal FBS levels were advised for further medical checks.

Vitamin A status of children

Preliminary results showed that 31.6 percent of the children aged two to ten years who were tested in Mand were vitamin A-deficient as defined by serum retinol <20 μg /dl. This indicates a serious problem, as the cut-off for a problem of public health significance is 15 percent (IVACG, 2002).

Dental health status of children

Dental screening was conducted for 85 children aged 1–14 years, who were measured for their weights and heights. Only three children (3.5 percent) had healthy teeth. Many children had teeth that were so damaged that they were indicated for extraction or permanent teeth had already been extracted. Few children had dental treatment for unhealthy teeth (filled teeth). Most children had multiple caries (up to 16 caries per child). The number of caries was greatest in the five to six year old children (around seven caries per child). There appeared to be more caries among girls than boys.

Agroforestry survey

The neglect of the agroforestry and food production systems in Pohnpei has been documented for some

30 All adults were invited to take a FBS measurement, if they wanted. There were 30 volunteer adults for this.

Table 6.12 Problems related to decreased production and consumption of locally grown food in Mand listed by the Mand Community Working Group, July 2005

	Reasons first given by Working Group	*Further comments on these reasons after analysis by Working Group*
1	Negligence (*soukautih*), including producing and preparing local food.	People can make a change in their lives; work is necessary in life.
2	Getting used to imported food, and preferring imported food.	People can make choices for local food; taste preferences can change.
3	People getting sick and not able to go to their lands.	This is often the result of many years of a poor diet; this can be improved.
4	Not enough time to work on food production due to employment.	This is often an excuse; people can choose how they use their time.
5	Not enough planting material.	This is mainly the lack of initiative for getting planting material.
6	Neglecting the quality of local food and neglecting local food.	People can make a change in this and stop neglecting local food.
7	Denying the importance of local food for health.	People can learn more about this and give proper importance to local food.
8	Living far away from their land.	This is an excuse.
9	Westernization (*Piripirin mweiet*).	This is the use of westernization in an unproductive way.
10	Little time/hard to cook local food.	There are modern ways to save time in cooking local food.
11	People not wanting to plant food.	This is a matter of laziness.
12	Rice is faster and easier to cook than local food.	If people value local food, they will not mind some extra work.
13	More imported food is available.	You don't have to take it; this is a matter of choice.
14	Not enough money to buy planting material.	Most planting material can be obtained free of charge.
15	People not wanting to get dirty.	You can later wash yourself.
16	Imported foods are very convenient.	This is related to the first reason and is also a matter of choice.
17	More money is now available to buy imported food.	This is a matter of choice; you also need money for other things.
18	Women too busy with child care, household work/family changed, fewer people in household to assist mothers.	It is true, but women can learn to schedule their time more efficiently.
19	Visiting friends (wasting time).	This is related to the first reason and managing time.
20	Spending time with sports and walking around (idleness).	This is a matter of choice and time management.
21	Imported food is cheaper.	Many families can grow their own food.
22	The extended family structure has changed.	Adjustments can be made; some of old practices can be taken up again.

time (Raynor, 1991). However, a systematic documentation in Mand was needed in order to present an up-to-date assessment of the degree of the neglect in Mand and to help guide plans for increasing local food production. A main survey finding was that the agroforestry system is under-utilized (Shaeffer, 2006). Of the 43 randomly selected households participating in the survey, 70 percent of the respondents reported that traditional farming has declined since they were children. However, 98 percent said that they believed that the community should keep family food production as a high priority. A village water study showed that there are problems with the community piped water system with fecal contamination at different sites.

Other qualitative information

Table 6.12 provides insight into attitudes and perceptions of Mand community members relating to local food production and consumption and actions needed for increasing it. In preparation for the intervention, the Mand Community Working Group listed the major reasons that they believed have caused the decrease in local food production and consumption. Responses were recorded individually and then discussed as a group. On analysing the data, inconsistencies were seen, which led to further discussions and comments.

One member explained how this study had motivated his community to start planting and eating local food, saying, "We thought we were healthy but then this study showed that we are not healthy." He also expressed his amazement at the richness of their food resources, stating, "Look at all the foods that we have on our food list. We have so many and they are so good for us … People are now really talking about local foods. Now they are starting to know that what they valued (like rice) was wrong and that their food is really better for them." Another member stressed, "God made us to eat our own foods. We need to go local!"

Some food taboos and beliefs were explored, specifically relating to foods that cannot be eaten by lactating and pregnant adult women. Distinctions were made between beliefs held in Pohnpei and those more distinctly held by people originally from Pingelap.

Intervention strategies

A mix of intervention strategies was planned during the documentation phase, including: community meetings, training in cooking and farming techniques, a drama club for the youth, newspaper articles, recipe collection, a programme working with elementary students promoting rare banana varieties and the initiation of a smokeless charcoal oven construction programme – which would facilitate baking (a healthy cooking method). New partner agencies were involved in the project, which added further impetus to the project. The study results were presented at a seminar in Kolonia (the main town of Pohnpei) for partner agencies and Mand Community members and a further meeting was held in Mand to present the study results to the community.

In addition, a half-day "strategy planning" workshop for partner agencies, facilitators and community members was held on 5 June 2006, with the purpose of reviewing project aims, study findings and initial intervention activities. A visit by Professor Harriet Kuhnlein and Chief Bill Erasmus from CINE coincided with this workshop, and helped greatly in providing information on the CINE food systems programme and on experiences elsewhere related to the promotion of traditional food systems. The workshop was important for increasing understanding of the project, cementing relationships and planning project strategies and activities.

Future policy considerations

The CINE methodology for documenting traditional food systems has proven to be a useful tool in this environment and culture, and helped communities learn the value of their traditional food systems and health status. The project in Mand enhanced interest among other communities in Pohnpei, which have requested arrangements for similar projects. Plans are now in place for extending some components to these communities, in particular, training on the new findings of high nutrient values of Pohnpei foods and varieties, guidance on growing and preparing vegetables and charcoal oven construction and use. However, in the future the focus will be on programmes that have state-wide outreach (i.e. church, school, radio, etc.) in order to maximize the impact of the work throughout the state. Regional leaders learning about the Mand project became interested in the approach and suggested initiating similar programmes in other parts of the Pacific. Staff resources were identified as the substantial limiting factor to that expansion. Efforts were needed to secure staff for IFCP and to extend the work. On the other hand, many agencies within Pohnpei became partners in the project and initiated new programmes to further promote local foods within their own work plans. Future policy considerations should stress the importance of strengthening the collaboration with key community players, in particular, leaders in the traditional sector, church and the youth.

Conclusion

The Mand community has serious nutrition-related problems, notably vitamin A deficiency, obesity and diet-related non-communicable diseases. Greater consumption of locally produced foods could contribute to alleviation of these nutritional disorders. Awareness of the unique local food resources and innovative approaches suitable to the situation in Mand and other Pohnpei communities is needed. For example, many people in Pohnpei still did not know that some of their older Pohnpei banana cultivars, including *karat* and *utin iap*, are very nutrient rich and contain provitamin A carotenoid substances – which are important for maintaining good health – and many people did not understand the relationship between diet, healthy lifestyles, and specific health problems. The importance of interagency, community-based efforts in this work is essential.

This is the first comprehensive set of data related to both traditional food resources, dietary intake and health status collected for a community in Pohnpei and it is unique for the Pacific region. This area of the world has been involved in very few health and nutrition research projects related to both documentation of the food resources and health problems, and yet the health and nutrition problems are serious. Thus, this study was significant for Pohnpei as well as for the other parts of the Pacific ●

Acknowledgements

Warm thanks are extended to Professor Harriet Kuhnlein and the Centre for Indigenous Peoples' Nutrition and Environment (CINE) for involving Pohnpei in this project and providing expert guidance, to Gail Harrison and Rally Jim for comments on this chapter, Robert Andreas and Eugene Joseph on the local food names, and Rosemary Schleicher and Stephanie Bialek for their assistance in the assessment of vitamin A status. Thanks are also extended to the Mand Community and partner agencies: Island Food Community of Pohnpei Board, Pohnpei Office of Economic Affairs/Pohnpei Agriculture and Marine Development, Pohnpei Department of Health/Public Health and Dental Divisions, College of Micronesia-FSM Land Grant Program, Pohnpei Department of Land and Natural Resources/Historic Preservation Office, FSM National Government, Pohnpei Environmental Preservation Agency, Peace Corps Micronesia, Japanese Overseas Cooperation Volunteers, Emory University, KP Studios, Secretariat of the Pacific Community (SPC), SPC/GTZ Pacific-German Regional Forestry Project, SPC Lifestyle Health Section, SPC Pacific Agricultural Plant Genetic Resources Network, SPC Regional Germplasm Centre, Sight and Life, Centers of Disease Control and Prevention, United Nations Children's Fund, Xyris Software Australia, University of the South Pacific, DSM Nutritional Products and University of Adelaide.

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Chapter 7

Traditional food systems of Indigenous Peoples: the Ainu in the Saru River Region, Japan

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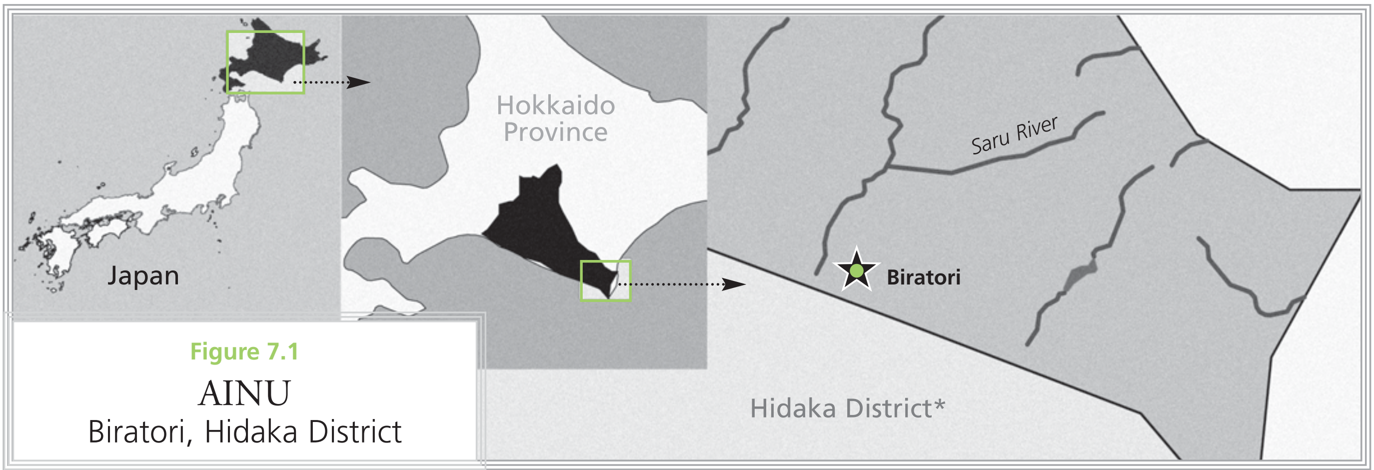

Figure 7.1
AINU
Biratori, Hidaka District

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.
**Hidaka outline digitized from*
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> "Revitalizing the Ainu food culture will help to re-establish the dignity of the Ainu in the present society."
>
> **Mr Koichi Kaizawa, community leader**

Abstract

The Ainu are an Indigenous People who live mainly in the northern part of Japan. In 2004, a research team led by the community leader Mr Koichi Kaizawa began to examine the use of traditional food in the Saru River region. When they started the research, they found that the usage of traditional Ainu food was extremely limited because of the government's powerful assimilation of the Ainu into mainstream society. Thus, the research team decided to select the food items to be studied based on two criteria:

1. Traditional food that the Ainu continue to eat.
2. Traditional food that the Ainu would like to preserve for future generations.

Traditional knowledge regarding the use of these food items was collected and their nutritional composition was determined. In addition, an extensive effort was made to re-introduce the Ainu traditional food to the community through a series of cultural events in an attempt to create the kind of social change that will help the Ainu to regain their cultural health.

Introduction

Numerous researchers have had a keen interest in Ainu[31] culture in the past and have examined various aspects of it. Among the many Ainu settlements in Hokkaido, the people living in the area along the Saru River have been the centre of academic research. While many academic papers have been written and published, the life of the Ainu living in this area has not improved and the decline of Ainu culture continues. The research team, with the support and initiative of the community leader, aimed to conduct the kind of research that would make a positive contribution to the life of the local Ainu by ensuring their extensive involvement. The examination of the Ainu traditional food culture in the Saru River region began at the end of March, 2004. The research group spent three months conducting interviews with key informants and collecting basic archival material, as well as food samples for composition analysis. Since the research methods developed by the Centre for Indigenous Peoples' Nutrition and Environment (CINE) (Kuhnlein *et al.*, 2006) required modifications in order to examine the situation of the Ainu community effectively, the research group first considered appropriate approaches. As a result, it was decided to combine the CINE methods with research that the local Ainu group was already conducting in their efforts to preserve the Ainu traditional food culture. It was therefore not possible to include all of the CINE recommended methods.

The research group first collected basic relevant information on the area and the people. Data on Ainu traditional food were then collected using four different methods. In addition, the research group documented the ongoing efforts to preserve the Ainu traditional food and other aspects of Ainu cultural tradition. Particular emphasis was placed on analysing the history and cultural changes that led to the present situation of the Ainu people in the Saru River region. Following the completion of these steps, the team then proceeded

[31] Ainu is also spelled Aynu in recent documents. In this chapter, the more conventional spelling of Ainu is used.

to determine the nutrient composition of selected Ainu food samples.

Research team and participatory research methods

The preparation for the research began in the spring of 2004 when Dr Iwasaki-Goodman contacted the Ainu community leader, Mr Koichi Kaizawa. After signing a research agreement, the research team was formed. The central figure was Mr Taichi Kaizawa of the Ainu Culture Research Center, whose ethnic background is Ainu and who worked as a researcher at the prefectural research centre, specializing in Ainu culture. His mother, Miwako Kaizawa, an Ainu food specialist, provided her expertise in conducting fieldwork. The research team was joined by Dr Hidetomo Iwano (specialist in food composition), Dr Hiroki Inoue and Dr Satomi Ishii (nutritionists). The research team members agreed that the goal of the research was to improve the socio-cultural environment for the Ainu, through promoting understandings of Ainu traditional food and revitalizing the use of it, thereby contributing to their emotional and physical health. The team especially agreed to ensure their actions would respect the dignity of the individual participants who provided private information. A written introduction on the purpose and the methods of the research was prepared in Japanese and, at the start of each interview, the project was explained to participants verbally. Each participant then signed a letter of consent.

Background

Biratori is a town located in the western end of what is called the Hidaka District in the southern part of Hokkaido, the northern-most island in Japan (Figure 7.1). (The name Biratori comes from the Ainu word *Piraturu*,[32] meaning the area between the cliffs.) Biratori's total land mass is 743 16 km^2, stretching 52.8 km on its east–west axis and 41.1 km on its north–south axis, with its town boundaries forming a triangular shape.

[32] Ainu words are italicized to distinguish them from Japanese words.

Table 7.1 Households and population in the 17 sub-districts of Biratori

Sub-districts	*No. of households*	*Population*
Kawamukai	60	168
Shiunkotsu	107	340
Saruba	75	217
Nina	307	838
Honcho	795	1 792
Kobira	59	179
Nibutani	190	483
Nioi	103	250
Nukibetsu	248	640
Asahi	50	156
Memu	33	100
Osachinai	48	132
Horokeshi	25	80
Furenai	535	1 149
Iwachishi	43	138
Toyonuka	20	53
Niseu	2	8
Total	**2 700**	**6 723**

Biratori Town, 1999.

Biratori is approximately 20 minutes drive away from Monbetsu, the nearest city, and 70 minutes from Tomakomai, the nearest commercial and industrial centre. It takes approximately 2 hours to drive to Sapporo, the centre of Hokkaido, and 75 minutes to Chitose Airport, the gateway to Tokyo. Public transportation (buses and trains) connects Biratori town centre with these cities. However, bus services between Nibutani – one of the sub-districts of Biratori where the research was conducted – and other cities are infrequent. Although private cars are essential to meet basic needs in Nibutani, commercial districts providing meat, fish and vegetables are nearby.

Biratori is divided into 17 sub-districts. The total number of households and the population in each of these sub-districts is shown in Table 7.1. Research was conducted mainly in Nibutani, Osachinai, Shiunkotsu, Nukibetsu and Toyonuka because these are the communities where many Ainu live side-by-side with non-Ainu. These areas are known for the highest concentration of Ainu residents in relation to the total population in Japan. Accurate statistical data on the population of Ainu in each municipality are unavailable because the national census does not differentiate Ainu from non-Ainu. However, the Hokkaido Prefectural Government conducts a survey every seven years to estimate the Ainu population. According to their 1999 report, 1 577 Ainu are living in Biratori. This figure includes only people that identified themselves as Ainu and does not include those that were not willing to identify themselves as Ainu because of the ongoing social prejudice. Furthermore, Biratori township[33] has always treated Biratori town as one community with Ainu and non-Ainu living side-by-side.

The people in Biratori enjoy four distinct seasons annually. The difference in seasonal temperatures during summer and winter is great, with a high of 31 °C in summer and a low of minus 25 °C in winter, with an average annual temperature of 7.7 °C. The number of days of snowfall in the winter is approximately 37, with a total accumulation of approximately 127 cm. While the weather in Biratori is typical for the northern part of Japan, it receives less snow than the central part of Hokkaido. Agriculture, dairy farming and animal husbandry are the main industries in Biratori. Rice production is the main agricultural crop, but Biratori is also known for its vegetable production (the tomato being the symbol of the town). Beef production and racehorse raising are also important to the local economy. In 1965, approximately half of the people in Biratori were engaged in agriculture, dairy farming and forestry. However, since that time the number of people in these primary industries decreased to about one-third of total employment.

There has been a gradual decline in the number of children in Biratori, which is reflected by school enrolment records. In 2004 a total of 394 students attended seven elementary schools, 192 students attended four junior high schools and 149 students attended a senior high school. In addition, 42 students attended a special school for children with disabilities at the elementary, junior high and senior high school levels. At present, Ainu children go to school with non-Ainu children and receive the standard education, which follows the national curricula provided by the Ministry of Education.

In order to encourage children to appreciate local history and culture, the Biratori Education Board has produced supplementary material to be used at schools. These books focus on local history, where Ainu play a key role. Interest in these subjects among school educators is strong, and numerous lectures and seminars on Ainu culture have been given. In June 2004 the teachers in Biratori and surrounding areas organized a popular Ainu cooking workshop where cooking methods of Ainu traditional dishes were demonstrated.

History of Ainu in Biratori[34]

The climatic and geographical conditions in the Saru River region have always been well suited for human habitation, plants and other wildlife. Numerous archaeological sites along the Saru River reveal evidence of human settlements dating from 6 000 to 9 000 years ago. In the long history of human settlement in this region, Ainu culture is believed to have been started by a pit-dwelling people that began to build houses on the flat ground and to use hearths around 1000–1100 AD. Artefacts with distinct characteristics of this period have been excavated in archaeological sites in the Saru River region, including 30 *casi* (stockade) remains, dated to 1500–1600 AD. Construction of a *casi* is believed to have been an important cultural element in Ainu culture of that period.

Ainu lived along riverbanks, where several households were grouped together, with each group led by a male Elder who served as a leader. They engaged in hunting, fishing and gathering. Ainu believed that *kamuy* (gods) provide food and other necessities in response to prayer and gratitude, expressed through a variety of ceremonial rituals. *Iyomante* (a bear spirit sending ceremony) is the most important ceremony and still continues to play a core role in Ainu culture.

33 A "township" is a larger area in which there are towns.

34 This section is a brief summary of Biratori Choushi, History of Biratori Town (1974).

As the Japanese began to migrate to Hokkaido from the main island around 1400 AD, contact between Ainu and Japanese became more frequent and often ended with confrontations. A series of wars between Ainu and Japanese immigrants led to the Shakushain War, where Ainu throughout Hokkaido fought against Japanese of the Matsumae Feudal Clan in southern Hokkaido. The leader, Shakushain, was poisoned at the reconciliation ceremony organized by the Matsumae Feudal Clan and the Ainu lost their power.

After this war, the Matsumae Feudal Clan established trading posts throughout Hokkaido to control the trade of goods from and to Hokkaido. A trading post was set up along the Saru River and Ainu began trading kelp, parched small sardines, Shiitake mushrooms, salmon, etc. It is recorded that Ainu suffered under an oppressive trading system in which they were forced to produce trading goods. During this period, Ainu in the Saru river region fished in the ocean in the spring, harvested kelp in the summer and fished for salmon in the autumn to produce trading goods. In the winter, Ainu men spent their time repairing and maintaining their fishing boats, while women wove *at-rus* (an Ainu robe). Ainu also cultivated vegetables and grains for food.

The beginning of the Meiji Era (1867–1912) marked the beginning of colonization of Hokkaido by the Hokkaido government (itself established in 1886). As a way to assimilate Ainu into mainstream society, the Hokkaido government passed the "Hokkaido Former Aboriginal Protection Law", promoted Ainu agriculture and began forcing Ainu children to enter Japanese schools. At the same time, the Hokkaido government passed numerous regulations to prohibit Ainu from hunting and fishing and practising traditional rituals.

The Saru River region was not an exception and many immigrants (non-Ainu) from the main island moved into the area. The population of Biratori soon tripled and Ainu became a minority group. In 1899, the Biratori community, together with other neighbouring communities, established a town hall and began its administration, and in 1954 the community gained legal status as a township (Biratori Town, 1974).

Current issues in Biratori

In 1997 the Nibutani Dam was completed in the region, thus damming the most important river for the local Ainu in the heart of the Ainu settlement region. The dam construction seriously affected the socio-cultural spheres in the lives of the local people. Recently, the government announced that it intends to construct another dam in the tributary of Saru River for further management of the Saru River water system.

A three-year research project in Biratori was conducted from April, 2003 to March, 2006 to assess the impact that the second dam construction would have on the culture of the indigenous Ainu (Ainu Culture Preservation Research Committee, 2005). This research included interviewing Elders concerning their experience and knowledge of Ainu culture, which inevitably included Ainu traditional food culture.

That impact assessment project was one of the tangible outcomes of the "Nibutani Dam Case" that clarified the need for assessing the impact on Ainu culture prior to the initiation of development projects (Ainu Culture Preservation Research Committee, 2005). For the construction of the Nibutani Dam, two Ainu landowners refused to acquiesce to the expropriation of land they owned. This led to a legal contest in the Sapporo District Court in the early 1980s. After many years of courtroom trials, the Court handed down a decision in 1997 that declared the government's actions in pursuing this development project as illegal. The Court stated that the government should have considered whether public interests, such as the control of floods provided by the construction of the Nibutani Dam, should have priority over the Ainu people's rights to enjoy their culture. Additionally, the court stated that the government had failed to assess the effects that the construction of the Nibutani Dam would have on the local Ainu culture, thereby ignoring values that required serious consideration. This decision is significant, in that it made it mandatory for the planning of development projects to include an assessment of the impact on local Ainu culture. Evidently, this applies to the construction of the second Biratori Dam.

Significant changes have occurred in the social and political environment in terms of the aboriginal issues in Japan. In 1997, "The Law Concerning Promotion of Ainu Culture and Dissemination and Enlightenment of Knowledge about Ainu Traditions" was enacted. The new law replaced the "Former Aboriginal Protection Law" that had been in effect for more than 100 years, and had served as the legal basis for assimilating the Ainu into mainstream society. In the new law, the government of Japan stated its intention to support the Ainu in preserving their cultural tradition and in creating the kind of society where they can maintain their pride as an ethnic group. The new law inevitably accelerated the revitalization movement of Ainu culture, which had been steadily but quietly happening during the 1980s. Thus, various branches of the Hokkaido Association of Ainu have been actively conducting Ainu culture promotion programmes.

On 12 May 2003, the town of Biratori established the "Committee for the Ainu Culture Preservation Research", which includes local Ainu Elders, government officials and experts of related areas such as law, landscaping and anthropology (Ainu Culture Preservation Research Committee, 2005). The Committee was set up to supervise the Ainu culture preservation research and to make recommendations to the mayor of the town of Biratori. The Committee is composed of 15 permanent members, and invites advisors as needed.

Besides the Committee for the Ainu Culture Preservation Research, the Ainu Culture Preservation Research Office (ACPRO) was formed and four groups were established to conduct various tasks in the office (Ainu Culture Preservation Research Committee, 2005). The four groups were in charge of fieldwork data compilation, model building and computer simulations. Twenty local people were selected for their knowledge and interest in Ainu culture and hired on a full-time basis. The community leader of this research, Koichi Kaizawa, became the head of ACPRO.

In 2003, the three-year research began with the General Affairs section of the Ainu Culture Preservation Research Committee, 2005, drafting an overall schedule for the project. The first year was set aside for preparation and training of research staff for filing data, simulations and fieldwork. The main research was conducted in 2004, with a focus on structured fieldwork, data filing, analysis and simulation trials. Also, the Committee considered some of the mitigation measures arising within the project, and methods of testing them. The final year (2005) was spent on finishing research activities, considering details related to mitigation and completing the overall research project.

Examining Ainu traditional food

Ainu and their traditional food uses in the changing social environment

In this section, background information is given on recent Ainu history in relation to food, and the research methods used to examine Ainu traditional foods.

One of the important issues regarding the changes in Ainu traditional food in the Saru River region is the social change that Ainu experienced when the Japanese began migrating into that area in the late-nineteenth century. As more Japanese moved into the region, the Ainu population diminished, became politically weaker and eventually constituted a minority group. Obviously, such changes had serious effects on the everyday life for the Ainu, where traditional food played an important role.

Having conducted a number of interviews with Ainu of various age groups, the research group learned that significant social changes in the last 100 years have created complex patterns of traditional food usage. It became evident that the way traditional food is viewed and utilized differed between age groups. The Ainu Elders learned traditional Ainu food use from their parents and grandparents at a young age, and later experienced the great social changes under the government's assimilation policy that forced them to give up the Ainu way of life and live as Japanese. The second group was the middle-aged Ainu who lived mainly as Japanese, and the final group was the young Ainu who grew up with a limited exposure to Ainu culture at home and learned various aspects of Ainu culture by attending classes and other organized cultural events. The knowledge of traditional food differed in these three age groups and they expressed different views on the issues related to its usage.

Ainu Elders and traditional food use

Those Ainu who experienced drastic social change in their childhood were in their seventies and eighties during the research period. They experienced the traditional Ainu culture and acquired knowledge relating to Ainu life at home. They also saw the government's assimilation policy gradually dismantling the Ainu traditional culture and, further, experienced severe social discrimination. Under such social conditions, many of the Elders suppressed their knowledge of Ainu culture while trying to adopt the Japanese way of life. They were discouraged from using their mother-tongue and forced to speak Japanese at school. Having become the social minority, the Ainu had no choice but to live their lives as Japanese. The Ainu Elders frequently offered such observations as, "I did not teach my children Ainu language and Ainu way of life, because I thought they wouldn't need it." Except for those who made their living in tourism, performing Ainu dance and music, Ainu did not openly practise their culture. As a result, Ainu culture gradually lost its vitality, and the traditional food – an important part of that culture – became blended into Japanese food.

Social discrimination is a serious factor in any social assimilation process. As an example, our research shows that Ainu avoided consumption of *pukusa* (wild onion) – an important traditional food – to avoid becoming subject to social discrimination. This tendency is found in our research for Ainu traditional food use in general. One Ainu elderly woman recalled that she stopped cooking Ainu dishes at home when she married a non-Ainu man. Many elderly Ainu women gradually shifted from cooking Ainu dishes to cooking Japanese dishes. It is clear that social discrimination against Ainu accelerated the Japanization of the Ainu food system.

In interviews with Ainu Elders, we heard such expressions as, "We ate … [certain Ainu traditional food], since there was no other food to eat in the old days." This expression reflects the difficult socio-economic condition in which a minority group, such as the Ainu, had to live at that time. Having lost the traditional subsistence way of life and being forced to adopt farming according to government policy, Ainu did not have much to live on. Needless to say, everyday food at home was affected significantly. Ainu traditional food, despite its social, cultural and nutritional value, became associated with the negative experience of that time. As the socio-economic condition surrounding Ainu improved, they gradually shifted to eating more Japanese food. Although many Ainu Elders expressed their preference for Ainu food, by making such comments as "I really like old food", others associated the Ainu traditional food with their poverty and regarded Ainu food as the food of the past and something they did not need anymore.

During the Meiji era, the government issued various regulations that restricted hunting and gathering activities among Ainu, and rice farming was introduced. Ainu began keeping domesticated animals, such as pigs, and began to grow potatoes and beans. These food items, as well as Japanese seasoning, such as miso (fermented soybean paste), were incorporated into the Ainu food system as new ingredients or substitutes for traditional Ainu food items. Such changes also prompted the Japanization of Ainu traditional food.

Middle-aged Ainu group and traditional Ainu food

At the time of the research, the children of Ainu Elders were 40 to 60 years old, and were the first generation of Ainu who had not learned the Ainu way of life, such as language and other aspects of Ainu culture. Rather, they spoke Japanese and lived as Japanese. This affected all aspects of Ainu culture, of which the food system is a very important part. Thus, the Ainu food culture that the Elder generation had fostered went through significant changes as this middle-aged generation grew up.

Two main patterns of change can be seen in Ainu traditional food in this period. The first pattern is that many food items, such as wild vegetables, were incorporated into Japanese cuisine. They no longer had the Ainu names and they were used as ingredients for Japanese dishes, such as *cimakina* (udo) mixed with vinegar miso sauce, *pukusa* (wild onion) mixed with egg to make "wild vegetable tempura". Those Ainu who were 40–60 years old at the time of this study had been eating wild vegetables mainly in Japanese dishes with Japanese names, rather than Ainu names. Many of the younger generation of Ainu cooked and ate these food items without knowing that they were actually traditional Ainu food.

A second pattern of change was that many of the Ainu traditional dishes continued to be cooked for Ainu ceremonial occasions, in which they play symbolic roles. Although these food items and dishes were no longer parts of everyday food for many Ainu, they served to strengthen ties with Ainu culture and heritage on special occasions. The Elders took the central roles in preparing Ainu dishes for various ceremonies, often being assisted by those of the younger generations.

Changes in Ainu food use affected other aspects of their food culture, such as the traditional preservation method and the ecological knowledge used in harvesting food. Ainu Elders, who lived without refrigerators and freezers, dried wild vegetables so that they could be used year-round. When freezers became available, the next generation of Ainu began freezing them and did not practise the traditional drying method. Also, the Elders who went into the forest to hunt animals and gather wild vegetables had acquired the ecological knowledge required for sustainable harvesting of plants and animals. However, as such ecological knowledge was not sufficiently passed down to the younger generation, a depletion of these resources has resulted.

Many Ainu who were between 40 and 60 years old during the study did not learn enough about Ainu language and culture for its full preservation, and their homes were no longer places where Ainu traditional food was prepared and preserved. Instead, Ainu food became integrated into Japanese cuisine and, further, various traditional Ainu dishes were only preserved as ceremonial dishes. Those Ainu who grew up in that environment did not consciously appreciate Ainu food culture at home. Moreover, they grew up with the feeling that they "do not know much about Ainu food".

Ainu youth and revitalization of Ainu traditional food

Many young Ainu grew up in homes where Ainu culture was not actively practised, but have been given opportunities outside the home to learn various aspects of Ainu culture. Ainu culture revitalization began in the 1980s, with the opening of Ainu language classes in Biratori. A variety of Ainu-themed events were held in the Saru River region, providing the opportunity to learn traditional dances, songs and food culture. One Ainu mother in her fifties said, "My daughter knows Ainu dishes better than I do because she has been attending Ainu language classes where she learned various aspects of Ainu culture including Ainu dishes."

Recent Ainu social conditions differ from those of decades ago when Ainu food culture was losing its vitality and people faced severe social discrimination and poverty. Both the general public and the Ainu population themselves began to recognize the value of Ainu culture and made, and continue to make, conscious efforts to preserve the cultural knowledge that Ainu ancestors had fostered in the past. Changes are observed in the Saru River region: more local people are now studying Ainu language, making Ainu tools and performing traditional dances. Ainu traditional food also has been regaining the interest of local people.

The first example of the revitalization effort concerning food culture in the Saru River region was the "*Aep* Ainu food research project" in 1999. Local Ainu, 40 to 50 years of age, who themselves had little exposure to the Ainu culture in the home, served as the core of a research group that interviewed and recorded the knowledge of Elders, thereby directly learning traditional Ainu knowledge themselves.

Problems in gathering quantitative dietary data

The research group, after learning the complex patterns of Ainu traditional food use in the Saru River region, realized that collecting quantitative data on traditional food use in Ainu households would be challenging. For a start, there were few Ainu Elders who still held

Table 7.2_Ainu traditional food *(20 species/varieties)*

	Scientific name	English/common name	Local name	Seasonality	Preparation
	Wild vegetables				
1	*Allium victorialis* (2 var.)	Wild onion (fresh, dried)	pukusa	April–May	Cooked in soup
2	*Amphicarpa bracteata Edgeworthii* var. japonica	Aha bean	aha	November	Boiled, cooked with rice, dried
3	*Anemone flaccida* (2 var.)	Anemone (fresh, dried)	pukusakina	May–June	Boiled, cooked in soup
4	*Angelica edulis*	Angelica (fresh)	cihue	May	Peeled and consumed fresh
5	*Aralia cordata*	Spikenard (fresh)	cimakina	May–June	Fresh, pickled, boiled, grilled
6	*Lilium cordatum* (2 var.)	Perennial lily (root, powder)	turep	June–July	Used to make turep starch
7	*Lilium cordatum* var. *glehnii*	Fermented turep	on turep	–	Added in deer soup and vegetable soup
8	*Matteuccia struthiopteris*	Ostrich fern (dried)	sorma	April–May	Salted, deep fried, boil, dried
9	*Petasites Japonicus*	Butterbur (fresh)	korkoni	June	Boiled, peeled, salted, soup
10	*Phellodendron amurense*	Fruit of amur cork	sikerpe	–	–
	Cultivated grains				
1	*Echinochloa crus-galli*	Barnyard millet	piyapa	September–October	Porridge, dried
2	*Panicum italicum*	Italian millet	munciro	September–October	Steamed, pounded to make cake
3	*Panicum miliaceum*	Egg millet	shipuskep	September–October	Dumpling, cooked with vegetable dishes, and thick soup, dried
4	*Solanum tuberosum*	Frozen potatoes	pene emo	April	Soaked in water, mashed, made in to balls, dried
	Fish and game				
1	*Cervus nippon*	Hokkaido deer	yuk	January	Eaten raw as sashimi, barbequed, dried
2	*Oncorhynchus*	Dried salmon	atat	December–March	Cooked, broiled, soup
3	*Margaritifera margaritifera*	Freshwater pearl mussel	pipa	Summer	Cooked, and shells used as tools

– No data.

traditional knowledge. There were only about 20 people available who knew the old ways in the Saru River region. Furthermore, the younger generation of Ainu, having had limited exposure to Ainu culture at home, identified the ceremonial dishes as Ainu traditional food, but had the perception that what they ate every day was not part of the traditional Ainu food – even though some food items were the same as that eaten by the Elders in former times. Another difficulty in collecting quantitative dietary data was that traditional Ainu food use varied a great deal depending on the composition of the household. In households with Elders there was apparently more Ainu food use, while those with younger Ainu used far less. Therefore, the research team decided to use only the qualitative data collected by interviewing local Ainu.

Methodology

In February 1998, the Biratori Ainu Culture Preservation Group (BACPG) organized an overnight camp in which local Elders and local youth discussed ways to protect the traditional Ainu food culture. The youth group collected information regarding where and how to gather wild vegetables, and how to preserve and cook them. After the camp, the youth group used information given by the Elders to collect wild vegetables. In the subsequent year the BACPG gathered additional information by conducting interviews with Elders.

In the spring of 2004, the research team conducted a new series of interviews with Ainu Elders. Each interview lasted two hours (approximately), where

Elders were asked questions regarding food use and preparation. The research group then conducted group interviews with Ainu youths living in the Saru River region. The questions asked derived from the results of the earlier interviews with the Elders, with the aim of investigating the level of knowledge regarding Ainu traditional foods among the younger generation of Ainu. Three groups, each consisting of two to four people, were interviewed, totalling seven young informants. In addition, three young Ainu were asked to write about their experiences relating to Ainu food.

Research results

Research conducted by the Biratori Ainu Cultural Preservation Group (BACPG)

BACPG began their effort by holding an overnight camp to talk with local Elders in February 1998. They gathered information on Ainu traditional food through interviews with Elders and learned that there were slight differences in the methods of hunting, preservation and cooking between the areas of the upper, middle and lower parts of the Saru River. After this camp, BACPG held more interviews with Elders, collected wild vegetables, preserved and cooked them, following the information given by the Elders. BACPG put together the research results and produced a booklet titled *Aepu* [What We Eat].

Members of BACPG focused on the kinds of Ainu food that Ainu Elders currently used, as well as those that they did not use in everyday life, but wanted to be passed down to the next generations. As a result, 20 traditional food items were chosen (Table 7.2). BACPG also asked where these were found, and when and how to collect them, as well as the preservation and cooking methods used for them (Table 7.3).

BACPG also documented Ainu rituals for going into mountains and rivers for food gathering. In these rituals, the Ainu offer prayers to gods, and through the prayers they strengthen the spiritual ties with nature and give thanks to the gods. For each of the wild vegetables, BACPG documented the geo-physical characteristics of the area where they can be found, collection method, as well as preservation and cooking methods.

Table 7.3 Collection and preservation methods of some Ainu traditional foods

Food names	*Collection and preservation methods*
Wild vegetables	
Wild onion	Collect in April to mid-May, dry them by the end of May
Anemone	Collect in beginning of May to mid-May, dry them by mid-June
Udo, Spikenard	Collect in mid-May to mid-June
Japanese butterbur, coltsfoot	Collect in beginning to mid-June, dry them by the end of June
Angelica, fresh	Collect in mid to the end of May
Aha bean	Collect in beginning to mid-Nov, dry them by mid-Nov
Ostrich fern, fiddle head fern	Collect in mid-April to mid-May, dry them by mid-May
Perennial lily	Collect in mid-June to beginning of July, preserve them by mid- July
Cultivated grains	
Egg millet	Seed them in mid-May, weed in mid-June, harvest in end of Sept. to the end of Oct., dry them by mid-Nov
Barnyard millet	Seed them in mid-May, weed in mid-June, harvest in end of Sept to end of Oct, dry them by mid-Nov
Italian millet	Seed them in mid-May, weed in mid-June, harvest in end of Sept to end of Oct, dry them by mid-Nov
Frozen potatoes	Collect them in mid-April in the vegetable garden, soak in water and dry them
Fish and wild game	
Freshwater pearl mussel	Collect them in summer in fresh water
Dried salmon	Cut salmon into three (borne and top and bottom sides) and dry salmon outside in the cold
Hokkaido deer	Catch and cut in mid-Jan

BACPG presented the Elders with pictures, so that a reader could follow the instructions. With *turep* (a wild tulip – see Table 7.1), from which the Ainu used to extract starch, BACPG gave detailed instructions, showing each step leading to the extraction of the starch. As for cultivated grains, they illustrated the steps from seeding to harvesting, as well as preservation of grains and cooking methods. Traditionally, shells of *pipa* (freshwater pearl mussel) were an important material for making tools to harvest grains. BACPG documented and presented how to make the harvesting tools out of *pipa* shells. Preservation of salmon, and flensing of deer were also explained in detail, using pictures.

Every year, BACPG holds cooking classes in November, January and February to learn from the Ainu Elders and also to introduce various Ainu dishes to the people in the community. To date (2006), 13 dishes have been demonstrated in these cooking classes: 1) *cep ohaw* (fish soup), 2) *citatap* (chopped mixture of salmon head and milt), 3) *kosayo* (bean soup), 4) *konp sito* (dumplings with kelp source), 5) *cipor sayo* (rice soup with salmon roe), 6) *aha mesi* (rice with wild beans), 7) *piyapa sayo* (rice soup with millet), 8) sweet bean soup, 9) *kina rur* (wild vegetable soup), 10) *pene emo* (frozen potato), 11) *turep sayo* (soup with wild lily), 12) *huype* (liver) and 13) *tonoto* (liquor).

Interviews with Elders

The Elders who were interviewed talked about various kinds of food items that they gathered, processed and ate. In the following paragraphs, 15 food items are described (including *pipa* shells) that the Elders identified as important to traditional Ainu culture.

Pukusa (wild onion)

Pukusa is currently popular among young people as well as elderly people. With cultivated *pukusa* becoming increasingly available it can be found in markets. Therefore, *pukusa* has gained popularity not only in Ainu communities, but outside them also. Interestingly, the Ainu Elders in Nibutani recall *pukusa* as the food that they avoided eating when they were young. Due to the strong taste of *pukusa* and the social prejudices against Ainu, *pukusa* became a negative symbol of the Ainu. Now people simply enjoy the taste and the nutritional value of *pukusa*. However, the traditional way of processing and cooking *pukusa* – by drying it in the shade and cooking it in soup – has not been sufficiently passed down to the younger generation.

Pukusakina (anemone)

Pukusakina was one of the wild vegetables mentioned frequently in our research, but outside the Ainu community it is not known to be an edible substance. However, not many people of the younger generation knew about *pukusakina* or knew how to eat it. The Elders explained that they collected *pukusakina* and dried them for use during winter, by tying them together like a reed screen and hanging them outside to dry. They also ate *pukusakina* fresh after boiling it in water to get rid of the harshness. *Pukusakina* was served in deer meat soup and vegetable soup and was said to be good in many dishes. It was used widely in the days before Japanese assimilation policies came into force.

Cimakina (udo, spikenard)

Cimakina is a well-known vegetable that is eaten in spring. There are two different uses for *cimakina*: food and medicine. Elders mentioned that they pickled it or ate it with vinegar and miso paste. This is apparently the modern recipe for eating *cimakina*, adopted from the Japanese cuisine. The Elders also talked about boiling and grilling *cimakina*. This is consistent with literature on traditional Ainu food culture, which recorded that Ainu used to boil the fully grown stem of *cimakina* and take it with them when they went into the mountains. The Elders said that they also used to eat it fresh, in the same manner that they ate *cihue* (angelica) (see next page). Fully grown *cimakina* was peeled and eaten. It was not as sweet as *cihue*, but was considered to be a good snack. According to the literature, Ainu cooked *cimakina* in hot water and drank the juice to cure scabby skin. However, this medicinal use was not mentioned by any of the Elders in our research.

Korkoni (Japanese butterbur, coltsfoot)

Korkoni is a very popular wild vegetable, eaten widely by Ainu and non-Ainu. Ainu used to gather *korkoni*, boil it in water, peel its skin and eat it in *ohaw* (soup). It was also salted for preservation. Most traditional dishes using *korkoni* have been passed down to younger generations with some changes in recipes, such as frying it with oil.

Korkoni was used for purposes other than eating. People used the leaves for wrapping things or as a temporary pots and saucers. They also used *korkoni* leaves for wiping wooden floors to produce a shine. *korkoni* was also effective as a medicine for curing beriberi. The Elders still knew about its use for these purposes.

In the interviews, the Elders mentioned an interesting preservation method for *korkoni*. Fully grown *korkoni* is harvested, wrapped with leaves of Japanese knotweed and slightly salted. Treated in this way, *korkoni* stayed fresh, perhaps because of the sterilizing effect that the leaves of Japanese knotweed are known to have. However, this preservation method has not been passed on to the younger generation.

Aha (aha beans)

Aha is not used as much by the present Ainu because other beans (soybeans, red beans, etc.) have become available. Also, it is time consuming to harvest, wash and process these beans. Some participants mentioned that *aha* was tasty but that they did not go to collect it. Others said that they knew where they could pick a lot of *aha* which they then boiled and ate. Most often *aha* was cooked with rice, in much the same way as *sipuskep* (egg millet) and *piyapa* (barnyard millet) are cooked. The Elders recalled *aha* being slightly sweet and tasty.

Sorma (ostrich fern)

In the earlier research, it was reported that *sorma* was eaten in some areas, but not in every Ainu community. Elders from the Saru River region said that they boiled them in water, dried them for preservation and that they also salted *sorma* for preservation. Drying was the traditional method of preservation, while salting was introduced under the influence of Japanese dishes. It was also reported that people now deep-fry *sorma* or cut it into small pieces, deep-fry them and eat with soy sauce and sugar seasoned with red pepper.

Turep (wild lily)

Turep is uniquely an Ainu food item in that it was one of the most important wild vegetables in Ainu food culture, yet it was never adopted into Japanese cuisine. In the Saru River region, the root and the stem grow up to several centimetres above ground, and these were used to make *turep* starch. The tuber was mashed and strained to make two kinds of starch: ichiban-ko was the finest starch and niban-ko was less refined. Since only a small portion of ichiban-ko is produced in the process, it was very precious and some Ainu used it as stomach medicine. Niban-ko or *turep* was mainly used to make dumplings. The doughnut-shaped *turep* was hung to dry with a string running through a hole in the middle – a way of preservation without leaving waste. What was left after making *turep* starch, mostly fibre, was wrapped with leaves of *korkoni* and mugwort, and left to ferment for about two weeks. After further processing the fermented *turep* to make more starch, it was made into a ball and dried for preservation. Dried *turep* was eaten in deer soup and vegetable soup. Since the fermentation process requires special knowledge and produces a strong smell, it is now rare to find anyone who ferments *turep* for everyday use. In addition, other kinds of starch are now widely and cheaply available in stores.

Cihue (angelica)

Ainu used to eat *cihue* while they were on outings. One Elder recorded, “We found *cihue* in the mountain, and we picked it, peeled it and ate it fresh. Depending on the area, some *cihue* are sweet and others are bitter. We ate it only fresh (not cooked).” The peel of *cihue* is hard. However, once it is removed, the inside is soft and good to eat. Well-grown *cihue* contains slightly sweet water-like juice in the centre. In the early summer when people went into the mountain to pick *turep*, they enjoyed *cihue* to quench their thirst or eat as a snack. Today it is very rare to find young Ainu who know the use of *cihue*.

Sipuskep (egg millet)

Sipuskep was brought to the area a long time ago and was incorporated into Ainu food culture. There are two kinds of *sipuskep*: *nitne sipuskep* (hard egg millet) and riten *sipuskep* (soft egg millet). One Elder said, “*nitne* is rice, *riten* is sticky rice”. *Nitne* can be a meal by itself and it is tastier than *piyapa* (barnyard millet). The Elders said how much they enjoyed eating *sipuskep*, but since it was not abundant it had not become one of their everyday foods. *Sipuskep* was popular among the Ainu in Saru River region, and they liked *sito* (dumplings), made of ground *sipuskep* flour. The flour was also used to make local specialties, such as *ratashikep* (cooked vegetable dish) and *kosayo* (sweet thick soup with beans), which children generally like for its sweetness.

Piyapa (barnyard millet)

Piyapa was also called *aynu-amam* (grain for humans). Since rice is called *sisam-amam* (grain for Japanese), the name indicates that *piyapa* was an important part of Ainu food culture. *Piyapa* grew liberally around Ainu houses, and people considered it as an "everyday food". Ainu used to eat *piyapa* regularly before the Meiji era (began 1867) when rice became available. The most common way of preparing it was *piyapa sayo*, i.e. *piyapa* porridge.

Munciro (Italian millet)

Munciro was an important part of Ainu food culture in times past. Like *piyapa*, it was called *aynu-amam* (grain for humans). There were also two kinds of *munciro*: *nitne* and *riten*. However, one Elder recalled, "We did not grow *nitne munciro* (rice millet). We steamed *riten munciro* (sticky rice millet) and after cooling it, we pounded it and made tasty sticky *munciro* cake."

Pene emo (frozen potatoes)

Pene emo was introduced to Ainu relatively recently; therefore, the pronunciation of *emo* (potatoes) is similar to that of the Japanese. Previously, it was prepared only among the Ainu in the Saru River region. In the spring, Ainu collected the potatoes left in the field over the winter that the Japanese farmers did not pick in the previous autumn, as they were too small. They first soaked them in water and mashed them, made them into balls and cooked them in the hearth. The freezing of potatoes during winter increases their sweet flavour and children enjoyed eating *pene emo* as a snack.

Atat (dried salmon)

Salmon was called *kamuy cep*, meaning "fish of gods", was the most important food in an everyday Ainu meal. Salmon has been precious food from the past to the present and Ainu upstream and downstream the Saru River region all harvested and ate salmon in various ways. One Elder recalled, "I broiled and cooked salmon and enjoyed eating it. My father, on his way home, found dead salmon along the riverbank and used to bring them home. We made *ruype* (repeatedly freezing and drying salmon) and ate it". One Elder who lived upstream of the Saru River said, "We did not get much salmon. But every once-in-a-while, my elder brother used to catch some. Even if it was midnight, we made *ohaw* (soup) and woke everybody up, even our neighbours and enjoyed the soup together. We would also stick *imanit* (skewer used for broiling fish) through salmon and broil it." Salmon dishes have been passed down to younger people and *ruype* is a popular local speciality.

Yuk (Hokkaido deer)

Most Elders said that they did not eat deer when they were young. *Yuk*, along with salmon, was one of the most important food items in Ainu culture, but in recent years it was not a familiar part of everyday food among the Saru River Ainu. The reason for this decline has been the requirement of deer hunting licences that have not been readily available for Ainu. Also, it was not possible for Ainu men to leave home and work for many days to hunt *yuk*.

When Ainu did acquire *yuk*, it was considered a special treat. They ate the meat, internal organs and also the blood and processed every part of the *yuk* in various ways. Now, people eat *yuk* meat and liver raw as sashimi, or as barbeque.

Pipa (freshwater pearl mussel)

Pipa, especially the shells, was closely related to Ainu life. The shells were used as a tool for harvesting grains such as *sipuskep*, *puyapa* and *munciro*. The Elders said that they did not eat *pipa*, but used the shells as tools for harvesting grain. *Pipa* refers to shells, but the people in the Saru River region also used the term to refer to the tool for harvesting grain. In this area, there used to be a river valley where *pipa* were abundant, and it was named *pipauci*, the river valley with shells. The Ainu settlement nearest to this valley is called *pipauci kotan* (pipauci village) currently in the centre of Nibutani. Although *pipa* was not eaten regularly, it became an important food during periods of food shortages.

Group interviews

In the spring of 2004, a series of group interviews was conducted based on data collected in 1998 in the BACPG study and in subsequent interviews with Elders. Seven women, 20–50 years of age, familiar with Ainu traditional dishes were selected, and asked about their experience with cooking and eating food items mentioned by the Elders. All participants expressed positive attitudes towards these food items, showing that the Ainu traditional food culture was being preserved in some Ainu households. The participants said that they ate wild vegetables in the spring, and preserved *pukusa* and *pukusakina* to eat in soup throughout the year. They have been cooking Ainu dishes with miso paste, rather than salt. They also talked about their experience of avoiding eating *pukusa*, when they became old enough to know the social prejudice against Ainu, which is associated with its strong smell.

The participants recalled eating various kinds of wild vegetables and fish when available. Eating Ainu foods was more than filling their stomachs with food. They remembered the pleasant experience of walking into the mountains with their mothers, sisters and friends to collect wild vegetables, enjoying the fresh air, sharing fun time. In winter, they recalled eating deer and bear. As for the changes in preservation methods, they concurred that they now freeze many of the wild vegetables, rather than drying them as they used to do in the past.

Written questions

A list of 15 Ainu food items, including *pipa* shells, was shown to three participants, who were then asked to write down their experience with these Ainu foods. This method was used with those participants who have experience with Ainu traditional foods, but were not able to participate in interviews.

The results were consistent with those of the interviews. Among eight kinds of wild vegetables, the participants said that they had eaten most of them. *Chifue* was the one item that three participants had never had. As for cooking methods, the participants described a variety of ways to cook *pukusa* in miso soup, egg omelettes, stir-fry(s) with other vegetables, or marinated in soy sauce mixed with miso paste. Among the three kinds of cultivated grains and vegetables, *sipuskep* (egg millet) was commonly eaten, but the other two were not. The participants answered that they ate about half of the dishes that were listed.

Market research

There were only two Ainu wild vegetables sold in the markets: *pukusa* and *korkoni*. Fresh pukusa was sold at markets around May, but it was cultivated specifically for market sale. The price of *pukusa* was about 190 yen per 10 g. Since the nutritional value of *pukusa* has become well known the demand for it has increased, and *pukusa* has become widely available in markets in urban areas such as Sapporo. Also, *pukusa*, marinated in soy sauce, was sold at the market for about 400 to 450 yen per 50 g. *Korkoni* was also a popular food item throughout Hokkaido, and it was sold at markets year-round. The price of *korkoni* was similar to that of other vegetables: about 180 to 190 yen per 100 g.

Salmon was also a very popular food item in average households in Hokkaido, and was sold in markets all year long. The price of salmon varied depending on the species and quality, as did the method of processing (fresh, salted, dried and others). However, salmon was a common fish and its price varied.

Nutritional components of traditional food

Since the Japan Food Composition Database did not include many of the wild vegetables and meat mentioned here, the research group conducted their

Table 7.4 Nutrient composition of Ainu traditional food *(per 100 g of edible portion)*

Food items	Moisture	Energy		Protein	Fat	CHO	Fiber (soluble)	Fiber (insoluble)	Fiber (total)	Ash	Vit A	Vit A
	g	kcal	kJ	g	g	g	g	g	g	g	RE µg	RAE µg
Wild plants												
Aha bean[1]	48.7	230	959	15.1	6.7	27.2	–	–	8.4	2.3	–	–
Anemone, dried[2]	5.7	371	1 551	26.3	6.6	51.6	3.6	28.3	31.9	9.8	–	–
Anemone, fresh	90.5	36	152	2.6	0.4	5.6	0.4	3.1	3.5	0.9	–	–
Angelica, fresh	91.7	31	130	0.6	0.2	6.7	–	–	–	0.8	–	–
Butterbur, fresh[3]	95.8	13.2	55	0.3	0	3	0.1	1.2	1.3	0.7	8.16	4.1
Fermented Turep	11.2	351	1 469	3	0.2	84.4	1.6	5.7	7.3	1.2	–	–
Fruit of armur cork[2]	8.8	389	1 624	12.1	8.9	65	–	–	–	5.2	–	–
Ostrich fern, dried	7.8	376	1 570	36	4	48.9	–	–	–	3.3	–	–
Perennial lily, powder	17.8	330	1 371	0.1	T	81.9	–	–	–	0.2	–	–
Perennial lily, root	75.6	95.4	399	1.4	0.2	22	0.2	1.6	1.8	0.8	–	–
Spikenard, fresh[3]	94.4	21	89	0.8	0.1	4.3	0.3	1.1	1.4	0.4	0	–
Wild onion, dried[2]	5.6	366	1 530	35.4	4.5	46	–	–	–	8.5	–	–
Wild onion, fresh	88.8	42.2	176	3.5	0.2	6.6	0.5	2.8	3.3	0.9	347.5	173.7
Cultivated grains												
Barnyard millet[3]	13.1	362	1 512	9.7	3.7	72.4	0.4	3.9	4.3	1.1	0	0
Egg millet[3]	14	356	1 463	10.6	1.7	73.1	0.1	1.6	1.7	0.6	–	0
Italian millet[3]	12.5	359	1 499	10.5	2.7	73.1	0.4	3	3.4	1.2	0	T
Potatoes, frozen	15.7	340	1 421	1.5	0.8	81.7	–	–	–	0.3	–	–
Fish and game												
Hokkaido deer[2]	70.8	156	653	19.5	8.7	0	0	0	0	1	3	3
Pearl mussels, fresh water	82.9	70	293	10.3	1.4	3.2	–	–	–	2.2	34	34
Salmon, dried[3]	64	153	638	25.7	5.5	0.1	0	0	0	4.7	43	43

CHO Carbohydrate.
T Trace value (Below detection limit).
– No data.

own analysis in May 2004. Samples of vegetables or meat were collected and preserved in the traditional ways by freezing or drying and sent to the Food Science Laboratories of the Rakuno Gakuen University. Composite samples from several like plants (n = 1) and one sample of deer meat were made. Of the 15 items that were identified as important in the interviews, *pipa* was not analysed, since it was not usually used for food. Local deer hunters provided deer meat in January when the deer-hunting season began. Standard food composition analyses and microanalyses were conducted using the general component analysis in Japan. Moisture was determined with vacuum drying, protein determined with the Kjeldahl method and multiplied by 6.25. Sodium was determined by atomic absorption spectrometry, and ICP luminescence was used for calcium, phosphorus, iron, potassium, magnesium, zinc and copper. Soluble and insoluble dietary fibre were determined by the Prosky-Strange method and combined for total dietary fibre (Iwasaki-Goodman *et al.*, 2005, 2006).

The nutrient composition of Ainu food items is shown in Table 7.4, which contains values from these original analyses as well as data from the Japanese Composition Tables.

Results for dried *pukusa* (wild onion) showed that it had a ten-fold higher energy level than fresh *pukusa*.

ß-carotene	Total carotene	Folic acid	Vit B_6	Vit C	Vit D	Vit E	Vit B_{12}	Calcium	Iron	Zinc	Phosphorous	Magnesium	Sodium	Copper	Potassium
µg	mg	µg	mg	mg	µg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
–	–	–	–	–	–	–	–	42	4	–	240	98	3	–	1 000
–	–	–	–	–	–	–	–	1 100	19.5	2.5	450	210	7	0.58	3 600
–	–	–	–	–	–	–	–	56	1.4	0.3	43	22	2	0.06	400
–	–	–	–	–	–	–	–	34	0.2	0.1	15	11	2	0	390
49	49	12	0.01	2	0	0.2	0	40	0.1	0.2	18	6	35	0.05	330
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	1 500	6.2	0.4	160	65	16	0.31	1 500
–	–	–	–	–	–	–	–	230	8.7	5.6	640	160	260	3.1	630
–	–	–	–	–	–	–	–	3	0.5	–	–	–	–	0.28	13
–	–	–	–	–	–	–	–	9	0.2	–	–	–	–	0.09	350
0	0	19	0.04	4	0	0.3	0	7	0.2	0.1	25	9	T	0.04	220
–	–	–	–	–	–	–	–	330	9.6	4	730	220	7	1.43	3 600
2 000	2 170	85	0.16	59	0	0.9	0	29	1.4	0.4	30	22	2	0.16	340
0	0	14	–	–	–	–	–	7	1.6	2.7	280	95	3	0.3	240
0	0	13	–	–	–	–	–	9	2.1	2.7	160	84	2	0.38	170
–	–	29	–	–	–	–	–	14	4.8	2.7	280	110	1	0.45	280
–	–	–	–	–	–	–	–	24	3.1	0.9	71	20	8	0.7	23
–	–	1	0.52	1	T	0.5	0.6	3	3.5	2.5	220	23	43	0.17	360
–	–	42	0.02	–	–	1.1	10.3	43	3.5	1	160	73	540	0.05	230
–	–	10	0.52	0	28	1.2	8	19	0.8	0.5	240	20	1 500	0.07	250

1 Report of Health Promotion Project using Ainu plants, Ainu Museum,1996.
2 Composition analysis was completed in 2005 at Rakuno Gakuen University.
3 Japan Standard Food Composition Chart.

It contained more potassium, phosphorus and iron than when fresh, which showed that the drying method significantly enhanced the nutritional values of *pukusa*, through the loss of moisture. Similarly, dried *sorma* (dried ostrich fern) was a good source of energy, but also a good source of sodium, zinc and copper. The energy level of *turep* (wild lily) was found to be higher than in potatoes, and *turep* was a good source of carbohydrate and calcium. The first batch of starch made from *turep*, called ichiban-ko, can be used as medicine. *Turep* fibre and leftover starch were rich in both soluble and insoluble fibre. *Yuk* (deer meat) contained less energy than beef, because these wild animals tend to be lean.

Community activities

Ainu cooking workshop, 23 June 2004

On 23 June 2004, an Ainu cooking workshop was held for teachers of home economics in both elementary schools and junior high schools in Biratori. The Research Council of Educators in Biratori organized the workshop, "food culture" being their chosen research theme, which focused on Ainu traditional food as their subject. The teachers of six elementary schools and eight junior high schools in Biratori, and three teachers from outside of Biratori participated. The instructor demonstrated the cooking of three dishes: *yuk ohau* (deer soup), *sipuskep meshi* (rice with millet) and *konp sito* (dumpling with kelp sauce), while participants observed and took notes.

Most participants had never had Ainu dishes before and had various thoughts on Ainu food culture after the cooking workshop. One participant thought that deer, being wild meat, must have a distinct taste that would require an effort to enjoy. However, participants found the deer soup tasty. Other participants indicated that they had never eaten wild vegetables, despite the fact that they see them around their homes. Participants were also surprised to learn about the ancient skills of the Ainu, e.g. cultivating grains such as millet, etc. They were interested in the fact that the word *konp* (kelp), which is a part of Japanese vocabulary, is originally an Ainu word.

After the cooking demonstration, a discussion was held about how to introduce Ainu traditional food culture to students at school. The participants expressed their willingness to incorporate various aspects of Ainu food culture into class material. Teachers who came from outside Biratori were eager to organize similar cooking workshops for teachers in their regions. Some participants expressed the need for providing nutritional information and recipes for the Ainu dishes.

"Hararaki Time": introducing Ainu culture at school

Nibutani Elementary School began its efforts teaching the children the unique characteristics of the local community in 1996, when a prefectural conference on education was held in Nibutani Elementary School. Teaching Ainu culture was one component of such effort, and the programme called "Hararaki Time" has been held every year since. For "Hararaki Time", one area of Ainu culture, such as food culture, craft or language, was chosen at the beginning of the year, and a series of workshops organized, inviting local people as instructors. All students take part in "Hararaki Time" at least twice before graduating from elementary school.

Studying about Ainu food culture was, reportedly, one of the most popular workshops. Students learned about Ainu cultivation of grains such as millet, starting with planting, weeding and harvesting. First, the students were divided into small groups that worked together to take care of gardens planted in spring. In summer, students went to Chitose to collect *pipa*. They learned how to make tools with the *pipa* shells and used the tools for harvesting grains in mid-September. After drying the millet, the students learned to cast off the husks and grind the millet to make millet powder. They eventually learned to make dumplings with the millet flour.

Conclusion

The situation of the Ainu in the overall context of the Indigenous Peoples' Food Systems for Health Program demonstrates how a cultural group of Indigenous Peoples can begin the first steps to revitalize their culture that is close to complete assimilation in the larger Japanese national society. Traditional food is used as the avenue for this revitalization. Here the understanding, appreciation and use of traditional Ainu food in the contemporary context are described, with special attention to differences among three generations of Ainu. Interestingly, foods formerly part of the Ainu culture but now adapted for use by the larger Japanese society, are no longer considered "Ainu", resulting in a very short list (15 items) of foods which are uniquely Ainu. An impediment to the nutritional status survey was the difficulty in identification of Ainu participants because many Ainu in the region were reluctant to self-identify as Ainu, due to the discomfort of potential discrimination by their non-Ainu neighbours. To date there were no health surveys in the region disaggregated by ethnicity with which to understand Ainu health status – therefore, this information could not be reported here.

Following the Nibutani Dam court decisions that required an assessment of the impacts of flooding the traditional Ainu territory containing many traditional foods and medicines, and that recognized the Ainu right to enjoy their culture, the Ainu research team conducted research from 2004–2006 under the leadership of Koichi Kaizawa, the Ainu community leader. They conducted primary qualitative research, and included results derived earlier by the Biratori Ainu Culture Preservation Group. Interview information from local Ainu Elders and younger Ainu developed two criteria used to choose Ainu foods for study and cultural preservation: 1) Ainu traditional foods that Elders continued to appreciate over the years, and 2) Ainu traditional foods that they would like to preserve for future generations. From this list 15 food items (one was used to make tools) were identified and studied. The research group also collected these food samples for composition analysis at the Department of Food Science at the Rakuno Gakuen University in Hokkaido.

The results of both interviews and composition analysis showed that Ainu have fostered rich knowledge about interesting and nutritionally sound traditional Ainu foods. The research team plans to re-introduce this basic information to the Ainu community in the Saru River region with various education activities. This will enable the Ainu to promote an appreciation for the Ainu culture within and outside of the Ainu community, thus creating the kind of social change through which Ainu will regain a culturally healthy environment ●

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We thank Mr and Mrs Koichi Kaizawa for their leadership and commitment to conduct this research. Their dedication to revitalize the Ainu food culture has been indispensable throughout our research.

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Chapter 8

Thailand: food system and nutritional status of indigenous children in a Karen community

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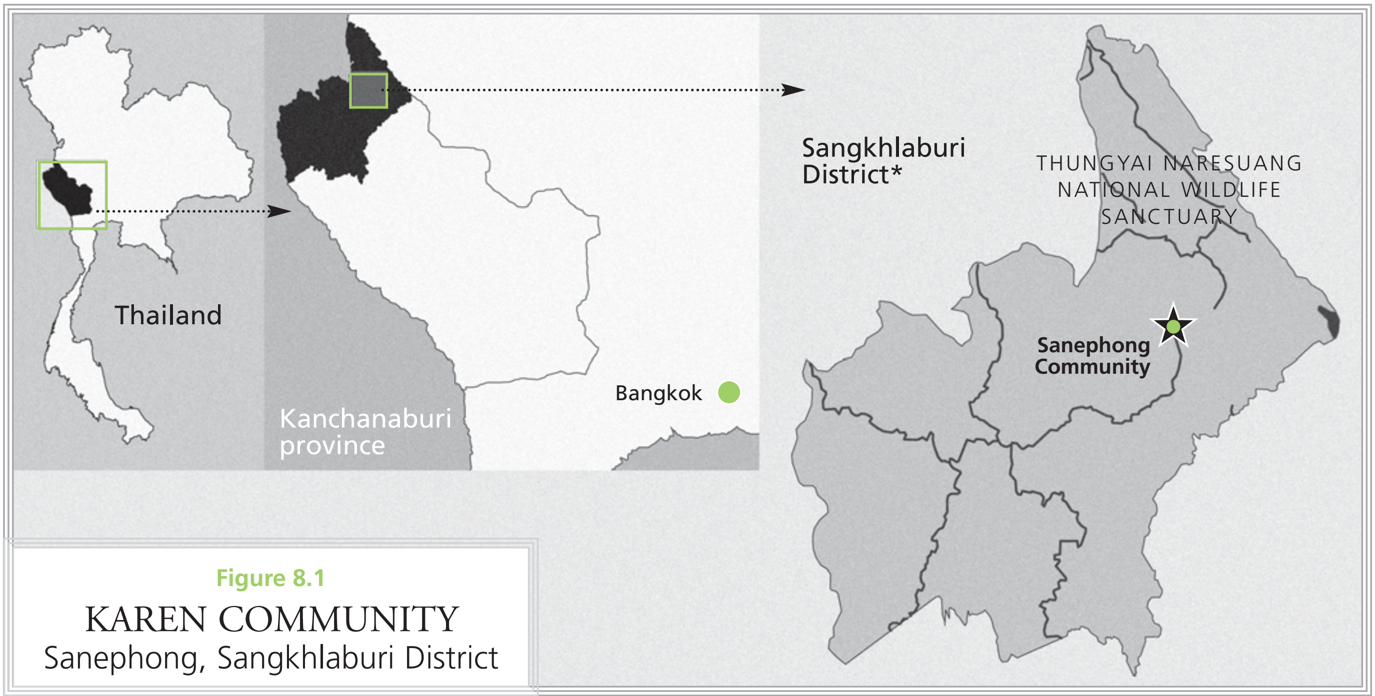

Figure 8.1
KAREN COMMUNITY
Sanephong, Sangkhlaburi District

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.
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Photographic section >> XXIV

"...All the foods we eat belong to Mother Nature – the Karen are grateful to her..."

Ye la mong, Karen community leader

Abstract

To promote nutrition and health among Indigenous Peoples in Thailand and other developing countries, it is essential to understand their food systems and related behaviours and practices. This chapter describes the process and results of a preliminary participatory research between a group of interdisciplinary researchers and community members in Sanephong, a small Karen village in western Thailand.

Many interdisciplinary methods were used, i.e. standard anthropometric methods, biochemical assessments, focused ethnographic study, focus group discussion, in-depth interviews and 24-hour recalls. Key results indicate that the food system was, in general, favourable.

Three hundred and eighty-seven traditional food species were identified. Eight species of those were high in minerals and vitamins, according to portion size consumed. However, an improvement in nutritional status and health was necessary for children and mothers.

The overall nutritional status of children suggested acute and chronic malnutrition problems: 20 percent stunting (n = 37), 14 percent underweight (n = 26), 5 percent thin (n = 9) and 1 percent overweight (n = 2). Mean energy intakes of the children did not meet the Thai Dietary Reference Intake (DRI): 58 percent of the Thai DRI in 6 to 11 months, 50 percent in 1 to 2 years, 56 percent in 2 to 5 years, and 69 percent in 5–12 years. For children 2–12 years, dietary vitamin A, vitamin C and fat intakes were inadequate. Iron intakes were low among most children (mean at 29 percent Thai DRI in 1 to 2 years, 35 percent in 2 to 5 years and 42 percent in 5 to 12 years). Thus, it is recommended that the improvement of nutrition and health in this indigenous community should be built upon their available food sources, with the possible exception of iron-rich foods.

The promotion of available good sources of iron is one strategy to prevent anemia. Iron supplementation can also be used. Promoting culturally appropriate childcare practices, as well as better mother and child interaction, are also essential.

Introduction

Indigenous Peoples in most developing countries are often neglected in development efforts, as they are minority groups in those societies. These Indigenous Peoples are often the poorest of the poor and increasingly at great risk of losing their biological and cultural diversity, which consequently affects their health, nutrition and quality of life now and in the future. To understand indigenous food systems, and to promote food and nutrition security appropriately will assist developing countries in achieving one of the most important Millennium Development Goals: (Goal 1) to reduce poverty and hunger among disadvantaged people (ACC/SCN, 2000). Also, this effort will lead to environ-mental sustainability in those communites – once people learn how local food is good for their health, they will have the incentive for intensive participation for taking care of their environment. This chapter discusses a participatory research study that aimed at understanding the food system in a small Karen community in western Thailand.

Overview of the community

Sanephong is a Karen community in a Laiwo sub-district, the Sangkhlaburi district, Kanchanaburi province. It is located in the Thungyai Naresuan National Wildlife Sanctuary some 336 km northwest of Bangkok adjacent to the Myanmar border, and about 12 km east of Sangkhlaburi municipality (Figure 8.1). This community can be reached only by a four-wheel-drive vehicle or by motorcycle. In the rainy season, however, it can only be reached by trekking along the mountainous and muddy trail.

At the time of the study, there were 126 households in Sanephong. Aside from wooden and bamboo houses, there was a Buddhist temple, a rice mill and a solar panel (energy source). Infrastructures provided by the government included a primary school operated by the Border Patrol Police Department, a childcare centre, a field station of the Division of Hill Tribe Development and Welfare and a community paddy (rice) bank. The community leader's house was located in the centre of the village. There were seven grocery shops. Some of these shops also provided cooked foods including noodles and snacks, such as crispy snacks, candy and beverages – including an orange-flavour syrup –which most children in the village can buy.

The population of Sanephong village at the time of this research was 661 inhabitants with 345 males (52.2 percent) and 316 females (47.8 percent). Most of them were registered with Thai nationality. The target group for this project is children 0–12 years old. There were 225 children less than 13 years old (34.5 percent); 61.1 percent of adults were 13 to 59 years old, and 4.4 percent were 60 years old and above. Fifty percent of participating women were of reproductive age (15 to 49 years old).

Formal leaders are known as *Kamnan* (a sub-district headman) and *Phuyaiban* (a village headman). However, informal leaders, such as monks and respected Elders, are also important leaders in the village. Vernacular Karen is their main language, while Thai is also spoken, especially by the younger generation. Although Buddhism is the official religion, it can be said that most people here still believe in Animism. Thus, Buddhist and Animist ways and practices are often intermingled. When the villagers perform their seasonal festivals, their inspirations are closely related to spirits of nature, i.e. worshiping the "Mother Earth" and the "Rice Mother". Accordingly, all entities, including animals, trees, rocks and rivers possess a spirit. As such, ritual practices to pay respect to the spirits are required to ensure the community's well-being. If such rituals are not fully practised, it is believed that someone could be punished by the spirits in the form of an illness or bad luck. From a practical perspective, the indigenous beliefs and value systems are linked to the way of life – once entities, e.g. animal, tree, rock, river, are included in their mental and cultural models, they are then considered to be a constituent part of the population itself. Therefore, many people believe that to help maintain their beliefs and value system means to help sustain their natural resources. These practices, it is believed, have helped to maintain their traditions and to sustain their natural resources.

At the time of the study, there were four major subsistence bases. Subsistence base in this case means the natural landscape areas from which local people procure food sources by ways of farming and gathering. These were: 1) Sanephong Base (240 hectares), 2) Jakhiphue Base (32 hectares), 3) Thichwe Base (4.8 hectares) and 4) Thupho Base (320 hectares). For this study, data were collected only from the Sanephong Base because local people utilized most resources from this area. Sanephong Base is an alluvial plain valley that lies from east to west. Local people used this area for many purposes, i.e. village settlements, growing wet rice and orchards of bananas, mangos and jackfruits. Many vegetables, including gourds and pumpkins, were commonly planted in household backyards. Fish and aquatic animals were available in the perennial stream (*Kheraw-Khi*) from a surrounding high mountain. Wild plants and vegetables were also available along both sides of the stream.

Subsistence activities

Rice growing was the main subsistence activity in Sanephong. However, only 58 percent of households reported producing enough paddy for household consumption. Animal foods were said to be abundant in the surrounding forest, but big game hunting and catching small animals, such as squirrels, flying foxes, field mice, and birds, were prohibited in this area – regardless of Indigenous Peoples' rights. Most people reportedly survived by fishing and gathering aquatic animals, such as crabs, shells, shrimp and frogs from the streams. Traditionally, sharing food (especially rice), is a strong Karen moral principle, despite the presence of market economy penetration. Thus, they grow rice not only for themselves, but also for others. For this reason, the local Karen usually divide their paddy into two parts: for their own household consumption and one for their visitors. After harvesting, the Karen also donate paddy to the community Buddhist monastery, and to the community rice bank. The paddy stock is reserved so that families that do not produce enough can borrow paddy. Aside from this, some can borrow paddy from their cousins.

Community development and change

The Karen in Sanephong village have reportedly lived in this area for over 200 years. Originally, they scattered in autonomous and small communities (five to ten households tied by kinship). Their community was isolated and marginalized by the mainstream culture because of its long distance from other communities. According to their history, the local people maintained their own culture for a long period. It was during the reign of Thailand's King Chulalongkorn (1853–1910) that the central Thai government initiated the centralization of national administrative policy that required each autonomous village, including Sanephong, to elect a village headman. This formal leader had to be approved for the position by the state in order to take administrative roles on behalf of the central Thai government. Afterwards, development projects were gradually introduced into Sanephong along with the influx of national policies.

In 1962 the community primary school was founded and since its inception has been operated by the Patrol Border Police Division. It is not operated by the Ministry of Education, like most schools in the country, for security reasons (border and remote area). Modern education has helped young Karen in Sanephong to read and write Thai, the national language. In general, children in Sanephong receive similar educational opportunities as others in Thailand (free of charge until secondary school, grade nine). Nevertheless, most Sanephong children finish only primary education (grades one to six) because their families cannot afford expenses (i.e. transportation, education materials, clothes, etc.) necessary for secondary education outside their community. Many attend informal education programmes that are available nearby.

In 1974 the Thai government declared the National Wildlife Conservation area in Thungyai Naresuan Sanctuary should include the living area of Sanephong. This initiation has had a tremendous impact on the local Karen way of life. For instance, the law prohibits the Karen from cutting down trees and from practising their method of allowing cultivated fields to lie fallow. Therefore, they cannot open new areas for agriculture. Consequently, the planting rotation period had to be shortened and this has occasionally resulted in the inadequate food production that led to starvation in the local area. The law also prohibits them from hunting wild animals in the surrounding forest, even for subsistence purposes. As a result, at the time of the study some of the inhabitants, especially the young, worked for cash outside the village and some chose to grow more cash crops including chili and coffee and/or to domesticate buffalo and oxen. According to the Rural Development Information Centre (2004), the average annual income per capita in Sanephong was 19 789 baht (US$516) compared to the national average at 28 412 baht (US$741).

Water and sanitation

As reported for this study, the local Karen used stream water for laundry and bathing. Stream water (90 percent), rainwater (63 percent), and pipe water (44 percent) were used for drinking (totals are greater than 100 percent because multiple sources were used). Only half of households reported boiling their drinking water. Nevertheless, it was common that lactating mothers and infants in Sanephong drink only boiled water. A community pipe water system was available, but water supplied by this system was not yet sufficient throughout the year. Cesspools were commonly used, especially for households located near the stream. For households further away from the stream, they went into the jungle for sanitary purposes, especially during the dry season. For those living by a stream, water for washing clothes, bathing, and drinking came from the same area, but toilet areas were separate.

Nutrition and health

The community primary school promoted health and nutrition among school children through school gardens (growing vegetables and a fish pond), a school milk programme (200 ml/child every school day), a daily school lunch programme, and a programme aiming at controlling iodine deficiency disorders (using iodized cooking salt and iodized drinking water), weekly iron supplementation and growth monitoring. The district health office provided annual dental care and parasite examination for school children once a year. At the community child centre, children under the age of five years were provided with lunches (e.g. rice and soup with meat and vegetables or noodles prepared by childcare workers). They were also provided with 200 ml of UHT milk (natural whole milk) every school day (a programme part-funded by the local administration – *Or-Bor-Tor*). The transportation of milk was managed by that local administration.

Ten village health volunteers (three women and seven men) were responsible for primary health care in Sanephong. These volunteers were under the supervision of the district health office. Their responsibilities included: (1) assisting health officers and mid-wives in nutrition, for example, growth monitoring, maternal and childcare, antenatal care, immunization, etc.; (2) health prevention and promotion activities; and (3) providing basic health care services for common local health problems, such as malaria, cold, headache, Thai hemorrhagic fever and diarrhea. Schoolteachers also helped to advise local women during their pregnancies and provide transportation for them to the hospital in the case of an emergency delivery. Resulting from the high prevalence of malaria, the local people had been provided with a blood slide diagnostic service and cared for by the malarial control agency. The district hospital was located about 12 km from the village so during the rainy season travel was particularly challenging, as patients had to be taken along the muddy road across the mountain to the hospital.

The main objective of this study (Phase 1) was to understand traditional food systems and the nutritional status of children in the indigenous Sanephong community. This understanding was to be achieved in order to apply this knowledge to improve the health and nutrition of 0–12 year-old children and their care providers, particularly in respect to micronutrient nutrition, through better utilization of their own foods (Phase 2). The study was descriptive research using quantitative and qualitative methods.

Methodology

This preliminary study commenced in December 2004, and completed in September 2005. Field data collection was conducted only during the dry season (March–June 2005). A participatory research design was followed for this study, which promoted a strong partnership between a group of interdisciplinary researchers and the indigenous community members in Sanephong. The research team also worked in close collaboration with the Centre for Indigenous Peoples' Nutrition and Environment (CINE) in the development of a protocol and research methodology (Kuhnlein *et al.*, 2006).

At the beginning, the research team met several times with the community members as well as local non-governmental organizations (NGOs) in order to create common understandings about the study approach and procedures. All communication between researchers and community members was conducted in both Thai and Karen languages, utilizing interpreters as necessary. Two community representatives participated closely in the development of the research protocols. Participatory processes were especially emphasized in order to help facilitate the work between the community and the research team throughout the project. Ethical approval was granted by the Mahidol University Committee on Human Rights Related to Human Experimentation on 21 January 2005.

Many interdisciplinary methods were used in this study. Standard anthropometric methods (Gibson, 1990) of weight and height measurements were used to assess the nutritional status of children less than 13 years old. Clinical examinations were used to detect the visible sign of goitre, paleness, angular stomatitis and dental caries. These examinations were performed by trained nutritionists from the Institute of Nutrition, Mahidol University (INMU). For morbidity (reported sick), data of children aged 0–12 years old were collected. For those under six years old, mothers were asked whether their children had any sickness within the last month (i.e. respiratory infection and diarrhea). Children over six years old were asked the same question. An interpreter translated questions and answers from Thai to Karen and from Karen to Thai. Haematocrit levels indicated the iron status of school children. For this phase, the study used secondary data from the Provincial Health Office collected by trained health officers. This task group monitored anaemia of children across the country. Collection of haemoglobin data was planned for the next phase of the study.

To understand Sanephong's infant-feeding practices, mothers with children up to two years of age were interviewed about breastfeeding and complementary food practices in terms of the time of introduction, frequency and amount of each food item. Twenty-four hour dietary recalls of children less than 13 years old were conducted to obtain systematic data on their food intakes – mothers provided information for the children under six years old. For children six to nine years old both children and mothers supplied information. The Institute of Nutrition Mahidol University Food Composition Database (INMUCAL New Database 3.2 [ND 3.2]) (Burlingame, 1996; Coordinating Office-ASEANFOODS, 1996; Health Department-Nutrition Division, 1987; Health Department-Nutrition Division, 1992; INMU, 2005; Puwastien *et al.*, 2000) was used to analyse nutrient content of foods consumed as reported in the recalls. Thai Dietary Reference Intakes (DRI) from 2003 were used as the reference (Changbumrung, 2003). For foods identical or similar to other Thai foods the INMUCAL database was used. For foods not in this database, nutrient composition was imputed from similar foods.

The Focused Ethnographic Study was used to gather information on food use, cultural food beliefs and perceptions on foods rich in micronutrients and other nutrients (Kuhnlein and Pelto, 1997). The suitability of various traditional foods for children and methods of food acquisition in terms of purchase, trade and home growing (including foods collected from natural resources) were also recorded. Additional information was collected on food purchases, the involvement of household heads, women and others in food production and food accessibility, especially with regard to micronutrient-rich food sources. Lists of purchased food items were collected from all seven local shops to determine the communities' intakes and expenses on imported foods. Further, seven-day household expenditure and home garden surveys were conducted.

To obtain a traditional food list of this community, several methods were used. Focus group discussion and in-depth interviews with key informants (both men and women) were employed to document traditional food items. For each food item, details about edible parts, seasonality, name in Karen or Thai, and like or dislike by both mother and child were compiled. This traditional food list was later confirmed by selected community Elders as they were most knowledgeable in this area (Blum *et al.*, 1997). Photographs of traditional foods were also taken.

Plant taxonomists and local Karen collected plant specimens for herbarium records of plant resources. They also identified scientific names, English names and Thai common names (Craib and Kerr, 1951a, 1951b).

In addition, a pile-sorting technique was applied to investigate food perceptions using two sets of cards, one for adult food items and the other for children's food items (37 cards in each set). Each card contained a food name in both the Karen and Thai languages, the food picture, and a number on the reverse side. Only the most common and frequently consumed food items were used. The cards were sorted by respondents into piles describing perceptions of each respondent (Blum *et al.*, 1997). Data on foods normally consumed by children included common names in Thai and English, local names (Karen) as well as scientific names. Among this group, 19 food items were selected for analysis based on their potential nutrient content. Out of the 19 foods items, 3 were fresh fruits, 2 were cooked rice, and 14 were vegetables. Food samples were prepared in the field based on the INMU laboratory protocol. Moreover, qualitative data collection was conducted by means of in-depth interviews using a semi-structured questionnaire and through observation (Yoddumnern-Attig, Sirirassmee and Boonchalaksri, 1998) in order to gain information on knowledge, attitudes and practices regarding food and nutrition among mothers and children, as well as on their communication patterns. All interviews were conducted by trained researchers in Thai, using interpreters to translate since interviewees spoke and understood Karen.

Results and discussion

Food system in Sanephong

Food procurement

In Sanephong community, food-procurement activities were divided into three categories: (1) foraging (i.e. fishing, hunting and gathering foods from natural habitats); (2) cultivation of food crops and rearing of fish and animals, requiring intensive labour and technological investment (i.e. growing orchards, vegetables [83.6 percent of households], dry and wet rice cultivation, livestock and fish husbandry); and (3) purchasing fresh (meat, fish, vegetables and fruits) and dry (snack, sweet and candy, beverage, fat and oil, canned fish, flour, sugar, etc.) food items and condiments (fish sauce, salt, shrimp paste, pepper, monosodium glutamate, etc.).

In general, local village Karen still depended on foraging and domestication for their foods. Food purchasing, however, has increased over the years because of decreased availability of certain foods as well as the initiation of a new market economy in the community. More recently, the number of small shops increased to seven from only a few, where local food items were sold for cash. Local Karen indicated decreased yield and environmental change as major contributing factors to the decreased availability.

Table 8.1 Percentage of energy supplied from locally produced and market foods for children in Sanephong

Source of food energy	*Energy (%)*			
	Total children *n = 86*	*Children 1<2 years* *n = 11*	*Children 2<5 years* *n = 27*	*Children ≥5* *n = 48*
Locally produced (traditional)	63.5	69.2	59.1	64.8
Market (imported)	36.5	30.8	40.9	35.2

In June 2005, the total weekly household expenditure in Sanephong was 237 baht or US$6.2, of which 60 percent (139 baht or US$3.6) was spent on food. Excluding six households (10 percent) with unusual expenses (transportation and debt), the total household expenditure in this community amounted to only 153 baht (US$4) and their food expenditure increased to 75 percent (115 baht or US$3). Therefore, the average monthly household expenditure for food in Sanephong was around 460 baht (US$12) which was still much less than the country average of 3 769 baht (US$98.3) per month in the same year.

Data from the seven community shops indicated that local Karen spent more on animal protein foods (i.e. pork, chicken, egg), totaling 1 682 baht (US$44) per day and fish (including aquatics) at 794 baht (US$20.7) per day. Sales of vegetables, fruits, cereal, fat, oil and condiments ranged from 346–405 baht (US$9 to 10.5) per day. Overall, rice (most of which was produced locally) was still the main source of energy. Table 8.1 shows the percentage of energy derived from locally produced and market foods for children in the community. In general, adults and children obtained the majority of dietary energy from local sources, and some of these were purchased from local farmers. Also, it was noted that importing of rice from other areas of Thailand was necessary. Therefore, it was estimated that approximately 85 percent of adult dietary energy came from local Karen food sources.

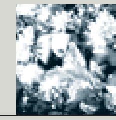
Food availability

Overall, the Karen people of Sanephong had abundant food sources for their subsistence. Of foods that were foraged or domesticated, 387 traditional food species/varieties were identified (17 percent animals and 83 percent plants) during the summer of 2005. Out of the 66 animal species/varieties, 5 were reared domestically (duck, cow, buffalo and goat). Only chicken eggs and pork, however, were available for purchase at the small local shops. Of 321 identified plant species/varieties, 177 (51 rice and roots, 89 vegetables, 37 fruits) were cultivated, 126 (108 vegetables, 18 fruits) were wild and 17 were both cultivated and wild (11 vegetables,

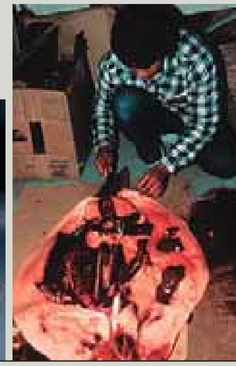
Photographic section

“Give thanks to our food, Elders and ancestors daily.”

Inuit








▲
Pangnirtung
(G. Charbonneau-Roberts)

Data collection – card sorting
(H.V. Kuhnlein)

Butchering seal meat
(H.V.K.)

Butchering a caribou head
(H.V.K.)

◀◀
Previous page
Inuit blackberries, 'paurngat'
(Inuit Research Team)

◀
Jonah Kilabuk with arctic char
(I.R.T.)

▼
Pangnirtung Fjord
facing Kuulik in winter
(I.R.T.)

▲
▲
Narwahl ‘maktaaq’
(L. Goodman)

High cost of groceries
(I.R.T)

Beluga ‘maktaaq’
(H.V.K.)

▲
‘Inuksuk overlooking Iqaluit’
(I.R.T.)

▶
Coke can (S. Yohannes)

Nuxalk

"The old foods are the new foods!"

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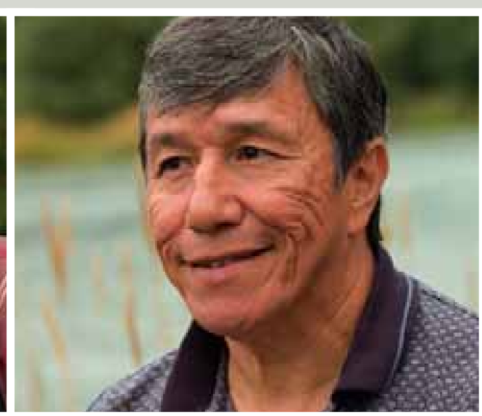

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Spring salmon roe and steaks (kpstudios)

Salmon fillets hung for smoking (k.)

▲
Clayton Creek waterfalls (k.)

▶
Chief Andy Siwallace, Hereditary Chief and Elder (k.)

Bill Tallio, a proud Nuxalkmc (k.)

◀
Previous page
Three of the main species of salmon (k.)

▲▲
Red huckleberries, sweet and tart (k.)

Bella Coola Valley, Table Mountain (k.)

Wild grey currants (k.)

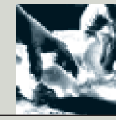
▲
The sacred bald eagle (k.)

◀
Salmon in habitat (k.)

▶
Typical Nuxalk carving style (k.)

"Caribou blood gives strength and warmth, and it keeps you from getting hungry for a long time."

Gwich'in

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▲
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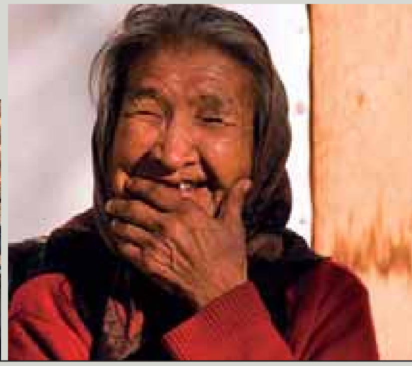
Fish camp (kpstudios)
Cutting fish (H.V. Kuhnlein)
Cranberries (k.)

▲
Smoking fish (k.)

◀
Alice Vittrekwa,
Gwich'in Elder (k.)

▶
Lakes in Gwich'in territory (k.)

◀◀
Previous page
Northern lights (k.)

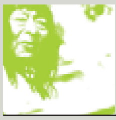

▲
Fish and hotdog: modern contrast (k.)
Agnes Neyando, Gwich'in Elder (k.)
Conne fish roe (k.)

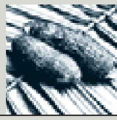
▶
Hunting grounds near Yukon border (k.)

▼
Sacred mountain and Peel River (k.)

Awajun

"With our foods from the wild, the river and our fields we are strong and alert."





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◀▲
From fields to home:
the daily journey
(kpstudios)

◀
Fish and snails are cooked
together (k.)

▲
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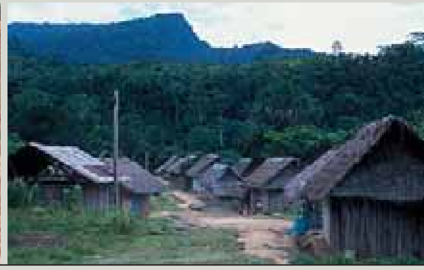
Research to select food attributes
(Awajun Research Team)

A meal of cassava, *pituca* and soup
of palm hearts and chicken (k.)

Interviews about food patterns
(A.R.T.)

▲
Cocona from our fields (A.R.T.)

◀
Ugkush: a valued vegetable (k.)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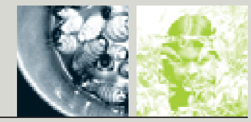
Macambo seeds (k.)
The community of Mamyaque (k.)
Suri: a favorite food (M. Roche)

▲
Sr. Kinin: the walking library of Cenepa (k.)

▶
Rosita and Maria:
two research partners (k.)

"…We need our plants
and our jungle
in order to have strength
and to live better."

Ingano



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Araza fruit (Ingano Research Team)
Yachaicury school pupils (I.R.T.)
Chili peppers from Ingano farm (I.R.T.)

◀
Ingano shaman (I.R.T.)

▲
Ingano territory – Indi Wasi (I.R.T.)

▼
Armadillo (I.R.T.)

◀◀
Previous page
Child behind tomato (I.R.T.)

▲
▲
River travel (I.R.T.)
Ecological promoters (I.R.T.)

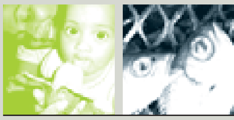
◄
Shaman with youth (I.R.T.)

▲
Mojojoy beetle larvae (I.R.T.)

▼
Working on the vegetable farm (I.R.T.)

Pohnpei

"God made us to eat our own foods. We need to go local!"



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▲
▲
Karat, the State Banana of Pohnpei, exists as several types, including *Karat Pako* (left) and *Karat Pwehu* (right)

Karat as an infant food fed by Mihne Pretrick to her child, Tammy

Slices of eight carotenoid-rich banana cultivars of Pohnpei

Preserved breadfruit, *mahr*, is being prepared

(Pohnpei Research Team)

▲
Reef fishing (kpstudios)

▶
Nidia George tends her cooking on an open fire, still a common way of cooking (k.)

◀◀
Previous page
Working together is an important part of local life (P.R.T.)

▲
Breadfruit (center front), different types of taro (left and right back), bananas and other food displayed by Merlain Alik (P.R.T.)

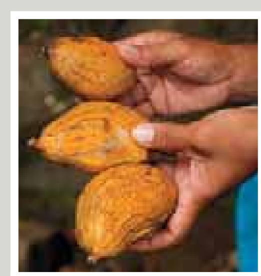
Rose apple, a traditional fruit in Pohnpei

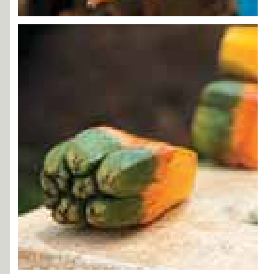
Adelino Lorens shows a huge yam from Pohnpei (P.R.T.)

◄
Merlain Pony with a corm of giant swamp taro (*Cyrtosperma* sp.) (k.)

▼
Chestnut is a popular seasonal crop (P.R.T.)

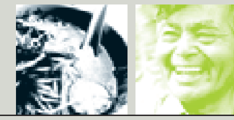
Pandanus is a popular fruit and is especially important on the atoll islands (k.)





“Revitalizing the Ainu food culture will help to re-establish the dignity of the Ainu in the present society.”

Ainu



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▲
Cutting salmon demonstration (Ainu Research Team)

Drying *pukusa* (A.R.T.)

Japanese market food (kpstudios)

▶
On turep akam (k.)

▼
Soup using Ainu greens as garnish (k.)

◀◀
Previous page
Ainu soup (k.)

▲▲
Koichi Kaizawa demonstrating traditional plant (k.)
Traditional Ainu ceremony (k.)
Pukusa (A.R.T)

▲
Muncio (k.)

◄
Cutting *yuk* (A.R.T)

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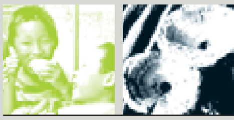
Dried seaweed (k.)

Karen

"...All the foods we eat belong to Mother Nature – the Karen are grateful to her..."



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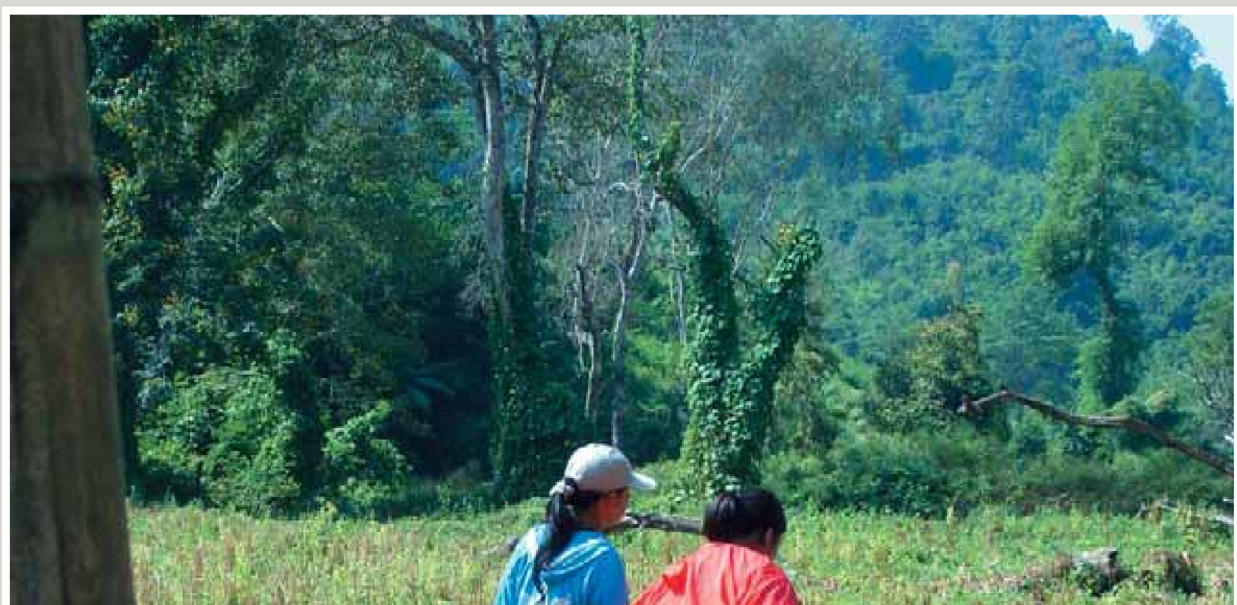

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Buddhist temple where people pray and chat (Karen Research Team)

Children enjoy ripe mango from the home orchard. (K.R.T.)

Breast feeding takes place for at least one year after birth. (K.R.T.)

A home in Sanephong (K.R.T.)

▲
Feeding grandson with rice and stir fried dark green leaves (K.R.T.)

▶
The Karen main diet is rice, chili paste and vegetables. (K.R.T.)

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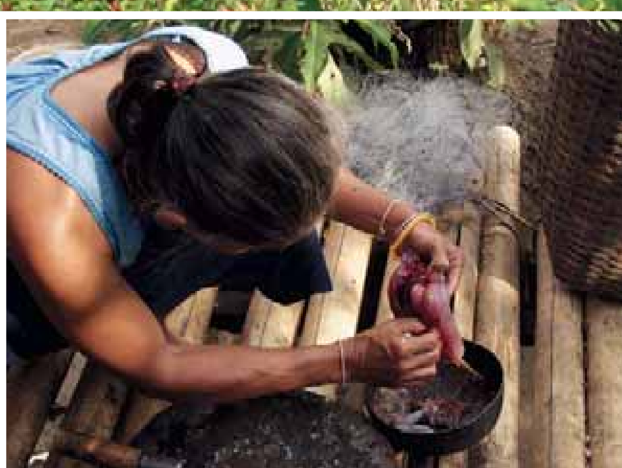
Previous page
Two girls trek to the farm (K.R.T.)



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Pile sorting food cards for perceptions about food for children (K.R.T.)

Karen research team participants (K.R.T.)

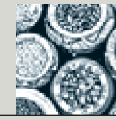
Ma-waeng- Karen vegetable (kpstudios)

▲
Husband and wife collecting Karen red chilis (K.R.T.)

◄
Preparing local fish before cooking. (K.R.T.)

“Greens give us strength, we grew up on them.”

Dalit

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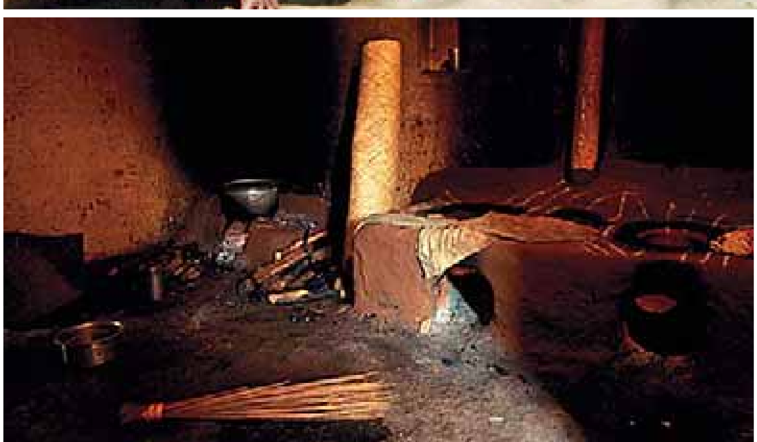

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Storing seed grain (kpstudios)

▲
Crop diversity in Dalit field (k.)

▲▶
Research work at night (k.)

▶
Dalit bullock (k.)

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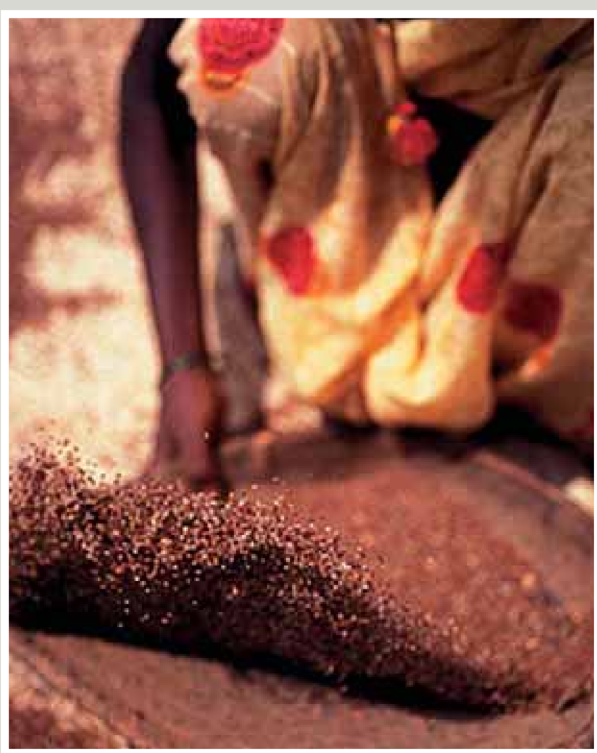
Dalit research team members (H.V. Kuhnlein)

Dalit kitchen (k.)

Wild fruit, kaki pandu (Dalit Research Team)





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Dalit Elder woman (k.)

Dalit chicken in nest (k.)

Research to understanding Dalit food meanings (k.)

▲◀
Market food in Dalit area (k.)

▲
Millet, legumes, oil seeds (k.)

◀
Cleaning grain (k.)

Bhil

"Thank you Mother for the food that you've given us!"

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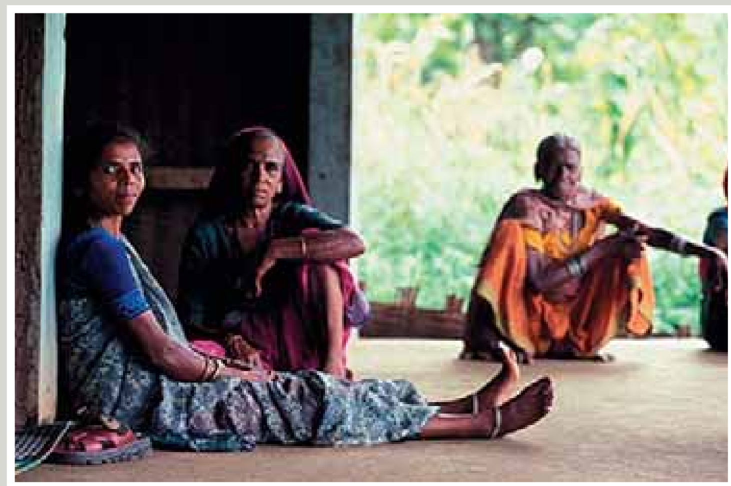

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Millet chapatti and vegetable – a typical Bhil meal (kpstudios)

Junglikand and cooked slices (k.)

Adult portion sizes of meat curry and rice (k.)

▲
Bhil leaders (k.)

▲▶
Bhil women (k.)

▶
Active Bhil youth (k.)

◀◀
Previous page
Bhil women in rice field (H.V. Kuhnlein)

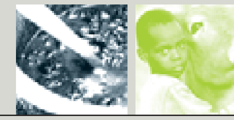
▲
▲
Dry land rice and bullock (k.)
Doli mahooda seeds (k.)
Bhil root food (k.)

▲
Bhil men in group meeting (k.)

▶
Bhil mother and child (k.)

“Our culture and traditional knowledge of our food systems are the pillars of our heritage. Please join us to promote and protect them. Thank you very much.”

Maasai



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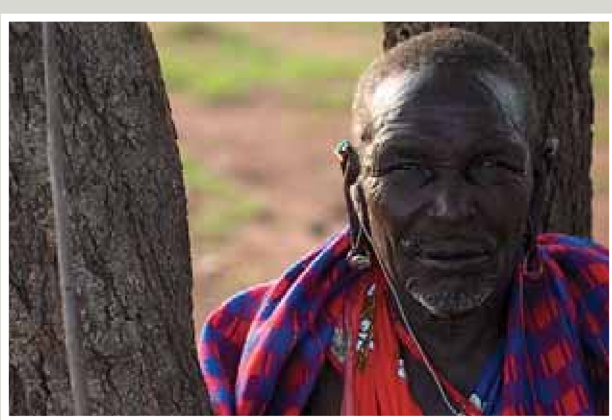


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Lamb and potato soup (kpstudios)

Ole Leipa with blood drink (k.)

Oldepe soup (k.)

▲
Pastoralism (k.)

◀
Olkerei Ole Nchoki, Maasai Elder (k.)

Nabarua, Maasai woman (k.)

◀◀
Previous page
Child with calf (k.)



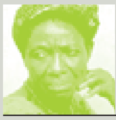
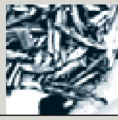
▲
Blood and meat stew (k.)
Modern sugar beverage (k.)
Grewia gathering (T.A. Johns)

◄
Dorcas Nashipai, Maasai
Research Assistant (k.)

▼
Milking (k.)

Igbo

"People who depend on foreign food eventually die of hunger."

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Banga soup and cassava foofoo (k.)
Botanist in action (k.)
Elizabeth Chinwe Okeke (k.)
Cocoyam farm (k.)

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Igbo chiefs (k.)

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Previous page
Yam market (kpstudios)

▲
▲
Igbo woman (k.)
Village hut (k.)
Igbo leader (k.)
Woman pounding foofoo (k.)

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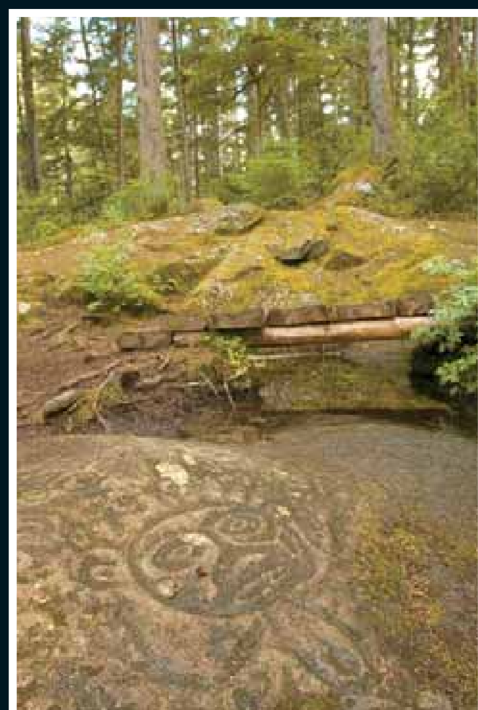
Igbo children (k.)

▶
Palm oil press (k.)



Ancient Nuxalk Petroglyphs (kpstudios)

Table 8.2 Karen traditional food *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source		
					Cultivated	Wild	Cultivated/wild
	Cereals, grains and seeds						
1	*Oryza sativa* L. (17 var.)	Rice	beu-awng-jer, beu-bawng-khu-kli, beu-bawng-yu-ye, beu-bawng-zawng, beu-bi-khi, beu-bo-kaing, beu-er-uan, beu-I-klaing, beu-I-wung-bawng, beu-I-wung-pha-du, beu-I-wung-zer-nu, beu-le-daing, beu-phu-kaing, beu-ther, beu-tho-khawng, beu-ua-phu, beu-yawng-hai	Oct.–Dec.	X		
2	*Oryza sativa* L. (10 var.)	Glutinous rice	aing-khawng-ler, aing-khi-bawng, aing-liaw, aing-pher-chaing, aing-sher-gu, aing-ter-yaing-the, aing-wow-baeng, aing-ya-phi, aing-zer, aing-zer-bung-zer-la	Nov.–Dec.	X		
3	*Sesamum indicum* L.	Sesame	de-zer	Dec.–Jan.	X		
4	*Zea mays L.* (7 var.)	Corn	beu-khe-aing, beu-khe-beu, beu-khe-cher, beu-khe-king-kaing, beu-khe-zer, beu-khe-ker-zi, beu-khe-xer	Jan. June–July, Nov.–Dec.	X		
5	–	–	nawng	Nov.–Dec.	X		
6	–	–	phe-che-za	Jan.	X		
7	–	–	zuy	Dec.–Jan.	X		
	Roots and tubers						
1	*Colocasia esculenta* (L.) Schott (2 var.)	Taro	khu-tho-zer, ku-bawng,	Sept.–Dec.	X		
2	*Dioscorea alata* L.	–	ne-thing	Nov.	X		
3	*Dioscorea esculenta* (Lour.) Burkill	–	ter-khu-thi	Dec.–Jan.	X		
4	*Ipomoea batatas* (L.) Poir.	Sweet potato	cher-thi-ya-bawng-thai	Oct.–Nov.	X		
5	*Manihot esculenta* (Lour.) Burk.	Cassava	bo-kaing-du / ker-bawng-kaing-thing	Jan.–Dec.	X		
6	–	–	khu-a-di	Sept.–Dec.	X		
7	–	–	ku-cher-bawng-ner	Sept.–Dec.	X		
8	–	–	khu-pha-du	Jan.–Aug.	X		
9	–	–	khu-phlo-za	Sept.–Dec.	X		
10	–	–	khu-tho-bung-baing	Sept.–Dec.	X		
11	–	–	khu-tho-ju-khaing	Sept.–Dec.	X		
12	–	–	ku-wa	Sept.–Dec.	X		
	Fish and seafood						
1	*Channa limbata*	Snakehead	ya-li	Jan.–Dec.		X	
2	*Cyclocheilichthys apogon*	–	ya-sai-tawng-kaw	Jan.–Dec.		X	
3	*Dangila siamensis*	–	ya-sai-a-i	Jan.–Dec.		X	
4	*Garra fuliginosa* (2 var.)	–	ya-lung, ya-thei	Jan.–Dec.		X	
5	*Hemibagrus nemurus*	Yellow mystus	ya-chu	Jan.–Dec.		X	
6	*Lobocheilos quadrilineatus*	–	ya-ka-tawng-yu	Jan.–Dec.		X	
7	*Mystacoleucus marginatus*	–	ya-ber-za	Jan.–Dec.		X	

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	*English/common name*	*Karen name*	*Seasonality**	*Food source*		
					Cultivated	*Wild*	*Cultivated/wild*
8	*Pseudomystus siamensis*	Bumblebee catfish	ya-ko-ke	Jan.–Dec.		X	
9	*Puntioplites proctozysron*	Smith's barb	ya-khlow-la	Jan.–Dec.		X	
10	*Syncrossus beauforti*	–	ya-ki	Jan.–Dec.		X	
11	*Tor* sp.	–	ya-mung	Jan.–Dec.		X	
12	–	–	ya-phawng	Jan.–Dec.		X	
13	–	–	ya-phla	Jan.–Dec.		X	
14	–	–	ya-phlawng-nga	Jan.–Dec.		X	
15	–	–	ya-ta-ku	Jan.–Dec.		X	
16	–	–	ya-to-taw	Jan.–Dec.		X	
17	–	–	ya-xu-wu	Jan.–Dec.		X	
18	–	–	ya-zei-muing-ker	Jan.–Dec.		X	
19	–	–	ya-zer-mi	Jan.–Dec.		X	
	Shellfish						
1	– (3 var.)	Crab	chu-ae-kawng-la, chu-ae-lai, chu-ae-wo	Jan.–Dec.		X	
	Shrimp/snail						
1	*Macrobrachium hirsutimanus*	Haingclaw shrimp	zer-dawng	Jan.–Dec.		X	
2	–	–	khlu-mi	Jan.–Dec.		X	
3	–	–	khlu-mi-thung	Jan.–Dec.		X	
	Amphibian						
1	*Kaloula pulchra*	Painted bullfrog, Painted burrowingfrog	di-ow-awng	May–Aug.		X	
2	–	–	di-e	Jan.–Dec.		X	
3	–	–	di-muing	Jan.–Dec.		X	
4	–	–	di-nawng-thai	Jan.–Dec.		X	
5	–	–	tha-bawng	March		X	
	Animals, birds, eggs, insects						
1	*Atherurus macrourus*	Bush-tailed porcupine	zer-ba	Jan.–Dec.		X	
2	*Bos taurus*	Domestic cattle	cha-ner	Jan.–Dec.	X		
3	*Bubalus bubalis*	Domestic water buffalo	per-na	Jan.–Dec.	X		
4	*Capra hircus*	Domestic goat	bi	Jan.–Dec.	X		
5	*Hystrix brachyura*	Malayan porcupine	cher-wu-chu	Jan.–Dec.		X	
6	*Macaca* sp.	Macaque	cha-aw	Jan.–Dec.		X	
7	*Naemorhedus sumatraensis*	Serow	cher-pha	Jan.–Dec.		X	
8	*Sus scofra*	Wild boar	thu-mei	Jan.–Dec.		X	
9	*Tupaia glis*	Common treeshew	nung-khwe	Jan.–Dec.		X	
10	–	–	ling-bawng	Jan.–Dec.		X	
11	–	–	ling-le	Jan.–Dec.		X	
12	–	–	ling-lung	Jan.–Dec.		X	
13	–	–	sa-bu	Jan.–Dec.		X	

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source		
					Cultivated	Wild	Cultivated/wild
14	–	–	sher-phu	Jan.–Dec.		X	
15	–	–	wa-xa	Jan.–Dec.		X	
16	–	–	wa-xa-ua-khu	Jan.–Dec.		X	
17	–	–	wuy	Jan.–Dec.		X	
18	–	–	wuy-zer	Jan.–Dec.		X	
	Reptile						
1	*Varanus bengalensis*	Bengal monitor	xaw	Jan.–Dec.		X	
2	*Varanus salvator*	Water monitor	kei	Jan.–Dec.		X	
3	–	–	khlaeng-cha	Jan.–Dec.		X	
4	–	–	khlaeng-sawng	Jan.–Dec.		X	
5	–	–	khlaeng-zo	Jan.–Dec.		X	
	Fowl						
1	*Ahas boschas domesticus*	–	thu-tha	Jan.–Dec.	X		
2	*Centropus* sp.	Coucal	thu-phawng-nawng	Jan.–Dec.		X	
3	*Gallus gallus*	Red jungle fowl	chawng-meng	Jan.–Dec.		X	
4	*Anthracoceros albirostis*	Oriental pied horn bill	thu-khaing	Jan.–Dec.		X	
5	*Psittacula* sp.	Parakeet	thu-dai-ya-ka	Jan.–Dec.		X	
6	–	–	hei-za	Jan.–Dec.	X		
7	–	–	thu-bawng-ji-lu	Jan.–Dec.		X	
8	–	–	thu-lai	Jan.–Dec.		X	
9	–	–	thu-luy	Jan.–Dec.		X	
10	–	–	thu-shawng-chi	Jan.–Dec.		X	
	Insects						
1	*Gryllus bimaculatus degeer*	–	xer-lai-zu-wa	Nov.		X	
2	–	–	zawng-ri	Feb.		X	
	Vegetables						
1	*Abelmoschus esculentus* Moench. (2 var.)	Okra, Lady's finger	buay-ker-tia, che-pong-ua	Jan.–Dec.	X		
2	*Acacia pennata* Wild. subsp. *insuavis* Nielson	–	phu-zei-du	April	X		
3	*Acacia rugata*	–	pher-chaing-du	Jan.–Dec.	X		
4	*Aegle marmelos* (L.) Corr.	Bael fruit tree, Bengal quince	ping-la	Apr.–May	X		
5	*Allium fistulosum* L.	Welsh onion	zer-khu-za-wow / e-krer	Jan.–Dec.	X		
6	*Alpinia galanga* (L.) Wild	Greater galangal	e-chaing	Jan.–Dec.	X		
7	*Alpinia* sp.	–	phu-zua-khawng	Jan.–Dec.		X	
8	*Amaranthus* sp.	–	ma-kha-du	May–June		X	
9	*Anacardia occidentale* L.	Cashew nut tree	xu-zai-xeu-za	May–Sept.	X		
10	*Ananas comosus* L. Merr.	Pineapple	na-ra-za	Jan.–Dec.	X		

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source		
					Cultivated	Wild	Cultivated/wild
11	*Archidendron jiringa* Nielsen	–	zer-nai-za	Jan.–Dec.			
12	*Artocarpus heterophyllus* Lamarck	Jack fruit	nuay-la-bawng	Jan.–Dec.	X		
13	*Auricularia polytricha* Sacc.	Jew' s ear, Tree ear	xer-bla-ble	May–June		X	
14	*Baccaurea ramiflora* L.	–	sa-shu-la	Feb.–May		X	
15	*Bambusa affinis* Munro.	–	wa-puang	May–Aug.		X	
16	*Bambusa bambos* (L.) Voss (2 var.)	–	wa-bawng, wa-zu	July–Aug.		X	
17	*Bambusa* sp.	–	wa-kluing	July–Aug.		X	
18	*Basella alba* L.	–	phlow-phli-du	July–Oct.	X		
19	*Benincasa hispida* (Thumb.) Cogn.	Wax gourd	ler-za	Jan.–Dec.	X		
20	*Boesenbergia rotunda* (L.) Mansf.	–	sa-ro	Jan.–Dec.			X
21	*Brassaiopsis ficifolia* Dunn.	–	nawng-ner-khi-ua] / ka-phlu-tai	Jan.–Dec.	X		
22	*Brassica alboglabra* Bailey	Chinese kale	ba-du-phow-muing- lawng	Jan.–Dec.	X		
23	*Brassica chinensis* Jusl. var. *parachinensis* (Bailey)	Flowering white cabbage, Chinese cabbage	ba-du	Sept.	X		
24	*Brassica pekinensis* (Lour.) Rupr. var. *cylindrica*	Celery cabbage	ba-du-ua	July–Aug.	X		
25	*Caesalpinia mimosoides* Lam.	–	phlaing-du	Jan.–Dec.		X	
26	*Cajanus cajans* (L.) Millsp.	Pigeon pea, Angola pea, Congo pea	beu-kli-za	Nov.–Dec.	X		
27	*Canavalia gladiata* (Jacq.) Dc.	–	mi-za	Dec.		X	
28	*Canna edulis* Ker-Gawl.	Australian arrowroot	bo-da-thing	Oct.–Apr.	X		
29	*Capsicum annuum* L. var. *Annuum*	Chili	cher-khe-pha-du	Jan.–Dec.	X		
30	*Capsicum frutescens* L. var. Frutescens	Bird pepper	cher-khe-yu-i	Sept.	X		
31	*Capsicum frutescens* L. var. *Frutescens*	Chili	cher-khe-za	Nov.	X		
32	*Capsicum* sp. (3 var.)	Chili	cher-khe-chawng-shaw, cher-khe-kha-derw-waing-za, cher-khe-ua,	Jan.–Dec.	X		
33	*Carica papaya* L.	Papaya	klo-ji-la	Nov.–Mar.	X		
34	*Centella asiatica* (L.) Urb.	Asiatic pennywort	wawng-xawng-du	Jan.–Dec.			X
35	*Citrus aurantifolia* (Christm. & Panz.) Swingle	Common lime	per-no-klai-za	June	X		
36	*Citrus medica* L. var. *medica*	Citron	sa-zui-la	Jan.–Dec.	X		
37	*Citrus* sp.	–	ma-klaw-za	May –Aug.	X		
38	*Cleome gynandra* L.	Bastard mustard	pha-chiang-du	May	X		
39	*Coccinia grandis* (L.) Voigt	Ivy gourd	ser-mler-du	Jan.–Dec.			X

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source: Cultivated	Food source: Wild	Food source: Cultivated/wild
40	*Coffea* sp.	–	kha-fae-du	Jan.–Dec.	X		
41	*Coriandrum sativum* L.	Chinese parsley	pha-ka-chi-zaing	Oct.	X		
42	*Costus speciosus* (Koen.) Sm.	–	shui-laing-du	Mar.		X	
43	*Crateva magna* Dc.	–	kawng-tha-du	Jan.–May		X	
44	*Cucumis melo* L.	Melon	thi-muing-za	July–Aug.	X		
45	*Cucumis sativus* L. (2 var.)	Cucumber, Sour cucumber	thi-muing, thi-chaing-za	Sept.–Dec.	X		
46	*Cucumis* sp.	–	thi-khwa	Sept.–Oct.	X		
47	*Cucurbita moschata* (Buch.) Poir.	Pumpkin	ler-khe-za	Jan.–Dec.	X		
48	*Curcuma parviflora* Wall. (2 var.)	–	mai-ta-raw-thing, phu-ya-bawng	Jan.–Dec.			X
49	*Cymbopogon citratus* (Dc.) Stapf	Lemon grass	guang-yi	Jan.–Dec.	X		
50	*Dendrocalamus asper* (Roem. & Schlt) Backer ex Heyne	–	wa-kli-zerng	July–Sept.		X	
51	*Dillenia indica* L. (2 var.)	–	khong-za, sa-phlu-za	Apr.–July		X	
52	*Diplazium esculentum* (Retz.) Sw.	–	kai-khu-du	Jan.–Dec.		X	
53	*Dracaena* sp.	–	mi-beu-zawng-thi	Mar.–June		X	
54	*Eichhornia crassipes* (C. Mart.) Solms	Water hyacinth	chuay-thaing-du	Aug.–Sept.	X		
55	*Entada* sp.	–	be-ke-du	Apr.–May		X	
56	*Eryngium fortidum* L.	Stink weed	phla-ker-chi	Jan.–Dec.	X		
57	*Erythropalm scandens* Blume	–	gawng-chu-na-du	Feb.–Apr.		X	
58	*Gnetum gnemon* L. var. *tenerum* Markr.	–	le-khawng-du	Jan.–Dec.		X	
59	*Hibiscus sabdariffa* L. var. *sabdariffa*	Roselle, Red sorrel	che-pong-wo	July–Oct.	X		
60	*Hydrocotyle umbellata* L.	–	sa-nawng-wa-du	Jan.–Dec.		X	
61	*Ipomoea aquatica* Forsk.	Water spinach, Water convolvulus	sa-ni-wo-du	Jan.–Dec.	X		
62	*Kaemferia* sp.	–	phu-bawng-thing	Jan.–Dec.		X	
63	*Lagenaria siceraria* (Molina) Stanley	Bottle gourd	thi-lui-za	Mar.–Sept.	X		
64	*Lasia spinosa* Thw.	–	kawng-khuy-khu-du	Jan.–Dec.		X	
65	*Lemmaphyllum carnosum* (J. Sm. Ex Hook.) C. Presl	–	kawng-thaing-du	Jan.–Dec.		X	
66	*Luffa acutangula* (L.) Roxb.	Angle loofah	dei-lei-za	July	X		
67	*Luffa cylindrica* (L.) M. Roem	–	ther-khu-mai-du	May–June		X	
68	*Lycopersicon esculentum* Mill. (4 var.)	Tomato, Wild tomato	yawng-chaing-za, kha-derw-waing-pa-du, kha-derw-waing-phu, kha-derw-waing-za	Sept.–Oct.	X		

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source		
					Cultivated	Wild	Cultivated/wild
69	*Lygodium flexuosum* (L.) Sw.	–	thu-kaing-khu-du	Apr.–May		X	
70	*Mangifera indica* L.	Mango	xu-la-bawng	Mar–Apr.		X	
71	*Marantha* sp.	–	mer-row-thaing	Oct.–Apr.	X		
72	*Marsilea crenata* Presl.	–	chawng-khu-pei-du	Jan.–Dec.		X	
73	*Melientha suavis* Pierre	–	ze-la-phu-me-la-kla	Apr.-May			X
74	*Mentha cordifolia* Opiz	Mint, Kitchen mint	sho-rer-ni-du	Jan.–Dec.	X		
75	*Morinda citrifolia* L.	Noni	yi-yu-la	Jan.–Dec.	X		
76	*Moringa oleifera* Lamk.	Horse radish tree	ka-maing-der-du	Jan.–Dec.	X		
77	*Mormodica charantia* L.	Balsam pear, Bitter cucumber	mawng-ka-la-du	Jan.–Dec.		X	
78	*Mormodica chochinchinensis* Spreng.	–	bai-khai-du	Jan.–Dec.		X	
79	*Musa* sp.	–	sa-kuy-ya-mei	Jan.–Dec.		X	
80	*Ocimum americanum* L.	Sweet basil	wawng-zai-du	Jan.–Dec.	X		
81	*Ocimum sanctum* L. (2 var.)	Holy basil	waing-ker-phlo, waing-ker-phlo-wo	Jan.–Dec.	X		
82	*Passiflora foetida* L.	–	nawng-thaing-xa-za	Jan.–Dec.		X	
83	*Piper sarmentosum* Roxb.	–	pu-le-la	Jan.–Dec.		X	
84	*Pisum sativum* L.	Sugar pea, Garden pea	bawng-ba-za	Nov. –June	X		
85	*Psophocarpus tetragonolobus* (L.) Dc.	Four-angleed bean	buay-ker-lu-za	Sept.–Oct.	X		
86	*Raphanus sativus* L. var. *hortensis* Baker	Chinese radish	ba-du-thing	July–Aug.	X		
87	*Sauropus androgynus* (L.) Merr.	–	ze-la-phu-du	Jan.–Dec.			X
88	*Solanum melongena* L. (3 var.)	Brinjal, Eggplant	yawng-ju-za, yawng-mu-lai-za, yawng-jiw-za	Jan.–Dec.	X		
89	*Solanum torvum* Sw.	–	yawng-kha-zei-za	Jan.–Dec.	X		
90	*Sphaeranthus africanus* L.	–	kawng-ther-du	Aug.–Sept.			X
91	*Spondias pinnata* Kurz.	–	phai-yu	Jan.–Dec.		X	
92	*Tamarindus indica* L.	Tamarind	mawng-khlong-du	May–June/ Aug./Feb.	X		
93	*Vigna unguiculata* (L.) Walp. Subsp. Unguiculata (4 var.)	Black soya bean, Cow pea, Yard long bean, Asparagus bean	thu-zer, thu-bu-beu, thu-phlaing, thi-kli-zer	Nov.–Dec.	X		
94	–	–	ba-du-gha	July–Aug.	X		
95	–	–	baing-mei-muing	Aug./Nov.–Dec.		X	
96	–	–	baing-za	Nov.	X		
97	–	–	bo-ter-lerw	Jan.–Dec.		X	
98	–	–	chawng-li-la	Jan.–Dec.		X	
99	–	–	chaw-xer-lia-du	Mar.–May		X	
100	–	–	cher-nge-phlo	Sept.–May	X		

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source		
					Cultivated	Wild	Cultivated/wild
101	–	–	cher-nge-waing- thawng-ther	Sept.–May	X		
102	–	–	da-bawng-meu, da-bawng-yu	June–Aug.		X	
103	–	–	di-khawng-du	May–Oct.		X	
104	–	–	jawng-ping-thing-du	Jan.–Dec.		X	
105	–	–	jerw-mei-du	June–July/ Feb.–Apr.			X
106	–	–	kawng-ther-me	May–June		X	
107	–	–	kawng-zong-za	Jan.–Dec.			X
108	–	–	kher-daw-pow	Mar.–May		X	
109	–	–	kher-ta-phae	Feb.–May		X	
110	–	–	khu-khu-la	Nov.	X		
111	–	–	khu-thi-phow	July–Aug.		X	
112	–	–	khwe-bai-za	Mar.–Apr.		X	
113	–	–	khwe-wai	Feb.–Apr.		X	
114	–	–	klu-pho	Nov.		X	
115	–	–	kre-neng-za	Oct.–Nov.	X		
116	–	–	ku-bawng-du	Mar.–July		X	
117	–	–	kwa-jawng-kung	May–Sept.		X	
118	–	–	kwa-phu-chaing	Jan.–Dec.		X	
119	–	–	la-phlow	Nov.	X		
120	–	–	la-zu-za	Nov.	X		
121	–	–	le-kha-la	Jan.–Dec.	X		
122	–	–	li-wo-du	Feb.–June		X	
123	–	–	ma-pho	Feb.–June		X	
124	–	–	mawng-pho-du	Jan.–Dec.		X	
125	–	–	me-gawng-muing	Feb.–Apr.		X	
126	–	–	mia-pher-la-du	Apr.–May		X	
127	–	–	mi-du-zawng	Mar.–Apr.		X	
128	–	–	ming-beu-zawng-laing	Jan.–Dec.		X	
129	–	–	na-ker-wawng	July–Nov.	X		
130	–	–	nawng-kha-du	May–Sept.		X	
131	–	–	nawng-ner-khi-wow	Jan.–Dec.	X		
132	–	–	nawng-thu-l-yu	Jan.–Dec.		X	
133	–	–	nawng-thu-lui	Feb.-Mar.		X	
134	–	–	nawng-wai-du	Apr.–May		X	
135	–	–	nawng-za	June–July/Sept.		X	
136	–	–	ne-dong-phaing-thing	Feb.–Mar.	X		
137	–	–	pher-cha-chai-du	Jan.–Dec.		X	
138	–	–	pher-ki-mu	Jan.–Dec.	X		

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source: Cultivated	Wild	Cultivated/wild
139	–	–	phlaeng-ker-daing-du	June–Aug.		X	
140	–	–	phle-khu-zer	Feb.–Apr.	X		
141	–	–	pho-ke	May–Oct.	X		
142	–	–	phu-du	Jan.–Dec.		X	
143	–	–	phu-jer-du	Jan.–Dec.		X	
144	–	–	phu-jer-pho	Jan.–Dec.		X	
145	–	–	phu-ju-khai	June–Feb.		X	
146	–	–	phu-pheng-du	June–Aug.		X	
147	–	–	phu-yu-eng	Jan.–Dec.		X	
148	–	–	phu-ze-ze-du	Jan.–Dec.	X		
149	–	–	sa-na-sa-rai-du	Jan.–Dec.		X	
150	–	–	sa-ni-wa-du	Jan.–Dec.		X	
151	–	–	sa-zuay	Jan.–Dec.		X	
152	–	–	sa-zuay-la	June–July		X	
153	–	–	sa-zung-du	Jan.–Dec.	X		
154	–	–	shaw-ai-du	May–June		X	
155	–	–	show-shuay-du	Jan.–Dec.		X	
156	–	–	soy-pha-ku	Jan.–Dec.		X	
157	–	–	tawng-za	Mar.–June		X	
158	–	–	ter-pow-ter-na-du	Mar.–May		X	
159	–	–	thaing-laing-dong-za	Aug.–Nov.		X	
160	–	–	tha-thaw	Jan.–Dec.		X	
161	–	–	ther-du	Jan.–Dec.	X		
162	–	–	ther-ku-za	Nov.	X		
163	–	–	thi-du	Jan.–Dec.		X	
164	–	–	thu-lu-khaing-meung	Jan.–Dec.		X	
165	–	–	thu-pho-muing-chaing	Jan.–Dec.		X	
166	–	–	thu-taw-hawng	Nov.–Mar.	X		
167	–	–	ua-khu-du	Feb.–Apr.		X	
168	–	–	wa-kli	July–Aug.		X	
169	–	–	wa-mi	July–Aug.		X	
170	–	–	xa-di-du	Apr.–May		X	
171	–	–	xa-zing-du	Jan.–Dec.		X	
172	–	–	xer-ai	July		X	
173	–	–	xer-beu-phong	July		X	
174	–	–	xer-cha	May		X	
175	–	–	xer-chong	May		X	
176	–	–	xer-ka-chawng-zer	Sept.		X	

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source: Cultivated	Food source: Wild	Food source: Cultivated/wild
177	–	–	xer-khi-bawng	July		X	
178	–	–	xer-ku-bawng	June		X	
179	–	–	xer-maing-du	May–July		X	
180	–	–	xer-pher	July		X	
181	–	–	xer-phlong	June		X	
182	–	–	xer-thu-xwe	June		X	
183	–	–	xer-wa-khu	Sept.		X	
184	–	–	xer-wing-za	Oct.–Nov.	X		
185	–	–	xer-za	July–Aug.		X	
186	–	–	zaing-ner-mer	Jan.–Dec.		X	
187	–	–	zer-baw-du	Jan.–Dec.		X	
188	–	–	zer-khu-za-wo-bung	Jan.–Dec.	X		
189	–	–	zer-na-za	Jan.–Feb.		X	
190	–	–	ze-yawng-kha	May–June		X	
191	–	–	zi-khwai-du	May–June		X	
	Fruits						
1	*Aegle marmelos* (L.) Corr.	Bael fruit	ping-za	Mar.–May	X		
2	*Anacardium occidentale* L.	Cashew nut	xu-zei-kheu-za	Mar.–May	X		
3	*Annanas comosus* (L.) Merr.	Pineapple	na-ra-za	Jan.–June	X		
4	*Artocarpus heterophyllus* Lamarck (2 var.)	Jackfruit	nuay-xu-za, nuay-phlae	Apr.–May	X		
5	*Artocarpus* sp.	–	nuay-pha-za	May–July		X	
6	*Averrhoa carambola* L.	Carambola	khaing-khong-za	Jan.–Dec.	X		
7	*Baccorea ramiflora* Lour.	Burmese grape	sa-chu-za	Apr.–May		X	
8	*Bouea macrophylla* Griff.	–	xawng-za	Mar.–May	X		
9	*Carica papaya* L.	Papaya	klerw-ji-za	Jan.–Dec.	X		
10	*Castanopsis diversifolia* DC.	–	zi-za	May–July		X	
11	*Citrus grandis* (L.) Osbeck	Pomelo, Shaddock	zong-u-za	June–July/ Sept.–Dec.	X		
12	*Citrus reticulata* Blanco	Tangerine, Sour mandarin	to-za	Sept.–Oct.	X		
13	*Citrus sinensis* (L.) Osb.	Acidless sweet orange	li-mung-za	Sept.–Oct.	X		
14	*Clerodendrum infortunatum* L.	–	kwa-phu-chaing	July–Aug.		X	
15	*Cocos nucifera* L.	Coconut	phlo-za	Jan –Dec.	X		
16	*Cucumis melo* L.	Melon	thi-muing-za	Aug.–Sept.	X		
17	*Durio zibethinus* L.	Durian	tu-re-za	May–Sept.	X		
18	*Elaeagnus latifolia* L.	–	thong-za	Mar.–Apr.			X
19	*Ficus chartacea* Wall. Ex King var. *torulosa* wall.	–	ding-za	Jan.–Dec.		X	

Continued

Table 8.2 *(continued)* **Karen traditional food** *(387 species/varieties)*

	Scientific name	English/common name	Karen name	Seasonality*	Food source		
					Cultivated	Wild	Cultivated/wild
20	*Ficus* sp. (2 var.)	–	ku-na-l-za, ku-ye	Jan.–Dec.		X	
21	*Flueggea virosa* (Roxb. Ex Wild.) Voigt.	–	ming-thawng-phla-za	May–July		X	
22	*Litchi chinensis* L.	Litchi	phong-mi-za	Apr.–June			X
23	*Mangifera indica* L. (6 var.)	Mango	xu-daing-ya-za, xu-dow-za, xu-eu-paw, xu-perw-lerw, xu-thi-khaw-za, xu-tawng-phaing	Mar.–May	X		
24	*Musa sapientum* L. (13 var.)	Banana	sa-kuy-phla-l-ji-awng, sa-kuy-phla-phri, sa-kuy-pi-la, sa-kuy-thong, sa-kuy-thung-lung-za, sa-kuy-xwa, sa-kuy-yawng-kerw, sa-kuy-daing-to, sa-kuy-phla-kwa, sa-kuy-xlae, sa-kuy-ya-chaing, sa-kuy-ya-wo, sa-kuy-phla-pher-taing	Jan.–Dec.	X		
25	*Nephelium lappaceum* L. (2 var.)	Rambutan	phong-zu-me, phong-zu-za	April–June			X
26	*Passiflora foetida* L.	–	nawng-thaing-xa-za	May–Aug.		X	
27	*Phyllanthus acidus* (L.) Skeels.	Star gooseberry	ma-yom	Jan.–Dec.	X		
28	*Physalis angulata* L.	Ground cherry	yawng-shi-pong	Feb.–Apr.		X	
29	*Psidium guajava* L. (2 var.)	Guava	lia-awng-ka-wo-za, lia-awng-ka-za	Mar.–May	X		
30	*Saccharum officinarum* L.	Sugar cane	chi-phu	Jan.–Dec.	X		
31	*Salacca wallichiana* C. Mart.	–	khong-za	Mar.–June			X
32	*Sandoricum koetjape* (Burm. F.) Merr.	Santol	du-za	June–July		X	
33	*Schleicheraoleosa* Oken.	Ceylon oak	ker-zong-za	June–July		X	
34	*Syzygium* sp.	–	ming-za	Mar.–Apr.		X	
35	*Ziziphus* sp.	–	laing-ju-mi-za	May		X	
36	–	–	ku-maw-puay-chaw	Jan.–Dec.		X	
37	–	–	kwa-jawng-kong	May		X	
38	–	–	nawng-za	Sept.		X	
39	–	–	per-thu-za	June–July		X	
40	–	–	phi-za	July–Aug.		X	
41	–	–	pi-laew	June		X	
42	–	–	yawng-mua	June			X

* Seasonality varies with variety.
– No data.

6 fruits). All the traditional foods – local species or foods which were available in the village, cooked in traditional ways and accepted by local people (Kuhnlein and Receveur, 1996) – can be identified in the Karen language, 258 species/varieties of which could be identified by their Thai names, 233 species/varieties by their scientific names, and 141 species/varieties by their English names. Of these, 108 species/varieties have basic nutrient and micronutrient information available. Table 8.2 presents the list, as complete as possible, for the Sanephong Karen food system. It is important to note that many food species do not have scientific identifications or English names. There is an obvious abundance of diversity of foods within traditional Karen knowledge in the region, but much scientific work remains to be done.

Seasonality

Carbohydrate food sources were plentiful and available throughout the year in Sanephong. Harvesting rice and other carbohydrate sources (45 varieties, i.e. corn, potato and taro) usually took place during the cool season (October–January). Most households store these foods for year-round consumption. Because of several factors, including land control, intensive labour, technological investment and inadequate rainfall, rice production increasingly became a complex issue for the local people since there were many households that no longer produced enough rice for their own consumption.

Vegetables (leaves, shoots and flowers) were also abundant in Sanephong, with 57 species/varieties reportedly available year-round, 86 species/varieties in the dry season, 108 species/varieties in the wet season and 75 species/varieties in the cool season. Fruits (21 species/varieties), such as banana, papaya, star fruit and coconut, were available year-round. Only during the dry season vitamin-rich fruits (23 species/varieties), including mango, guava and jackfruit, were available. Fruits (17 species/varieties), such as santol, wild rambutan and durian, were found in the wet season, both wild and cultivated.

Fish, snails, shrimp, crabs, frogs and other aquatics animals (31 species/varieties) were found naturally throughout the year and were commonly eaten in Sanephong. During the wet season (June to September), there were more varieties and greater quantities available. Fish was the most important protein source for the locals. Domesticated fowls, wild insects, goats and wild animals were also available and consumed in this community.

Food processing, preservation and cooking methods

Home-pounded rice was more common than milled rice. Boiling and then rinsing was the method used for cooking rice. Sticky rice was commonly used for dessert, usually steamed or boiled with coconut milk. Karen preferred to eat fresh or boiled vegetables rather than stir-fried vegetables. In general, vegetables were not preserved because of the fact that there were plenty of them available. Some vegetables like *pak-koom* (crataeva leaves) and *pak-sian* (bastard mustard leaves) were preserved using a salting technique. Sun-dried chili is also popular among the locals. Occasionally, fruits such as banana and *ma-prang* (gandaria, marian plum) were sun dried, but otherwise fruits were mainly eaten fresh. However, for fish and other meats preservation, such as sun drying, salting and souring fermentation, were common in the village. Fermentation was also used for preserving some varieties of beans, such as *bai-sa*.

Food consumption

In Sanephong, most people ate two or three meals a day. Family members usually ate together with each person having his/her own individual rice plate. They shared two or three main dishes, for example, fresh or boiled vegetables and *nam-prick* or *prick-tum* (chili, salt, monosodium glutamate) and a bowl of soup (left-over water from boiling vegetables with a small amount of salt and/or monosodium glutamate). Thus, the food consumption pattern in Sanephong was generally monotonous with a large amount of rice, vegetables and chili as major ingredients in local menus. Animal protein sources were available but not plentiful. When available, the local people liked to cook spicy fish soup (water, fish, red onion, garlic, chili and vegetables). Fat and oil were used less in their cooking. Some

Table 8.3 New nutrient data of Karen foods and potential dietary contributions

	English name	Karen name	Scientific name	Serving size*	Nutrients per serving (% Thai RDI)									
					Iron		Ca		Vitamin A Equivalent**		Vitamin C		Folate	
				g	mg		mg		µg		mg		µg	
1	Shellfish	Khlu-mi	Unidentified	35	5.8	(39)	112	(14)	–	–	–	–	–	–
2	–	Pak-man-mu or Le-khawng-du	*Gnetum nemon* L. var. *tenerum* Markr.	50	0.7	(5)	26	(3)	92	(15)	25	(42)	35.5	(18)
3	–	Kawng-thaing-du	*Lemmaphyllum carnosum* (J. Sm. Ex Hook.) C. Presl	50	1.35	(9)	46	(6)	61	(10)	2	(3)	18	(9)
4	–	Sa-ni-wa-du	Unidentified	50	1.1	(7)	124	(16)	19	(3)	2.5	(4)	8	(4)
5	–	Yawd-fak-kao or Bai-khai-du	*Mormodica chochinchinensis* Spreng.	50	0.45	(3)	57	(7)	77	(13)	73.5	(123)	86.5	(43)
6	–	Ther-khu-mai-du	*Luffa cylindrica* (L.) M. Roem.	50	1.1	(7)	65.5	(8)	62	(10)	2.5	(4)	32	(16)
7	Citron	Bai-ma-ngua or Sa-zui-la	*Citrus medica* L. var. medica	50	2.1	(14)	373.5	(47)	49	(8)	37.5	(60)	37	(19)
8	–	Gawng-chu-na-du	*Erythropalm scandens* Blume	50	0.75	(5)	79	(10)	39	(7)	2	(3)	28	(14)

– No data.
* Serving size derived from 24 hour dietary recall method.
** Beta-carotene 12 µg = 1 µg Vitamin A (IVACG, 2004).
Note 1: Thai Recommended Daily Intakes (Thai RDI) for children six or more years of age (Food Control Division, 1998).
Note 2: Food item is considered a good source of a nutrient if one serving meets 10-19% of the Thai RDI and excellent source if one serving meets ≥20% of the Thai RDI.

popular fried dishes included fried fish, fried egg and stir-fried vegetables, i.e. fern or *kai-khu-du* (*Diplazium esculentum* [Retz.] Sw.), *pak-man-mu* (*Gnetum gnemor* L. var. tenerum Markr.) (dark green leaves), bamboo shoot, banana flower, etc. Coconuts were grown in the village, and coconut milk was commonly used in dessert recipes (i.e. steamed sticky rice with coconut milk and durian cooked with coconut milk). Traditional dishes, such as *kanom-jene-nam-ya* (rice noodle with spicy soup) and *ka-bong-jo* (fried bamboo shoots mixed with curry paste and rice flour), were still popular in Sanephong.

Traditional foods with high potential

Rice, corn, taro, potato, fish, coconut milk and oil were key traditional foods providing macronutrients (carbohydrate, animal protein and fat). As for key micronutrients, the main sources were vegetables (208 species/varieties) and fruits (62 species/varieties). For example, vitamin A and vitamin C were found to be high in young papaya leaves, young bitter gourd leaves, cassava leaves, ivy gourd, swamp cabbage, noni leaves, Chinese cabbage and pumpkin. Mango, ripe papaya, guava, star fruit, ripe banana and pomelo were also rich in beta-carotene (vitamin A equivalent) and vitamin C. Iron and calcium-rich foods included wild game, green frogs and crickets (Puwastien *et al.*, 1999).

From these food items, 19 animal and plant species/varieties were submitted for nutrient analysis. Results indicated that eight species are high in minerals and vitamins when considering both nutrient density and portion size consumed compared against the Thai Recommended Daily Intakes (Thai RDI – Food and Drug Adminstration of Thailand, Food Control Division, 1998). *Khlu-mi* (a kind of snail) was found to be high in iron (≥20 percent Thai RDI) and calcium (10–19 percent Thai RDI). *Pak-man-mu* was found to be high in vitamin C and is a good source of beta-carotene and folate. *Yawd-fak-kao* (*Momordica chochinchinensis* Spreng) (young leaves) is also high in vitamin C and folate and is a good source of beta-carotene. *Bai-ma-ngua* (*Citrus medica* L. var. *medica*) (dark green leaves) is high in vitamin C and calcium, and is also a good source of iron and folate. *Ther-khu-mai-du* (*Luffa cylindrica* [L.] M. Roem) is a good source of vitamin A and folate. *Gawng-chu-na-du* (*Erythropalm scandens* Blume) is a good source of calcium and folate. *Kawng-thaing-du* (*Lemmaphyllum carnosum* [J. Sm. Ex Hook.] C. Presl) is a good source of vitamin A. *Sa-ni-wa-du* (dark green leaves) is a good source of calcium (Table 8.3).

Little used or currently unused traditional Karen food items

The Sanephong Karen identified five traditional foods as being little used or unused food items in their community. They mentioned that *bai-sa* (a kind of bean) was one of the neglected items. Sesame was commonly used for cooking oil previously, but most people used palm oil instead at the time of this study. In addition, they mentioned that some varieties of bananas were disappearing. A kind of traditional cereal was no longer available because of drought. Some varieties of wild birds, such as *nok-tu-kai*, were rarely found in the surrounding forest.

Understanding food-use patterns

Infant-feeding and infant foods

In summer 2005, all infants (n = 24) were reportedly breastfed from birth up to two months. Eighteen of these infants (75 percent) were reportedly given colostrum. At six months, 22 infants (92 percent) were still breastfed. No underweight (weight for age) was found in infants less than seven months old. Twenty-one children over one year old (87 percent) were breastfed. Since breastmilk alone was no longer adequate after six months, one child younger than one year old (8 percent) and nine children between one and two years (36 percent) were found to be underweight.

Complementary food

Half of the infants in this study received complementary food rather late. Moreover, they received mainly rice mixed with watery soup (from boiling vegetables). The other cohort of infants also received complementary food that was low in both amount and frequency. Therefore, complementary food practices in this community need improvement in both quality and quantity, especially among children between one and two years old.

Dietary intakes of children

Mean energy intakes of Sanephong children did not meet the Thai DRI (58 percent of Thai DRI for children 6–11 months, 50 percent for one to two years, 56 percent for two to five years and 69 percent for 5–12 years). Carbohydrate intakes comprised more than 70 percent of the total energy intake among children over one year old. Protein intakes were inadequate among children one to two years old (mean intake at 48 percent Thai DRI), but were adequate in other groups (70 percent of Thai DRI for 6–11 months, 72 percent for two to five years and 78 percent for 5–12 years). Most of the protein consumed by the children zero to two years old came from breastmilk. Children over two years of age reportedly received more protein from plant sources than from animal sources (more than two times/week); their fat intakes were low as well, at 15–20 percent of energy.

Vitamin A intakes were found to be adequate in children between six months and two years old because of their intake of breastmilk (mean intake at 103 percent Thai DRI for 6–11 months, 76 percent Thai DRI for one to two years). For children 2–12 years old, vitamin A intakes were found to be extremely low during the dry season (mean intake at 13 percent Thai DRI for two to five years, 16 percent for 5–12 years). These low vitamin A intakes, together with low fat intakes, indicated that sub-clinical vitamin A deficiency might exist among many children over two years of age in this community. Also, vitamin C intakes were found to be adequate in children under two years old, again due to breastmilk (mean intake at 99 percent Thai DRI for 6–11 months, 78 percent for one to two years), but very low in children over two years of age (28 percent Thai DRI for two to five years, and 52 percent for 5–12 years).

Iron intakes were undoubtedly inadequate among the children (mean intake at 29 percent Thai DRI for one to two years, 35 percent for two to five years, 42 percent for 5–12 years). Moreover, most of the iron came from plant sources, such as rice and vegetables. Calcium intakes were extremely low (mean intake at 22 percent Thai DRI for one to two years, 8–9 percent for 2–12 years). Nevertheless, large amounts of rice contributed to adequate thiamine intakes in children of 5–12 years old (mean intake at 80 percent Thai DRI).

Children's nutritional and health status

Overall nutritional status of children suggested chronic and acute malnutrition problems: 20 percent stunting (n = 37), 14 percent underweight (n = 26), 5 percent thin (n = 9), with only 1 percent overweight (n = 2) in the village (Table 8.4). Children under one year of age were fine in both terms of nutrition and health status. No underweight was found among infants (under 12 months old); however, three infants less than 11 months old were stunted and one infant was overweight at 11 months old. For children between one and two years old, 27 percent were underweight, 5 percent were stunted and 50 percent reported sick. For pre-schoolers (two to five years old), 18 percent were underweight and 24 percent were stunted and there was a morbidity (reported sick) rate of 45 percent. Among school children (5–12 years old), 11 percent were underweight, 21 percent were stunted and there was a 32 percent morbidity rate. Physical examination among these children indicated 11 percent anemia, 0.5 percent visible goitre, 0.7 percent night blindness, 3 percent angular stomatitis, 65 percent dental carries and 6 percent gum bleeding.

Food perceptions and beliefs

The interviews and the card pile sort exercise showed that Karen women were found to believe white rice to be an important and healthy food, especially for pregnant and lactating mothers and young children, and fish was seen to be important for healthy brain development. A kind of soup, *kang-leang-hua-plee* (made with banana flower, fish, pepper and plenty of water), was reported to increase breastmilk during lactation. Vegetables, such as fern, ivy gourd, *bai-ma-ngu* (*Citrus medica* L. var. *medica*), *pak-man-mu* (*Gnetum nemon* L.var. *tenerum* Markr.), rosella leaves and *sa-ni-wa-du* (a kind of dark green leaves), were considered good for health. Fruits such as pineapple, banana, ripe papaya,

Table 8.4 Health and nutritional status of 0–12 year old children in Sanephong village

	No. cases *(% within total sample)*		***No. cases*** *(% within age category)*							
			< 1 yr		*1 < 2 yr*		*2 < 5 yr*		*≥ 5 yr*	
Total sample	***185***	***(100)***	***12***	***(100)***	***22***	***(100)***	***51***	***(100)***	***100***	***(100)***
Underweight	26	(14)	0	(0)	6	(27)	9	(18)	11	(11)
Stunting	37	(20)	3	(25)	1	(5)	12	(24)	21	(21)
Thin	9	(5)	0	(0)	1	(5)	4	(8)	4	(4)
Overweight	2	(1)	1	(8)	0	(0)	0	(0)	1	(1)
Visible goiter	1	(0.5)	0	(0)	0	(0)	0	(0)	1	(1)
Angular stomatitis	5	(3)	0	(0)	0	(0)	0	(0)	5	(5)
Reported sick	69	(37)	3	(25)	11	(50)	23	(45)	32	(32)
Anaemia (n=47)*	5	(11)	0	(0)	0	(0)	0	(0)	5	(5)
Reported night blindness (n=145)*	1	(0.7)	0	(0)	0	(0)	0	(0)	1	(1)
Reported gum bleeding (n=182)*	10	(6)	0	(0)	0	(0)	0	(0)	10	(10)
Dental caries (n=179)*	116	(65)	1	(17)	3	(14)	26	(51)	86	(86)

* Number of children examined for this parameter; otherwise n = 185.

ripe mango, guava, young coconut, salak palm, star fruit and pomelo, were also reported as being good for health. However, too many fruits were known to cause abdominal discomfort in adults and diarrhea in infants. There were also taboos connected to giving fruits to young children with fever and malaria.

It was felt that lactating mothers and young children should not eat too much starchy food, such as corn, taro, potato and pumpkin, which can cause abdominal discomfort and/or diarrhea. Further, if lactating mothers ate some young leaves like mango leaves, *yawd-ma-kok* (*Spondias pinnata* Kurs) and noni leaves, their infants might become ill. It was reported that pregnant and lactating women, as well as young children, should avoid wild animals, i.e. reptiles, insects and aquatic animals (like frogs, turtles, crabs and snails). Nevertheless, many mentioned that food taboos should not apply generally since it also depends on each individual; for example, they said that some got ill while some did not by consuming the same foods.

From pregnant mothers' points of view, white rice, fish, pork, chicken, eggs, milk and some vegetables, such as fern or *kai-khu-du* (*Diplazium esculentum* [Retz.] Sw.), *pak-man-mu* and rosella leaves were good foods. Fruits, including banana and ripe papaya were mentioned as good for infants and mothers to keep them healthy and strong. Some mothers also said that corn, taro, potato and pineapple should not be eaten, as they can cause indigestion, abdominal pain and diarrhea. Wild animal meats were noted as being harmful to both infants and pregnant women.

Mothers of pre-school children suggested that white rice, pork, ripe papaya, guava and *pla-seou* made their children healthy and strong. *Pla-tid-hae* or *ya-ber-za* (*Mystacoleucus marginatus*), *pla-tong-na* or *ya-sai-tawng-kaw* (*Cyclocheilichthys apogon*), *pla-seou or ya-sai-a-i* (*Dangila siamensis)*, *pla-vien* or *ya-mung* (*Tor* sp.), *pla-kod* or *ya-chu* (Yellow mystus, *Hemibagrus nemurus*) (types of fish), ivy gourd, fern or *kai-khu-du* (*Diplazium esculentum* (Retz.) Sw.), *yawd-buab-pa* or t*her-khu-mai-du* (*Luffa cylindrical* (L.) M. Roem.), cabbage, cucumber and Chinese cabbage were food items that pre-school children preferred. Banana, ripe mango, papaya, pineapple, pomelo, wild pig and wild chicken were important food taboo items not to be consumed during fever and malaria. For healthy adults, white rice, fish such as *pla-vien*, *pla-kod*, *pla-tong-na*, *pla-seou*, *pla-kung* or *snakehead* (*Channa limbata*), egg, fern, ivy gourd, ripe papaya and young coconut were important foods.

Understanding food practices, behaviours and other related issues

Pregnant women

Most pregnant women in Sanephong received prenatal services at the district hospital. However, they did not often practise the hospital's recommendations, especially regarding diets. Most women reportedly ate as usual during their pregnancies (low in both protein and energy). Food beliefs and food taboos did not generally exert much power among these mothers, reflected in such comments as, "I eat whatever I feel like." They presented as having positive attitudes toward certain foods, especially dark green leafy vegetables. Compliance in taking iron supplements was also low. Some women had negative attitudes toward the supplementation because of side effects (reportedly dark coloured faeces and vomiting). Some mothers said how they would like their babies to be healthy and strong but admitted that they did not know how to achieve this.

Lactating mothers

Food beliefs appeared to be stronger among this group, especially on foods that they believed will help increase breastmilk. Mothers tended to eat more (i.e. rice, fish and other meats, except wild animal meats) during this period. A few days after delivery, mothers drank "spirit water" to reduce abdominal discomfort. Herbal medicine was said to be helpful for strength and blood, especially for those who were considered weak. Most mothers still believed that "heat" was important for their bodies and future health, so they usually practised a tradition called *U Fai* for one to two weeks after delivery. During *U Fai* , a small fire would be kept burning continually under the bed of the mother. She would rest on the bed allowing the heat from the fire to heal her internally. During this period, many women normally took only warm water and rice with salt. Traditional midwives and herbal medicine practitioners were influential among these mothers.

Children zero to four months old

All mothers gave colostrum to their children. Most mothers gave only breastmilk until their children were about three months old. Some mothers were already giving mashed rice with banana or salt or clear soup to their children at this age, and comments such as, "With a full stomach, babies will have sound sleep. These children are easy to raise", reflect their approach.

Children 5–12 months old

Most mothers gave mashed rice with salt, clear vegetable soup or banana to children at this age. Sometimes, they gave ripe papaya or mango as well. Usually, children were given two meals a day. Many mothers seemed not to put much effort into raising their children at this stage.

Children one to five years old

When children were about one year old, their mothers often allowed them to join family meals. They would not allow the children to eat spicy dishes until the age of three, when children often ate boiled eggs, vegetable soup, pork and fish. Vegetable soup with fish or egg was observed to be the favourite dish of children between one and three years old. Though some mothers prepared food for their children, most children after three years of age in Sanephong made their own food choices. Moreover, many children asked their mothers to buy snack foods (i.e. rice crackers, jelly, potato chips, etc.) for them. Mothers reportedly purchased these foods from small shops in the community because "children like these snack foods".

Children 6–12 years old

From six years old onward, Sanephong children ate like adults at their family meals. They enjoyed more varieties of foods and tended to eat more than those of a younger age. In school, more nutritious recipes, such as noodles, iron-rich soups, etc., were introduced. Milk was also provided to all students; however, it was mentioned that a number of children did not like to drink the school milk. Some children reportedly vomited or got diarrhea after drinking the milk. Snack foods were still significant food items for the children. At this age, they seemed to prefer fried and stir-fried food items as well.

Conclusion and recommendations

Based on these preliminary results, it is necessary that children and mothers in Sanephong improve their diets to promote better nutrition and health. This improvement can certainly be built upon the community's available food sources, with the possible exception of iron-rich food. Moreover, it will be essential to promote culturally appropriate childcare practices among community mothers and/or caretakers. Mother and child interaction is considered most critical, as this relates directly to quality of snack consumption among the children. In the short term, school intervention with an emphasis on nutritious local and modified traditional dishes should be most feasible. These interventions should be participatory and educational by design, with a strong emphasis on promoting strong involvement of the locals in all stages of the intervention.

Community-wide intervention is necessary as the second step. However, this intervention will not be possible without increased participation of local Karen, especially their leaders. Unlike Indigenous Peoples in developed nations, the Karen in Sanephong have been living with high food insecurity for many years, especially after the Thai government established the Thung Yai Naresuan National Park in order to preserve wildlife and natural resources. Throughout the years, there has been constant tension between the community and local forest officers because the Karen did not agree to move to a newly established location as suggested. This situation makes it difficult for the Sanephong Karen to trust outsiders (including those working for Karen well-being, such as the research team). Continuous migration of the Karen across the border from Myanmar through this community has also put the local government on high alert for security reasons. Thus, community-wide intervention can be complicated and should proceed only when the community is ready.

At a workshop where the research team presented preliminary research results, Sanephong representatives showed their willingness to support further intervention. However, it was also obvious from the discussion that a deeper understanding of their culture and ways of thinking are necessary for future successful collaboration. More insight into these aspects is essential if appropriate and useful development is to be achieved in this community. During this preliminary study, it was not possible to explore this further because significant time would be required to build trust in this context. Without these insights, it is unlikely that any community interventions could result in any significant improvement for the Karen people.

From a long-term perspective, it can be said that Sanephong is indeed faced with many "silent" challenges. According to community leaders, they foresee that food insecurity will be a significant problem within the next 20 years if the population in their community continues to increase at its current rate, and if current farming methods are continued in their present form. In the past, Sanephong was an autonomous community, in that the people's ways of life were mostly separated from the mainstream culture because of the distance to other communities. At the time of the study, the situation was changing rather dramatically as more and more people, especially the young, worked for cash outside their community. Thus, community leaders not only expressed their ongoing concern about their land and environment sustainability, but also about their culture and tradition, their self-reliance, their food diversity and security, and especially about the existing strong bond within their community. With this perspective, a holistic developmental approach addressing all these concerns, together with a strong emphasis on appropriate cultural development, is most certainly urgently needed for the Karen in Sanephong village, Kanchanaburi province in western Thailand.

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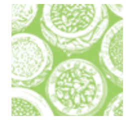

Chapter 9

Traditional food system of Dalit in Zaheerabad Region, Medak District, Andhra Pradesh, India

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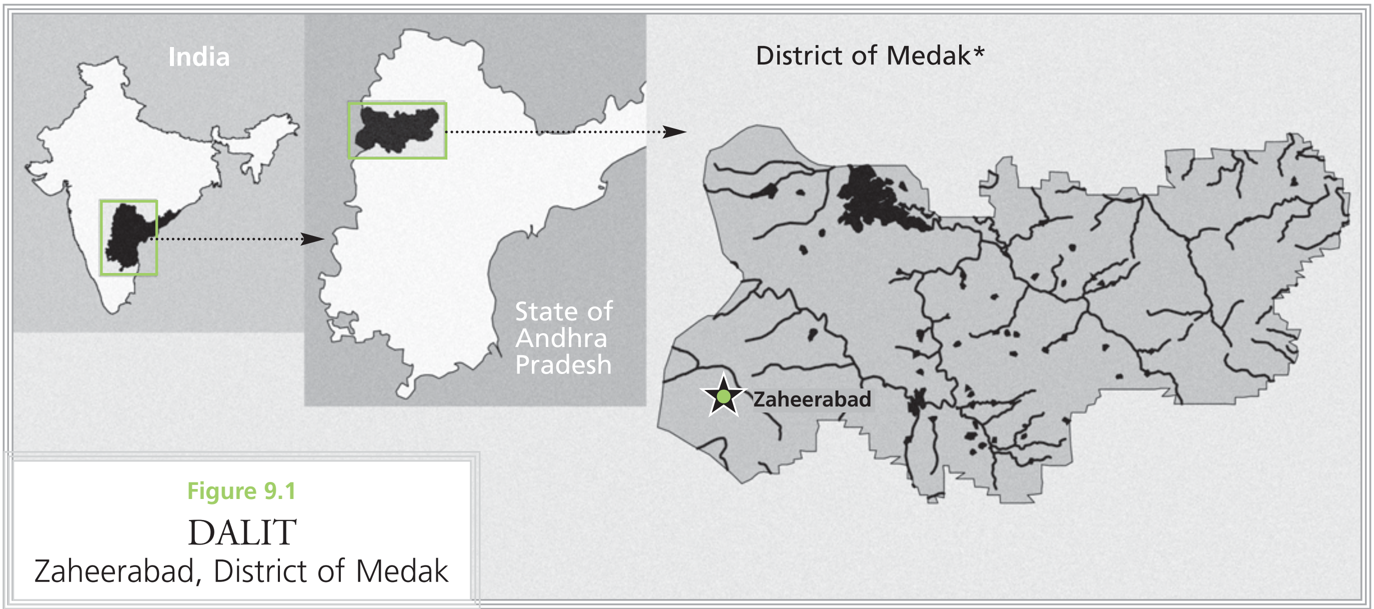

Figure 9.1

DALIT

Zaheerabad, District of Medak

Data from ESRI Global GIS, 2006.
Walter Hitschfield
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Deccan Development Society (DDS), Begumpet, Hyderabad, Andhra Pradesh, India

Photographic section >> XXVII

“Aakurololla chala balam unnadi, memu vati medi periginamu.”

“Greens give us strength, we grew up on them.”

Edulapally Bayamma, a community member (Telugu language)

Abstract

The Dalit traditional food system in the Zaheerabad region has survived, largely as a result of conservation and the continuation of rich agro-biodiversity by women, which not only yields high-quality food and medicine for humans, but also high-quality fodder and medicine for animals, and high soil fertility which accommodates a host of nutritious, uncultivated foods.

The Dalit food list includes an extensive variety (329 species/varieties) of cereals, millets, pulses, oil seeds, fruits, vegetables, greens, roots and tubers. Roots, leaves, flowers, fruits, gums and bark are consumed seasonally. A rich variety is seen in processing methods: cooking, smoking, roasting, boiling, sun drying, shade drying, shallow frying and deep frying.

The nutritional contribution of the Dalit food system is fascinating as many of the foods are uncultivated and are considered weeds by the scientific community. The wild fruit contribution to the food system helps to create a respect for the surrounding environment of the village and nurtures an appreciation for nature in the younger generation. New nutrient data are presented for 21 greens and 15 wild fruits. Medicinal uses for 12 plants are given. Food and nutrient profiles of Dalit women were found to be acceptable and demonstrated that the food system supports community health.

Introduction

The Zaheerabad region of Medak District in the South Indian State of Andhra Pradesh is situated in a semi-arid region. Andhra Pradesh is the fifth largest state in India, with Hyderabad the capital city. Medak District is located northwest of Hyderabad and one of ten districts of Telangana region of Andhra Pradesh, it lies between 17° 27’ and 18° 18’ northern latitude and 77° 28’ and 79° 10’ eastern longitude (Figure 9.1). The total geographical area of the district is 9 699 sq km, accounting for 3.5 percent of the total area of the state. The district has 1 265 villages and ten towns, with a population of more than two million (Registrar General & Census Commissioner, 1991).

Though semi-arid, lands here can receive erratic and heavy seasonal rainfall. Soils are highly degraded with soil depths in most places of less than 6 inches. Red soils dominate the land and productivity is regarded as generally low. Farmers report to feel extremely lucky if an acre of land produces 2 quintals (100 kg) of sorghum (cereal), and food security of the poor who mainly own these types of lands is threatened regularly. However, the Dalit of Zaheerabad have engaged in rural development activities to improve their nutrition. It is in this context that this research addresses agriculture of the poor and the role of uncultivated and wild food.

The scheduled caste representing the untouchables, called Dalit, is below the major four classes in the Hindu religion (Seenarine, 1996) with the majority living in extreme poverty and landless, illiterate and working as farm labourers (Annamalai, 2002). The Indian National Family Health Survey reported 17 percent of Dalit women to be short in stature and 42 percent to have chronic energy deficiency (International Institute for Population Sciences, 2000).

Agriculture of the poor in this district is characterized by consumption of many diverse plants, with a minimum of 8–12 crops being grown at the same time within the same field space. The symbiotic relationship between these crops can be seen in a wide range of issues: soil management, fertility management, internal cycle of inputs, pest control, labour management, diet management, risk insurance and many others. Farmers also look at their diverse field crops and wild foods from a spiritual point of view, and as a way of celebrating nature and establishing a communion with it. Over the millennia, uncultivated foods and wild foods have been an essential part of life for the poor in this region.

In this chapter, the phrase "uncultivated greens" may refer to edible green leafy plants growing naturally on the land and in uncultivated fields, partner crops in a cultivated field, or those available from cultivated plants but which are not the explicit objective of the cultivation. These are harvested at no cost by Dalit women farmers and consumed as vegetables, thus providing a rich source of nutrition and a source of food security. Reference to "wild" foods are to those not associated with agriculture and taken from forests or other non-agricultural spaces.

Background

Historical note

Medak was originally known as Methuku Durgam and was subsequently changed to Methuku because of the fine rice produced in this area. The Medak district first became part of the Kakatiya kingdom followed by the Bahamani, and later the Golconda kingdoms. Finally, with the fall of the Qutabshah dynasty, it was annexed to the Mughal empire. During the formation of Hyderabad State by the Asif Jahis, this district was detached and included in the Nizam's dominion. It finally became a part of Andhra Pradesh, which took effect on 1 November 1956 after the States Reorganisation Act (Chief Planning Officer, 1995).

Soils and water

The soils of the district are mainly red earth, comprising loamy sands, sandy loams and sandy clay loams. Red laterite soil is predominant in the Zaheerabad region. Black soils comprise clay loams, clays and silty clays and are found in Sangareddy, Andole, Narayankhed, and Narsapur regions. Red soils are generally non-saline and non-alkaline, while black soils are moderately alkaline with a highly soluble salt content.

The district does not have a major river. The Manjira, a tributary of the Godavari, is the only important river. Stored water is used for the drinking water needs of Hyderabad and adjoining areas. The other important streams in the district are the Haldi (or Pasupuyeru) and the Kudlair. The Haldi is a tributary of the Manjira and enters the district from the north and flows through Medak town. The Kudlair, which drains the Siddipet region, is another river in the district and forms a tributary of the Mahair.

Climate

The climate of the Zaheerabad region is characterized by hot summers and generally dry weather with rain showers expected during the monsoon season. The year is divided into three seasons: winter (November to February), summer (March to May) and southwest monsoon (June to October). Rainfall during the south-west monsoon months is about 84 percent of the annual rainfall, with July being the rainiest month. The average annual rainfall in the district is 896.7 mm.

May is the hottest month, with a mean daily maximum temperature of about 40 °C. With the onset of the southwest monsoon in the middle of June, the temperature decreases appreciably and the weather becomes more pleasant. December is the coldest month, with a mean daily maximum temperature of about 29 °C and a mean daily minimum temperature of about 14 °C. During the cold season, the night temperature may occasionally reach about 6 °C.

Cropping systems of Zaheerabad region

The Zaheerabad region of the Deccan plateau area hosts enormous agricultural diversity despite the extinction of several cultivars, including traditional varieties of sugarcane (*manchi cheruku*, *tella cheruku*, *gomari cheruku* and *nalla cheruku*), ground nut (*pedda baimugh*), foxtail millet (*manchu korra*) and redgram (*tella thogari*), and threats to several crops and varieties, especially pulses and millets. On average, each acre of farm, especially those of small and marginal farmers, hosts eight to ten varieties of various crops. Farmers today cultivate 20 to 30 different varieties of various crops in an area of 1 to 2 acres, each in small quantities. This diversity provides a wide variety of nutritious food to the family at different stages of each season, provides an assortment of fodder and feed for the livestock, improves the soil fertility and results in effective utilization of farmland. Crop diversity also ensures that, in times of unfavourable environmental conditions and climate, all food crops are not lost. Different farmers follow different cropping systems, depending upon soils and their situation, which are classified into "high", "medium" and "low" diversity farms. Livestock in the district is important for providing animals used for production of milk and for pulling plows. According to the 1993–1994 census for Medak district, the total livestock population included 512 000 cattle, 115 000 buffaloes, 238 000 sheep, 237 000 goats and other livestock (an additional 35 000 animals) (Chief Planning Officer, 1995).

Socio-economic profile

Medak has a total population of 2 269 800 persons, of whom 49 percent are female. Of this population, 85.5 percent live in rural areas. The district registered an annual population growth rate of 2.56 percent with a population density of 234 persons per sq km. Literacy is below the national average at 32.41 percent. However, male literacy is 45.15 percent, and female literacy is only 19.25 percent. Medak has a huge workforce, which stands at 47.78 percent, almost half the population. Of this, 78 percent are agricultural workers. The irrigated area as a percentage of cropped area is less than 30 percent. Of this, canal irrigation is only 3 percent (Chief Planning Officer, 1995).

In spite of all these handicaps and the predominance of rainfed agriculture and semi-arid environment, the district produces 160 kg per capita of food grains (Chief Planning Officer, 1995). Dalit form 17.5 percent of the population in the district and scheduled tribes comprise 4 percent of the population. Dalit women in the Zaheerabad region were reported to have had chronic energy deficiency (close to 60 percent with BMI below 18.5), with 71 percent of mothers working in agricultural activities, particularly fieldwork. Ninety-four percent used open-field toilets, and 79 percent were illiterate. Most mothers of young children were either pregnant or lactating (Schmid, 2005; Schmid *et al.*, 2006; Schmid *et al.*, 2007).

The Deccan Development Society (DDS) is a voluntary rural development organization which has been working with Dalit women farmers in Medak District for more than 15 years giving support to volunteer Dalit women's groups (*sanghams*) to enhance food security by reclaiming fallow lands and reintroducing elements of the local food system, particularly sorghum. The DDS has also developed demonstration schools and media centres to benefit Dalit sangham members. Health workers of the DDS have taken the lead to include uncultivated and wild foods in health promotion activities. In 2000, DDS initiated the study reported here to document the entire food system with the intention of managing local Dalit food to improve micronutrient nutrition and health.

Methodology

The study included individual and group interviews in Telegu using participatory methodologies, as described by Kuhnlein *et al.* (2006). For individual interviews with women, written informed consent was first obtained from the *sangham* leader in each village and then from each Dalit mother. A written signature or a thumb impression was accepted as consent. A total of 149 Dalit mothers and their young children (aged 6–39 months who were living in households with a *sangham* member) were recruited from a total of 19 villages. Many key informant interviews of regional leaders were also conducted to complete background understanding of the food system. Research assistants from the nearby city fluent in English and Telugu were trained to conduct the interviews. Representatives from the Centre for Indigenous Peoples' Nutrition and Environment (CINE), DDS and village leaders developed and signed a research agreement. Ethics approval was obtained by the Human Research Ethics Committee of the Faculty of Agricultural and Environmental Science of McGill University in Montreal, Canada (Schmid *et al.*, 2007).

Methodological themes and issues during the study used various tools with different groups (Table 9.1). Qualitative research included identification of species in the food system, seasonality and type of harvest and preference for use. One large sample for each species was collected and submitted for analysis at the National

Table 9.1 Themes and methods used in research with Dalit women in Zaheerabad

Themes	*Methods*
Attributes of foods and attribute ranking	Matrix ranking
Availability and consumption of foods per season	Interviews and focus groups with village women
Collection of recipes	Recipe competition
Food production process	Focus groups and interviews
Free list of foods used	Food inventory
General views on food and nutrition	Semi-structured interviews
Identification of uncultivated greens, tubers, roots and fruits	Transect walk
Medicinal values and other special features of foods	Focus group discussions
Nutrient composition analysis	Analysis at the NIN laboratory
Women's dietary data	24 hour recalls during two seasons

Institute of Nutrition (NIN) laboratory in Hyderabad. Analyses for nutrients were completed in duplicate or triplicate. A total of 32 fresh, raw samples were collected with the help of village volunteers, of which 26 were uncultivated green leafy vegetables. As soon as samples were received, they were cleaned for extraneous matter and cut into small pieces. A portion of each sample was digested using dry digestion procedures to measure trace minerals. Standard procedures of the Association of Official Analytical Chemistry (1984) were used for proximate composition and phosphorous content. The minerals were measured by Varian flame atomic absorption spectroscopy. For uncultivated greens and selected wild fruits nonaqueous reversed-phase HPLC methods for carotene separation (Zakaria *et al.*, 1979; Nelis and DeLeenheer, 1983) were explored and standardized. Food samples for vitamin C analysis were processed using metaphosphoric acid (Association of Vitamin Chemists, 1966) and vitamin C was determined with a modification of the method of Jagota and Dani (1982) using Folin-Ciocalteu reagent and a spectrophotometer at 760 nm.

Results

Traditional Dalit food list

To derive the traditional food list 12 key informants (three different age groups) met and created a free listing of food. The Community Food System Tables were created for most species in this list, and are reported on the CINE website (www.mcgill.ca/cine). The full list of foods traditionally consumed by Dalit families is presented in Table 9.2. It includes cultivated, uncultivated/wild and market foods.

In creating the community traditional food list, it became important to discuss foods with the village women in terms of recipes. Several terms unique to the food system evolved as noted in Table 9.3.

Market surveys were completed in six large villages where weekly markets were held, and where people normally purchased food. Village research assistants noted the kinds of purchased foods within food categories, and the number of items by food category is shown in Table 9.4. In general, some agricultural foods were found in markets, but the majority of Dalit women in the study grew their own food, as income was extremely limited.

Research assistants conducted unstructured interviews and focus groups with village Elders to determine the kinds of uncultivated foods that were still present in the region and retained in their knowledge, but which were little-used or unused during the research period. Nineteen of these foods are noted in Table 9.5.

Taxonomic identifications

Several foods in the traditional food list required taxonomic identifications with the assistance of a

Table 9.2 Dalit traditional food species list

	Scientific name	English/common name	Local name	Seasonality[1]	Preparation[2] cooked/raw
	Cereals and Grains				
1	*Eleusine coracana* (2 var.)	Finger millet	tella thaidalu, erra thiada	Summer (March–May)	Cooked
2	*Hordeum vulgare*	Barley	yavvlau	Winter (November–February)	Cooked with pulses
3	*Oryza sativa* (3 var.)	Rice	bailu nalla budda vadlu, bailu yerra vadlu, bailu tella budda vadlu	January–December	Boiled in water
4	*Panicum miliaceum*	Proso millet	kodi samalu	–	–
5	*Panicum miliare* (2 var.)	Little millet	sama, tella samalu	–	–
6	*Paspalum scrobiculatum*	Kodo millet	arekalu	–	Cooked
7	*Penisetum typhoideum*	Pearl millet, Italian millet	sajjalu	January–December	Cooked, roti, chapatti
8	*Setaria italica* (4 var.)	Foxtail millet	korralu	Winter (November–February)	Kichidi, pasham (sweet pudding), cooked
9	*Sorghum vulgare* (7 var.)	Sorghum	paccha jonna, tella malle jonna, erra jonna, kakimuttani jonna, sai jonnalu, rabi erra jonna, pyalala jonna	January–December	Cooked, roti
10	*Triticum aestivum* (3 var.)	Black thorny wheat	nalla mullu goduma, katte goduma, budda goduma	January–December	Cooked
11	*Zea mays* (2 var.)	Maize (dry)	makkalu	–	–
	Leafy vegetables				
1	*Acalypha malabarica**	–	pitta kura	Monsoon (June–October)	Curry with pulses
2	*Achyranthes aspera**	–	uthareni	Monsoon (June–October)	Curry with pulses
3	*Allium cepa*	Onion stalks	ulli poraka	Monsoon & Winter (June–February)	Curry with pulses and greens
4	*Allium sativum*	Garlic stalk	yelligada poraka	Winter (November–February)	Curry with pulses and greens
5	*Alternanthera tenella**	–	adavi punnaganti aalam	Monsoon (June–October)	Curry with pulses and greens
6	*Alternanthera sessillis**	–	ponnaganti kura	Summer (March–October)	Curry with pulses and greens
7	*Amaranthus gangeticus** (2 var.)	Amaranth tender	thota kura, thota kura kada	Monsoon & Winter (June–February)	Curry with pulses and greens
8	*Amaranthus paniculatus**	Rajagira leaves	rajagiri kura	Monsoon (June–October)	Curry with pulses and others
9	*Amaranthus polygonoides**	–	sirri kura	Monsoon (June–October)	Curry with pulses and others
10	*Amaranthus* sp.*	–	chakravarthi kura	–	Curry with pulses and others
11	*Amaranthus spinosus**	Amaranth spined	mulla doggali	Summer (March–October)	Curry with pulses and others
12	*Amaranthus tristis**	–	sirru aku	Monsoon (June–October)	Curry with pulses and others
13	*Amaranthus viridis**	–	doggali kura, puvvuthota kura	Monsoon (June–October)	Curry with pulses and others
14	*Aurthum graveolus wild**	–	adavi soya kura	Monsoon (June–October)	Curry with pulses and others
15	*Basella rubra**	Malabar spinach	yerra bacchali, mayalu	Monsoon (June–October)	Curry with pulses and others
16	*Baselia* sp. (3 var.)*	–	nalla bachali, pulla bachali, tella bachali	January–December	–
17	*Boerharia diffusa**	–	athaka mamidi kura	Monsoon & Winter (June–February)	–
18	*Brassica campestris* var.*	Mustard leaves	ava akulu	Winter (November–February)	Curry with pulses
19	*Brassica oleraceae* var. *capitata*	Cabbage	gobi gadda	Monsoon & Winter (June–February)	Curry with pulses and others

Continued

Table 9.2 *(continued)* **Dalit traditional food species list**

	Scientific name	*English/common name*	*Local name*	*Seasonality*[1]	*Preparation*[2] *cooked/raw*
20	*Brassica oleraceae* var. *botrytis*	Cauliflower	phul gobi	–	–
21	*Canthium spinosa**	–	balusuku	Monsoon (June–October)	–
22	*Carthamus tinctorius*	Safflower leaves	kusuma akulu	Winter (November–February)	Curry with pulses and others
23	*Cassia ariculata**	–	thengedu puvvu	Winter & Summer (November–May)	Curry with pulses and others
24	*Cassia fistula**	–	rela puvvu	Summer (March–May)	Curry with pulses and others
25	*Cassia tora**	–	tagarancha, chinna tentem kura	Monsoon (June–October)	Curry with pulses and others
26	*Celosia argentia**	–	gunagu, gurum kura	Monsoon (June–October)	Curry with pulses and others
27	*Cicer arietinum**	Chickpea leaves	sanaga akulu	Winter (November–February)	Curry with pulses and others
28	*Cleome gynandra*	–	thalaila	January–December	Curry with pulses and others
29	*Cocculus hirsutus**	–	doosari, cheepuru kura	Monsoon & Winter (June–February)	Curry with pulses and others
30	*Colocasia antiquorum*	Colocasia leaves	chama akulu	January–December	Curry with pulses and others
31	*Commelina benghalensis**	–	yennadri	Monsoon & Winter (June–February)	Curry with pulses and others
32	*Corchorus olitorius**	–	bankanti kura	Monsoon (June–October)	Curry with pulses and others
33	*Coriandrum sativum*	Coriander leaves	kothimiri	January–December	Curry with pulses and others
34	*Dioscorea bulbifera**	–	jungle kand	–	–
35	*Dolichos lablab* (2 var.)	Field bean	anapa puvvu, chikkudu aaku kura	Monsoon (June–October)	–
36	*Digera arvensis**	–	jonnachemchali	Monsoon & Winter (June–February)	Curry with pulses and others
37	*Enicostema hyssopifolium**	–	gorumadi	March–October	Curry with pulses and others
38	*Ficus glomerata*	–	medi pandlu	Winter (November–February)	–
39	*Hibiscus cannabinus* (2 var.)	Gogu	pundi-thella. pundi erra, sarkar pundi kurra (govt variety)	January–December	Curry with pulses
40	*Glycine max*	Soya leaves	soya koora	Winter (November–February)	Curry with pulses and others
41	*Gymnema sylvestre**	–	pola patram	–	–
42	*Lactuca runcinata**	–	atheli	Monsoon (June–October)	Curry with pulses and others
43	*Cassia sophera**	–	chenngi	January–December	Curry with pulses
44	*Leucas aspera**	–	tummi kura, chinnatummi kura	Monsoon (June–October)	Curry with pulses
45	*Maerremial emarginata**	–	elakachevula kura	Monsoon & Winter (June–February)	Curry with pulses
46	*Mentha spicata*	Mint	pudina	January–December	Curry with pulses
47	*Merremia tridentata* var. *hastate**	–	thadaka dobbudu	Monsoon & Winter (June–February)	Curry with pulses
48	*Mirabilis jalapa**	–	gurumashi, tellagurumashi	Monsoon (June–October)	Curry with pulses
49	*Moringa oleifera* (2 var.)	Drumstick	munaga kura, munaga puvvu	January–December	Curry with pulses
50	*Moringa oleifera*	Drumstick flowers	–	Winter (November–February)	Curry with pulses
51	*Murraya koenigii*	Curry leaves	karivepaku	January–December	Curry with pulses
52	*Oxalis corniculata**	–	adavi pulla koora, pilliadugula kura	Winter (November–February)	Curry with pulses
53	*Phyllanthus maderaspatensis**	–	poppu kura	Monsoon & Winter (June–February)	Curry with pulses

Continued

Table 9.2 *(continued)* **Dalit traditional food species list**

	Scientific name	English/common name	Local name	Seasonality[1]	Preparation[2] cooked/raw
54	*Physalis minima**	–	budda kasha, silleru kura	Monsoon (June–October)	Curry with pulses
55	*Piper betle*	Betel leaves	thamalapaku	January–December	Curry with pulses
56	*Portulaca grandiflora**	–	goduma payala	January–December	–
57	*Portulaca oleracea**(4 var.)	–	paruppu keerai, pappu kura, barre payala, ganga payala, nalla payala	Monsoon (June–October)	Curry with pulses
58	*Portulaca* sp*	–	sanna payala	January–December	Curry with pulses
59	*Rumex vesicarius*	–	chukka kura	Summer & Monsoon (March–October)	Curry with pulses
60	*Securingea virosa**	–	tella pulcheri	–	–
61	*Sesbania aegyptiaca*	–	avisa puvvu	Winter (November–February)	Curry with pulses
62	*Sesbania grandiflora*	Agati	avise, agathi	Monsoon (June–October)	Curry with pulses
63	*Solanum nigrum** (2 var.)	–	nalla kasha, kashapandla kura	Monsoon & Winter (June–February)	Curry with pulses
64	*Spinacia oleracea* (2 var.)	Spinach	pala kura, perinial palakura	January–December	Curry with pulses
65	*Tamarindus indica*	Tamarind leaves	chinta chiguru	Winter (November–February)	Curry with pulses
66	*Trachyspermum ammi*	–	oma koora	Winter (November–February)	–
67	*Trianthema decandra**	–	tella garjala	Monsoon (June–October)	Curry with pulses
68	*Trigonella foenum*	Fenugreek leaves	menthikoora	Winter (November–February)	Curry with pulses
69	*Trigonella foenum graecum**	–	adavi mentham kura	Monsoon & Winter (June–February)	Curry with pulses
70	*Zinziber officinale*	Ginger	allam aaku	Monsoon (June–October)	–
71	*Bascilla* sp*	–	angi bingi	Monsoon (June–October)	Curry with pulses
72	*Corchorus olitorius**	Jute leaves	bakantti	–	–
73	*Erythrina indica**	Indian coral tree	tellarjam puvvu	Summer (March–May)	Curry with pulses
	Roots tubers and vegetables				
1	*Abelmoschus esculentus*	Okra, lady finger	benda kaya	Winter & Summer (November–May)	Cooked
2	*Allium cepa*	Onion	neerulli/ ulligadda	January–December	Used as an ingredient in cooking
3	*Benincasa hispida*	Ash gourd	boodida gummadi	Winter (November–February)	–
4	*Beta vulgaris*	Beet root	beetu gadda	Summer (March–May)	–
5	*Brassica oleracea var otrytis*	Cauliflower	phul gobi	Summer (March–May)	–
6	*Canavalia gladiata*	Sword beans	adavi chamma kaya	Winter & Summer (November -May)	–
7	*Capparis horrida**		adavi adonda	January–December	–
8	*Capsicum* var. *grosa*	Capsicum	simla mirchi	Winter (November–February)	–
9	*Carica papaya*	Papaya green	poppayi kayi	January–December	–
10	*Coccinis cordifolia*	Ivy gourd	donda kaya	Winter & Summer (November -May)	–
11	*Colocasia antiquorum*	Colocasia	chama gadda	Winter & Summer (November -May)	–
12	*Colocasia antiquorum*	Colocasia stem	chama kada	Winter & Summer (November–May)	–
13	*Cucumis sativus*	Cucumber	keera kaya/ dosa kaya	Summer (March–May)	–
14	*Cyamopsis tetragonoloba*	Cluster Beans	goruchikkudu	Winter & Summer (November–May)	–
15	*Daucus carota*	Carrot	gajjara gadda	Summer (March–May)	–
16	*Dolichos lablab*	Field beans	kuura anpakaya	Winter (November–February)	–

Continued

Table 9.2 *(continued)* **Dalit traditional food species list**

	Scientific name	*English/common name*	*Local name*	*Seasonality*[1]	*Preparation*[2] *cooked/raw*
17	*Entoluma macrocarpom*	Mushroom	putta godugulu	Monsoon (June–October)	–
18	*Faba vulgaris*	Double beans	pedda chukudu	Summer (March–May)	–
19	*Ipomoea batatas*	Sweet potato	ratnapuri gadda/ chilagada dumpa	Summer (March–May)	–
20	*Lagenaria siceraria*	Bottle gourd	sora kaya	Winter & Summer (November–May)	–
21	*Luffa acutangula*	Ridge gourd	beera kayi	Winter & Summer (November–May)	–
22	*Lycopersicon esculentum* (2 var.)	Green tomato	tamata pandu, kapiringa pandlu	January–December	–
23	*Mangifera indica*	Green mango	mamidi kayi	Monsoon (June–October)	–
24	*Mirabilis jalapa*		gurumash gadda	–	–
25	*Momordica charantia*	Bitter gourd	kakara kaya	Winter (November–February)	–
26	*Momordica dioica*	Kakari gourd	adavi kakara	–	–
27	*Moringa oleifera*	Drumstick	mulaga kada	Summer (March–May)	–
28	*Phaseolus coccineus*	Scarlet runner beans	–	–	–
29	*Phaseolus vulgaris*	French beans	chekkudu	Winter & Summer (November–May)	–
30	*Raphanus sativus*	White raddish	mullangi/ ullem gadda	Summer (March–May)	–
31	*Solanum melongena* (3 var.)	Brinjal	Vankayaly, mullu vankaya, thell vankayalu	January–December	–
32	*Solanum tubersum*	Potato	alu gaddalu	January–December	–
33	*Trichosanthes anguina*	Snake gourd	potla kaya	Winter (November–February)	–
34	*Vicia faba*	Broad beans	pedda chikkudu	January–December	–
35	*Vigna catjang*	Cow pea pods	bebbari	Winter (November–February)	–
36	–	–	chenchu gadda	Summer (March–May)	–
37	–	–	domma dol gadda	Summer (March–May)	–
	Pulses				
1	*Cajanus cajan* (4 var.)	Pigeon pea dhal	year thogari pappu, buraka thogari, thella thogari, nalla thogari	January–December	As a curry / gravy
2	*Cicer arietinum* (5 var.)	Chick pea	desi yerra shenagalu, tella shenagalu, nalla shenagalu, shenagalu	January–December	As a curry / snack
3	*Dolichos biorus* (3 var.)	Horse gram	yerra ulavalu, nalla ulavalu, tella ulavalu	January–December	As a snack
4	*Dolichos lablab* (3 var.)	Field beans	tella anumulu, nalla anumulu, yerra anumulu	January–December	As a snack
5	*Lathyrus sativus*	Khesari-dhal	lanka pappu	January–December	–
6	*Lens esculenta*	Lentils	seri shenaga	January–December	As a curry
7	*Phaseolus aureus Roxb* (5 var.)	green gram	pesaripappu, manchi pesarlu, ganga pesari, balentha pesari, theega pesari	January–December	As a curry / snack
8	*Phaseolus aureus Roxb*	black gram dhal	minumulu	January–December	As a soup / gravy

Continued

Table 9.2 *(continued)* **Dalit traditional food species list**

	Scientific name	English/common name	Local name	Seasonality[1]	Preparation[2] cooked/raw
9	*Pisum sativum* (2 var.)	Pea	nalla bata gallu, tella bata gallu	January–December	As a curry / snack
10	*Vinga catjang* (2 var.)	Cowpea	terra bebbari, tella bebbari	January–December	Snack / soup
	Fruits				
1	*Achras sapota*	Sapota	sapota	Winter (November–February)	Consumed fresh
2	*Aegle marmelos*	Beal fruit	maredu	–	Consumed fresh
3	*Anacardium occidentale*	Cashew fruit	jeedi pandu	Summer (March–May)	Consumed riped
4	*Annona reticulata*	Bullock's heart	ramaphal	Winter (November–February)	Ripe
5	*Annona squamosa*	Custard apple	sitaphel	Winter (November–February)	Ripe
6	*Artocarpus heterophyllus*	Jackfruit	panasa	Winter (November–February)	Ripe
7	*Bassia longifolia**	Mahua	ippa	Summer (March–May)	Ripe and juiced
8	*Buchanania latifolia**	–	morri pandlu	Summer (March–May)	Ripe
9	*Carica papaya*	Papaya, unriped	poppadu pandu	January–December	Ripe
10	*Canthium dicoccum**	–	nakkiri	Summer (March–May)	Ripe
11	*Calycopteris floribunda**	–	bontha pandlu	Summer (March–May)	Ripe
12	*Carissa carandas**	–	kalmi	Summer (March–May)	Ripe
13	*Catunaregam spinosa*	–	balusuku	Monsoon (June–October)	Ripe
14	*Citrullus vulgaris*	Watermelon	tarbuja	Summer (March–May)	Ripe
15	*Citrus aurantifolia*	Lime	nimma	January–December	Ripe
16	*Citrus aurantium*	Orange	santra	Winter (November–February)	Ripe
17	*Citrus sinensis*	Sweet lime	musambi	Winter (November–February)	Ripe
18	*Cucumis melo*	Musk melon	kharbuja	November–May	Ripe
19	*Diospyros chloroxylon**	–	illentha	Summer (March–May)	Ripe
20	*Embilica officinale*	Indian gooseberry	userikayi, amla	Winter (November–February)	Ripe
21	*Ficus carica*	Fig	anjuru, anjeer	Winter (November–February)	Ripe
22	*Ficus glomerata**	Cluster fig	medi pandlu	Winter (November–February)	Ripe
23	*Gardenia gummifera**	–	chimit pandlu	Summer (March–May)	Ripe
24	*Grewia asiatica**	Phalsa	tada, thada	Summer (March–May)	Ripe
25	*Latina camera**	–	kaki pandlu	Summer (March–May)	–
26	*Lycopersicon esculentum*	Tomato	tamata pandu	Monsoon & Winter (June–February)	–
27	*Malus sylvestris*	Apple	sepu	Winter (November–February)	–
29	*Mangifera indica*	Mango	mamidi	Summer (March–May)	Ripe, juiced, pickled, jam
30	*Morus* sp.	Mulberry	sudi pandlu/ thuthara pandlu	January–December	Ripe
31	*Musa paradisiaca*	Banana	areti pandu	January–December	Ripe
32	*Passiflora edulis*	Passion fruit	passion fruit	Winter (November–February)	Ripe
33	*Phoenix dactylifera* (2 var.)	Dates	khajoor pandu	January–December	Ripe, dried, fresh
34	*Phoenix sylvestris**	Palm tree	itha	Summer (March–May)	Ripe
35	*Pithecellobium duke*	Manila tamarind	seema chintha, karukkapalli	Summer (March–May)	Ripe
36	*Psidium guajava*	Guava	jama	Monsoon & Winter (June–February)	Ripe
37	*Punica granatum*	Pomegranate	danimma	Monsoon (June–October)	Ripe

Continued

Table 9.2 *(continued)* **Dalit traditional food species list**

	Scientific name	*English/common name*	*Local name*	*Seasonality*[1]	*Preparation*[2] *cooked/raw*
38	*Semecarpus anacardium*	Marking nut	nall jeedi	Summer (March–May)	–
39	*Solinum nigrum**		kashe pandlu	Winter (November–February)	–
40	*Syzygium cumini*	Jambul, Java plum	alla nerudu	Monsoon (June–October)	–
41	*Vitis vinifera* (2 var.)	Grapes	angoor	Winter & Summer (November–May)	Ripe
42	*Zyziphus jujuba*	Ziziphus	reni	Winter (November–February)	Ripe
43	*Zizyphus enoplia**	–	parki	June–October	Ripe
44	*	–	chemidi pandlu	Summer (March–May)	Ripe
45	*	–	dodi pandlu	Summer (March–May)	Ripe
46	*	–	pam padga	Summer (March–May)	Ripe
47	*	–	pitta pandlu	Summer (March–May)	Ripe
48	*	–	pulichera pandlu	Monsoon (June–October)	Ripe
	Animal foods				
1	*Anas. platyrhyncha*	Duck	bathu	–	–
2	*Antilope cervicapra*	Deer	ledi	–	–
3	*Arius sona*	Fish	jellalu	–	–
4	*Bos taurus*	Beef	pedda mamsam	–	Fried or as curry
5	*Bos taurus*	Cow's milk	aavu paalu	–	–
6	*Bubalus bubalis*	Buffalo meat	barre mamsam	–	–
7	*Bubalus bubalis*	Buffalo's milk	barre paalu	–	–
8	*Bubalus bubalis*	Ghee	neyye	–	–
9	*Bubalus bubalis*	Buffalo's milk concentrate	khova	–	–
10	*Bubalus bubalis*	Cow curd	perugu	–	–
11	*Bubalus bubalis*	Buttermilk	salla	–	–
12	*Capra hyrchusb*	Goat meat	meka mamsam	January–December	As a curry
13	*Capra hyrchusb*	Goat milk	meka paalu	–	–
14	*Capra hyrchusb*	Goat heads and legs	meka thala, kallu	–	–
15	*Catla catla*	Fish	botchee	–	–
16	*Columba livia intermedia*	Pigeon	pauvram	–	–
17	*Gallus bankiva murghi*	Hen egg	guddu	January–December	Boiled, fried as curry
18	*Crus* sp.	Cranes	kongalu	–	–
19	*Gallus bankiva murghi*	Chicken/Fowl	kodi	January–December	As curry
20	*Lepridae sylvilagus*	Rabbit	kundelu	–	–
21	*Ophiocephalus striatus*	Fish	mottalu	–	–
22	*Ovis aries*	Mutton meat	potel mamsam	January–December	Fried or as curry
23	*Ovis aries*	Sheep, male (ram)	potel mamsam	–	–
24	*Paratephusa spinigera*	Crab	endra kaya	–	–
25	*Sclurus* sp.	Squirrel	udatha	–	–
26	*Sus cristatus*	Pig wild	adavi pandi	–	–
27	*Sus scrofa*	Pig meat	pandi	–	–

Continued

Table 9.2 *(continued)* Dalit traditional food species list

	Scientific name	English/common name	Local name	Seasonality[1]	Preparation[2] cooked/raw
28	*Varanidae varanus*	Monitor lizard	udumu	–	–
29	–	Birds	budda kongalu	–	–
30	–	Birds	bur akalu	–	–
31	–	Birds	dandi bebbarlu	–	–
32	–	Birds	guvulu	–	–
33	–	Birds	kamjulu	–	–
34	–	Crane	neeti kongalu	–	–
35	–	Fish dry	endu chapa	–	–
36	–	Prawns dry	endu royalu	–	–
37	–	Tortoise	thambelu	–	–
38	–	Venna	butter	–	–
39	–	–	adavi dummana	–	–
40	–	–	kamma kaki	–	–
	Nuts and oil seeds				
1	*Anacardinim occidentale*	Cashew nut	jeedi palukulu	Summer (March–May)	–
2	*Arachis hypogaea* (3 var.)	Groundnut/ Peanut	baimugulu, baimugulu pindi	–	Oil
3	*Areca catechu*	Areca nut/ Betel nut	poka pachellu vakkalu	Summer (March–May)	–
4	*Brassica nigra*	Mustard seed	avaalu	January–December	Oil
5	*Buchanania latifolia*	Piyal seeds	morri palkulu	January–December	Oil
6	*Carthamus tinctorius*	Safflower	kusumalu	January–December	Oil
7	*Cocos nucifera* (4 var.)	Coconut	kobbari kaya	January–December	Numerous preparations
8	*Guizotia abyssinica*	Niger seeds	gaddi nuvvulu	January–December	Oil
9	*Helianthus annus*	Sunflower seeds	nalla kusumalu	January–December	Oil
10	*Linum usitatissimum*	Linseeds	aviselu	–	Oil / spicy powder
11	*Prunus amygdalus*	Almond	badam	Summer (March–May)	–
12	*Sesamum indicum*	Sesame seeds	nuvvulu	–	Oils
	Spices				
1	*Allium sativum*	Garlic	elligadda, lahson	–	–
2	*Capsicum annum* (2 var.)	Chillies	mirapa kayai, lal mirch, mirapa kayai	–	–
3	*Coriandrum sativum* L.	Coriander	dhaniyalu, dhania	–	–
4	*Cuminum cyminum*	Cumin seed	karra jela, jeera	–	–
5	*Curcuma domestica*	Turmeric	pasupu, haldi	–	–
6	*Elettaria cardamomum*	Cardamom (small)	choti elachi	–	–
7	*Ferula asfoetica*	Asafoetida	hing, enguva	January–December	–
8	*Myristica fragrans* (2 var.)	Nutmeg	jaji kayi, japathri	–	–
9	*Papaver somniferum*	Poppy seeds	gasalu, khuskhus	–	–
10	*Pimpinella anisum*	Fennel	soapulu	–	–
11	*Piper nigrum*	Black pepper	meriyalu, kali mirch	–	–

Continued

Table 9.2 *(continued)* **Dalit traditional food species list**

	Scientific name	*English/common name*	*Local name*	*Seasonality*[1]	*Preparation*[2] *cooked/raw*
12	*Syzygium aromaticum*	Cloves (dry)	lavangalu	–	–
13	*Tamarindus indica*	Tamarind pulp	chintha pandu, imli	–	–
14	*Tachyspermum amoni*	Bishop's weed	ajwain, omum	–	–
15	*Trigonella foenum-graecum*	Fenugreek seeds	menthalu, methi	–	–
16	*Zingiber officinale*	Ginger	allam, adrak	–	–
	Drinks				
1	*Borassus flabellifer*	Toddy sweet	kallu	–	–
2	*Saccharum officinarum* (3 var.)	Jaggery cane drink	bellam palu, cheruku palu	–	–
3	–	Chai Tea	chai	–	–
4	–	Cola	sallati sisalu	–	–
5	–	Gaseous water	Soda	–	–
6	–	Neem tree sap	vepa kallu	–	–
	Miscellaneous foods				
1	*Saccharum officinarum* (2 var.)	Jaggery	bellam, shekkari	–	Used as a sweating agent
2	–	Sweet biscuits	biscatllu	–	–
3	–	White bread	double roti	–	–
4	–	–	pappad	–	–
5	–	Mushrooms	potta godugulu	–	–
6	–	Honey	thena	Summer (March–May)	–
7	–	–	candy (hard)	–	–
8	–	–	chocolate	–	–
9	–	–	ice cream	–	–
10	–	–	bun (sweet)	–	–

1 Winter (November–February); Summer (March–May); Monsoon (June–October)
2 When preparation is not specified, there are various techniques used.
* Uncultivated species.
– No data.

herbarium specialist. Fresh plants were collected with the root system intact during the flowering or fruit-bearing stage. Labelled samples were placed in a plant press and given to a taxonomist for identification. Table 9.6 lists the plants that were identified. Several traditional foods remain unidentified, in particular several wild fruits.

Crop diversity

Farmers' fields were observed in order to gain insight into Dalit food crop diversity. The cropping systems were shown to prevail in red and black soils in winter and summer seasons. It is obvious that traditional knowledge of the different soil conditions leads to different crop diversities, depending on whether the farmer prefers high, medium or low diversity (Table 9.7). Irrigated fields had much less diversity. While the main crops were limited to six to eight, each crop had several varieties. In addition, a host of uncultivated greens found among cultivated crops enhanced the biodiversity of the field and the community diet upon harvesting.

Table 9.3 Description of food terms

Food term	*Description*
Buvva	Boiled and cooked cereal or millet
Attu	Savory pancake made with flour of pulses, cereals and millets
Charu	Spicy soup-like dish makes of pulses, tamarind and tomatoes
Chutney	Ground, spicy side dish made with vegetables, greens, pulses, oilseeds and tamarind
Kura	Side dish, usually spicy, made with vegetables, meat, fish, chicken and egg
Gudalu	Boiled whole gram
Jaggery	Refined and solidified molasses
Kichidi	Cooked mixture of cereal and pulse
Kapillu	Millets are exposed to flame slowly and rubbed in gunny bag to remove hull and husk
Laddu	Sweet ball usually made of gram flour
Masala	Ground and powdered Indian condiment and spice
Muruku	Hand extruded, salted, long, thin, deep-fried gram flour snack
Papad	Thin wafer-like rounds made of gram or cereal flour; stored in dry form; fried before serving
Pasham	Sweet pudding-like desert preparation
Pyalalu	Popped millets
Podi	Dry powder
Podi karam	Dry powder and dry curry
Pulusu	Sour gravy preparation usually made with tamarind pulp
Rawa/nooka	Broken cereal or millet
Roti/chapathi	Made with cereal or millet dough, thin round, baked on open pan
Sambar	Pulse and vegetable preparation which is spicy and eaten with cereal or millet
Sangati	Softly cooked cereal or millet
Upma	Savory dish made of broken cereal or millet
Vada	Small patties, deep-fried snack
Vadiyalu	Fresh chick pea; smoked lightly and consumed after chaffing and cleaning

Table 9.4 Number of items in food categories found in local village markets

Type of ingredient	*No. of items*	*Percent of total*
Animal food	18	13
Roots	3	2
Oil seeds	8	5
Spices	16	12
Fruits	13	10
Pulses	11	8
Nuts	3	2
Vegetables	16	12
Cereals	5	4
Sweets	5	4
Millets	6	4
Drinks	2	2
Greens	14	10
Ready to eat cereal	17	12
Total	**137**	**100**

Table 9.5 Little-used or currently unused traditional food noted by Elders

	Scientific name	*Local name*
1	Unknown	Angi bingi*
2	*Allium sativum*	Elligadda, Yelligadda poraka
3	*Amaranthus tristis*	Koya kura, Sirru aku*
4	*Amaranthus viridis*	Kuppi kura, Doggali kura*
5	*Aurthum graveolus wild*	Adavi soya kura*
6	*Boerhavia diffusa*	Athaka mamidi kura*
7	*Canthium spinosa*	Balusuku*
8	*Cassia fistula*	Rela puvvu*
9	*Cocculus hirsutus*	Doosari*
10	*Dolichos lablab*	Chikkudu aaku kura
11	*Enicostema hyssopifolium*	Gorumadi*
12	*Ficus racemosa*	Medi pandlu*
13	*Glycine max*	Soya kura
14	*Lactuca runcinata*	Atheli*
15	*Maerremial emarginata*	Elakachevula kura*
16	*Merremia tridentata* var. *hastata*	Thadaka dobbudu*
17	*Mirabilis jalapa*	Gurumashi*
18	*Oxalis corniculata*	Adavi pulla kura*
19	*Sesbania aegyptiaca*	Avisa puvvu*

* Uncultivated greens.

Table 9.6_List of newly identified plants with scientific names

Scientific name	*Local name*
Acalypha malabarica	Pitta kura
Alternanthera tenella	Adavipunnaganti aalam
Cleome gynandra	Thalaila
Commelina benghalensis	Yennadri
Corchorus olitorius	Bankanti kura
Dioscorea bulbifera	Jungli kand
Lactuca runcinata	Atheli
Merremia tridentata var. *hastata*	Thadaka dobbudu
Mirabilis jalapa	Tellagurumashi
Phyllanthus maderaspatensis	Poppukura
Physalis minima	Budda kasha

Nutrient composition of traditional Dalit foods

In and around the Zaheerabad region of Medak district in Andhra Pradesh, Dalit regularly consumed some uncultivated leafy green vegetables. Since proximate composition and trace mineral content of these leafy vegetables were not available, studies were conducted by the DDS in collaboration with the NIN to collect and analyse these vegetables. Research was also completed to understand nutrient parameters in local varieties of pulses, grains and seeds and wild fruits, and these data are also reported here. Mean values for proximate composition and minerals in uncultivated greens and several local varieties of pulses, seeds and grains are given in Table 9.8.

Table 9.7 Crops and varieties on Dalit farms *(English and/or local names)*

Red soils: Winter rainfed

High diversity

Redgram (Erra thogari, Tella thogari, Nalla thogari and Burka thogari), Jowar (Gundu jonna,Thoka jonna,Tella mallejonna, Garib jonna and Erra Jonna), Field Bean (Tella Anumulu, Erra Anumulu and Nalla Anummulu), Cow pea (Tella Bebbarlu and Erra bebbarlu), Hibiscus (Erra pundi, Nalla pundi and Tella pundi), Green Gram (Kidki Pesari, Theega Pesari,Baandari Pesari and Manchi Pesari), Black gram (Manchi minumu, Sarkar and Nunupu minumu), Bajra, Sesamum, Niger, Foxtail millet (Tella Korra,Erra korra and Nalla korra), Finger millet, Kodo millet, Horse gram

Jowar, Bajra, Red gram, Hibiscus, Field bean, Cowpea, Green gram, Black gram

Green gram, Jowar, Field bean, Cow pea, Hibiscus

Groundnut, Jowar, Field bean, Cowpea, Gingelly, Hibiscus

Medium diversity

Jowar, Bajra, Hibiscus

Gingelly, Jowar, Hibiscus

Gingelly, Jowar, Red gram

Dry land paddy, Finger millet

Low diversity

Niger

Bishop's weed (Voma)

Sun Hemp

Horse gram

Black soils: Winter rainfed

High diversity

Redgram (Erra thogari,Tella thogari,Nalla thogari and Burka thogari), Jowar (Gundu jonna,Thoka jonna, Tella mallejonna, Garib jonna and Erra jonna) Field Bean (Tella Anumulu,Erra Anumulu and Nalla Anummulu) Cow pea (Tella Bebbarlu and Erra bebbarlu) Hibiscus (Erra pundi ,Nalla pundi and Tella pundi) Green Gram (Kidki Pesari, Theega, Pesari,Baandari Pesari and Manchi Pesari) Black gram (Manchi minumu, Sarkar and Nunupu minumu), Bajra, Sesamum, Foxtail millet (Tella Korra,Erra korra and Nalla korra), Finger millet, Kodo millet, Horse gram

Medium diversity

Red gram, Jowar, Field bean, Cow pea, Black gram

Red gram, Jowar, Field bean, Cow pea, Hibiscus, Green gram

Low diversity

Black gram, Manchi Pesalu, Gingelly, Hibiscus

Green Gram, Saijonna (for fodder only)

Sunflower

Red Soils: Summer

Medium diversity

Rabi Jowar, Safflower

Rabi Jowar, Horse gram

Black soils: Summer

High diversity

Rabi jowar (Sai jonna, Tella malle jonna, Erra jonna and Pyalala jonna), Chick pea (Tella change, Nalla change and Erra change), Wheat (Budda Godhumalu and Katte Godhumalu), Safflower, Mustard, Linseed, Lathyrus, Lentils, Peas (Nalla battagalu, Tella battagalu and Yerra battagalu), Oats, Hibiscus, Cucumber creeper

Chickpea, Safflower, Lentils, Lathyrus, Peas, Linseed, Mustard

Medium diversity

Jowar, Chickpea, Safflower

Chickpea, Safflower

Low diversity

Safflower

Coriander

With irrigation farms planted

High diversity

Sugarcane, Maize, Field bean, Hibiscus, Castor, Cluster bean, Portulaca oleracea, Sesbania

Turmeric, Castor, Brinjal, Tomato, Cluster bean, Hibiscus, Anise

Medium diversity

Ginger, Chillies, Castor

Garlic, Coriander

Low diversity

Paddy

Potato

Onion

Sun hemp

Differences were found in vitamin C and total carotene content of uncultivated greens species grown in either red or black soil. Table 9.9 demonstrates some species showing higher levels on a particular type of soil. The reasons for different nutrients by soil type are not known.

The results of wild fruit analysis are presented in Table 9.10. Beta carotene varied from 5–429 µg/100g and total carotenes varied from 38–4 237 µg/100g.

Additional qualitative data on food use

Through a series of qualitative interviews and focus groups, women discussed the attributes of uncultivated greens in terms of medicinal value, general availability in each season, taste, overall use, ability, use as cattle fodder and ability to use as green manure (e.g. re-plough into the soil as fertilizer). These properties were scored separately and summed to derive the overall most popular greens. The most popular and highly appreciated uncultivated greens of the 29 analysed were *budda kasha*, *sanna payala*, *adavi pulla koora*, *angi bingi*, *jonnachemchali*, *pittakura*, *bankanti kura* and *yennadri* (see Table 9.2 for scientific names). Culturally, the Dalit characterized their foods as cool and hot. Cool foods included sweet lime, apple, grapes, watermelon, musk melon, cucumber, ice cream, butter milk, curd, pomegranate, chick pea, pigeon pea, *ragi*, *rabi sorghum* porridge and sago. Hot foods included crab, foxtail millet, chicken curry, fish, egg, papaya, custard apple, bishop weed, ghee, linseed spicy powder, jaggery and tea.

With sharp agro-climatic constraints farmers strived to diversify their sources of food with crop diversity. Farmers celebrated large crop diversity – especially the diversity of uncultivated greens present in their fields – with great reverence. One example was celebration of "Shoonyam Panduga", a festival celebrated in the month of December when most of the winter and summer crops reached maturity. Farmers worshiped the earth by walking around the field singing special songs related to the festival and also offering food and curry made with more than five uncultivated greens available during that time.

Importance of uncultivated greens as food for the poor

Most poor rural people consumed uncultivated crops at least 50 to 80 days in a year. While working in their fields, the poor gathered these greens and brought them home. Those who did not work as farmers went to nearby fields specifically to gather these greens. *Doggali koora*, *gangavayeli*, *sannavayeli* and *pundi* were consumed throughout the year. *Pundi* and *doggali koora* were eaten more than 20 times in a year by some families. Some of the greens (e.g. *gunugu*) were sold as green fodder in nearby towns. Uncultivated foods such as *chennangi*, *soyikoora*, *adonda* and *adivikakarakaya* were also sold in towns because they were liked by urban dwellers, and were recognized as good for health. Greens such as *talaili* and *kashapandla chettu* were never uprooted, as they were less available and they were recognized for their high medicinal value. Even the landlords asked the farm labour women to not weed these two plants, so as to protect them. Some women earned a living by selling these uncultivated greens in nearby towns.

Reduced availability of uncultivated greens in fields using chemical fertilizers

Uncultivated greens were present mostly in farm fields where manure was applied or where chemical fertilizers were not applied. Very few greens were seen in fields treated with chemical fertilizer, as they die when they are young because of the burning effect. In fertilized fields only half of what used to be available was present, with greens available for picking only after one or two irrigations. However, farmers felt it was not safe to eat these greens and they were generally not collected.

Importance of uncultivated greens during famine

Historically, uncultivated foods were important during famine and stress periods. Eighteen years prior to this

Table 9.8 Nutrient composition of selected Dalit traditional foods *(per 100 g of edible portion)*

New Food Items	*Moisture*	*Energy*		*Protein*	*Fat*	*CHO*	*Crude Fiber*	*Ash*	*Calcium*	*Phosphorus*	*Iron*	*Copper*	*Magnesium*	*Manganese*	*Zinc*	*ß Carotene*
	g	*kcal*	*kJ*	*g*	*g*	*g*	*g*	*g*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*
Cereals and grains																
Foxtail millet	11.2	331	1 384	12.3	4.3	60.9	8	3.3	31	290	12.9	–	–	–	–	–
Kharif sorghum	8.5	373	1 559	8.0	3.1	78.3	0.8	1.3	10.3	297	13.3	0.6	1.5	153.9	2.5	–
Kodo millet	8	361	1 509	7.7	1.8	80.5	0.2	1.8	23.5	208	–	2.9	5.1	67.3	2.8	–
Little millet	7.6	373	1 559	6.9	2.0	82.5	0.1	0.9	22.4	169	25	1.1	1	53	2.8	–
Red foxtail millet	7.4	381	1 593	9.0	1.2	81.2	0.2	1	13.8	210	21.5	1.1	1	82.4	3.7	–
Red sorghum	8.6	360	1 505	7.6	3.5	78.2	0.6	1.5	11.8	315	7.6	0.8	1.1	143.6	3	–
Leafy vegetables																
Adavi mentham kura	74.4	92	385	2.7	1.9	16	3.4	1.6	171	33	34.9	0.2	84	1.7	0.8	–
Adavi pulla kura, Pilliadugula kura	72.6	90	376	6.0	2.5	10.8	4.1	4	331	98	139	0.5	116	3.4	1.1	6.8
Adavi soyakura	78.3	73	305	2.9	0.8	13.5	2.4	2.1	412	48	26.6	0.4	134	4	1.1	–
Adavipunnaganti aalam	80.8	53	222	4.6	0.7	7.1	2.2	4.6	535	41	11.2	0.2	122	3.1	0.3	–
Angi bingi	75.9	75	314	6.2	1.1	10	21	4.7	554	112	16.7	0.2	158	1.6	0.8	–
Atheli	85.1	46	192	4.0	1.1	5.1	1.7	3	320	152	13.6	0.4	130	2.7	1	–
Bankanti kura	72.5	88	368	5.0	0.8	15.2	2.8	3.7	366	77	15.4	0.2	82	1.3	0.5	2.5
Budda kasha, Silleru kura	79.4	65	272	6.0	0.8	8.5	1.5	3.8	424	96	24.5	0.7	177	101	1.6	–
Chenngi	67.4	109	456	8.5	1.3	15.9	3.3	3.6	882	125	10.7	0.4	258	3	1.1	11.9
Doosari, Cheepuru kura	44.4	189	790	9.1	1.9	33.8	7.6	3.2	1152	107	10.7	0.6	161	2.8	1.4	–
Elakachevula kura	40	202	844	14.3	1.5	32.8	5.4	6	1350	166	97	0.9	479	70	1.7	–
Gorumadi	53.2	140	585	7.0	0.7	26.5	4.2	8.4	1641	81	49.9	0.6	384	10.1	1.4	–
Gunagu, Gurum kura	83.1	49	205	3.9	0.3	7.6	2.1	3	398	78	20.9	0.3	291	2.5	0.8	1.2
Gurumashi	83.4	51	213	4.9	0.7	6.2	1.6	3.2	344	30	11.5	0.4	227	1.2	0.4	–
Jonnachemchali	33.3	183	765	9.3	1.6	32.8	8.8	14.2	3237	154	111.3	0.7	520	21.3	2.7	6.9
Nalla kasha	81.4	62	259	4.6	1.7	7.1	2.4	2.8	367	79	7.1	0.4	87	1.4	0.7	14.1
Pittakura	69.7	97	405	5.4	1.0	16.5	3	4.4	1342	152	40.7	0.4	130	2.7	1	–
Poppukura	60.9	132	552	3.0	2.6	24.1	4.2	5.2	767	91	59.4	0.3	205	5.7	1	–
Rela puvvu	73	95	397	4.4	1.4	16.3	3.3	1.6	184.6	94	10.6	0.2	3.4	73	1.1	–

Continued

Table 9.8 *(continued)* **Nutrient composition of selected Dalit traditional foods**

New Food Items	*Moisture*	*Energy*		*Protein*	*Fat*	*CHO*	*Crude Fiber*	*Ash*	*Calcium*	*Phosphorus*	*Iron*	*Copper*	*Magnesium*	*Manganese*	*Zinc*	*ß Carotene*
	g	*kcal*	*kJ*	*g*	*g*	*g*	*g*	*g*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*
Leafy vegetables *(continued)*																
Sanna payala	92.1	24	100	1.4	0.4	3.6	1.1	1.4	124	25	25.3	0.1	113	0.6	0.3	–
Tagarancha, Chinna tentem kura	72.7	87	364	6.8	0.7	13.8	2.7	3.7	869	108	9.7	0.3	94	1.3	1.2	5.3
Tella garjala	85.2	38	159	2.9	0.4	5.8	1.9	3.8	219	45	20.7	0.2	79	3.4	0.5	0.7
Tellarjam puvvu	78.1	69	288	5.0	0.7	10.6	3	2.6	639	109	4.1	0.3	6	174.2	0.9	–
Thadaka dobbudu	44.6	196	819	12.5	3.9	27.8	5.3	5.9	556	140	49.1	0.7	250	4.2	1.6	–
Thalaila	50.6	161	673	14.2	2.7	19.9	2.7	9.1	2 245	235	212.9	0.3	6.4	298.1	2.2	–
Thengedu puvvu	76.7	84	351	2.5	2.2	13.6	3.7	1.3	167	42	12.7	0.2	58	0.6	0.6	–
Tummi kura, Chinnatummi kura	65.1	110	460	3.7	1.2	21.2	4.5	4.3	719	46	81.6	0.5	64	5.8	1.1	4.1
Uthareni	81.3	65	272	3.3	0.3	8.3	3.3	3.5	417	68	12.5	0.2	188	3.6	0.4	10.5
Yennadri	87.4	35	146	2.3	0.4	5.6	1.9	2.4	243	47	17	0.1	67	1.6	0.4	–
Roots tubers and vegetables																
Gurumash gadda	59.5	191	798	3.0	0.4	42.2	3.5	5.2	1 838	110	7.3	0.3	1.0	120.2	2.2	–
Pulses																
Black Pigeon pea	5.6	370	1 547	22.6	1.6	66.4	0.4	3.4	17.7	371	4.3	1.4	1	119.8	3.3	–
Red gram	13.4	335	1 400	22.3	1.7	57	1.5	3.5	73	304	5.8	–	–	–	–	–
Red Pigeon pea	6.4	367	1 534	22.1	1.7	65.9	0.5	3.4	33.2	367	4.2	1.4	1.2	113.8	3.2	–

CHO Carbohydrates.
– No data.

Table 9.9 Vitamin C and total carotene in uncultivated greens grown in either red or black soil

Uncultivated greens	*Vitamin C (mg/100 g)*		*Total carotene (µg/100 g)*	
	Red soil	*Black soil*	*Red soil*	*Black soil*
Adavi ponnagnti aalam	110.2	107.8	5 434	5 150
Angi bingi	204.2	239.9	8 469	9 344
Athelli	64.8	91.5	6 454	6 461
Bankanti kura	151.2	117.2	7 019	8 431
Budda kasha	135.5	114.0	6 340	3 128
Elakachevula kura	164.0	111.8	8 787	12 882
Gunagu	99.0	125.5	2 963	3 967
Gurumash gadda	388.2	263.4	–	–
Gurumashi	391.2	161.3	14 891	9 836
Jonnachemchali	127.4	101.5	5 360	6 438
Nalla kasha	257.7	113.4	13 919	5 674
Palakura	84.2	249.6	5 080	11 308
Pitta kura	296.0	198.5	4 904	11 002
Sanna payala	47.4	60.2	2 286	2 470
Tagarancha	225.0	198.0	10 418	6 742
Tella garjala	88.6	77.3	6 052	6 112
Thadaka dobbudu	123.5	175.9	7 779	9 321
Thalaila	84.5	106.2	12 448	11 183
Tummi kura	134.9	175.0	3 155	7 020
Uthareni	31.8	94.6	6 022	5 311
Yennadri	123.6	103.9	3 502	4 164

– No data.

Table 9.10 ß-carotene and total carotenoid content of wild fruits

Telugu name	*ß-carotene*	*Total carotenoids*
	µg/100 g (fresh weight)	*µg/100 g (fresh weight)*
Ambadikayalu	16.9	570.7
Balusakupandluu	19.9	404.5
Bothapandu	12.3	161.3
Chitmit	12.7	260.4
Eethapandu	191.2	396.8
Illintha	16.6	514.7
Irkipandu	12.2	63.7
Kakipandu	177.2	1 300.4
Kalmi	326.7	1 026.3
Kasipand	147.3	2 058.0
Medipandu	5.4	37.7
Morripandu	354.1	1 302.7
Nakkarapandulu	428.6	4 236.8
Pitlapandlu	22.4	766.8
Pulcheri	29.0	73.4

research, during a famine in the Zaheerabad region, people survived for four months eating only these uncultivated greens, especially *doggalikoora*, *gangavayeli*, *sannavayeli*, *pundi*, *gunugu koora*, *uttareni* and *kapringa pandlu*. People ate more curries made from these greens. Rotis were made from *jowar* flour mixed with pundi because there was not enough other flour. Poor people would restore wells for watering fields and collect these greens from nearby sugarcane fields.

Uncultivated greens as tasty and rich sources of nutrition

Villagers testified that these greens were tasty and healthful. For example, Santoshamma of Basanthpur village reported that, "*Doggali koora* is more nutritious than a chicken egg". When preparing uncultivated greens for consumption, the leaves of different greens may be cooked together without spices, and only a small amount of oil. Generally they were cooked with pulses. Even without added flavouring they were tasty, according to Seshamma of Algole village. Sometimes leaves of these greens were cooked by adding onion.

High medicinal value of uncultivated greens

Uncultivated crops played a key role in the health of poor people. They utilized these greens in different forms – curry, leaf extracts and pressed into tablets (greens are pounded to paste, pressed and shade dried) to cure common ailments such as headaches, swellings, wounds, scabies, improper digestion, and major diseases such as jaundice and diabetes. *Atteli koora*, when fed to post-natal mothers, was known to improve breastmilk availability to infants. When lactating mothers ate

Table 9.11 Medicinal uses of edible plants noted by Dalit women of Zaheerabad

Scientific name	*Telegu name*	*Medicinal use*
–	Angi bingi	Gutaguta, polapatram, angibingi; for good digestion, dried leaves are made into powder, mixed in breast milk and fed to infants; leaf curry given for jaundice
–	Guntagalagari	Juice is antiseptic; tonic for hair growth
–	Bakantti	For serious wounds the mixture of guntagalagari and bakantti leaf powder is applied
–	Tellarjam puvvu	For white discharge the bark of the plant is eaten as a paste
Achyranthes aspera	Uthareni	The roots of the plant are used as a toothbrush to heal tooth disorders
Cassia ariculata	Thengedu puvvu	Leaf powder is applied to severe burns
Ficus glomerata	Medi pandlu	Latex (milk) is applied to soften boils and apses
Lagerstoemia parviflora	Chenngi	Juice is applied on swollen parts of the body
Physalis minima	Budda kasha	For good eyesight
Portulaca sp.	Sanna payala	For different skin diseases the juice of leaf is applied in combination with jaju (a special type of soil)
Securingea virosa	Tella pulcheri	For white discharge and heavy bleeding, the leaf and the fruits are eaten fresh or leaf is made into paste and soaked in neera overnight
Solanum nigrum	Nalla kasha	For jaundice the leaf and fruit is eaten; leaf juice is applied to swellings

– No data.

pundit, it was understood to be good for infants as it keeps the stomach clean. Uncultivated plants, like *kashapandla chettu*, were known as "Davakhana leni Mandu" ("medicine available without the existence of hospital").

During the interviews with Dalit village women it became clear that several food plants were used for medicinal purposes and they wished this to be recorded. Therefore, interviewers also probed for this information. A summary of key species of uncultivated greens and their use as medicine is presented in Table 9.11 with scientific names and common Telegu names.

An interview exercise was completed with 11 Dalit women who were asked to identify uncultivated greens gathered in the region and which greens they consumed. Table 9.12 demonstrates how many women could identify (ID) each uncultivated green by its Telegu name, how many could not identify (cannot ID) and how many wrongly identified (WID) each green. The last two columns demonstrate how many women could use or not use the species. It is surprising how universally known these greens were, with most women being able to identify them by name or use them. Also, many women used the plants without having a name for them.

Dietary assessment and anthropometry of children

Dietary assessments were conducted as reported in Schmid *et al.* (2006) and Schmid *et al.* (2007). Table 9.13 summarizes food group and nutrient intake of women in DDS *sanghams* (DDS-AP) in comparison to reported data for rural Andhra Pradesh (AP) and for the pooled All-India States (SP).

Average consumption of cereals and millets for all groups was consistently higher than recommended amounts for a healthy diet (using RDA of India). Milk and milk product consumption was low for all groups. For the AP and SP rural women, consumption of pulses and legumes, fats and oils, vegetables and greens tended to be low. However, the DDS *sangham* women consumed adequate amounts of cereals and millets, pulses and legumes, vegetables and greens.

Reported intakes of energy, protein, and iron exceeded standards. Women consumed 43 percent of dietary energy from traditional food. The balance of daily energy was from white rice (donated by government) or oil (purchased). While iron intakes were generally adequate (although bio-availability of these primarily plant-based diets is not known), intakes

Table 9.12 Familiarity and use of uncultivated greens by Dalit women *(number of women out of 11)*

Scientific name	*Name*	*ID*	*Cannot ID*	*WID*	*Used*	*Not used*
–	chinna payali	10	0	1	11	0
–	kura thonda	10	0	1	11	0
–	nalla baili	5	5	1	10	1
–	pulichinta	4	1	6	7	4
–	puppyaku	7	1	3	10	1
–	thakkeli	8	0	3	9	2
Achyranthes aspera	uthareni	9	0	2	10	1
Amaranthus polygamus	thota kura	10	0	1	11	0
Basella sp.	pulla bachali	9	1	1	11	0
Cassia tora	tagarancha	10	0	1	10	1
Celosia argentia	gunagu	10	0	1	11	0
Cleome gynandra	thalaila	10	0	1	11	0
Cocculus hirsutus	doosari	8	0	3	8	3
Colocasia antiquorum	chama akulu	11	0	0	11	0
Commelina benghalensis	yennadri	7	2	2	10	1
Digera arvensis	jonna chemchali	7	4	0	11	0
Gymnema sylvestre	pola patram	8	0	3	10	1
Hibiscus cannabinus	pundi erra	11	0	0	11	0
Hibiscus cannabinus	sarkarpundi-govt variety	10	0	1	11	0
Lactuca runcinata	atheli	9	0	2	11	0
Cassia sophera	chenngi	7	2	2	10	1
Leucas aspera	tummi kura	9	0	2	11	0
Maerremial emarginata	elakachevula kura	9	1	1	11	0
Mentha spicata	pudina	9	0	2	11	0
Mirabilis jalapa	gurumashi	9	0	2	10	1
Piper betle	thalampaku	11	0	0	11	0
Portulaca sp.	sanna payala	11	0	0	11	0
Solanum nigrum	nalla kasha	9	0	2	10	0
Solanum nigrum	kashapandla kura	9	1	1	11	0
Spinacia oleracea var	perinial palakura	6	0	5	9	2
Zinziber officinale	allam aaku	9	0	2	8	3

ID Number of women who could identified.
WID Number of women who wrongly identified.
– No data.

for vitamin A and vitamin C were low in comparison to standards.

The dietary pattern in this region included cooked foods and very little consumption of raw foods except for fruits. For several reasons, people no longer ate wild seasonal fruit as in former years, which is a reason for low vitamin C consumption in this population. Also, dietary analysis software may not have had a complete database for these nutrients, particularly for vitamin C in the greens.

Table 9.14 describes results of children reported by the National Nutrition Monitoring Bureau for Andhra Pradesh and the DDS *sanghams*. While the ages are not precisely comparable, the DDS Dalit

Table 9.13 Food and nutrient intake profile of women in Andhra Pradesh (AP), States Pooled (SP) and DDS-AP

	Recommended (g)	*AP-Intake (g)*[1]	*SP-Intake (g)*[1]	*DDS-AP Dalit women (g)*[2]
Food groups				
Cereals and Millets	460	542	464	661
Pulses and Legumes	40	35	33	86
Vegetables	60	38	40	92
Greens	40	10	13	39
Milk and Milk products	150	166	95	93
Fats and Oils	20	14	13	19
Sugar and Jaggery	30	12	23	20
Fruits	–	–	22	142
Nutrients				
Energy (Kcal)	2 425	2 430	2 172	2 567
Protein (g)	60	58	56	66
Iron (mg)	28	26	26	29
Vitamin A (μg)	600	352	288	239
Vitamin C (mg)	40	34	35	28

1 National Nutrition Monitoring Bureau, 2002.
2 Data modified from Schmid *et al.*, 2005, n = 149.
– No data.

had a higher percentage of children with normal weight for age. However, the number of moderately and severely malnourished children was roughly comparable.

With respect to vitamin A status in all of India, the prevalence of Bitot spots was 0.8 percent in pre-school children. About 60 percent of pre-school children in India are undernourished. In Andhra Pradesh, 1.1 percent had clinical signs of vitamin A deficiency (NNMB, 2002). In this study, a few women and children (approximately 8 percent) reported night blindness or exhibited symptoms of Bitot's spot or conjunctival xerosis. However, 35 percent of women reported night blindness during pregnancy (Schmid, 2005).

Table 9.14 Distribution of children by weight for age

Category	*1–5 years (%)*[1]	*6–39 months (%)*[2]
Normal children	8.5	37
Mild under nutrition	40.6	22
Moderate under nutrition	43.4	41
Severe under nutrition	6.9	

1 National Nutrition Monitoring Bureau, 2002.
2 Zaheerabad Dalit children. Data from Schmid *et al.*, 2005, n = 149.

Conclusions

The Dalit food system was found to have a wide diversity of food species, many of which were unrecognized to date. Women farmers display a wealth of traditional knowledge in their ability to recognize, grow and prepare these foods, and to also use them as medicine. In partnership with the NIN nutrient analysis laboratories, new nutrient composition data for uncultivated greens and wild fruits have been determined and reported here. Many excellent nutrient sources are in the Dalit food system.

Many types of green leaves were consumed as vegetables and most are rich sources of calcium, iron, carotene and vitamin C. These greens were inexpensive sources of many nutrients essential for growth and maintenance of normal health. Consumption of uncultivated foods and wild fruits in adequate amounts should be encouraged for the entire family. Further, these food systems should be supported for production and consumption in midday meals and in schools at all levels ●

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Chapter 10

The Bhil food system: links to food security, nutrition and health

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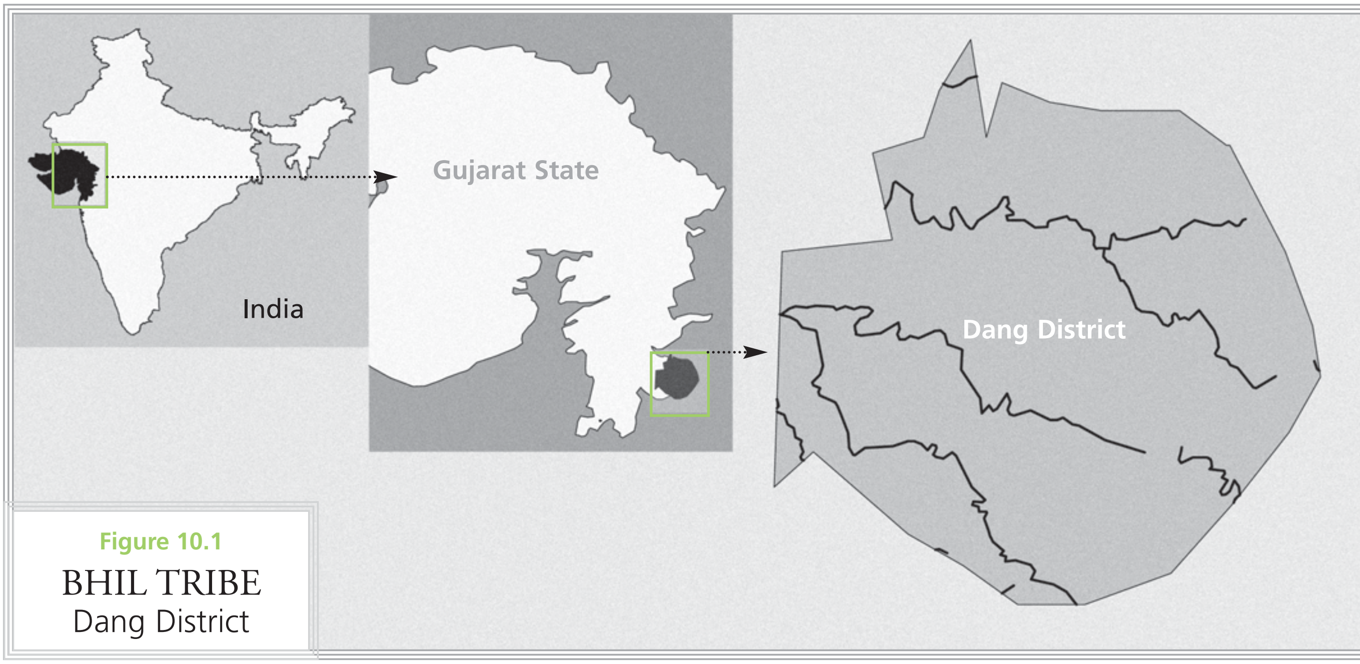


Figure 10.1
BHIL TRIBE
Dang District

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.

1
FAO Regional Office
for Asia and the Pacific,
Bangkok, Thailand

2
Child Eye Care
Charitable Trust,
Mumbai, India

Photographic section >> XXX

> “Thank you Mother for the food that you’ve given us!”
>
> **Bhil saying**

Abstract

The Bhils of India are a good example of an Indigenous People with diversity in their culture, tradition and environment. The Bhil study undertaken in collaboration with Child Eye Care Charitable Trust is part of 12 case studies addressing a commitment to research into areas of nutrition and health, with an emphasis on the impact of food environments on health of Indigenous Peoples. Employing community-based participatory research methods, the Bhil traditional food system was documented, pointing to the use of 94 foods – including a variety of plants, small domestic animals and local fish – with preparation and processing methods unique to the Bhil culture.

Dietary assessments showed that for children and mothers the percentage of energy from local cultivated and wild indigenous foods was 68 percent for children and 59 percent for women. A particular point of concern is that although drumstick and fenugreek leaves have high carotene content and are readily available in the community, only 1 percent of the study group consumed them. In fact, several micronutrient-rich traditional foods were infrequently consumed.

The dietary energy and protein intakes of most pregnant women and pre-school children did not meet Indian Recommended Dietary Allowances. Women and children were short in stature with low body weights, consistent with malnutrition, according to National Centre for Health Statistics standards.

A directory of Bhil foods has been developed in collaboration with the community. Improvement of food security, nutrition and health with implications for community-friendly policies and programmes are expected to be direct outcomes of the study.

Introduction

Understanding the food systems of Indigenous Peoples and improving or strengthening these systems in the context of nutrition and health pose unique challenges. It is well recognized that traditional foods and dietary diversity within an ecosystem can be powerful sources of nutrients and, thus, better health. In view of their habitat and dietary habits, Indigenous Peoples often distinguish themselves from other population groups. Their food patterns are influenced by environmental constraints and vary from extreme deprivation in lean seasons to high levels of intake of several foods during harvest and post-harvest periods. Tribal food-related practices and patterns are highly influenced by their traditions and environment; consequently, understanding the wide diversity of food systems of Indigenous Peoples and improving and strengthening these systems in the context of nutrition and health merit attention.

Hundreds of tribes exist in different parts of India, a good example of indigenous populations with a vast diversity in their cultures, traditions and environments. There is a rich habitat of natural foods in Indian tribal environments that need to be used to promote food security, nutrition and health. However, challenges of geography, agricultural technology, cultural habits, lack of formal education, poor infrastructure, including health care facilities, and poverty lead to development of poor nutrition and health. This chapter provides a case study of the Bhil tribe from the Dang district, in Gujarat, western India (Figure 10.1). The Bhils occupy a large territory, and inter-regionally they are known as a diverse group.

Cultural and economic background

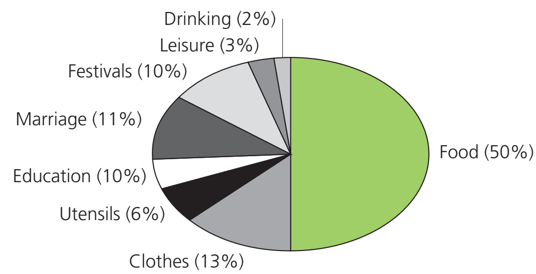
Dang is the smallest and poorest district of Gujarat State, in the Sahyadri mountain range, with a population of 38 500. It is traditionally known as "Dandak" or "Dandkarnya" which is mentioned in the Ramayana, the ancient Sanskrit epic. Only 6 percent of the district includes the non-tribal population. There are predominantly five different tribes: the Bhils, Kolchas, Kotwalias, Kuknas and Warlis. The Bhils form 30 percent of the total population of tribes, with around 11 500 people in 53 villages. The word "Bhil" is derived from the Dravidian word "Billoo" meaning bow and arrow. As a community they are strong people, known to be honest and experts in the use of bow and arrow. They are traditionally linked to the Rajputs (warrior clan of central India), and are the largest modern tribal group in India with substantial communities in Gujarat, Madhya Pradesh, Rajasthan and Maharashtra. Fifty-five percent of Bhils is male and 45 percent is female. On average, 15 percent of males are educated up to seventh to tenth standard (high school), 20 percent are educated up to third to fourth standard (primary level) and 65 percent are illiterate. Among females, 10 percent are educated up to seventh to tenth standard, 15 percent are educated up to third to fourth standard and 75 percent are illiterate.

For six months of the year, 30–40 percent of Bhils migrate to neighbouring areas in Maharashtra for employment in sugar factories or mango orchards. Around 25 percent earn an annual income of approximately Rs21 000 (about US$500). Approximately 60 percent of Bhils live in poverty, and most live in mud hut homes. Fishing and forest hunting are common.

Of total income, about 50 percent is spent on food, 13 percent on clothes, 6 percent on purchase of utensils, 5 percent for education, 11 percent on marriage, 10 percent on celebration of festivals, 3 percent on leisure and 2 percent on drinking, smoking, etc. (Bhattacharjee *et al.*, 2002) (Figure 10.2).

Girls usually marry at 14–15 years of age and boys marry at 15–16 years of age. Teenage pregnancies are very common, with an interval between two pregnancies at around 12 to 14 months. Tribals have preferences for both male and female children. If they only have one-sex children, they continue having children until they have both male and female children. However, young tribals are now seen to be having only two to three children.

Figure 10.2 Percent distribution of Bhil family spending



As a move towards women's empowerment, the Child Eye Care Charitable Trust (CECCT) has initiated the revival of the "Vavli" system that was earlier practised among the Bhil women. This system is an age-old tradition where the girl, once married, identifies a plot of land (quarter to half acre) near a perennial water source. Here she can grow seasonal vegetables and sell them in the market. The money earned belongs to her and cannot be claimed by her husband, according to protocol. Women usually buy food, ornaments or clothes with this money. The CECCT initiated this practice in one village and it is now is being extended to all 53 villages.

Child Eye Care Charitable Trust (CECCT)

The CECCT, based in Mumbai, has been involved extensively in support and development of tribal health care in various states in India. The Dang district is a key location where CECCT is actively involved in providing and facilitating holistic health care and support to tribals. CECCT works with 60 villages in Dang District, 53 of which are populated with Bhils. In each village, the staff of CECCT consists of two organizers, one health worker and two facilitators. The mission of CECCT is to improve child survival and child eye care through an integrated eye care programme, and health and nutrition-related interventions.

Table 10.1 Bhil traditional food *(95 species/varieties)*

	Scientific name	*English/common name*	*Local name*	*Seasonality*	*Preparation*
	Cereals				
1	*Amaranthus paniculatus*	Amaranth	rajkeera	–	–
2	*Eleusine coracana*	Ragi or Finger millet or African millet	naglano	March–June	Roti, bhakri
3	*Oryza sativa*	Rice (hand pounded)	chokha	January–December	Cooked
4	*Panicum miliaceum*	Common or Proso millet	varai	October–January	Cooked
5	*Pennisetum typhoideum*	Pearl millet	bajra	–	Rotli
6	*Sorghum vulgare*	Sorghum	jowar	April–August	Rotli, gruel
7	*Triticum aestivum*	Wheat	gahoo	January–December	Rotli, gruel
8	*Zea mays*	Maize or Corn	makka	August	Roasted or as such
9	–		kharai	August	Roti, bhakri
	Fish and seafood				
1	*Carcharias* sp.	Shark	khari fish	–	Curry
2	*Coilia dussumieri*	Mandeli	mandli	November–June	Steamed with egg plant and potato
3	*Elops saurus*	–	river fish	June–September*	Curry
4	*Harpodon nehereus*	Bombay duck	bubla	–	Steamed, fried with vegetables
5	*Paratephusa spinigera*	Crab	karachala	June–December	Curry
6	*Thaleichthys pacificus*	–	small fish fry	–	–
7	–	–	bodiya river fish (ravas)	June–September*	Curry
8	–	–	kokil zinga fish	June–September*	Fried or curry
9	–	–	muru fish	June–September*	Curry with vegetables
	Vegetables				
1	*Abelmoschus esculentus*	Lady's finger	bhindi	August–September	Vegetable curry
2	*Agaricus bisporus*	Mushroom	kukkagodugu	July–August	Curry, dry vegetable
3	*Amaranthus spinosus*	Prickly amaranth	matla bhaji	June–September*	Boiled vegetable
4	*Asparagus racemosus*	Asparagus leaves	satavari	Year–round	Boiled vegetable
5	*Bambusa arundinacea*	Bamboo	bamboo	June–September*	Pickled, boiled
6	*Carissa carandas*	–	karonda	April–July*	Curry
7	*Chlorophytum tuberosum*	–	ugat phylli	August–September	Vegetable curry
8	*Cicer arietinum*	Bengal gram leaves	chana bhaji	November–March	Vegetable curry
9	*Cucurbita maxima*	Red pumpkin	lal bhopla	October–December	Boiled vegetable, fried
10	*Dalbergia latifolia*	–	sisam	March–May*	Semi-liquid preparation
11	*Dictyophora* sp.	Bamboo mushroom	vasarta	June–July	Dried, curry
12	*Lagenaria vulgaris*	Bottle gourd	dudhi	January–December	Vegetable curry
13	*Momordica charantia*	Bitter gourd	karela	June–September	Vegetable curry
14	*Moringa oleifera*	Drumstick	saragvani sing	January–June	Vegetable curry
15	*Phaseolus coccineus*	Scarlet runner beans	lili papadi	October–January	Vegetable curry
16	*Solanum melongena*	Eggplant or brinjal	baingan	January–December	Curry
17	*Tectona grandis*	–	teakwood leaves	April	Curry
18	*Trigonnella foenum graecum*	Fenugreek	methi	November–February	Vegetable curry

Continued

Table 10.1 *(continued)* **Bhil traditional food** *(95 species/varieties)*

	Scientific name	*English/common name*	*Local name*	*Seasonality*	*Preparation*
19	–	Elangve leaves	–	March–May*	Boiled vegetable
20	–	–	loti	June-September*	Bhaji
21	–	–	mokha	December-February	Curry
22	–	–	sag tree	June-September*	Bhaji
23	–	–	terani bhaji	June-September*	Bhaji, dry with dhal
	Meat and meat products				
1	*Bos Taurus*	Cow	gai	June-September*	Roasted, curry
2	*Capra hyrchusb*	Goat	bakri	January–December	Curry
3	*Lepus capensis-Leporidae*	Rabbit	sasboo	December–April	Curry
4	*Rattus norvegicus*	Rat	onder	November–March	Roasted
5	*Sus scrofa*	Wild pig	jungli bhund	November–August	Boiled, roasted, curry
6	*Varanus flavescens* (yellow) or *Varanus bengalensis*	Monitor lizard	–	Year–round	Curry
	Poultry				
1	*Columbia livia intermedia*	Pigeon	kabotar	March–May*	Boiled and roasted
2	*Gallus bankiva murghi*	Hen fowl	murghi	March–May	Curry
3	*Haliastar spherus*	Whistling kite	samadi	March	Curry
4	*Picoides pubescens*	Downy woodpecker		March	Curry
5	*Psittaciformes*	Parakeet, parrot	popat	March	Curry
6	*Strigidae*	Owl	ghuvad	March	Curry
7	–	–	chakvat	March	Curry
8	–	–	titar	March	Curry
	Fruits, nuts and seeds				
1	*Achras sapota*	Sapodilla fruit	chiku	November–March	Fresh, ripe
2	*Aegle marmelos*	Bael fruit or wood apple	billa	November–December	Fresh, ripe, chutney
3	*Annona reticulata*	Bullocks heart	ramphala	March–May	Fresh, ripe
4	*Annona squamosa*	Custard apple or sweetsop	seetaphel	August–September	Fresh, ripe
5	*Artocarpus heterophyllus*	Jackfruit	phanas,	April–September	Fresh, ripe
6	*Bassia longifolia*	Mahua	mahvoda	June	Flowers used for making wine, dry seeds
7	*Bassia latifolia*	–	doli mahuda	–	Oil
8	*Carica papaya*	Papaya	papeeta	January–December	Fresh, ripe
9	*Cordia rothai*	Gumberry	gunda	March–May*	Pickle, chutney
10	*Emblica officinalis*	Indian gooseberry	amla	February–May	Chutney
11	*Ficus racemosa*	Wild fig	umbara	February–May*	Chutney, raw
12	*Guizotia abyssinica*	Niger karsani	–	–	–
13	*Lycopersicon esculentum*	Tomato	tomato	January–December	Boiled, in dhal
14	*Magnifera indica*	Mango, ripe	aam	February–May	Fresh, ripe
15	*Psidium guajava*	Guava	jamrookh	October–January	Fresh, ripe
16	*Syzygium cumini*	Indian black berry	jamboo	May–June	Fresh, ripe

Continued

Table 10.1 *(continued)* **Bhil traditional food** *(95 species/varieties)*

	Scientific name	*English/common name*	*Local name*	*Seasonality*	*Preparation*
17	*Zizyphus jujuba*	Indian jujube	bore	October–January	Fresh, ripe
18	–	–	kakad	February–March	Pickle
	Pulses and legumes				
1	*Cajanus cajan* (2 var.)	Red gram dhal (tender pods, dry seeds)	tuver	January–December	Dhal
2	*Dolichos biflours*	Horse gram	kulad	April-June*	Boiled, steamed
3	*Dolichos lablab*	Field bean	val papdi	Winter	Fried, steamed
4	*Glycine max merr.*	Soybean	soyabean	January–December	Boiled, vegetable
5	*Lens esculenta*	Lentils	masoor	January–December	Dhal, boiled
6	*Phaseolus aureus Roxb* (2 var.)	Green gram, whole seeds, split seeds	moong	January–May	Dhal
7	*Phaseolus mungo*	Black gram	Udad	January–December	Dhal, steamed, ground, fried as fritter
8	*Pisum sativum* (2 var.)	Peas (Green tender, dry)	vatana	December–April	Dhal, steamed, ground, fried as fritter
9	*Vigna catjung* (2 var.)	Cow pea (pods, dry)	chowli, chowli sing	January–December	Dhal, steamed, ground, fried as fritter
	Roots and tubers				
1	*Asparagus racemosus*	–	shatavari	June–September*	Boiled
2	*Amorphophallus campanulatus*	Yam or Elephant foot	suran	October–May	Boiled vegetable
3	*Chlorophytum borivilianum*	White musali bhaji	safed musali bhaji	June–September*	Boiled vegetable and roasted
4	*Colocasia antiquorum*	Colocasia	aloknala	June–September	Boiled vegetable
5	*Dioscorea esculenta*	Spinney yam	kankholi		–
6	*Ipomoea batatas*	Sweet potato	shakariya	October–May	Boiled, fried, grated
7	*Solanum tuberosum*	Potato	batata	January–December	Boiled, fried, grated
8	–	Red tuber	kand koychi	June–August	–
9	–	–	jungli kand	June–August	Soaked, boiled and eaten with salt

– No data.
* Seasonality of use rather than months harvested.

Principal objectives and scope

Research was designed to understand the existing problems of food insecurity and malnutrition and gender equality and women's empowerment with this population. Using community-based participatory research methods, this study documented the Bhil traditional food system. This knowledge can be used to develop food security, nutrition and health promotion programmes and promote development strategies that contribute to preserving the ecosystem diversity of the Bhils and support their livelihoods, and to reduce vulnerability.

Methodology

Documentation of the Bhil community food system and identification of the traditional food species were undertaken in 2001–2002. This formed part of an FAO study entitled *Documenting Traditional Food Systems of Indigenous Peoples: Process and Methods with International Case Studies*, which included five case studies in Asia (Kuhnlein, 2003).

Household food consumption and dietary assessment surveys of 187 Bhil households yielded information on traditional food patterns, seasonal dietary habits, and procurement of food and cost of food production.

Table 10.2 Nutrient composition of selected Bhil traditional foods *(per 100 g of edible portion)*

Food items	*Moisture*	*Energy*		*Protein*	*Fat*	*CHO*	*Fiber (total)*	*Ash*	*Calcium*	*Iron*	*Copper*	*Zinc*	*Magnesium*	*Manganese*	*Phosphorus*
	g	*kcal*	*kJ*	*g*	*g*	*g*	*g*	*g*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*	*mg*
Cereals and grains[1]															
Pearl millet (bajra)	12.4	361	1 511	11.6	5.0	67.5	1.2	2.3	42	8.0	1.06	0.02	137	1.15	296
Sorghum (jowar)	11.9	349	1 459	10.4	1.9	72.6	1.6	1.6	25	4.1	0.46	1.60	171	0.78	222
Vegetables[2]															
Doli mahuda seeds	9.8	559	2 337	9	44.4	30.9	3.4	2.5	64	7.3	0.50	1.30	88	0.6	153
Junglikhand, cooked	84	63	263	0.9	0.1	14.5	0.4	0.1	31	2.5	0.04	0.50	8	0.1	9
Junglikhand, raw	81	72	301	1.4	0.3	16	0.8	0.5	10	0.8	0.08	0.30	18	0.1	33
Mokha leaves	66.1	111	464	3.5	0.9	22.1	4.4	3	831	5.1	0.10	0.70	173	1.2	51
Mushroom, dry	22	272	1137	20.6	4.3	37.8	11	4.3	94	79.4	1.40	6.10	147	2.4	487
Terana leaves	89	34	142	1.8	0.8	4.8	1.7	1.9	230	0.9	0.10	0.30	48	2.0	55
Fruits[1]															
Indian gooseberry (amla)	81.8	58	242	0.5	0.1	13.7	3.4	0.5	–	–	–	–	–	–	–
Indian jujube (bore)	81.6	74	309	0.8	0.3	17	–	0.3	4	0.5	0.12	0.10	–	0.17	9

CHO Carbohydrate.
– No data.
1 Gopalan, G., Rama Sastri, B.V., Balasubramanian S.C. 2002.
2 Nutritive value from NIN analysis.

Dietary information gathered from in-depth interviews provided the primary data to direct research operations. In this regard, key informant interviews were a powerful research tool to supplement and complement the information collected.

Community food system data

To determine the foods normally consumed, data were collected through field visits and a rigorous food consumption survey adapted from standard tools (Kuhnlein and Pelto, 1997; Kuhnlein, 2000; Kuhnlein, 2003). Scientific names, common names, and food preparation were documented and are presented in Table 10.1. Nutrient values for all foods were calculated using the Indian Food Composition Tables (Gopalan, Rama Sastri and Balasubramanian, 2002).

Food samples that did not have documented food composition values in the Indian Food Composition Tables were analysed at the National Institute of Nutrition in Hyderabad, India. These data are presented in Table 10.2, along with nutrient information on key foods mentioned in this chapter.

Dietary assessment

The survey team – consisting of one nutritionist, two community partners, one sociologist and the CECCT director – visited each household to collect quantitative dietary intake for one day, estimated by 24-hour recalls using the weighed method (Reddy, 1997). For each meal, the recall data included the food item consumed, its ingredients, the quantity in grams of the raw and cooked weight, and the cooked weight in household measures. Data were entered into two Excel spreadsheets: one detailed the household food pattern and another detailed individual dietary intake. Diets were analysed for all foods, and the nutritive value of the diet was calculated for energy, protein and micronutrient content using the Indian Food Composition Tables (Gopalan, Rama Sastri and Balasubramanian, 2002).

Food frequency intake and related data – such as ownership of land, names and ages of individual members of the household and whether the mother was pregnant or lactating – were collected using food frequency questionnaires and household interviews, respectively.

Analysis and findings

Traditional food list

Ninety-five foods generally consumed by the Bhils were identified and tabulated. Foods were classified into food groups, and the numbers of food per group are shown in Table 10.3.

The Bhils were noted to have a high consumption of protein-rich foods such as meat and poultry, with 14 types of meat and poultry consumed. This level of consumption of meat and poultry was because of ready availability of animals in the jungle. Thirteen types of legumes and seven different kinds of cereals were also widely consumed.

Not all foods had identified nutrient contents. The nutritive values of certain foods (missing data in food list) were not available from published sources, but were included as imputed values in analysis.

Table 10.3 Food group classification of Bhil traditional food list

Food category	*No. items*
Cereals	9
Fish and seafood	9
Fruits, nuts and seeds	18
Green leafy vegetables	13
Meat and poultry	14
Other vegetables	10
Legumes	13
Roots and tubers	9
Total	95

Methods of obtaining food

The Bhils cultivated their own vegetables and fruits in farms and home gardens. The main cultivated crops were rice and *ragi* (finger millet) and, depending on irrigation facilities, other cereals and legumes were grown. Apart from this, they grew a few fruit trees such as mango, custard apple, guava, *ramphal* (Bullock's heart) and jackfruit. Fruits were also collected from the jungle. Fruits were usually eaten in times of scarcity, depending on seasonal availability. During summer, they ate *amla* (Indian gooseberry), jackfruit, *ramphal*, banana and mango. Of these, mango, jackfruit, *ramphal* and banana were grown in home gardens (by those who had more than 4 acres of land). During the monsoon, they ate *jamboo* (blackberry), banana and bamboo shoots and in winter, they ate *bore* (Indian jujube), *amla*, custard apple, guava and banana. *Amla* was picked from the forest and the remaining fruits were grown in home gardens or farms. Papaya was cultivated throughout the year in home gardens. Important methods of obtaining food were cultivation, gathering from the forests and hunting (animals and birds from the forest and rats from the fields) (Table 10.4).

Table 10.4 Methods of obtaining Bhil traditional food

Method	*No. items*
Cultivated	29
Domesticated	3
Gathered	9
Gathered, cultivated	1
Wild, gathered	32
Wild, gathered, cultivated	7
Wild, hunted	14
Total	95

All cereals commonly consumed were cultivated. These included rice, wheat, maize, *ragi*, *jowar* (sorghum), *kharai* and *varai* (common millet). Overall, 26 foods were cultivated, while 32 grew wild and were gathered from the jungle. Eight kinds of fruits and all leafy vegetables were collected from the jungle. They were eaten in large quantities when they were easily available. However, fruits such as papaya and mango were also cultivated. Fourteen animals and birds were hunted, while only three (goat, cow and hen) were domesticated and consumed. Owing to the ease with which these animals were obtained and the relatively low cost, these

Table 10.5 Seasonality of Bhil traditional food

Season	*No items*
February–March (monsoon)	1
February–May	1
March–May	9
April–June	6
April–July	1
May–June	1
June–September	23
October–May	1
October–January	4
November–December	1
November–January	2
November–February	2
November–May	1
November–August	1
December	2
Throughout the year	20
Whenever possible	5
Total	81

Table 10.6 Number of families in study grouped by land holding *(No. of acres)*

Group	*No. of acres*	*No. of families*			*Total*
		Summer	*Monsoon*	*Winter*	
1	0	14	7	10	31
	0.5	0	1	0	1
2	1	12	10	10	32
3	1.5	1	5	0	6
	2	16	9	0	25
4	2.5	1	4	0	5
	3	10	6	10	26
5	4	6	10	9	25
6	5	12	12	11	35
	10	0	1	0	1
Total		72	65	50	187

Table 10.7 Participants in study

Description of participants	*No. of participants*
Infants (1 to 3 years)	124
Pregnant women	40
Lactating women	96
Elderly persons	41
Total	301

were also eaten relatively frequently. Eight wild foods were also cultivated. These included fruit such as jackfruit and *bore*, and green leafy vegetables such as teakwood, drumstick and *matla* (prickly amaranth).

Fish was an integral part of the diet and most families consumed it frequently because it was easy to obtain. Fish was usually caught from rivers or ponds using fishing equipment made of bamboo (traditionally called *malli*, *katua* and *bothudi*).

Seasonality

Food seasonality was recorded (Table 10.5). Nineteen foods were consumed throughout the year, while 23 foods were consumed between June and September (during the period of monsoons). Most were fish, other seafood and green leafy vegetables. About 16 foods identified were consumed during summer. Most fruits, especially mango, were a favourite among families during summer. Meat and certain leaves such as Bengal gram (chick pea) leaves were eaten during summer. Seasonality of some items was not defined in the study period.

Dietary intake – household and individual

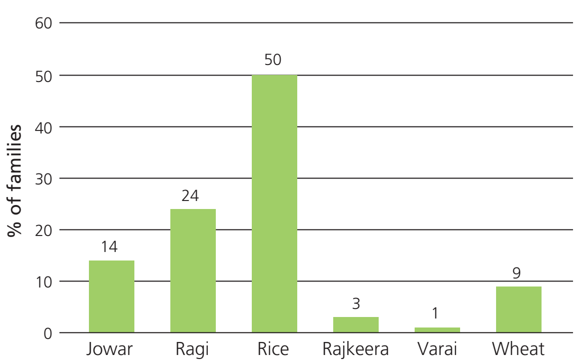
Table 10.6 illustrates the distribution of families and land holding per season. Families were classified into six categories in this analysis according to amount of land accessed, and 187 families were included. Food patterns of these families were recorded for three major seasons: summer, monsoon and winter. The study included 72 families for summer, 65 families for monsoon and 50 families for winter.

Table 10.7 shows the total number of children (one to three years of age), pregnant and lactating mothers and Elders participating in the study. Most breastfed children were zero to one year old, although children between one and two years were also breastfed in addition to receiving complementary foods.

Table 10.8 Consumption of cereals by land holding group *(No. of families)*

Group	No. of acres	Jowar rotla	Ragi roti	Rajkeera porridge	Rajkeera roti	Rice	Varai	Wheat roti
1	0	4	5	2	0	17	0	3
	0.5	0	1	0	0	0	0	0
2	1	5	11	0	0	12	0	4
3	1.5	1	2	0	0	3	0	0
	2	4	7	0	0	12	1	1
4	2.5	1	0	0	0	3	0	1
	3	4	5	0	0	13	1	3
5	4	2	4	1	0	16	0	2
6	5	5	8	2	1	17	0	2
	10	0	1	0	0	0	0	0
Total		26	44	5	1	93	2	16

Figure 10.3 Daily consumption of cereals by percentage of families



Cereals

Table 10.8 shows the consumption of cereals in the study group. The most commonly consumed type of cereal was rice (50 percent of the study group), of which 35 percent of families had 4 or more acres of land. However, 65 percent of families were in the lower income bracket (i.e. less than 4 acres of land). Due to the low cost and high availability of rice, it was consumed more often than other cereals among all groups. Rice was followed by *ragi* (24 percent), of which 70 percent of families had less than 3 acres of land. *Jowar* was consumed by 14 percent of families, of which 73 percent were in the lower income bracket. Wheat was consumed by 9 percent of families, of which 75 percent had less than 3 acres of land. *Ragi*, wheat and *jowar* were mainly consumed in the form of chapatti or roti. Figure 10.3 shows the consumption of cereals in 24-hour recalls by percentage in the study group. It was also noted that while the traditional *ragi* was consumed by some of the population, there was poor consumption by pregnant women, which was attributed to lack of awareness about its nutritive value and limited cultivation among households.

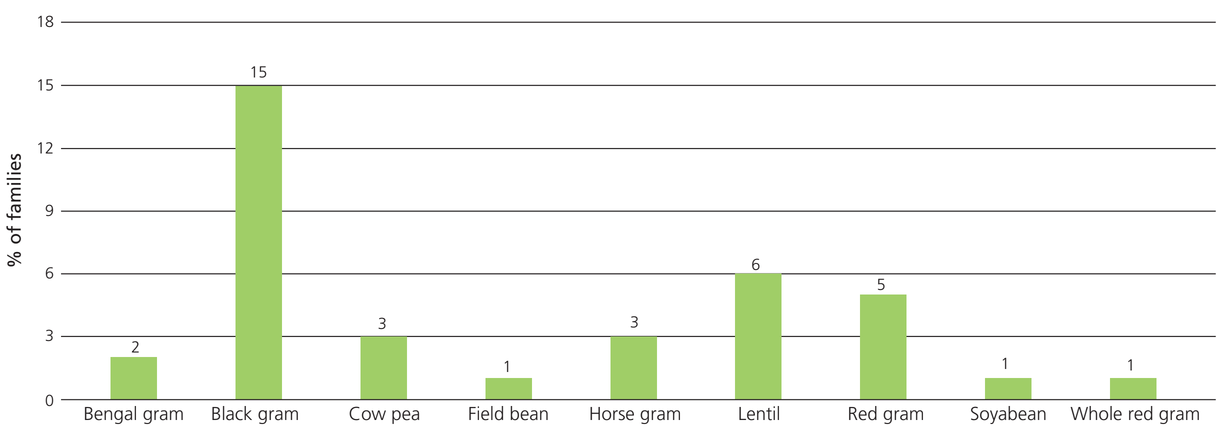
Legumes

Table 10.9 shows the pattern of consumption of legumes in the study group on a single day. These formed an important source of protein in the diet combined with other plant protein sources, predominantly cereals, roots and tubers. Black gram, the most common legume eaten, was consumed as dhal or gruel by 15 percent of families, of which 61 percent owned less than 3 acres of land. Black gram was followed by lentil, which was eaten by 6 percent of families, followed by red gram. There was no distinction in consumption of lentil by any land-holding group, although red gram was mainly eaten by the lower income group. Horse gram was another legume that was eaten by 3 percent of the study group. Figure 10.4 shows the consumption of legumes by percentage of families.

Table 10.9 Consumption of legumes by land-holding group *(No. of families)*

Group	*No. of acres*	*Bengal gram flour porridge*	*Black gram*	*Black gram porridge*	*Black gram Bengal gram mix*	*Chowli*	*Horse gram*	*Horse gram porridge*	*Lentil*	*Red gram*	*Whole red gram*
1	0	0	5	1	0	0	0	1	4	1	1
	0.5	0	1	0	0	0	0	0	0	0	0
2	1	1	0	5	0	1	1	1	0	2	1
3	1.5	0	0	0	0	0	0	0	0	0	0
	2	0	1	2	0	0	0	0	2	1	0
4	2.5	0	0	1	0	0	0	0	0	0	0
	3	1	1	0	0	0	0	1	0	3	0
5	4	0	3	1	0	0	0	0	3	1	0
6	5	1	4	2	1	0	0	2	3	2	0
	10	0	0	0	0	0	0	0	0	0	0
Total		3	15	12	1	1	1	5	12	10	2

Figure 10.4 Daily consumption of legumes by percentage of families



Meat and poultry

Only around 17 percent of the study group ate some form of meat or poultry on the day they were interviewed (Table 10.10 and Figure 10.5). Most animals were hunted and eaten occasionally, usually two to three times in a month – a good source of protein in the daily diet. Domesticated animals like goats and chickens were eaten more frequently (10 percent of families) because of availability. Pig (pork) was eaten by only three families in the study group, and rabbit was also a common food.

Fish and seafood

Fish was obtained from the river or sea. This was also an easily available source of food and it was the most common food item consumed in this food group (27 percent of families). Varieties of fish are available during the monsoon season or throughout the year. This was a major source of protein and calcium in the diet. Dried *bubla* (lizardfish, commonly referred to as Bombay duck) was the most common fish eaten (22 percent of families). This was usually cooked with potato and *brinjal* (eggplant) as curry and eaten with either rice or roti. Shark and *mandeli* were also eaten frequently

Table 10.10 Consumption of meat and poultry by land holding group *(No. of families)*

Group	No. of acres	Bullock/ Cow meat curry	Hen fowl curry	Ghorpad curry	Goat meat curry	Parrot meat curry	Rabbit meat curry	Rat meat curry	Wild pig meat curry
1	0	0	2	0	0	0	1	0	0
	0.5	0	0	0	0	0	0	0	0
2	1	0	1	0	1	0	0	0	2
3	1.5	1	0	0	0	0	0	0	0
	2	0	0	1	2	1	2	0	1
4	2.5	0	0	0	0	0	0	1	0
	3	0	1	0	0	0	1	0	0
5	4	0	2	1	3	0	0	0	0
6	5	0	1	0	3	0	1	0	0
	10	0	0	0	0	0	0	0	0
Total		1	7	2	9	1	5	1	3

(48 percent of the fish-eating families). Table 10.11 shows the consumption pattern of seafood.

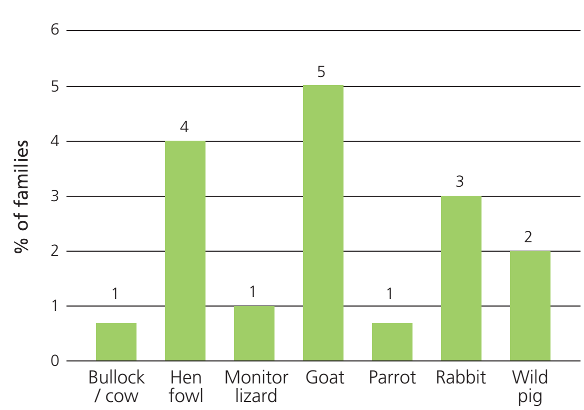
Green leafy vegetables and other vegetables

Most of the green leafy vegetables were gathered from the jungle. Only 5 percent of families ate leafy vegetables either by themselves or with rice flour. *Brinjal*, one of the most frequently eaten vegetables (9 percent of families), was usually eaten as part of a curry or dried. Fish with potato and *brinjal* was a common dish. Tomato was added mainly to dishes for flavour and taste. Both *brinjal* and tomato were commonly added because they were usually grown at home by the women and were available throughout the year. Other vegetables eaten were tender bamboo shoots, mushroom, lady's finger/okra and drumstick. Chili chutney and garlic chutney formed a significant part of the diet (Table 10.12).

Roots and tubers

It was found that roots and tubers were a good source of carbohydrate in the diet. The most common tuber was potato because of its low cost and high availability throughout the year. Approximately 11 percent of the study group included potato in their diet either as a vegetable or as part of a curry with fish and *brinjal*.

Figure 10.5 Daily consumption of meat and poultry by percentage of families



Other tubers, such as *aloknala* (colocasia), *kankholi* (spinney yam) and *kand koychi* were usually gathered from the wild. While *aloknala* was eaten throughout the year, *kankholi* and *kand koychi* were eaten during the monsoon and winter seasons. Table 10.13 describes the consumption by land holding.

Fruits

Wild fruits, found in the jungle, were eaten (particularly by men) in times of food scarcity. Several studies have shown a close relationship between the tribal ecosystem and nutritional status (Laxmaiah *et al.*, 2007).

Table 10.11 Consumption of seafood by land holding group *(No. of families)*

Group	No. of acres	Bodiya river fish curry	Bubla fish and potato curry	Bubla fish curry	Crab curry	Khari fish curry	Kokil fish and Kankholi veg.
1	0	0	3	1	1	1	0
	0.5	0	0	0	0	0	0
2	1	0	1	0	1	2	0
3	1.5	0	0	0	0	0	0
	2	1	0	0	0	0	0
4	2.5	0	1	0	0	0	0
	3	1	1	2	1	0	0
5	4	0	0	0	0	1	0
6	5	1	2	0	2	2	1
	10	0	0	0	0	0	0
Total		**3**	**8**	**3**	**5**	**6**	**1**

Table 10.12 Consumption of green leafy vegetables and other vegetables by land holding group *(No. of families)*

Group	No. of acres	Terani vegetable	Ugat phylli vegetable	Matla vegetable	Fenugreek leaves	Bamboo shoot curry	Bamboo vegetable	Brinjal and potato vegetable	Brinjal vegetable
1	0	0	0	0	0	0	0	1	0
	0.5	0	0	0	0	0	0	0	0
2	1	0	0	1	0	0	1	3	1
3	1.5	0	0	0	0	0	0	0	0
	2	1	1	2	0	2	0	1	0
4	2.5	0	0	0	1	0	0	0	0
	3	0	0	0	1	0	0	0	0
5	4	1	0	0	0	1	0	1	0
6	5	0	0	0	0	0	0	1	0
	10	0	0	0	0	0	0	0	0
Total		**2**	**1**	**3**	**2**	**3**	**1**	**7**	**1**

Generally, fruits are a favourite among the Bhils. In summer, mango and guava were the most frequently eaten fruits. In winter, *amla* and *bore* were commonly eaten. Papaya was noted as eaten throughout the year (Table 10.14).

Family dietary patterns

Family dietary patterns usually included eating a cereal such as wheat, *ragi*, *jowar rotla* (bread) and a lentil curry or *dhal*. Chili chutney was a daily accompaniment in the Bhil diet. Bhils with fewer resources would occasionally not eat at night or would have chapatti with chili or garlic chutney. Families with less than 3 acres of land consumed tea, prepared without milk, only one or twice in a week.

Relationship between micronutrient-rich foods and consumption pattern

The ten richest foods in total carotene content from the traditional food list were analysed. Figure 10.6

Kokil fish curry	*Kokil fish curry with with brinjal and potato*	*Mandeli fish and potato curry*	*Mandeli fish curry*	*Muru fish and vegetable curry*	*Muru fish curry*	*River fish and Muru fish curry*
0	0	0	1	0	0	0
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	0	1	0	0
0	0	1	0	0	0	0
0	0	0	0	0	0	0
0	1	0	2	0	1	0
1	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	0	0	0	0	0
1	**1**	**2**	**4**	**1**	**1**	**1**

Chowli vegetable	*Chili chutney*	*Field bean vegetable*	*Fish & pumpkin curry*	*Garlic chutney*	*Lady's finger vegetable*	*Mushroom curry*	*Soyabean vegetable*	*Chili garlic chutney*
0	25	1	0	3	0	0	0	0
0	0	0	0	1	0	0	0	0
1	27	0	0	4	0	0	1	0
0	4	0	1	1	0	0	0	0
0	23	0	0	2	0	0	0	0
0	4	0	0	1	0	0	0	0
1	24	0	0	0	0	1	1	1
1	24	1	0	0	0	0	0	0
1	32	0	0	2	1	0	0	0
1	1	0	0	0	0	0	0	0
5	**164**	**2**	**1**	**14**	**1**	**1**	**2**	**1**

shows the percentage of families in the study group consuming them. Tomato, papaya, cowpea and crab were the most frequently eaten among the carotene rich foods. Although drumstick and fenugreek leaves were high in carotene content, only 1 percent of the study group consumed them.

Among the iron-rich foods, lentils and *bubla* were each consumed by 6 percent of families, followed by *mandeli* fish, cowpea and crab, which were each consumed by 3 percent of families. Dried *karonda* was the vegetable with the highest iron content, but was not eaten by any families in the study group. Green leafy vegetables such as Bengal gram and *matla* were the next richest iron sources (Figure 10.7).

Among vitamin C-rich foods, tomato is relatively low. However, it was consumed by more families (6 percent) than the other foods in this category, making it an important source of the vitamin. *Amla*, which has the highest vitamin C content, was rarely consumed (2 percent) (Figure 10.8).

Table 10.13 Consumption of roots and tubers by land holding group *(No. of families)*

Group	No. of acres	Aloknala tuber	Kand koychi	Kankholi	Sweet potato curry	Potato and drumstick leaves
1	0	1	1	1	0	0
	0.5	0	0	0	0	0
2	1	0	0	0	0	1
3	1.5	1	0	0	0	0
	2	0	0	0	1	0
4	2.5	0	0	0	0	0
	3	1	0	0	0	1
5	4	0	0	0	1	0
6	5	0	0	0	0	0
	10	0	0	0	0	0
Total		3	1	1	2	2

Table 10.14 Consumption of fruits by land holding group *(No. of families)*

Group	No. of acres	Mango	Papaya	Guava	Mahua	Mahuda	Amla	Bore
1	0	0	0	0	1	0	2	0
	0.5	0	0	0	0	0	0	0
2	1	0	1	0	1	1	1	0
3	1.5	1	0	0	1	0	0	0
	2	3	0	1	0	0	0	0
4	2.5	0	1	0	0	0	0	0
	3	1	2	3	0	0	1	1
5	4	0	1	0	0	0	0	2
6	5	1	2	0	1	0	0	1
	10	0	0	0	0	0	0	0
Total		6	7	4	4	1	4	4

Figure 10.6 Relationship between carotene rich foods and daily Bhil consumption

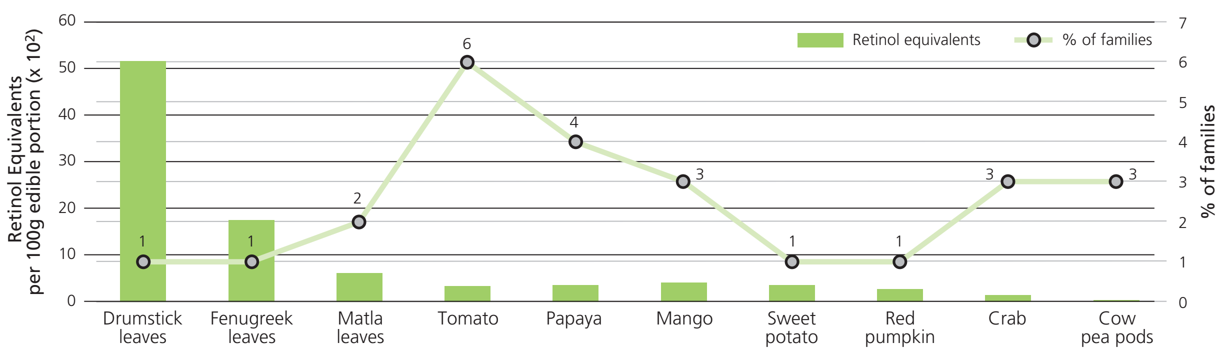


Figure 10.7 Relationship between iron rich foods and Bhil daily consumption

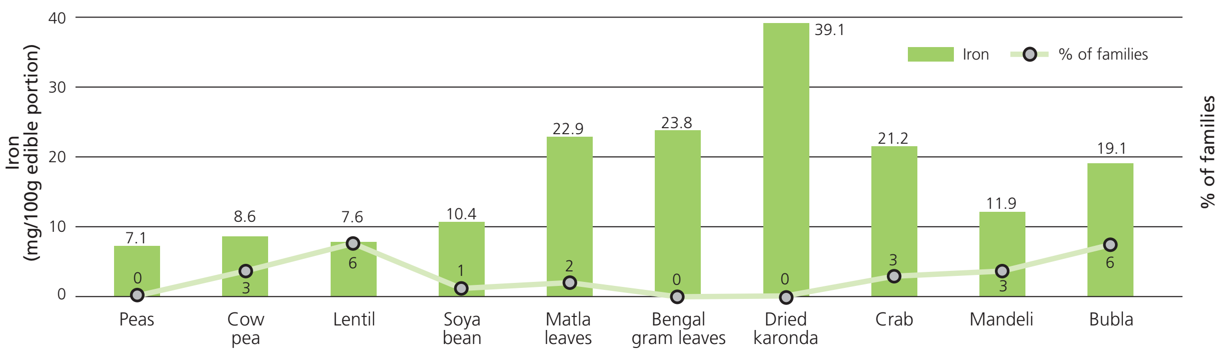
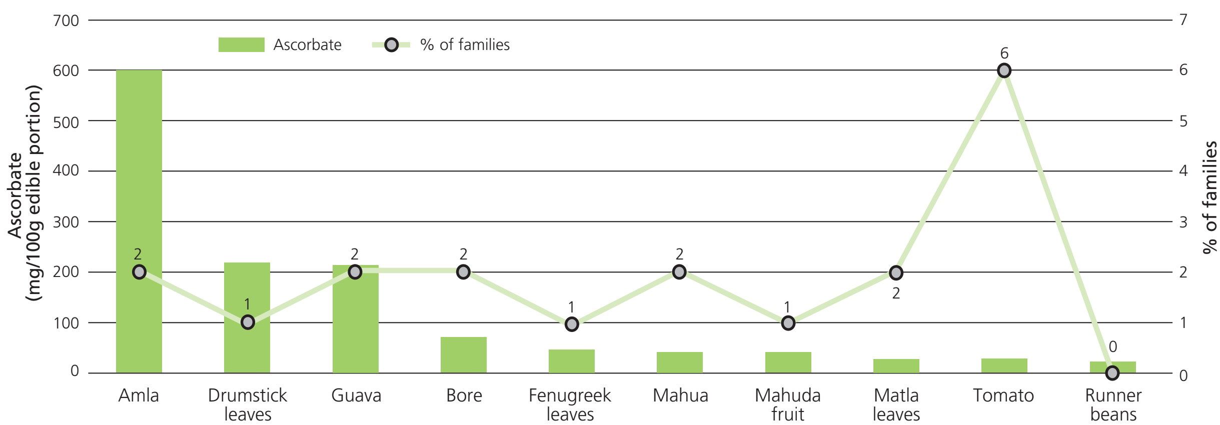


Figure 10.8 Relationship between vitamin C rich foods and Bhil daily consumption



Studies carried out by the National Nutrition Monitoring Bureau in different Indian states revealed that, even though there had been marked decrease in prevalence of severe undernutrition in the country in the last three decades, the prevalence of undernutrition remained high. The prevalence of undernutrition in tribal communities was relatively higher compared to the urban as well as rural counterparts (Krishnaswamy *et al.*, 1997).

Dietary habits of children

Frequency of food intake among children (one to three years)

The frequency of food intake in children was tabulated on a daily, weekly and seasonal basis. Data collected covered the three seasons: summer, monsoon and winter. Fifteen children were included in this analysis. Children between the ages of one and two years were breastfed once in the morning and also given complementary foods. Purchased milk was rarely given because of its high cost. However, those who domesticated goats or cows gave a diluted cup of milk to children if it was available. All children consumed the locally available biscuit almost every day. Children's foods highest in carotene content were *matla* leaves, papaya, crab, tomato, fenugreek leaves and drumstick leaves. Crab and drumstick leaves were eaten twice a week, while green leafy vegetables were eaten once or twice a week. Tomato was eaten more frequently because of its cultural acceptance and versatility in cooking. Tomato is used widely in lentil, curry and chutney preparations in India among both tribals and non-tribals. It is also eaten raw by children and adults. Given its desirable sour and sweet taste and its ability to liquefy the dish, the tomato was a favourite in most meals and dishes.

Foods highest in iron content that were consumed by children were green leafy vegetables, such as Bengal gram or *chowli* leaves and *matla* leaves, and fish such as *bubla* and *mandeli*. These foods were eaten once or twice per week.

Dietary assessment of children (one to five years)

The diets of 40 children in the age group of one to five years were assessed. The children were grouped into two age categories: one to under three years (25 children) and three to five years (15 children). The average daily energy intakes of the diets were calculated. It was noted that the energy content of the diets was very low, amounting to only around 50 percent of the Indian Recommended Dietary Allowances (RDA) in the one to under year age group, while that of children in the three to five year age group provided a little over 50 percent of the Indian RDA for the age group. Table 10.15 presents the average intake of foods for children one to five years. Table 10.16 shows percent energy contribution of each of the food categories to their daily diet. Processed foods were sugar and rusk, a local salted biscuit that is a favourite among children, often eaten at breakfast or as a snack during mid-evening. Cultivated and wild indigenous foods provided a total of 68 percent of energy, whereas processed biscuits and other purchased foods contributed a total of 32 percent.

Dietary habits of pregnant and lactating mothers

Frequency of food intake among pregnant and lactating mothers

The frequency of food intake by pregnant and lactating mothers was tabulated on a daily, weekly and seasonal basis. Fifteen mothers were included, of which eight were lactating, six were pregnant and one was both pregnant and lactating. The intake of carotene rich foods, such as mango and fenugreek leaves, was generally one to three times per week. Iron-rich foods, such as *bubla* fish and *mandeli* fish, were eaten by three mothers one to two times per week. *Matla* leaves were eaten by ten mothers and consumed one to three times per week. Few vitamin C rich foods were consumed. Three mothers ate the only vitamin C rich fruit, *amla*, at least once a week.

Dietary intake analysis found that dietary energy and protein intakes of most pregnant women and pre-school children did not meet the Indian RDAs for many nutrients.

Table 10.15 Average intake of food in grams by Bhil children *(one to five years) (n = 40)*

Food group	*Food category*			
	Cultivated	*Wild*	*Processed*	*Purchased*
Cereals	40	–	–	127
Local biscuits	–	–	29	–
Legumes	10	–	–	28
Roots and tubers	135	100	–	–
Green leafy vegetables	30	92	–	–
Other vegetables	90	190	–	–
Fruits	100	92	–	–
Meat and poultry	–	77	–	–
Fish and seafood	–	–	–	32
Fats and oilseeds	–	–	–	8
Sugar	–	–	5	10

Table 10.16 Percent energy contribution of food categories to Bhil children's diet *(n = 40)*

Food group	*Food category*			
	Cultivated	*Wild*	*Processed*	*Purchased*
Cereals	18	–	–	18
Local biscuits	–	–	1	–
Legumes	3	–	–	4
Roots and tubers	6	6	–	–
Green leafy vegetables	6	7	–	–
Other vegetables	3	3	–	–
Fruits	2	3	–	–
Meat and poultry	–	11	–	–
Fish and seafood	–	–	–	3
Fats and oilseeds	–	–	–	3
Sugar	–	–	0.5	2.5
Total	**38**	**30**	**1.5**	**30.5**

Dietary assessment of pregnant women

Diets of 40 pregnant women in the age group of 19 to 40 years were assessed. A mean dietary energy intake of 1 501 kcal was noted. The major food group contributing to dietary energy was cereals, providing nearly 74 percent of the total dietary energy. This was followed by legumes, vegetables or meat, sugar and fat/oil, which contributed to the remaining 26 percent. It was observed that cultivated and purchased cereals like rice, wheat and *jowar* were consumed more commonly compared to *ragi*. Households included those that did not cultivate *ragi*. Tables 10.17 and 10.18 describe the average intake of foods and the energy contribution of food categories to the Bhil pregnant women's diets. Cultivated and purchased foods contributed over three-quarters of dietary energy, around a quarter of dietary energy was provided by indigenous/traditional foods and 2 percent of dietary energy was obtained from processed foods.

Several studies elsewhere in India have shown that iron deficiency anaemia continues to be widespread in all communities (NNMB, 2003). Apart from strengthening iron and folic acid distribution programmes, there is an urgent need to improve household consumption of protective foods, such as green leafy vegetables, fruits and small livestock and indigenous fish that are good sources of iron and other micronutrients.

Anthropometric assessment

Women and children were found to have short statures and low body weights consistent with malnutrition as assessed by the National Centre for Health Statistics standards (Hamill *et al.*, 1977) and reflect data from Indian tribal populations recently reported (National Institute of Nutrition, 2000). Analysis of anthropometric data of 1 420 children, across all age groups, found that the prevalence of underweight status, assessed as moderate malnutrition was 45.8 percent, and the prevalence of underweight status assessed as severe malnutrition was 35.2 percent. Moderate malnutrition is defined as weight-for-age (WFA) <-2 SD from the median of the reference population and severe malnutrition is WFA <-3 SD from the median of the reference population. Only 16.1 percent of children had normal nutritional status. These findings were consistent with previous findings on tribes in Andhra Pradesh (NNMB, 2000).

Food preservation methods

The Bhils used traditional methods of food preservation or they consumed prepared foods within the same day or the following day for breakfast. Harvested foods were preserved for periods of drought or scarcity. Preservation methods included drying, roasting and

Table 10.17 Average intake of food in grams by Bhil pregnant women *(n = 40)*

Food group	*Food category*			
	Cultivated	*Wild*	*Processed*	*Purchased*
Cereals	324	–	–	326
Local biscuits	–	–	26	–
Legumes	–	–	–	81
Roots and tubers	140	175	–	–
Green leafy vegetables	127	300	–	–
Other vegetables	200	100	–	–
Fruits	–	11	–	–
Meat and poultry	–	118	–	115
Fish and seafood	–	–	–	8
Fats and oilseeds	–	–	–	15

Table 10.18 Percent energy contribution of food categories to Bhil pregnant woman's diet *(n = 40)*

Food group	*Food category*			
	Cultivated	*Wild*	*Processed*	*Purchased*
Cereals	25	–	–	27
Local biscuits	–	–	1	–
Legumes	–	–	–	7
Roots and tubers	4	5	–	–
Green leafy vegetables	2	5	–	–
Other vegetables	3	2	–	–
Fruits	–	9	–	–
Meat and poultry	–	3	–	3
Fish and seafood	–	–	–	2
Fats and oilseeds	–	–	1	1
Total	**34.6**	**24.0**	**2.1**	**39.3**

the use of cow manure (Bhattacharjee *et al.*, 2006). Karsani niger seeds, rice, *varai* and legumes were preserved in bamboo baskets coated with cow manure. These containers were left in the sun to dry and then were filled with the seeds or grain. The manure helps to repel any insects from infesting the seeds or grain. A few families occasionally used neem leaves to preserve rice. Fire ash was also used as a preservative for legumes, such as black gram and red gram. Generally, no preservation method was used for *ragi* because the bitter red covering helps prevent insect infestation.

Drying was the most effective method of preservation among the Bhils. Excess catches of fish, such as *muru*, were first roasted over a hot plate or *tava* (flat iron pan used for roasting), and then dried and kept for consumption within a couple of days. Excess meat would be dried, by piercing it with sharp bamboo knives, and barbequing it over fire. Once it was well heated, it was stored by being wrapped in cloth and kept in bamboo baskets. When required, it would be taken out, cut into pieces and added to curries. Mushrooms were also dried and stored in baskets, which were normally used for catching crabs.

Ragi papads (dried thin pancakes) were made by making *ragi* batter, rolling it out into thin round shapes and leaving them in the sun to dry. They were then packed and marketed.

Processing of complementary foods

While carrying out the dietary assessment, the team conducted demonstrations on the preparation of complementary foods for infants and young children. Bhil women were encouraged to bring mixtures of cereals, legumes and nuts as available from their households. These mixtures were combined in proportions of 5:1:1 and were roasted, dried and finely ground by the traditional stone mill. This mixture could then be stored at room temperature for a period of up to two months in airtight containers.

This mixture was then combined with locally available cooked and mashed vegetables, or mashed fruit, and given as gruel to the infants and young children. Drawing upon such examples, mothers were advised to introduce complementary foods made from locally available ingredients to infants of six months of age and to continue breastfeeding up to two years of age – a practice that has been accepted by many Bhil women.

Conclusions

The key factors in this study were the Bhil people and their food system. The food-related behaviour of the Bhils played an important role in the food consumption and dietary practices. Food-related behaviour is complex and is determined by the interplay of many factors such as social, economic, cultural, traditional, environmental, etc. Understanding these factors, which affect nutritional status, becomes even more relevant when Bhil culture and traditions are threatened by modernization. It is, therefore, important to gain further insights into Bhil lifestyles, understand the way they live and uniquely utilize and manage their food and related resources. This can throw light on the potential elements that can be optimally utilized.

The results of the research presented here point to the need for strategic community-based interventions to improve food security, nutrition and health of the Bhils. There is a need to strengthen and promote food-based nutrition strategies and make use of the value of indigenous Bhil foods to diversify the diet. Specifically, nutrition education activities could be targeted towards pregnant women and young children who form the most vulnerable sections of the community. Further, dietary diversification, education and communication activities need to be strengthened and promoted for better health and nutrition of infants and children in Bhil communities. Bhil food diversity can be used productively for more sustainable and environmentally sound solutions to improving food security and nutrition ●

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Chapter 11

The Maasai food system and food and nutrition security

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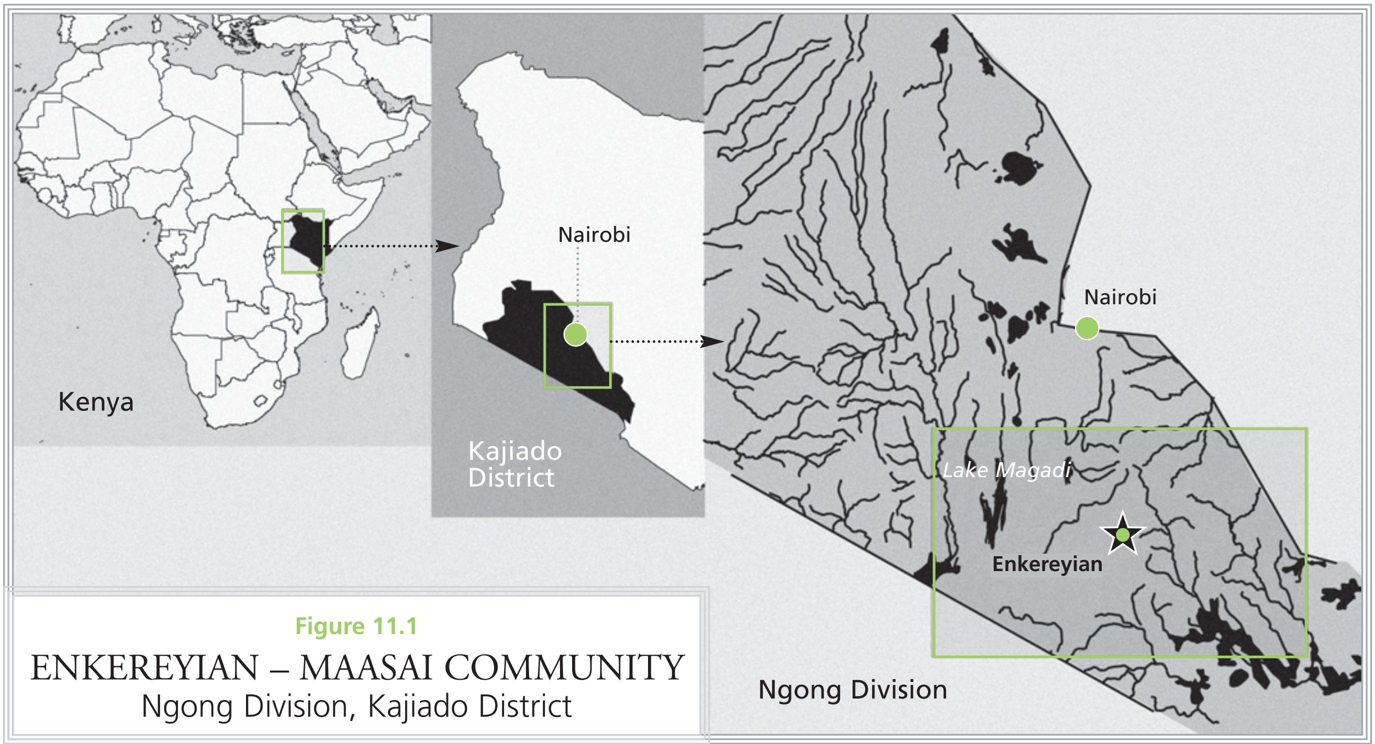

Figure 11.1

ENKEREYIAN – MAASAI COMMUNITY
Ngong Division, Kajiado District

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.

1
Rural Outreach Program (ROP),
Nairobi, Kenya

2
Mainyoito Pastoralist Integrated Development Organization (MPIDO),
Kiserian, Kenya

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Centre for Indigenous Peoples' Nutrition and Environment (CINE) and School of Dietetics and Human Nutrition, McGill University,
Montreal,
Quebec, Canada

Photographic section >> XXXIII

"Our culture and traditional knowledge of our food systems are the pillars of our heritage. Please join us to promote and protect them. Thank you very much."

Namuter Ole Leipa

Abstract

Two Kenyan Non-Governmental Organizations, Mainyoito Pastoralist Integrated Development Organization and Rural Outreach Program, undertook a study of traditional food use within the context of a situational analysis of the food security and nutrition problems faced by the Maasai pastoral community of Enkereyian.

Knowledge of traditional foods and information on the cultural, social and temporal context of their consumption was obtained through key informant interviews and gender-segregated focus groups. Species identification and nutrient composition of collected samples of wild fruits and herbal additives to milk and meat-based soups was undertaken.

A cross-sectional dietary survey of 120 households interviewed mothers on issues of food source and decision-making and included a 24-hour recall and three-day food frequency. While milk, blood and meat were found to be the key elements of the traditional diet, these animal-source foods contributed only 7 percent of the current energy intake, with maize and beans the primary staples in a diet that was, overall, energy deficient. Milk and meat were nonetheless the major source of vitamin A (80 percent of intake) and an important contributor of iron (11 percent).

Individual herbs provided appreciable amounts of some micronutrients, while wild fruits were good sources of vitamin C, and the most frequently consumed fruit *iyier* is rich in provitamin A (6.1 mg/100g ß-carotene). Previously collected data indicated prevalence of wasting and stunting above Kenyan averages that were exacerbated by prolonged drought conditions and lifestyle changes.

Within a strategy that increases the availability of animal-source foods through attention to improved water management, re-stocking and pastoralism-related policies, traditional foods can enable the community to meet nutritional, food security and livelihood needs in a more optimal manner.

Introduction

Mainyoito Pastoralist Integrated Development Organization (MPIDO) is an organization whose individual and group members represent Maasai communities in Kenya. MPIDO promotes, facilitates and works to create an enabling environment for serving human rights, including natural resources for sustainable livelihood among pastoralist Maasai society. Accordingly, this case study had an overall goal of improving the health and nutritional status of the Maasai community, while preserving indigenous knowledge (and foods) and conserving the environment. Consequently, the Maasai right to food and sound health can be enabled and their means to livelihood improved.

MPIDO is overseen by an elected Board of Directors. Operations are carried out by the Secretariat in conjunction with the General Committee made up of MPIDO staff and local community members. This project falls within the mandate of the thematic sub-committee on livelihoods. The project was brought to local Elders by the subcommittee who through a community-level consultative process entered into an agreement with the Elders. Two of the Elders, recruited as community-based consultants, acted as key informants. Moreover, through explaining the project to people in the village they played a key role in mobilizing the community for focus group discussions and gathering herbs and wild fruits. Two field assistants were trained on conducting key informant interviews and focus group discussions, dietary survey administration, and on how to collect plant samples for herbarium identification and laboratory analysis.

Rural Outreach Program (ROP) is also a Kenyan non-governmental organization working to improve the livelihood of rural dwellers. It has a strong focus on promotion of traditional foods and attendant indigenous knowledge, a priority that is foremost in the project. ROP has a strong research unit that provided technical expertise for this study. ROP's capacity and experience in community research and in the science of food and nutrition were essential components of the project.

Research site

Maa-speaking pastoralists in Kenya and the United Republic of Tanzania number approximately one million, some 60 percent of whom live in Kenya (CBS, 2001). Traditionally the Maasai are semi-nomadic pastoralists who migrate within semi-arid lowlands and more humid uplands to obtain water and pasture. The Enkereyian community is located in Ngong Division, Kajiado District, Kenya. The community is approximately 70 km directly south of the city of Nairobi and extends another 50 km towards Lake Magadi (Figure 11.1). Approximately 30 000 inhabitants are distributed in 20 village units and speak exclusively Maa within the community. Approximately 10 percent of the community also speaks Kiswahili, with less than 2 percent also speaking English.

The community occupies lands on the floor of the Great Rift Valley at an elevation of 1 200 to 1 500 metres. This semi-arid area experiences seasonal rainfall, with wet seasons typically in April to May and November to December. Within this environment, water is a limited resource with acute water shortages for livestock and household use occurring through at least several months of the year.

A large majority of the population are reported to obtain their livelihood through husbandry of cattle, goat and sheep. Family incomes were supplemented by the sale of milk, livestock and wild products, primarily charcoal and firewood. Wild plant food, primarily fruit and roots and honey as well as medicinal plants added to the diet, provided an important but understudied contribution to diet and health. Previous studies have documented Maasai diet-related ethnobotany and intake patterns (Johns *et al.*, 2000; Maundu, Ngungi and Kabuye, 1999; Nestel, 1989). Government surveys have identified nutrition and health problems in Kajiado District and data from the food systems documentation phase of the Centre for Indigenous Peoples' Nutrition and Environment Food Systems for Health Program provided important background as reported here.

Reduced carrying capacity of the environment for livestock, to a considerable degree related to drought and integration into the market, coincided in leading to increased sale of livestock and reduced herd sizes. The proximity to Nairobi and the extension of peri-urban areas and related markets into Ngong sub-district made purchased food a ready alternative to the consumption of the traditional diet. Dependence on purchased foods without income security, however, resulted in a lack of dietary self-sufficiency. Droughts over the past couple of decades underline a pattern of poverty, food crises and dependence on food relief. Serious food shortages in 1984, 1990–1992, 1996–1997, 2000–2001 and their emergence again in 2004–2005 suggest that the cycle is getting shorter without allowing sufficient time for the community to recover. With the extent of drought experienced in the Maasai territory, undernutrition has been documented with wasting and stunting of more than 10 and 50 percent of Maasai children respectively. Further details on overall nutrition status from a report of a World Vision survey are presented in Table 11.1.

Community water requirements are high and people experienced considerable hardship in travelling long distances (more than 20 km) to look for water for both human and livestock consumption. Women were only able to fetch domestic water using donkeys each carrying 30 litres of water. Five litres of this went to the school and people had only one day to rest before going back to fetch water. This cycle consumed women's time to the degree they were not able to engage in any other

Table 11.1 Nutritional status of children by Z-score and percentage with oedema

Indicators	*Malnutrition % distribution by gender*			
	Male	*Female*	*Both sexes*	*95%CI**
Wasting (weight-for-height Z-score < -2)	**15.5**	**10.2**	**13.0**	**9.6–17.6**
Moderate (-3 to –2 Z-score)	12.0	8.3	10.3	8.0–13.1
Severe (<-3 Z–score)	3.5	1.9	2.7	1.6–4.5
Oedema	**3.0**	**2.3**	**2.7**	
Underweight (weight for age Z-score < -2)	**33.4**	**25.9**	**30.0**	**25.1–35.7**
Moderate (-3 to -2 Z-score)	26.4	18.4	22.7	19.6–26.1
Severe (<-3 Z-score)	7.0	7.5	7.3	5.5–9.6
Stunting (height for age z-score < -2)	**58.1**	**46.7**	**52.8**	**46.1–60.3**
Moderate (-3 to -2 Z-score)	38.4	33.6	36.2	32.3–40.3
Severe (<-3 Z-score)	19.7	13.1	16.6	13.8–20.0

Source: World Vision Kenya, 2004.
* The 95% confidence interval is for both sexes.

meaningful and productive social and economic activities. During rainy season, both livestock and humans used water from the same earth dams. Water was therefore not clean and many people contracted water-borne diseases, including typhoid. Water contamination also adversely affected human health indirectly through livestock losses and subsequent reduction in food availability.

In addition to their importance for livelihoods, livestock are central to Maasai culture, society and identity. Cattle play a key role in important ceremonies, such as circumcision where blood is drawn. In other ceremonies, skins have a sacred function and cattle are the means of appreciation given to spiritual leaders at the time of the ceremony. In addition, a dowry in the form of cows forms an essential role in cementing links between families; the marriage of a man and woman contributes to traditional economic security and is the foundation into which children enter society. Cattle are an essential part of exchange typical of many other social relationships. Cattle husbandry defines the organization of society; a male Elder heads each household and livestock unit, with a clear differentiation of gender and age-defined roles around milking, grazing and other aspects of pastoralism. Further, traditional forms of healing draw on animal-source diets including milk, soup and blood.

In spite of the limitations of pastoralism for meeting the needs of the Maasai population in the contemporary context, this system continues to make essential contributions to the well-being of both national and local populations. For the latter, it provides a subsistence basis for the majority of the population, and for the former, a large portion of the meat consumed. Therefore, the situation of the Enkereyian community must be considered within a national context. Solutions for its chronic food insecurity and malnutrition depend on improved self-sufficiency and resource management, as well as rational national policies that ensure that the pastoral contribution to meat, milk and charcoal for urban residents is recognized and compensated in a manner consistent with historical authority and events, and present realities. Recently, the Maasai developed a strategic plan and will utilize the research from this project to strengthen women's knowledge and abilities to provide animal source foods for their children.

Objectives

The study aimed to:

1. Identify traditional foods consumed by the Maasai community.
2. Compile selected nutrient composition of traditional foods.

3. Determine the dietary use in the cultural context of the Maasai community.
4. Provide background for a possible health and food-based intervention to improve the health status of the Maasai community.

Methods

Study design

Food habits of the Maasai community were studied in conjunction with the collection and nutrient analysis of plant-based foods commonly used. The study also drew on available literature on nutritional status of the area and nutrient composition of foods. A cross-sectional survey was conducted between August 2004 and January 2005, a period that would normally comprise a dry season followed by short rains. In fact, because of ongoing drought conditions the dry season was more extreme than seasonal averages, and was compounded by the failure of the short rains to arrive.

Data collection

Key informant interviews

Two selected community consultants provided the initial preliminary information on foods consumed and the cultural context under which they are consumed. Further in-depth interviews were conducted with elderly men and women separately. Information collected in key informants interviewed included:

- history of the Maasai people;
- common foods consumed by the Maasai people at different stages of life;
- cultural context of dietary practices;
- list of plant-based food consumed, their use and seasonality.

Focus group discussions

Separate focus group discussions were held for women and men. For the men, discussions focused on general foods and their cultural context. Foods consumed specifically by (adolescent) males, e.g. during circumcisions, were discussed. For the women, foods consumed by infants, young children, and women in general and by pregnant and lactating women in particular were the focus of discussion. In all the discussions, special consideration was given to locally available food additives or adjuncts (herbs) and wild fruits that were commonly consumed.

Food sample collection and identification

During the focus group discussions, an inventory of foods, including herbs and wild fruits consumed, was made. Besides the mainstream Maasai traditional foods (animal-source foods), a diversity of herbs and wild fruits were consumed. Of these, 15 herbs and 11 wild fruits were selected for analysis based on their seasonal availability. They were collected and submitted to:

1. The East African Herbarium where their botanical names and respective family group were identified. The leaves, flowers and edible portions of the plants were submitted.
2. The Department of Food Technology and Nutrition laboratories of the University of Nairobi for selected mineral and vitamin analysis. Only the edible portions were submitted for the analyses.

Micronutrient analysis of herbs and fruits

A total of 15 herbs and 11 fruits were selected for analysis for vitamin A, vitamin C, iron, zinc, calcium and selenium. Vitamin A and iron deficiencies are of public health importance in Kenya (Sehmi, 1993; Government of Kenya and UNICEF, 1999). At the global level, zinc deficiency is gaining interest as a potential public health problem. Vitamin C deficiency among young children has been evident in the study area (MPIDO, 2005). Selenium is increasingly being mentioned as an important micronutrient, particularly with the advent of HIV/AIDS. Calcium was considered for analysis as an extra micronutrient.

Herbs and fruits for laboratory analysis were collected over a six-month period, between July 2004 and January 2005. Each herb was collected from three different plants, not more than 500 metres away from each other. The three samples of the same herb were then analysed in duplicate. Because of the scarcity of fruits in the dry season, it was not possible to use the same sampling method as used for the herbs. Fruits were collected from a single tree and analysed in triplicate.

For fruits and herbs consumed in raw forms, the edible portions were analysed directly. For herbs from which hot water extracts are added to soups or milk, known weights of usable portions were boiled in 100 ml water and their extracts in water were analysed for micronutrients. Computations were subsequently conducted to determine the amounts of nutrients in 100 g of edible portion. The following formula was used:

$$\text{Nutrient per 100g} = \frac{\text{Amount of nutrients in the extract}}{\text{Weight of usable portion}} \text{x100}$$

Vitamins A and C analyses were carried out using High Performance Liquid Chromatography, and iron, zinc, calcium, magnesium and selenium analyses were conducted by use of Atomic Absorption Spectrophotometry.

Dietary survey

Representatives of 120 households sampled randomly were interviewed during the months of October and December 2004. The mothers were interviewed on issues of food source and decision-making related to food choice, source, preparation and consumptions. A three-day food frequency, which included the source of food and intra-household food distribution (qualitatively), was also administered. Respondents were asked on how many days the pre-listed foods had been consumed in the households. The list was constructed during pre-testing of the dietary survey questionnaire and other foods not on the list could be added during the survey. The household members who consumed the food and the sources were also recorded.

To determine the household energy and nutrient consumption, a 24-hour recall was conducted. Mothers were asked about their food intake. All foods consumed from getting up to going to bed were recorded. To assess the amounts consumed most accurately, the interviewers carried household measures with them to enable the respondents to indicate the most appropriate size or volume. In addition, the cooking pans, spoons and sieves were used to estimate volumes and weights of home-prepared meals, while all the ingredients and their amounts were recorded.

Previous nutritional studies in project area

The nutrient content of major foods consumed, including the composition of meat, milk and blood, are available in the food composition table of Sehmi (1993).

The nutritional status of children in the study area was reviewed from two surveys, one conducted by MPIDO and Ministry of Health (MPIDO, 2004), and the other by World Vision Kenya (2004). The latter, carried out in the months of January and February, 2004, by World Vision's Loodariak Area Development Program, Kajiado District, reported nutritional status of children in Central Keekonyoikie. The survey was conducted during the dry season and at a time when the protracted droughts had just started. As shown in Table 11.1, 13 percent of children were below standards in the weight-for-height category, indicating that a considerable number were acutely malnourished at the time. Moderate wasting was found to be 10.3 percent, which is higher than the average wasting rate in Kenya (6.5 percent). Underweight (weight-for-age) may be an indication of mixed malnutrition (both long term and short term). About 23 percent of the children were found to be moderately underweight, which is quite comparable to the average underweight rate in Kenya (22 percent). Moderate rates of underweight (as low as 5 percent) have been reported in some parts of Kenya, while about 7 percent were found to be severely underweight.

In the subsequent Ministry of Health study, 800 households and 828 children under five years old (6–59 months old having height ranging from 65 to 110 cm) were surveyed in Central Keekonyoikie location at the very start of the drought period. The intent of this cross-sectional survey with random sampling was to describe nutritional status, investigate factors associated with malnutrition in the area and give valid recommendations to be used as a basis for immediate nutrition and/or health interventions. Weight, height and mid-upper arm circumference (MUAC) were measured as indicators of prevalence of wasting and acute malnutrition.

In this sample, 51.4 percent were male and 48.5 percent were female with 5 percent of all children below one year of age. The prevalence of wasting was 22.2 percent, with moderate and severe wasting found to be 14.1 and 8.1 percent respectively. The results of the MUAC measurements showed that 7.6 percent were malnourished (Z-scores less than -2) (data not shown).

The rates of acute malnutrition from both surveys of above 10 percent provided a justification for relief food, especially for the children under five years old. Thus, MPIDO initiated a general food ration programme (providing maize, beans and oil to families on a monthly basis) and supplementary feeding to non-centre young children was provided with a mixture of soya flour, maize and micronutrients.

Although a national survey assessing anaemia and iron, vitamin A and zinc status was conducted in Kenya in 1999 (MPIDO, 2004) no information was available from Maasai areas.

Photos

Photos were taken using a digital camera (3.2 mega pixels) for the study area in general and of the community members as they involved themselves in various activities. Photography of edible portions of the food samples collected – stems, leaves, roots and fruits – are on file with ROP.

Data analysis

Information emerging from key informant interviews and focus group discussions were categorized based on thematic issues of concern. Dietary data were imputed in the Statistical Package for Social Scientists package (Version 11) and analysed in the same package at ROP. Laboratory data were entered into MS-Excel using the same package. Mean micronutrient contents and standard deviations were computed.

Results

Table 11.2 reports species within the Maasai food list, followed by Table 11.3, which gives characteristics of unique Maasai foods. Table 11.4 outlines the source of foods and aspects of food decision-making.

Nutrient profile of basic Maasai traditional foods

Traditionally, the Maasai rely on meat, milk and blood from cattle for protein and energy needs. Thes research study showed that the foods and their by-products were consumed alone or in combinations in differing contexts by differing age groups. Table 11.5 shows the nutrient composition of Maasai meat, blood and milk as reported by Sehmi (1993) and by Foley and Otterby (1978).

Meat was shown to be an important source of energy and protein for the Maasai people. Meat was usually consumed during special occasions: circumcision and marriage ceremonies, among others. Soups, which were usually eaten with added herbs, were prepared whenever meat was available. Meat and bones were boiled in water with herbs. In some cases, herbs were boiled in water first, after which the water extract was added to the prepared soups. Blood was an exceptionally good source of iron and calcium and contributed protein and vitamin A. It was consumed whenever an animal was slaughtered or when a household member lost blood, principally in childbirth and circumcision. The broths (mixtures of blood and milk) were relatively low in protein and iron content. They did, however, provide appreciable amounts of calcium. They were consumed on special occasions that called for the slaughtering of animals.

Milk was also shown to be an important food for the Maasai. According to Maasai Elders, milk consumption patterns have changed only minimally over time, as compared to blood consumption. Milk and milk products were consumed any time of the day by all age groups, although these products were highly recommended for young children. There were four categories of milk products consumed:

- Fresh milk – obtained from the cow and ingested without being boiled. All people drank milk whenever it was available.
- Sour milk (*kule naisamis*) – made by fermenting the fresh milk for a day (mostly overnight) at room temperature. Young boys, not yet at the circumcision age, were common consumers.

Table 11.2 Maasai traditional food *(35 species)*

	Scientific name	*English/common name*	*Maasai name*	*Seasonality*
	Grains, legumes & nuts			
1	*Oryza sativa*	Rice	ormushele	–
2	*Pennisetum typhoides*	Bulrush millet	–	–
3	*Sorghum bicolor*	Sorghum	–	–
4	*Vigna subterranea*	Bambara groundnut	–	–
5	*Zea Mays*	Maize, maize meal	irpaek, orgali	–
6	–	Beans	impoosho	–
7	–	Chapati (without fat)	enchapati	–
8	–	Chapati (with fat)	enchapati	–
9	–	Peas	mpoosho	–
10	–	Unimix	enkurma doikempe	–
11	–	Maize and bean mixture	olkeseri	–
	Roots and leafy vegetables			
1	*Brassica oleracea* var. (2 var.)	Kales, cabbage	mbenek, mpuka	–
2	*Brassica oleracea* var.	–	–	–
3	*Ipomoea longituba*	Root	enchiliwa	June–December
4	*Ipomoea batatas*	Sweet potato	enkwashe oorkokoyo	–
5	*Manihot esculenta*	Cassava	–	–
6	*Solanum tuberosum*	Irish potato	inkwashen	–
	Wild fruits			
1	*Acacia drepanolobium*	Whistling thorn	eluai	–
2	*Acacia tortilis*	Umbrella thorn fruit	sagararam	September–November
3	*Balanites aegyptiaca*	Desert date	ilokua	November–December
4	*Carissa edulis*	Natal plum	lamuriak	May–July
5	*Grewia bicolor*	White leaved raisin	ositeti	July–August
6	*Grewia tembensis*	–	iyier	September–November
7	*Rhus natalensis*	Kwazul natal rhus	olmisigiyoi	May–July
8	–	–	ilpupuo	June–July
9	–	–	iltipaila	August–September
10	–	–	irkisubub	January–April
11	–	–	olokwa	–
	Herbs			
1	*Acacia kirki*	Flood-plain thorn, flood-plain acacia	olerai	March–December
2	*Acacia nilotica*	Arabic gum tree, babul	olkiloriti	January–December
3	*Acacia nubia*	–	oldepe	–
4	*Acacia senegal*	Gum arabic, Senegal gum	olibilie	January–August
5	*Albizia amara*	Bitter albizia	olperelong'o	January–December
6	*Lannea schweinfurthii*	False marula	olpanti	–
7	*Mystrolyxon aethiopicum*	–	olgdonga	–

Continued

Table 11.2 *(continued)* **Maasai traditional food** *(35 species)*

	Scientific name	*English/common name*	*Maasai name*	*Seasonality*
8	*Osyris lanceolata santalaceae*	Transvaal sumach, rock tannin-bush	olosesiae	January–October
9	*Salvadora persica*	Toothbrush tree	oremit	–
10	*Secamone punctulata*	–	osimantel	May–December
11	*Sterculia africana*	African star chestnut	olkarasha	January–December
12	*Vatovaea pseudolablab*	–	olkalei	January–October
13	*Ximenia americana*	False santalwood	olamai	March–November
14	–	–	olkimitare	–
15	–	–	olpupuoi	March–December
	Animal products			
1	*Bos taurus*	Cow meat	inkiri enkiteng	July
2	*Bos taurus*	Cow blood	osarge	July
3	*Bos taurus*	Cow broth (blood & milk)	nailanga	–
4	*Bos taurus*	Cow milk, not boiled, boiled	kulenairoua, kulenayiara enkiteng	January–December
5	*Bos taurus*	Cream	engorno	–
6	*Bos taurus*	Sour milk	kule naisamis	–
7	*Bos taurus*	Yoghurt	kule naoto	–
8	*Bos taurus*	Cow colostrum	isikitok	–
9	*Capra hircus*	Goat meat	inkiri enkine	April, August, December
10	*Capra hircus*	Goat blood	osarge lenkine	–
11	*Capra hircus*	Goat milk	kule enkine	June–August
12	*Capra hircus*	Goat broth (blood & milk)	nailanga	–
13	*Ovis aries*	Sheep meat	enkirongo	–
14	*Ovis aries*	Sheep milk	kule engerr	–
15	–	Porridge with blood	osaroi	–
16	–	Liquid fat	eilata	–
17	–	Lean dried meat in solidified fat	olpurda	–
	Fish			
1	–	Fish (small)	osinkiri kiti	–
2	–	Fish (large)	osinkiri sapuk	–
	Others			
1	*Saccharum officinarum*	Sugar	esukari	–
2	–	Cooking oil	eijata	–

– No data.

Table 11.3 Maasai traditional food characteristics

Traditional food item	*Comments: characteristics and use*
Basic traditional foods	
Eilata (liquid fat)	Available whenever animals are slaughtered
Inkiri (meat)	Cow, goat and sheep meat consumed mostly during ceremonies
Kulenairo (milk fresh)	Used to make tea and drank "as is"
Kulenaoto (milk sour)	Fermented overnight. Consumed mostly by pre-circumcised boys
Lean dried meat in solidified fat	Consumed together; can keep 6 months after animal slaughtered
Nailanga (blood + milk)	Red in colour and consumed mostly during ceremonies
Osarge (blood)	Drunk directly as soon as possible when from the animal
Osaroi (porridge + blood)	Blood is added to the porridge during preparation and is considered nutritious
Herbs[1]	
Olamai (*Ximenia americana*)	The stem prepared as oldebe and also used as an appetite stimulant
Olbiliel (*Acacia senegal*)	The roots are boiled in water until the water colorizes (red). The colored extract in water is then added to children's milk
Oldebe (*Acacia nubia*)	The stems are boiled in the soup until the soup colorizes. The soup is then consumed. Oldebe is a good appetite stimulant
Olerai (*Acacia kirki*)	The bark is boiled in water and the extract given to children for re-hydration and to women who have just given birth (for womb cleansing)
Olgdonga (*Mystrolyxon aethiopicum*)	The stems and leaves are boiled in water and added to soup for all age groups
Olkalei (*Vatovaea pseudolablab*)	The roots are consumed directly. It is consumed basically as food and no specific function attached
Olkarasha (*Sterculia africana*)	Roots are directly consumed by particularly the herdsmen. It is succulent in nature
Olkiloriti (*Acacia nilotica*)	Stem prepared as oldebe (boiled in soup until it colorizes) and also used as an appetizer
Olkimitare	Mostly herdsmen to quench thirst chew the roots directly. Most liked by male children who have just started to herd cattle
Olosesiae (*Osyris lanceolata*)	Roots are boiled in water until the water colorizes. The extract is then added to milk given to children. Believed to prevent cold and promote weight gain in children
Olpanti (*Lannea schweinfurthii*)	The roots are boiled in water and resultant extract in water added to children's milk
Olpelorong'o (*Albizia amara*)	The stem is boiled in water until the water colorizes. It is believed to promote growth in children of over 3 years of age
Osimantel (*Secamone punculata*)	Roots are boiled in water and added to children milk. It is believed to prevent cold
Fruit	
Eluai (*Acacia drepanolobium*)	Very seasonal and consumed mostly by children and women
Enchiliwa (*Ipomea longituba*) (root)	Consumed directly. It resembles Irish potatoes in look and is succulent
Ilpupuo	Very seasonal and consumed mostly by children and women
Iltipaila	Very seasonal and consumed mostly by children and women
Ilukwa (*Balanites aegyptiaca*)	Very seasonal and consumed mostly by children and women
Irkisubub	Very seasonal and consumed mostly by children and women
Iyier (*Grewia tembensis*)	Very seasonal and consumed mostly by children and women
Lamuriak (*Carissa endulis*)	Very seasonal and consumed mostly by children and women
Olmisigiyoi (*Rhus natalensis*)	Very seasonal and consumed mostly by children and women
Ositeti (*Grewia bicolor*)	Very seasonal and consumed mostly by children and women
Sagararam (*Acacia tortilos*)	Very seasonal and consumed mostly by children and women

[1] Those herbs and fruits with no scientific names could not be identified at the East African Herbarium.

- Yoghurt (*kule naoto*) – milk was fermented for about four days and stored in airtight containers. It resembled the conventional yoghurt. All age groups took this milk.
- Cow colostrum (*isikitok*) – when still thick and yellow in colour, this was considered nutritious and mostly given to young children, particularly boys. Adults did not take colostrum unless it was mixed with herbs.

The research found that fresh milk was an important source of protein, energy and calcium among these people. Yoghurt in the Maasai community may have other functional health benefits as a result of the probiotic microorganisms present. Cow colostrum was shown as an important source of protein and vitamin A, especially for children.

It was a common practice to add herbs to fresh or boiled milk for various reasons. These additions were generally considered nutritious and possessing medical functions; it was widely believed that additions of herbs to milk help children to fight diseases.

Nutrient composition of herbs

Herbs were added for flavour and/or for nutrition and medical functions in mainstream Maasai food, such as meat, blood, soup and milk. Some herbs were boiled in water directly and added to milk or soups, while

Table 11.4 Aspects of Maasai food sourcing and decision-making

Aspects	***Respondents** (n=120)*
Predominant source of food	Own (50%), Purchases (45.7%) Relief (3.2%) Other (1.1%)
Under what circumstance is food bought[1]?	Depends fully on purchase (32.0%), During unfavourable weather (52.1%), When has money or can afford (69.2%)
Who makes the decisions on source of food?	Husband (42.6%), Wife (26.6%), Both (17.0%), Other (13.0%)
Who decides on how food is prepared?	Wife (96.2%), Husband (1.1%), Both (1.1), Other (5.3%)
Who decides on intra-household food distribution?	Wife (93.6%), Husband (2.1%), Other (4.3%)

1 The percent figures do not add-up to 100% because of the multiple responses in the question asked.

Table 11.5 Nutrient composition of cow and goat meat, blood, milk and milk products *(per 100g edible portion)*

Foods	***Energy***		***Protein***	***Fat***	***Ash***	***Iron***	***Calcium***	***Vitamin A***	
								Retinol	***Carotene***
	kcal	*kJ*	*g*	*g*	*g*	*mg*	*mg*	*IU*	*μg*
Cow's blood[1]	95*	397	13.75	0.90	–	18.75	242	–	–
Cow's broth[1] (blood + milk)	46	192	0.94	–	–	1.69	133	–	–
Cow colostrum[2]	–	–	14.0	6.7	1.1	–	260	940–1 230	–
Cow's meat[1]	214*	895	24.40	12.75	–	3.56	313	–	–
Cow's milk[1]	73*	305	3.42	4.03	1.0	1.81	181	27	80.00
Cow's milk yoghurt[1]	74*	309	3.7	4.75	0.8	0.2	149	102	–
Goat blood[1]	78*	326	3.80	3.85	–	27.19	350	–	–
Goat broth[1] (blood + milk)	37*	155	2.08	2.30	–	1.53	297	–	–
Goat meat[1]	166*	694	15.43	10.00	–	2.16	45	0	–
Goat milk[1]	69*	288	3.48	3.48	–	0.9	180	32	0.00

1 Sehmi, 1993.
2 Foley and Otterby, 1978.
* Calculated.
– No data.

some were consumed "as is". Some of the herbs commonly used had attributed hypolipidemic and antioxidant properties, thus offering one explanation for the low incidence of heart disease despite high consumption of animal-source foods. The herbs were prepared and consumed in different forms. Almost all herbs were available throughout the year although their availability most likely improves during the wet seasons, and they were generally consumed in a specific season (as shown in Table 11.2). Table 11.6 shows the use and nutrient composition of some commonly used herbs.

Table 11.6 Micronutrient composition of commonly consumed herbs, leafy vegetables, roots and wild fruits *(per 100g edible portion)*

	Food items	*ß-carotene*	*Vit C*	*Iron*	*Zinc*	*Selenium*	*Calcium*
		mg	*mg*	*mg*	*mg*	*mg*	*mg*
	Herbs						
1	Olamai[1]	0.0 ± 0.0	2.2 ± 0.0	0.2 ± 0.0	0.2 ± 0.02	0.3 ± 0.0	9.3 ± 0.3
2	Oldepe[1]	0.0 ± 0.0	3.8 ± 0.0	0.4 ± 0.1	0.2 ± 0.04	6.5 ± 0.2	19.0 ± 0.5
3	Olerai[1]	0.0 ± 0.0	0.1 ± 0.0	3.1 ± 0.2	6.1 ± 0.2	2.6 ± 0.1	78.4 ± 2.1
4	Olgdonga[1]	0.0 ± 0.0	0.03 ± 0.01	9.3 ± 0.5	1.7 ± 0.1	1.3 ± 0.1	9.6 ± 0.3
5	Olibilie[1]	0.0 ± 0.0	2.8 ± 0.0	0.3 ± 0.0	0.3 ± 0.0	0.03 ± 0.0	10.1 ± 0.2
6	Olkalei[1]	0.02 ± 0.01	14.7 ± 0.3	2.3 ± 0.4	1.6 ± 0.0	2.6 ± 0.2	692.7 ± 47.7
7	Olkarasha[1]	0.0±0.0	8.6 ± 0.8	4.6 ± 1.4	3.1 ± 0.0	0.3 ± 0.0	1729.2 ± 32.5
8	Olkiloriti[1]	0.0 ± 0.0	6.8 ± 0.0	0.1 ± 0.02	0.5 ± 0.01	0.2 ± 0.0	4.7 ± 0.6
9	Olkimitare[1]	0.0 ± 0.0	25.4 ± 1.03	2.1 ± 0.4	15.5 ± 1.7	4.1 ± 1.1	750.0 ± 46.9
10	Olosesiae[1]	0.0 ± 0.0	0.2 ± 0.01	7.5 ± 0.3	4.9 ± 0.1	5.3 ± 0.3	42.6 ± 1.5
11	Olpanti[1]	18.0 ± 0.0	1.3 ± 0.0	0.3 ± 0.0	0.3 ± 0.01	2.1 ± 0.0	12.4 ± 0.5
12	Olperelong'o[1]	0.0 ± 0.0	0.0 ± 0.0	2.3 ± 0.0	0.04 ± 0.0	0.3 ± 0.0	5.2 ± 0.3
13	Olpupuoi[1]	0.1 ± 0.01	2.1 ± 0.0	0.3 ± 2.4	0.2 ± 0.0	1.6	9.9 ± 0.6
14	Osimental[1]	85.6 ± 0.0	3.9 ± 0.0	2.1 ± 0.1	0.5 ± 0.0	0.9 ± 0.0	15.10 ± 0.13
	Leafy vegetables						
1	Cabbage[2]	100.0	47.3	1.4	–	–	38.3
2	Kale[3]	2523.0	133.5	1.3	–	–	100.0
	Roots and wild fruits						
1	Eluai[1]	0.5 ± 0.01	65.9 ± 0.6	1.3 ± 0.0	1.6 ± 0.0	10.0 ± 1.7	47.9±12.6
2	Enchiliwa[1]	0.01 ± 0.01	9.4 ± 0.5	0.6 ± 0.0	0.0 ± 0.0	5.0 ± 0.8	146.5 ± 10.0
3	Ilpupuo[1]	0.1 ± 0.00	5.8 ± 0.3	34.7±0.0	3.1±0.0	12.5±	593.8 ±
4	Iltipaila[1]	0.0 ± 0.0	154.4 ± 2.0	3.1	–	0.0±0.0	6.8
5	Ilugua[1]	0.0 ± 0.0	147.0 ± 0.5	1.3 ± 0.0	–	2.5 ± 0.0	122.6±11.5
6	Irkisubub[1]	0.0 ± 0.0	23.4 ± 0.0	6.4 ± 0.9	2.7 ± 0.2	1.6 ± 0.0	45.3 ± 2.2
7	Iyier[1]	6.1 ± 0.1	60.9 ± 0.5	2.5 ± 0.0	0.0 ± 0.0	11.0 ± 0.7	157.9 ± 1.2
8	Lamuriak[1]	0.2 ± 0.0	54.1 ± 0.2	4.7 ± 0.6	5.7 ± 0.6	10.0 ± 0.0	215.0 ± 0.0
9	Olmisigiyoi[1]	0.2 ± 0.01	33.6	1.3	0.0 ± 0.0	25.0 ± 0.0	170.8 ± 16.0
10	Ositeti[1]	0.2 ± 0.01	17.3 ± 0.5	4.1 ± 0.0	0.0 ± 0.0	37.5 ± 2.1	418.1 ± 12.0
11	Sagararam[1]	0.1 ± 0.0	762	0.0 ± 0.0	4.4	0.0 ± 0.0	36.9

1 Analysed at the University of Nairobi.
2 Sehmi, 1993.
3 Shore, 1998.
– No data.

The herbs consumed were found to generally not be important as sources of ß-carotene. Only *osimantel* and *olpanti* contained much ß-carotene. *Olpanti* contained 18 mg/100g while *osimantel*, comparing favourably with cabbage, contained 85.6 mg/100g. *Oikimitara*, *olkalei* and *olkiloriti* were relatively important as sources of vitamin C, but did not compare favourably with the common vegetables, such as kales and cabbages. *Olosesiae*, *olgdonga* and *olkarasha* were relatively good sources of non-haeme iron. *Olosesiae* provided zinc. *Olerai* and *olkimatara*, *olosesiae* and *oldebe* provided relatively high levels of selenium. *Olkimatara* and *olkarasha* contained relatively high levels of calcium – higher than kales and cabbages.

It seems that *olkimatara*, *olosesiae* and *olkarasha* were the most important single herbs in providing a variety of important micronutrients. *Olkimatara* provided vitamin C, zinc, selenium and calcium. *Olosesiae* on the other hand provided iron, zinc and selenium at the same time. *Olkarasha* contained appreciable levels of iron and calcium.

Wild fruits and roots consumed

Wild fruits and roots were consumed mostly by women and children and were highly seasonal, with many having increased availability during and immediately after rainy seasons. Many of these fruits, which were not as sweet as cultivated fruits, can be bitter and were often unpalatable to non-Maasai. Though many were small-sized, they were nevertheless consumed in large quantities by children and women, and were, therefore, a significant source of micronutrients during their months of availability. Table 11.6 details the nutrient composition of several wild fruits consumed in the Maasai community.

As in the case of herbs, many fruits were found to be insignificant sources of vitamin A. Edible portions of *iyier*, however, contained 6.13 mg/100 g of ß-carotene while other fruits provided negligible amounts. All the fruits provided at least some vitamin C, with *sagararam* (which is also consumed by goats) exceptionally high (762 mg/100 g). By comparison, orange contains 60 mg/100 g of vitamin C (Sehmi, 1993). *Iltapaila* contained about twice the amount of vitamin C in oranges while *iyier* and *lamuriak* had amounts comparable to oranges. *Ilpupuo* had high amounts of iron and was not comparable to other fruits. *Sagararam* and *lamuriak* had higher levels of zinc relative to other fruits. All fruits analysed contained at least some selenium except for *iltipaila* and *sagararam*. *Ositeti* and *olmisigiyo* had, however, the highest content of selenium. All fruits had calcium in some amounts except for *iltipaila*, with *ilpupuo* and *ositeti* containing relatively higher amounts. No single fruit provided appreciable amounts of more than two micronutrients. *Ilpupuo* contained iron and calcium although the bio-availability of the former is unknown; *ositeti* contributed both selenium and calcium. *Sagararam* can be relied on as a relatively good source of vitamin C and zinc.

Food consumption patterns in the Maasai life-cycle

Birth to two years

Breastfeeding was the norm up to two years of age. In addition to breastmilk, young children were fed cream from cow's milk commonly known as *engorno*. The cream was extracted by boiling milk and leaving it to stand for the cream to separate, after which it was scooped from the top and given to young children. A common practice of adding burnt donkey dung to the cream before boiling and feeding to young children (most common at three months of age) was believed to help prevent cold and pneumonia. Fresh milk was also given, but rarely without additives. It was common to add herbs, which were first boiled separately in water and the resultant extract added to milk. The herbs were added for nutrition as well as medical functions as described above. Most of the herbs were roots, and are believed to be growth stimulators, dewormers, rehydrators and anti-diuretics, among other functions. Herbs formed an important part of young children's diets.

After circumcision

Before circumcision, girls and boys consumed the general diet consumed by adults. Children, however, were particularly good gatherers and consumers of wild fruits. They gathered many kilograms of wild fruits at their own leisure, particularly when they took animals for grazing. They shared their "harvest" mostly with their mothers and sisters. Male adults considered fruits as food for children and women, and consumed relatively little.

Immediately post-circumcision – 12 to 13 years for girls and 15 to 16 years for boys – special foods were provided. For girls, a mixture of sour milk and fresh blood (*osaraoi*) was given. Until several months after circumcision, these young people were not allowed to drink plain water – they were encouraged to add milk to it before drinking. Dry meat in solid animal fat (*olpurda*), fresh milk and liquid fat in blood were all commonly consumed. A number of herbs were also consumed. Following circumcision boys were encouraged to drink yoghurt and blood daily, on an hourly basis or whenever hungry. Dried meat, which had been stored in rendered fat and a mixture of fresh milk and blood, was given. For girls, drinking water without adding milk was discouraged. Post-circumcision, boys were officially called the "*morans*" and their official foods were fresh milk, fermented milk (equivalent to yoghurt) and meat (*inkiri*) in large amounts. The use of herbs in soups or consumption "as is" was common and a relatively wider variety of herbs was used by boys in comparison to the girls.

Adults

In general, adults (men and women) consumed a variety of staple traditional foods (meat, blood, soup and milk), as well as foods common among Kenyans such as *ugali* (maize meal), *githeri* (a mixture of maize and beans), kales, cabbages, and beans. Special recommendations pertained to pregnant and lactating women.

Pregnant women

Particular parts of meat were earmarked during slaughter for pregnant women, including the liver and kidney. Dried meat in solid fat and fresh and fermented milk were also given at this stage. The use of herbs was also common and women were encouraged to eat various recommended wild fruits and roots.

Postnatal and lactating women

Immediately after delivery, women were given:

- liquid fat for cleansing;
- concentrated solution of water and sugar for energy;
- fresh blood and milk;
- porridge with blood added;
- fresh milk;
- soup with various types of herbs.

Changing food consumption patterns of the Maasai of Enkereyian

In recent years, members of the community have grown dependent on food produced in other areas, a pattern that is more pronounced during the protracted droughts. During drought, animals were spared as sources of food, and migration to areas with green pastures was inevitable. In many instances, animals were sold at "throw away" price, with the money obtained being used to buy more conventional foods, purchased at shops or markets.

The dietary survey in this project was conducted during the drought season. Under these exceptional conditions, it was found that about half of the households depended on their own food sources, and close to half of the other respondents (45.7 percent) purchased food. During this particular time, MPIDO was distributing food (maize, beans and cooking oil) as a general ration in addition to a commercial pre-cooked mixture of maize, soya beans combined with mineral premixes supplied by a local company.

About 3 percent of households depended on the relief offerings as their predominant sources of food. The greatest determinant for the purchase of food was the availability of money irrespective of the season. Husbands, who usually were in better position to work and earn income, were the primary decision-makers on the sources of food. However, their wives determined how food should be prepared and distributed among the household members. This is a common pattern in other communities in rural Kenya.

Maize and white potatoes were the most important energy sources for the Maasai community. The latter was purchased, while the former was obtained from

Table 11.7 Nutrient composition of foods mentioned in Maasai 24-hour recalls *(per 100 g fresh weight)*

Food	Preparation	Energy		Protein	Retinol	Carotene[2]	Vitamin A	Iron
		kcal	kJ	g	IU[1]	µg	RE - µg[3]	mg
Maize, white	Consumed mixed with beans in main meals (lunch and supper)	358	1 496	10.3	0	0	0.0	4.5
Ugali (maize meal)	Consumed as porridge snack or main meals	373	1 559	12.4	0	0	0.0	2.3
Beans	Consumed mixed with beans in the main dishes. Sometimes consumed with ugali and chapatti	323	1 350	19.3	0	10	0.8	8.8
Chapatti	Made of wheat and consumed in the main meals	340	1 421	8.0	0	0	0.0	2.3
Unimix[4]	Given to young children in form of porridge	400	1 672	14.0	2 300	0	2 300	8
Cabbages	Vegetable	14	59	1.8	0	100	8.3	1.4
Millet (porridge)	Consumed as a snack	398	1 664	13.0	0	25	2.1	135
Milk	Used to make tea for breakfast and main meals	72.5	303	4.0	27	80	33.7	1.8
Sugar	Added to tea or porridge	375	1 568	0.0	0	0	0.0	0
Rice	Consumed mostly in main meals	357	1 492	6.3	0	0	0.0	1.5
Potatoes	Consumed mostly in main meals	81	339	2.0	0	26	2.2	1.4
Cooking oil	Consumed mostly in main meals	900	3 762	0.0	0	0	0.0	0
Meat	Consumed mostly in main meals	220	920	30.0	24	0	24	3
Kale	Consumed mostly in main meals	54	226	4.1	0	900	75.0	2.2

Source: Sehmi, 1993.
1 IU = International Unit (1 IU = 0.33 µgRE).
2 12 µg carotene = 1 µgRE.
3 RE = Retinol Equivalents.
4 Pre-cooked mixture of maize, soya beans and mixed with mineral premixes supplied by a local company.

the relief supply. Predominant sources of proteins were beans and milk, with the former obtained from relief supply while the latter was produced by the household. Meat was consumed at least once in three days by about 70.2 percent of the households, while most households rarely consumed blood. Herbs (gathered), even during the drought, were consumed with *eremit*, *olerai* and *olamai*[35] at least once in three days. Three wild fruits were mentioned with *iyier* being the most commonly consumed. Kales (purchased) were consumed at least once in three days by about half of the households interviewed. Fish, peas, sweet potatoes, groundnuts, sorghum and cassava were rare foods in the Maasai community.

It appeared that despite the protracted drought and attendant practice to spare animals, milk and meat were still highly consumed. However, animals were spared as a source of blood for normal consumption. At the time of data collection, relief food was an important food source.

35 Scientific names are given in Table 11.2.

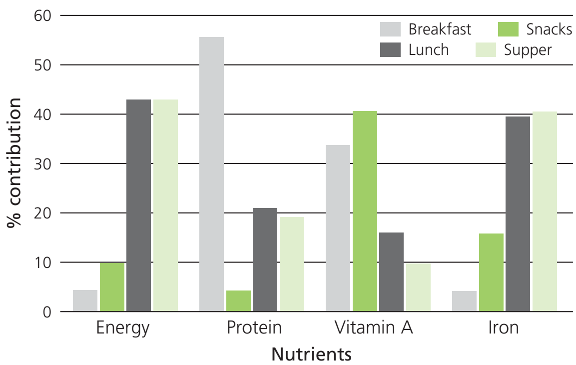
Nutrient intake

Food taken in the last 24 hours

In total, 14 major different foods (Table 11.7) were consumed, as recorded with 24-hour recalls.

The respondents did not mention herbs. This could be explained by the fact that men were the common consumers of herbs, and that most common herbs consumed during the dry season were the succulent ones. Men mostly consumed these to reduce thirst during herding. Anecdotal data, however, showed that the herb, *oremit*, was commonly used in milk tea in the breakfast meals throughout the year. Fruits were also not mentioned. Children consumed most fruits and this intake was not captured in the 24-hour recall. During the wet season, however, when fruits were in plenty, children always brought them home to share with their mothers.

Figure 11.2 Contribution of adult breakfast, snacks, lunch and supper to daily energy and nutrient intake



Adult nutrient intake per day

Daily energy, protein, vitamin A, and iron intake based on 24-hour recall data are shown in Table 11.8. When these values were compared with the recommended intakes for Kenyans as reported by Sehmi (1993), energy (for adults) and vitamin A consumption were low, while protein and iron intakes were in excess of the recommendations. A minimum energy intake of 2 100 kcal and 1 550 kcal is required per day for adults and children respectively.

A minimum intake of about 41 g and 18 g protein for adults and children respectively is recommended. For vitamin A, about 750 µgRE is recommended for non-pregnant female and male adults, while at least 500 µgRE is required for young children. At least 10 mg of iron and 28 mg of iron intake per day is recommended for young children and adults, respectively.

Common traditional foods (milk and meat) contributed only 6.2 percent to the energy consumed. Milk, however, contributed a higher proportion of the vitamin A intake. Milk also contributed about a tenth of the iron intake. Under the extreme drought conditions of the study period purchased or donated non-traditional foods in turn provided 93.8 percent of energy. Under more favourable conditions cooking oil, which made up more than half of the caloric intake, would be consumed only during ceremonies and in the preparation of chapattis. Chapattis in turn would normally only be consumed with meat or vegetable stews.

Table 11.8 Energy and nutrient consumption per adult per day *(total consumption divided by total number of household members)*

Nutrient	***Average quantity consumed*** *per person per day*	***Quantity*** *(% of total average)*	
		Milk	***Meat***
Energy *(Kcal)*	1 623	87.4 (5.4)	24.1 (1.5)
Protein *(g)*	126	4.7 (3.9)	3.3 (2.6)
Vitamin A *(RE)*	23	17.8 (77.5)	0.8 (3.4)
Iron *(mg)*	23	2.2 (9.6)	0.3 (1.4)

Table 11.9 Maasai food consumption pattern based on 3-day food frequency

Food	***Mean frequency***	***% households that consumed food item***	***Most common source of food item***
Maize	2.6	96.8	Gift (relief)
Milk	2.5	86.2	Own
Beans	2.4	88.3	Gift (relief)
Irish potato	1.9	84.0	Purchase
Porridge	1.6	63.8	Purchase
Cabbage	1.5	76.6	Purchase
Meat	1.3	70.2	Own
Kales	1.1	50.0	Purchase
Millet	0.8	33.0	Purchase
Sweet potato	0.8	9.6	Purchase
Peas	0.5	17.0	Purchase
Large fish	0.1	4.3	Purchase
Blood	0.1	3.2	Own
Groundnut	0.1	3.2	Own (2.1%)
Sorghum	0.04	2.1	Purchase
Cassava	0.01	1.1	Purchase
Herbs			
Oremit	2.5	70.0	Gathered
Olamai	1.0	40.0	Gathered
Olerai	0.8	30.2	Gathered
Olkiloriti	0.3	20.5	Gathered
Olperrolong	0.2	40.1	Gathered
Wild fruits			
Iyier	1.5	55.2	Gathered
Ilpupuo	0.8	25.3	Gathered
Olokwa	0.7	29.2	Gathered

As shown in Figure 11.2, most energy was obtained from the lunches and suppers. Most protein came from the breakfast meals while vitamin A was predominantly obtained from breakfast and snacks. Iron was mostly obtained from the lunches and suppers.

Results for the three-day food frequency (Table 11.9) likewise supports a pattern of maize, milk and beans as the main staples, with white potato, cabbage and kale and meat completing the diet of the majority of households. *Oremit* was the only herb used on a daily basis by the majority of households, and during the study period most households consumed the fruit *iyier*.

Conclusions

Meat, milk, blood, and soups were the basic traditional foods of the Maasai of Enkereyian, while herbs were either added to them or consumed directly. Meat, milk and blood provided an important (but decreasing) source of energy and nutrients. Wild non-domesticated fruits were mostly consumed by children and women. More recently, however, the Maasai have increasingly depended on food produced by others, especially during the protracted droughts. During droughts, the consumption of milk, meat, blood and herbs became rare and the availability of highly seasonal wild fruits diminished. Development agencies provided relief food, which became an important source of energy and nutrients during the drought period. Even in the absence of drought, other non-traditional foods were bought, prepared and consumed.

The contribution of traditional diets to energy and nutrients is declining rapidly. Young community members consequently lose the indigenous knowledge on food use and rely more on the conventional Kenyan foods. If some measures are not put in place, complete loss of traditional food practices appears inevitable. This is highly evident with the gradual loss of elder members of the Maasai community who carry most of this people's indigenous knowledge.

Maasai pastoralists living in changing socio-economic circumstances could achieve food security and optimal nutrition and health through: (1) effective management of the pastoral production system; (2) sustainable use of environmental resources including water; (3) nutritionally and culturally appropriate use of purchased foods; and (4) an informed and responsive policy framework. Improving the dietary intake and anthropometric measurements of young children is also a target. In recognition of the cultural importance of livestock (cattle, goats and sheep), increasing family access and use of animal source foods is crucial. Indicators for project success would be biological (anthropometry and dietary), interview (food security and physical activity) and process (activities and workshops evaluated by participants).

Preservation and maintenance of the Maasai traditional indigenous food-based knowledge can be done through continuous education of young members of the community about their traditional food systems and their cultural contexts. There is also a need to integrate the existing health and nutrition interventions with traditional food promotion. Strategies and programmes can increase the availability and consequently the consumption of animal source foods. Such efforts must address the problem of access to water and can involve restocking activities with small animals (goats and sheep) targeted at the most vulnerable households.

Further research could study the effect of traditional diets and Maasai child-feeding practices on simple nutrition indicators, such as anthropometry, psychosocial status and general health condition. This can be used to demonstrate the importance of traditional diets and child-feeding practices, and it can act as a pilot that can be replicated elsewhere among other Maasai and beyond.

Pastoralists of Kajiado District struggle to meet their basic nutrition and subsistence needs within a challenging physical environment. Poverty and malnutrition, stemming from historical determinants of land access and land tenure, are compounded by the progressive deterioration of pastures and other aspects of the biophysical environment, and potentially from integration of pastoralists into the market economy as an immediate adaptive response. Reduction in the consumption of milk, meat and other traditional foods adversely affects nutrition and food security. Limited income-generating alternatives such as charcoal-making and firewood sales have adverse environmental consequences, ultimately reducing the quality of pastures, the availability of wild foods, the productivity of pastoralism, and the well-being of the majority of the community.

This case study in the Food Systems and Health Program of the Centre for Indigenous Peoples' Nutrition and Environment revealed that the Maasai people had diverse foods and indigenous knowledge on preparation and use of the foods. These resources can be incorporated into strategies that would enable the community to meet their nutritional, food security and livelihood needs in a more optimal manner ●

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Chapter 12

The Igbo traditional food system documented in four states in southern Nigeria

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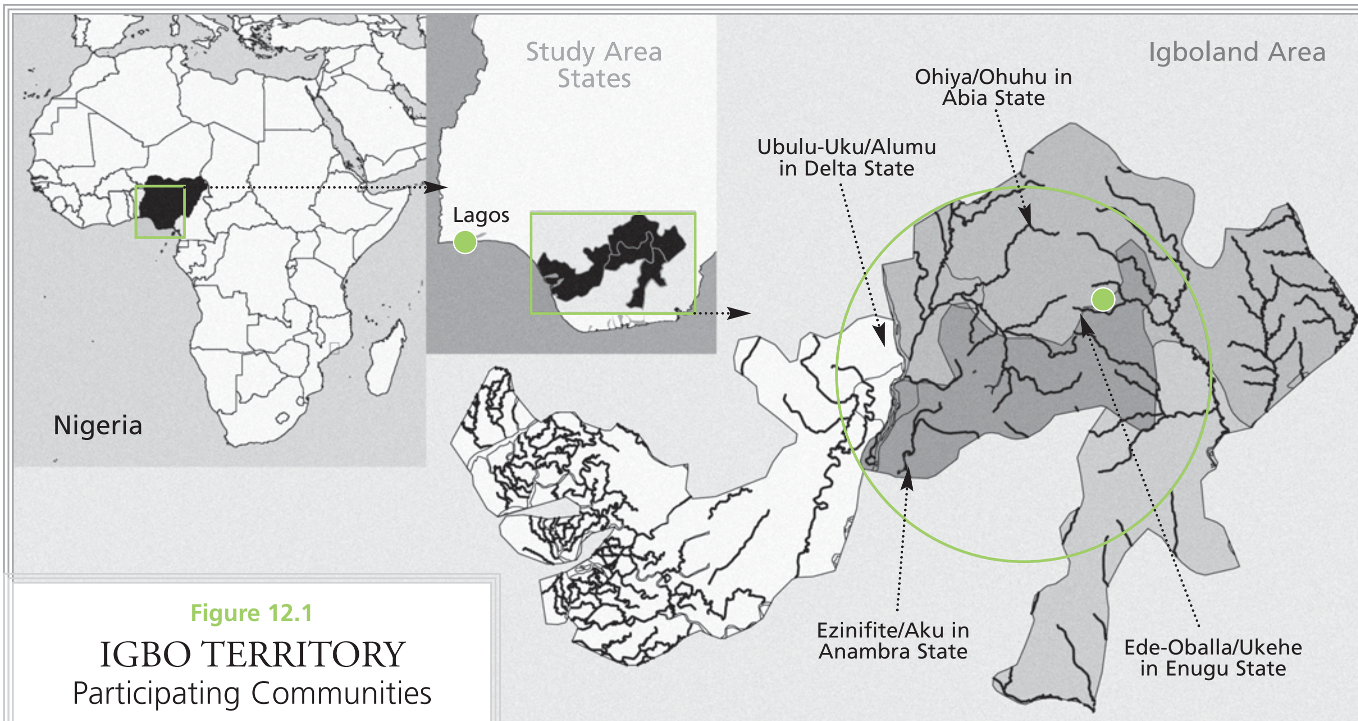

Figure 12.1

IGBO TERRITORY

Participating Communities

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.

1
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5
Department of Crop Science, UNN, Nigeria

6
Centre for Rural Development and Cooperatives, UNN, Nigeria

Photographic section >> XXXVI

"Ndi mba ozo na-azu na-anwu n'aguu."

"People who depend on foreign food eventually die of hunger."

Igbo saying

Abstract

Traditional food systems play significant roles in maintaining the well-being and health of Indigenous Peoples. Yet, evidence abounds showing that the traditional food base and knowledge of Indigenous Peoples are being eroded. This has resulted in the use of fewer species, decreased dietary diversity due to household food insecurity and consequently poor health status. A documentation of the traditional food system of the Igbo culture area of Nigeria included food uses, nutritional value and contribution to nutrient intake, and was conducted in four randomly selected states in which the Igbo reside. Quantitative and qualitative data collection methods were employed. A total of 220 food species including many varieties were documented.

The study revealed existing knowledge gaps of the composition of Igbo traditional foods. A number of little-used, uncommon vegetables with perceived health benefits were identified in some areas. Key traditional staple foods in the Igbo culture area included: yams (*Dioscorea* spp.), cocoyam (*Colocasia/Xanthosoma* spp.), cassava (*Manihot* spp.), maize (*Zea mays*), some of which were status symbols. Other food groups such as legumes, nuts, seeds, wild fruits and vegetables were abundant. Animal foods were available but expensive; the availability of wild/bush animals was limited because of deforestation and urbanization. Breastfeeding was noted to be the traditionally accepted method of infant feeding, while quality complementary foods posed some problems.

Most traditional foods/diets were inadequate in meeting the energy, calcium, riboflavin and niacin needs of the population. Red palm oil contributed 70 to 85 percent of provitamin A intake. There were community variations in the contribution of specific food groups to nutrient intakes. Based on the findings of this research, intervention options and policy considerations are suggested.

Introduction

Overall description of research area

Two communities were randomly sampled in each of four states: Ohiya/Ohuhu in Abia State, Ezinifite/Aku in Anambra State, Ubulu-Uku/Alumu in Delta State and Ede-Oballa/Ukehe in Enugu State (Figure 12.1). The detailed fieldwork was conducted in these eight communities.

Ohiya/Ohuhu communities are located in Umuahia Local Government Area (LGA) in Abia State. Umuahia had a population of about 213 630 in 1992 according to the Nigeria Population Census (NPC, 1992), and residents in the study were just a few kilometres from the state capital, Umuahia. The vegetation is deciduous and the climate is tropical. There is a small river nearby where people fish and grow vegetables. Ohiya/Ohuhu communities are distinctively known for a stem vegetable called *achara* (*Pennisetum* spp.) used for soup preparation, and fermented oil bean seeds presented as kola on big occasions. The *achara* stem vegetable is not common in other communities studied.

Ezinifite/Aku communities are located in Aguata LGA of Anambra State. Aguata LGA had a population of 289 049 (NPC, 1992). Politically, Ezinifite organizes its traditional authority around the Igwe. They are situated in the hinterland within the deciduous forests. Their location greatly influences their production, consumption and preservation of foods. Their main foods are yam, cassava and a few legumes, which are also seasonal.

Ubulu-Uku/Alumu communities are located in Delta State. They are located near the river basin belt of the Niger River that gave Nigeria its name. This location is a typical farming region, which explains why the inhabitants produce and consume many vegetables, cassava, yam, etc. Snails and bushmeat are also consumed. The traditional political organizations of Ubulu-Uku/Alumu communities are around the Obi of the communities.

Ede-Oballa/Ukehe communities are located at the heart of Nsukka LGA in Enugu State, near the University of Nigeria, Nsukka, and within the deciduous forest area. Its soils are very rich for the cultivation of legumes and vegetables. Unlike the other communities studied, Ede-Oballa/Ukehe may be one of the most fertile areas in the south-east zone of Igbo culture area. This area is rich in bushmeat and cultivated cereals. In 1992, Ede-Oballa had an estimated population of 12 447, with 5 760 males and 6 687 females (NPC, 1992).

Geographic and environmental characteristics

Geographically, south-eastern Nigeria extends from latitudes 4° 40’ to 7° 20’ north latitude, and 6° 00’ to 8° 20’ east longitude. The culture area occupies about 50 000 km^2 of Nigeria’s total area of 923 768 km^2 (Figure 12.1). The states of the Federal Republic of Nigeria occupied by the cultural group are Abia, Anambra, Ebonyi, Enugu and Imo States where they are the dominant group. In Rivers and Delta States, the Igbo cultural group occupies almost a third of the states.

The land surface of the Igbo culture area is dominated by plains which are less than 200 m above sea level, and which include some upland areas within the Udi, Plateau and Awka-Orlu regions which in some cases are greater than 520 m above sea level (particularly the Nsukka area). The plain – which is the dominant feature in the area (Ofomata, 1975) – may have resulted from alternating denudation activities. The areas covered by the plains are Anambra State within the Anambra-Niger River plain, Imo State at the foot of Awka-Orlu upland at the axis of Orlu, Owerri, Umuahia and Aba. This lowland joins the so-called Niger Delta plains. Ebonyi and Abia States fall within the Cross-River plain.

The annual rainfall of the area ranges from 4 000 mm in the southern area to about 1 700 mm at Nsukka in the northern area. There are considerable variations in total annual rainfall from year to year. In the southern part towards the coastal region, a tropical wet climate is experienced, while the rest of the region has a tropical dry climate (Koppen, 1940). According to Monanu (1975), although both classes of climate imply an average annual surplus, the seasonal distribution is more significant than the average annual rainfall total. Most soils are moist throughout the year.

The temperature pattern closely follows the rainfall distribution. The southern portion of the area has an average annual temperature between 26 and 27 °C, while that in the north is between 27 and 28 °C. There are two major seasons in the area: rainy and dry. The rainy season lasts from April to October in the northern part of the zone, while in the south the rains can start as early as March and last until November. The dry season lasts up to five months. Often, the dry season comes with the very dry northeast Trade Wind from the Sahara desert (the “Harmattan” wind). Some tourist attractions in the area are Agulu Lake, Ogbunike Cave, Green Lake and Enyigba Salt Lake.

Environmental protection issues

Soil erosion – especially gully, rill and inter-rill including riverbank flooding – remains the most important environmental problem in the area. The well-known gully erosion sites are the Agulu-Nanka in Anambra State, Orlu and Uruala areas of Imo State, Ozuitem, Abriba, Ohafia and Amucha in Abia State. Active gully erosion is estimated to affect about 2 percent of the total land area of Igbo cultural group. This is highly detrimental to the agricultural production life and land of the people.

Demographic characteristics

The population of the Igbo cultural group according to a 1991 national census was 25 million (NPC, 1992). The Owerri area has one of the highest population densities not only of Nigeria, but in the whole of Africa, with Imo State up to Anambra State area having 460 persons per km^2 at that time. Education infrastructure in the states had not been fully developed and illiteracy was frequent. Only 41 percent of women aged 15 and older was literate in 1999, compared with 58 percent of men (FOS, 2000). The goal of achieving equal access to primary education by girls and boys had not yet been attained. The recent enrollment rates for both sexes declined from 87 to 84 percent in boys and 82 to 77 percent in girls (FOS/UNICEF, 2000). Education progresses through pre-primary, primary, secondary and post-secondary levels, and there are also technical schools and colleges of education.

Cultural characteristics

Generally, the Igbo people share a common basic culture centred on a common language, common institutions and common religious and cosmological beliefs. This type of unity within a variable cultural complex has full expression in the area represented by kola-nut and white chalk customs, the vigour in Igbo music and dance movements, highly developed art of wall decoration and delicate body paintings, pottery designs, weaving, folklore, oral literature, "mmuo" dances and drama, traditional games and pastimes such as wrestling, acrobatics, archery and fencing (Uchendu, 1965). Due to its patrilineal nature, the society has a strong preference for the male child. The extended family system or network is predominant and functions not only as a kinship system but also as a social welfare and security mechanism. Cultural norms and practices coupled with the influence of religion have tended to determine the place of women in Igbo culture, with roots in tradition, culture and religion. Discrimination against women is no longer as static or as strong as previously because the government recognizes the rights of women, and women's organizations work to ensure that the rights of women are protected (Onwuejeogwu, 1981).

Different parts of Igbo culture area still observe food taboos. Women still deliver their babies under the care of traditional birth attendants. Despite the campaign against early marriage and teenage pregnancy, these are prevalent practices. Today women still do not participate in land issues, traditional kola nut practices, etc.

General description of the food system circumstances

Agriculture is a long-standing occupation of the people of the zone. Farm size is small, about 1.5 hectares. Rainfed crop production is dominant. Cropping is based on fallow system on outlying farms while compound and other farms close to homesteads are continuously cropped (Ndiokwelu, 1998).

All crops are sold and a proportion is used for food. Industrial crops like cocoa, rubber and cotton are grown in minor quantities in the zone, but are cash crops. Yam (*Dioscorea* spp.), maize (*Zea mays*), cassava (*Manihot* spp.), cocoyam (*Colocassia* spp.), edible legumes, vegetables and rice (*Oryza sativa*) are grown extensively in some areas of the zone. Mixed cropping based on root/tuber crops is universally practised. Rice is grown as a sole crop in seasonal swamps. The dominant tree crops are oil palm, citrus, banana, plantain, kola, coconut, mango and rafia palm. There are still pockets of food gathering, hunting and fishing, but deforestation has made it difficult to hunt regularly. Fishing is carried out in the riverine areas, such as Delta Igbo or near Adani and Nkpologu areas in Enugu State. Livestock farming (local cow, goat, pig, chicken, rabbit and fish) is practised in the Igbo culture area. In rural areas local chickens brood anywhere, yet there are well-established poultry farms in both rural and urban areas of the Igbo culture area. Many useful fruit trees are exploited from semi-wild conditions. These include breadfruit (*Treculia* sp.), African pear (*Dacroydes* sp.), *Irvingia* sp. and *Pentaclethra macrophylla* (oil bean seed), *Dialium* sp., *Parkia vitex* and *Chrysophyllum* sp. Wild and semi-wild leaf vegetables of importance in the zone include *Pterocarpus* sp., *Pergularia* sp. and *Gnetum* sp.

Overall health and nutrition status

Water and sanitation

In 2000, household piped water coverage was less than 30 percent and sanitation was less than 20 percent.

Sanitary means of excreta disposal in the communities was accessible by 56 percent of the population (FOS/UNICEF, 2000).

Nutritional status

Nutritional status of vulnerable groups in the country can be used as a measure to assess the nutritional status of the communities with whom we worked. The recently concluded Food Consumption and Nutrition Survey 2001–2003 found that, nationally, 42 percent of children were stunted, 25 percent were underweight and 9 percent were wasted (Maziya-Dixon *et al.*, 2004). The National Demographic Health Survey (NPC and ORC Macro, 2004) also showed that in the south-east (Ibgo area), 20 percent of children were stunted, 5 percent were wasted and 8.5 percent were underweight. These values were lower than in other zones.

Micronutrient deficiencies were also of great public health importance in the Igbo culture area. Available data from the 1993 Participatory Information Collection (PIC) survey showed that the prevalence of vitamin A deficiency was 9 percent in children and 7 percent in mothers (FGN and United Nations Children's Fund, 1993; FGN/UNICEF, 1994). Key nutritional findings for children aged 6–71 months in the southeast zone showed vitamin A dietary risk with a vitamin A deficiency (VAD) prevalence of 16 percent and serum VAD 15 percent (OMNI, 1993). The Multiple Indicator Cluster Survey (FOS/UNICEF, 2000) showed that less than a quarter of children between the ages of 6 and 59 months had received a vitamin A supplement in the preceding 24 months. The data indicated that the regions with the most serious prevalence of VAD had received the least supplementation, while the proportion of children receiving vitamin A supplements was as high as 47 percent in the southeast.

The data also showed that vitamin A supplementation was much more available in the urban than in the rural areas. A 1993 study (FGN and United Nations Children's Fund, 1993) showed that the Nigerian southeast had the highest prevalence of iron deficiency anaemia (IDA) for mothers (61 percent), while the lowest prevalence was in the northwest (12 percent). The prevalence rate for anaemia among children was highest in the southeast at 50 percent and lowest in the northeast (11 percent). Prevention is the best treatment of IDA, but it was only in UNICEF-assisted areas that supplementation was occurring. In the Igbo culture area, where anaemia was highest, only 16 percent of pregnant women received iron and folic acid supplements in the second trimester.

Iodine and zinc deficiencies have also been high. Historically, Nigeria has had one of the highest goitre rates in Africa (NPC and UNICEF, 2001), and the prevalence rates were much higher in the southwest (29 percent) and southeast (27 percent) than in the north (13 percent for both the northwest and northeast). The success of the Universal Salt Iodization (USI) can be gauged by the fact that in 1995 it was reported that 97 percent of all food grade salt manufactured in Nigeria was iodized (Egbuta and Hettiaratchy, 1996). Recently, it has been shown that 20 percent of children in Nigeria were deficient in zinc, higher (36 percent) in the moist savanna and lowest (6 percent) in the humid forest. In mothers and pregnant women, zinc deficiency was found in 28 percent and 24 percent, respectively (Maziya-Dixon *et al.*, 2004). Many food consumption studies have also highlighted deficiencies of other key nutrients such as calcium and B vitamins because of limited consumption of milk and animal products (Platt, 1975).

Methodology

Approach to the people

A letter of introduction was written to the Chiefs of the communities to be included in the study. The Chiefs then informed the villagers and explained the different stages of the process. The Chiefs asked the villagers to cooperate with the researchers at every stage, starting from focus group discussions to personal household visits. Informed consent in a culturally appropriate fashion was obtained from each participant involved in the study. No invasive procedures were performed; hence, the project posed limited risk to the individuals involved. No coercion was used to recruit individuals or to maintain their participation. Participants were informed that they could continue or discontinue the interviews at any time. They were also allowed to refuse participation without penalty. Community consent was obtained through the process of creating a research agreement. Privacy and confidentiality were upheld through a data-coding system. It was understood that project results would be be shared with the communities.

Interview sampling method

The study was carried out from June 2004 to June 2005. Households were randomly selected from each of the communities by balloting (a random draw) for the individual interviews. Some households were purposively selected based on the presence of mothers, children and/or infants. One hundred households were selected from each community, giving a total of 800 households. Respondents for the key informant interviews, focus group discussion, market interviews and card sorts were not part of the 800 households interviewed. For key informant interviews approximately ten knowledgeable men and women participated in each community. There are seven states in Nigeria where Igbo reside. Due to logistical and financial challenges, four states were randomly selected in order to capture the variations among states.

Data collection

The forms used in data collection were from the Centre for Indigenous People's Nutrition and Environment (CINE) with slight modifications (www.mcgill.ca/cine/research/global).

Key informant interviews

Chiefs and Elders of the communities were the key informants. They provided information concerning the structure of the village. They also guided the researchers in choosing knowledgeable people to be invited to participate in focus group discussions, as well as all other information that the researchers required.

Focus group discussions

Focus groups, each comprising a small group of people – usually of the same age and gender, and who were knowledgeable in a specific area – were assembled. The Chiefs of the communities helped the researchers gather groups of men and women farmers and adolescents, with eight to ten individuals in each group, who were capable of giving accurate information to the researchers. In each community, there were four groups of eight to ten people each, giving a total of 32 to 40 people per community. In total, for all communities there were 256 to 320 participants in focus groups.

A focus group guide was developed for use during discussions with the groups about the following topics: foods available and affordable and eaten in the community; foods eaten and liked by season; foods eaten and liked by mothers and children; foods seldom used or currently unused and reasons for their lack of use, patterns of food harvest.

Market survey

A market survey was carried out in the local markets. This was aimed at identifying micronutrient-rich foods available in the market along with prices, sources and seasons of availability. It was possible to identify micronutrient-rich foods in the market that were consumed by children.

Individual interviews

Using the community traditional food list and the selection of the shortlist of foods likely to be good sources of micronutrients – as developed from the previous steps – the researchers began individual interviews of 800 households. This activity aimed to identify the foods that were used in the communities and discover the meanings and other attributes that people attached to them. This guided the researchers to know whether and how these foods could be effectively used to improve micronutrient status.

Card sort activity

Before this exercise (Blum *et al.*, 1997) could be carried out, 130 cards were prepared with colour photos of traditional Igbo foods and those sold in the market.

During the exercise, the pictures were given to individuals, especially mothers in households, to sort into groups. This exercise aimed at determining how people classified and grouped foods contained in the traditional food list and their reasons for that classification. Numbers were written behind the pictures for identification. The numbers of the foods in particular groups were recorded and the reasons for the groupings.

Questionnaire

Questionnaires were distributed to 100 randomly selected households (determined by balloting) in each community, thereby giving out a total of 800 household questionnaires. Information was collected on the levels of taste appreciation among mothers and children on foods that were expected by the research team to be rich in micronutrients. Foods in the list of expected micronutrient-rich foods developed earlier were listed and the mothers and children were asked to score them based on their level of appreciation of these foods. Food scores ranged from one (1) (very much disliked) to five (5) (very much liked); a score of three (3) indicated indifference toward the food. With this, it was possible to identify taste preferences of popular foods. Each respondent was questioned about particular attributes of the foods on the shortlist before their introduction to infants as complementary foods. This procedure was also used to determine how these foods were useful to children between one and two years old. Their attributes were recorded. Infant food history was captured in an interview where the responding mother was asked about breastfeeding, complementary foods, period of solid food introduction, quantity eaten and frequency of intake.

Twenty-four-hour recall/weighed food intake

In each household, two 24-hour recalls were conducted for the mother and a child within one week and a weighed food intake was conducted by the research assistants. The intention was to understand the foods commonly used, the source of the foods, whether they are produced, purchased or gathered, the quantities consumed and the ingredients used in preparation.

Anthropometric measurements

Weight

Weight measurement was carried out on 100 children in each community using a beam weighing scale. The children were weighed wearing only shorts or minimum clothing. All measurements were made according to standardized procedure (Lohman, Roche and Martorell, 1988).

Height

For children who were older than two years old, a vertical measuring rod was used to obtain height. Infants and children less than two years of age were measured using a wooden length board (baby length measurer) designed by the Appropriate Health Resources and Technologies Action Group, Ltd (WHO, 1987).

Taxonomical identification of food species

Igbo food samples not found in Nigerian Tables of Food Composition were also analysed. Fresh samples of plants were collected, processed, preserved, mounted and identified for documentation during the field visits and then deposited in the internationally recognized herbarium of the Department of Botany of the University of Nigeria, Nsukka.

Sampling, and laboratory analysis

Food samples were collected during field visits by the research team. Samples were placed in polyethylene bags and sent to the laboratory immediately for analysis. After drying and milling, the samples were analysed for several nutrients.

The analytical procedures of the Association of the Official Analytical Chemists (AOAC, 1995) were used for proximate composition, vitamin and mineral composition of the traditional foods. Protein from plant and animal sources was determined by the micro-

Kjeldahl method, which determined the amount of nitrogen in the sample. This was subsequently multiplied by a factor of 6.25. The fat content in the food samples was determined using the Soxhlet extraction apparatus. Moisture was determined immediately after harvest using a Mammet drying oven, by first weighing the sample in a top loading balance, drying it in an oven and re-weighing the dry sample. Moisture was calculated from the difference in weights. Ash was prepared by igniting a weighed portion of dried sample in a muffle furnace at 525 to 550 °C. The remaining residue (ash) was weighed. Dietary fibre was determined in the food sample after treatment with enzymes to digest starch and protein, after which the residue sample was re-weighed. Dietary fibre was computed after subtraction of protein and ash in the residue. Carbohydrate was calculated by subtracting the amount of moisture, protein, lipid and ash from a 100 g sample. Energy was calculated using the Atwater factors (Pearson, 1976). Iron, zinc, calcium and phosphorus were measured using atomic absorption spectrophotometer (Bosch, 200A). Ascorbic acid was obtained using 2, 6-dichlorophenolindophenol method, and ß-carotene was determined using high performance liquid chromatography (HPLC Hewlet Packard LP1600). Folic acid was determined with a microbiological method using *lactobacillus casei* after the samples were hydrolyzed using enzymes (Lumley and Wiggins, 1981).

Data analysis

Data from the questionnaires were keyed into the computer after coding using the Statistical Package for the Social Sciences (SPSS Version 12) software. The analysis included frequency distributions, percentages, means and correlations. Results of the weighed food intake calculations were presented as percentages of the recommended daily allowances established by FAO/WHO/UNU (FAO/WHO/UNU, 1985; FAO/WHO, 1988). Data from anthropometric measurements were analysed using National Center for Health Statistics (NCHS) standards of reference (NCHS, 1976). Indicators of nutritional status were used to assess levels of stunting, wasting, underweight, and normal status among the children in the communities. The defining criteria of nutritional status were as follows:

- underweight: weight-for-age <-2 standard deviation (SD) of the mean value of NCHS;
- wasting: weight-for-height <-2 SD of the mean value of NCHS;
- severe wasting: weight-for-height <-3 SD of the mean value of NCHS;
- stunting: height-for-age <-2 SD of the mean value of NCHS;
- severe stunting: height-for-age <-3 SD of the mean value of NCHS.

Results and discussion

Food list: identification and composition

The Igbo culture food list, including scientific names (where known) and their general uses, are shown in Table 12.1.

A total of 220 species and over 400 varieties of food items were documented. Of these, 174 were documented with their scientific names and 77 were found in the food composition tables currently in use in Nigeria (FAO, 1968), indicating the existing knowledge gap of the composition of Nigerian foods, and that of the Igbo culture area in particular. There is also a gap in the knowledge of the composition of foods and diets as they are currently consumed.

The composition of a number of little-used uncommon foods (mainly vegetables) reported to have health benefits were analysed. The composition of these foods is shown in Table 12.2. Most of these grow as weeds around the homesteads and are mainly eaten by the Igbos in the Delta area.

It is important to note that, apart from animal milk for infants, there was a lack of milk and milk products consumed in the Igbo culture area; generally, these foods are not within the food system. Milk and milk products are generally consumed by the rich, the vulnerable and the ill, but in very small quantities by children, owing to their high cost.

Table 12.1 **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
	Cereals, starchy roots and tubers							
1	*Colocasia esculenta*	Cocoyam	ede ofe, ngbowa, akikara	X	X	–	–	Boiled, dry chips
2	*Colocasia* var. *esculenta*	Cocoyam	akonoke	X	–	3	2	Boiled and pounded with cassava
3	*Colocasia* spp. (3 var.)	Cocoyam	cocoindia, nkpongnambing, okoroko	X	X	–	–	Boiled and pounded with cassava
4	*Dioscorea alata*	Water yam	ji abana, ji mvula	X	X	2	1	Boiled, pounded
5	*Dioscorea bulbifera*	Aerial yam	adu, aduinu	–	X	2	1	Boiled
6	*Dioscorea cayenensis*	Yellow yam	ji oku	X	–	3	2	Boiled, roasted, pounded
7	*Dioscorea dumentorium*	Three leafed yam	ona, uno	X	–	2	1	Boiled
8	*Dioscorea praehensilis*	Yam	ji okpuru	X	–	2	1	Boiled
9	*Dioscorea rotundata*	White yam	jiocha, ji igwe	X	X	4	4	Boiled, roasted, fried, pounded
10	*Ipomoea batatas* (2 var.)	Potatoes, sweet white, potatoes, yellowish red	ji nwa nnu	–	X	3	4	Boiled, fried
11	*Manihot esculenta* (2 var.)	Cassava (bitter type)	akpu nkola inu	–	–	4	4	Fermented for foofoo; boiled and sliced for dry chips
12	*Musa paradisiaca*	Plantain	osukwu, obuunu	–	X	4	4	Boiled, roasted, fried and made into flour
13	*Musa sapientum* (many var.)	Banana	unele	–	X	3	4	Eaten as ripe fruit
14	*Oryza glaberrima*	Red rice	osikapa	–	X	1	1	Milled, boiled
15	*Oryza sativa*	Rice	osikapa	–	X	4	4	Boiled, milled
16	*Pennisetum* spp.	Millets	achara	X	–	3	1	Used for soup
17	*Xanthosoma mafaffa* (2 var.)	Cocoyam	ede oku, edebuji, akpahuri	X	X	4	2	Boiled, roasted
18	*Zea mays* (3 var.)	Maize	oka, azizi	X	X	3	3	Fresh boiled, roasted, milled
	Legumes, nuts and seeds							
1	*Aframomum danielli*	–	olima (ubulu – uku)	–	–	4	2	Milled and used as a spice
2	*Anacardum occidentalis*	Cashew nut	nkpulu cashew	–	X	3	2	Toasted and eaten as snack
3	*Arachis hypogea* (2 var.)	Groundnut	opapa	X	X	4	4	Boiled, roasted. milled to paste
4	*Cajanus cajan* (3 var.)	Pigeon pea	agbugbu	–	X	4	4	Boiled, roasted and milled
5	*Canavalia ensiformis*	Jack bean	odudu	–	X	1	1	Roasted, milled used as thickener
6	*Citrullus vulgaris*	Melon seed	egusi	–	X	4	2	Milled for soup and meat substitute (patties.)
7	*Cocos nucifera*	Coconut	aku oyibo, akubekee	X	X	4	4	Eaten with other foods, milled to extract milk, sliced and roasted as candies etc

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
8	*Cola acuminata* (2 var.)	Kola nut	oji awusa	X	X	4	1	Eaten as stimulant and for cultural purposes
9	*Cola nitida* (2 var.)	Kola nut	oji igbo	X	X	4	1	Eaten as stimulant and for cultural purposes
10	*Cucurbita pepo*	Pumpkin seed	mkpuru anyu, ugboguru	X	–	3	2	Milled dry and used for soup
11	*Elaeis guineensis*	Palm nut	aku	–	X	3	4	Cracked and eaten with other fruits, roasted for oil extraction
12	*Glycine max*	Soya bean	–	–	X	–	–	Used as dried powder for infant feeding
13	*Irvingia gabonensis* (2 var.)	Dika nut	ogbono	–	X	4	3	Dry, milled and used as soup thickener
14	*Irvingia* spp.	Bush mango	ugiri	–	X	4	3	Dry, milled and used as soup thickener
15	*Kerstingiella geocarpa*	Ground bean	akidi ani	–	X	2	1	Boiled, roasted, milled
16	*Mucuna* spp.	Winged bean	okwe	–	X	2	1	Roasted, milled
17	*Pentaclethra macrophylla*	African oil bean	ugba	–	X	4	3	Fermented sliced and used for various dishes
18	*Sesamum indicum*	Beniseed	–	–	X	3	2	Roasted, milled for soup.
19	*Sphenostylis stenocarpa*	African yam bean	okpa odudu	–	X	4	3	Boiled, roasted and eaten as snack
20	*Teleferia* spp.	Pumpkin seed	mkpuru ugu	–	–	4	3	Boiled and eaten as snack
21	*Tetracarpidium conophorum / Plukenetia conophora*	Conophor	ukpa	X	–	4	4	Boiled and eaten as snack
22	*Tetrapleura tetraptera*	–	kpokirikpo	–	X	1	1	Boiled
23	*Treculia africana* (2 var.)	Breadfruit seed	ukwa	–	X	4	3	Boiled roasted and eaten as snack.
24	*Vigna sinensis*	Cowpea	akidi	–	X	3	2	Boiled, roasted
25	*Vigna* spp.	–	okpa nkilisi	–	X	3	2	Boiled
26	*Vigna subterranea*	Bambara groundnut	okpa ibi	–	X	4	4	Boiled, milled, roasted, & eaten as snack
27	*Cola lepidota*	Conophor	achicha (yellow inside, velvet black cover)	–	–	3	4	Peeled and eaten as a fruit snack
	Fruits							
1	*Abelmoschus esculenta*	Lady's finger	okwulu npiene	X	–	4	4	Used for soups
2	*Anacardium occidentalis*	Cashew	mkpuru cashew	–	X	4	4	Roasted and eaten as a snack
3	*Anonas comosus*	Pineapple	akwuolu	–	X	4	4	Fruit eaten when ripe
4	*Anonas muricarta*	Soursop	–	–	X	3	4	Fruit eaten when ripe
5	*Artocarpus communis*	Breadfruit	ukwa bekee	–	–	–	–	–
6	*Azadirachta indica*	Neem	dogoyaro	X	X	3	1	Used for malaria
7	*Canarium schweinfurthii*	Pear	ube okpoko	X	–	4	4	Soften in hot water and pulp eaten
8	*Carica papaya*	Pawpaw	okwuru ezi	–	X	4	4	Fruit eaten when ripe

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
9	*Chrysophyllum albiduim*	Bush apple	udala nkiti	–	X	4	4	Fruit eaten when ripe
10	*Citrus aurantifolia*	Orange	oroma nkirisi	X	–	2	1	–
11	*Citrus aurantium*	Orange	oroma	X	–	4	4	Fruit eaten when ripe
12	*Cocos nucifera*	Coconut	akuoyibe	X	X	4	4	Eaten raw with corn/maize
13	*Cola* spp.	Kola	oji ogodo	X	–	3	1	Chewed raw, medicinal
14	*Curcurbita pepo* (2 var.)	Pumpkin	anyu, ugboguru	X	–	4	4	Used to cook yam or cocoyam. Soften on cooling. Boiled and eaten as snack
15	*Curcurbita pepo* (1 var.)	Pumpkin	nkpuru anyu	X	–	4	3	Boiled, milled and used for soup
16	*Dacryodes edulis* (2 var.)	Pear	ube Igbo	X	–	4	4	Soften in boiled water or roasted and used to eat maize/corn or alone
17	*Dennettia tripetala*	Pepper fruit	mmimi	–	X	4	2	Hot pepper eaten alone or with garden eggs
18	*Dialium guineense*	Velvet tamarind	icheku	–	X	3	4	Eaten raw
19	*Elaeis guineensis*	Palm fruit	aku	X	X	–	–	Major source of cooking oil
20	*Garcinia kola*	Bitter cola	aki ilu	X	–	3	1	–
21	*Grewia* spp.	Jute plant	ayauma	X	–	–	–	–
22	*Husolandia opprosita*	Mint	aluluisinmo	X	X	3	1	Used for upset stomach
23	*Icacemia* spp.	–	urumbia	–	X	2	4	Eaten as a fruit
24	*Irvingia* spp.	Bush mango	ugiri	–	X	4	3	Fruit eaten when ripe
25	*Landolphia owariensis*	Rubber plant	utu npiwa	–	X	3	4	Fruit eaten when ripe
26	*Landolphia* spp. (4 var.)	Rubber plant	akwari, utu mmaeso, utu mmaenyi, ubune	–	X	4	4	Fruit eaten when ripe
27	*Lycopersicum esculentum* (4 var.)	Tomatoes	tomatoes	–	X	4	4	Used for stews and other preparations
28	*Magnifera indica* (4 var.)	Mango	mangoro	–	X	4	4	Fruit eaten when ripe
29	*Myrianthus arboreus*	Ujuju fruit	ujuju	X	X	3	2	Eaten raw when ripe
30	*Pachystela breviceps*	Monkey apple	udala nwaenwe	–	X	3	4	Fruit eaten when ripe
31	*Persia Americana*	Avocado pear	ube oyibo	X	X	–	–	English pear is ripened and eaten alon
32	*Piper umbellata*	Sand pepper	njanja	X	–	3	1	Dry leaves used for soup during the dry season
33	*Psidium guajava*	Guava	gova	X	–	4	4	Eaten when ripe
34	*Senna occidentalis*	Nigero plant	sigbunmuo	X	–	3	1	Used for cooking yam pottage
35	*Solanum macrocarpum*	Garden egg fruit	anyara	X	–	4	3	A fruit eaten with peanut butter or alone
36	*Sterculia* spp.	Kola (wild)	nkpuruamunwa ebunne	–	X	2	4	Wild fruit

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
37	*Uraria chamae*	–	okpaokuko	X	X	3	1	Used for soup, tuber used for insect bite
38	–	–	utabe efi	–	–	3	2	Wild fruit
	Vegetables and mushrooms							
1	*Acanthacean* sp.	–	azia	X	–	4	1	Used for soup, mixed with other vegetables for malaria
2	*Acanthoceae* sp.	–	ikpokpo	X	–	4	1	Used for soup; has cooling effect
3	*Ageratum conzoides*	Goat weed	olulu – ogwai	X	–	4	1	Used for soup
4	*Alchornea cordifolia*	–	nkpokokwa agwu					Used for soup
5	*Amaranthus viridius*	Greens	inine	X	–	4	4	Used for variety of purposes
6	*Amaranthus* spp.	Greens	inine	X	–	4	2	For food preparation
7	*Aspilia*	Anwinwa ani	bush marigold	X	–	4	1	Used for soup, for eating new yam
8	*Asystasia gangetica*	–	ukpom	X	–	–	–	–
9	*Boerhavia diffusa*	Hog weed	azuigwe	X	–	4	1	Used for egusi soup, root chewed for stomach pain
10	*Brillantaisia nitens*	–	agbolu – uku	X	X	4	1	Used for soups
11	*Bryophyllum pinnatum*	Life plant	mgbidingbi	X	X	4	1	Warm on the fire, squeeze for treating cough
12	*Chromolaena odorata*	Awolwo weed	kpugbum	X	X	4	2	Used for variety of food preparations water extract with chalk used for stomach pain
13	*Cissampelos mucrumatia*	–	obuaka enwe	X	–	4	2	Used for soup water extract plus chalk taken as a drink
14	*Colocasia esculenta*	Cocoyam	akanikwoede, ogbora	–	X	2	1	Used for soup and vegetable yam preparation
15	*Colocasia* spp.	Cocoyam flour	opi ede	X	–	3	1	Used for soups
16	*Corchorus olitorius*	Jute	arira, ahihara	X	–	4	3	Cut and used for soup and yam pottage
17	*Corchorus* spp.	Jute	kerenken	X	–	4	3	Cut and used for soup and yam pottage
18	*Cucurbita pepo*	Pumpkin	ugboguru	X	–	4	3	Used for soup and vegetable yam preparation
19	*Cymbogon citraus*	Lemon leaf	achalla oyibo	X	–	4	1	Medicinal, for soup, extract used for malaria
20	*Diospyros mespilifomis*	–	isi osisi	X	–	4	1	Used for improving appetite
21	*Elaeis guineensis*	Oil palm tree	ogbunkwu	–	X	4	1	Inflorescent ground and used for soup and for nursing mothers for cleansing
22	*Euphorbiacae*	–	alicemose	X	–	4	1	Used for soup, used for after birth pain
23	*Euphorbia hirta*	Seeded herb	okpokokwa ogu	X	–	4	1	Mixed with chalk for treating dysentery
24	*Gnetum africanum*	African salad	okazi	X	–	4	3	Used for soup and for native salad

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
25	*Grongronema latifollis*	Africana salad	utazi	X	–	4	1	Used for soup or lactating mother or the sick
26	*Heinsia crinita*	–	atama	X	–	3	1	Used for soups
27	*Heliotropium indicum*	–	isi – udele					Used for soups
28	*Husolondia opposite*	–	alulu isi mo					Used for soups
29	*Jatropha curcas*	–	ulu – oyibo					Used for soups
30	*Leptadenia* spp.	–	obi ogbome	X	X	4	1	Used for soup and squeezed for malaria and dysentery
31	*Manihot crantz*	Cassava leaf	ipoto (mpoto)	X	X	4	1	Steamed, crushed and used for soup
32	*Merremia*	–	agiliezi	X	–	4	1	Used for afterbirth pains
33	*Merremia*	–	olili	X	–	4	1	Used for soup, cut leaves used for rice; water extract used for stomach ache
34	*Momordica charantia*	–	ubafuncha	X	–	4	1	Used for soup, mixed with clay for malaria
35	*Moringa oleifera*	–	okwe – oyibo	–	–	–	–	–
36	*Myrianthus arboreus*	–	ujuju leaf	X	X	4	3	Used for soups
37	*Ocimum gratissimum*	Fever plant, Tea bush	nchuanwu,	X	X	–	–	Used to flavor variety of dishes
38	*Piper guineense*	Black pepper	uziza	X	–	4	2	Used for boiling met and flavoring soups
39	*Piper umbellata*	Sand pepper	njanja	X	–	3	1	Dry leaves used for soup during the dry season
40	*Pleurotus tuber*	Fungus	osu	X	–	4	2	Milled with melon seeds for soups and patties, eaten as snack or meat substitute
41	*Pterocarpus soyauxii*	Camwood	oha	–	X	4	3	Used for soups
42	*Polygalaceae*	–	ilenagbelede	X	–	4	1	Used for soup to improve appetite
43	*Portulaco oleracea*	Ntioke	water leaf	X	–	4	1	Used for increasing appetite, mixed with other vegetables for malaria
44	*Psychotria* spp.	–	anya – azu	X	X	4	3	Used for palm fruit soup
45	*Senna alata*	Senna plant	upulutu	X	–	4	1	Used for soup, used as a laxative
46	*Senna occidentalis*	Nigero plant	sigbonmuo	X	–	3	1	Used for cooking yam pottage
47	*Solanum macrocarpum*	Anara leaf	olubu	X	–	4	3	Used for vegetable yam and as garnish for native salad

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
48	*Spathodea campanulata*	Flame tree	ulumilli	X	X	4	1	Used for soups
49	*Talinum triangulare*	Water leaf	ngbolodi	–	X	4	3	Used with other vegetables for soups and stews
50	*Telfeiria occidentalis*	Fluted pumpkin	ugu	X	–	4	3	Used for soups and other dishes
51	*Uvaria chamae*	–	okpa okuko	X	–	4	3	Used as vegetable and in yam preparation.
52	*Verbenaceae*	–	ifulu – nkpiri	X	–	4	1	Used for soup for pregnant and lactating mothers, water extract taken
53	*Veronia amygdalina*	bitter leaf	olugbu	X	X	4	2	Used for soups, chewed raw or washed as cure for malaria and managing diabetes
54	–	Soft mushroom	ero akuru	X	–	4	2	Used for soups
55	–	Bright mushroom	ero awagaa	X	–	4	2	Used for soups
56	–	Marked mushroom	ero chikirikwo	–	–	4	2	Used for soups
57	–	Mushroom	ero/elo onyekamete	X	–	4	2	Used for soups
58	–	White mushroom	ero/elo ngbawa	X	–	4	2	Used for soups
59	–	Blue mushroom	ero nkpu	X	–	4	2	Used for soups
60	–	Tough mushroom	ero nku	X	–	4	2	Used for soups
61	–	Black mushroom	ero nkwu	X	–	4	2	Used for soups
62	–	Naked mushroom	ero ikpikpa	X	–	4	2	Used for soups
63	–	Purple mushroom	ero ububa	X	–	4	2	Used for soups
64	–	Smooth mushroom	ero ubakiri	X	–	4	2	Used for soups
65	–	–	nkanka	–	–	–	–	Used for soups
66	–	–	osusu	–	–	–	–	Used for soups
	Meat, poultry, eggs							
1	*Achatina* spp.	Snail	ejula, ejuna	X	–	3	4	Boiled, roasted and eaten with other foods
2	*Achatina* spp.	Snail eggs	akwa ejuna	X	–	2	1	Boiled and eaten
3	*Anas*	Duck	obogwu	X	X	1	1	Boiled, roasted and eaten with other foods
4	*Antilocarpa americana*	Antelope	ene	–	X	2	3	Boiled, roasted and eaten with other foods

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	*English/ common name*	*Local name*	*Seasonality*		*Appreciation* Score 1–4 (4= highest)		*Preparation*
				Rainy	*Dry*	*Mother*	*Children*	
5	*Bos* spp.	Beef (cow)	efi, ehi	X	X	4	4	Boiled, fried roasted or dried and used for a variety of purposes
6	*Canis cupus*	Bush dog	nkita ohia	–	X	1	1	Boiled, roasted and eaten with other foods
7	*Canis familiaris*	Dog	nkita	X	X	1	1	Boiled and eaten as a delicacy
8	*Capra eagagrus*	Goat	ewu	X	X	4	4	Boiled, fried roasted or dried and used for a variety of purposes
9	*Crocodiles mississipiensis*	Alligator	–	–	X	2	2	Boiled, roasted and eaten with other foods
10	*Duicker*	Deer	mgbada	–	X	1	2	Boiled and eaten
11	*Erethizoatidaei*	Porcupine	ebintu	–	X	2	2	Boiled, roasted and eaten with other foods
12	*Gallus gallus*	Chicken meat	okuko	X	X	4	4	Boiled, fried roasted or dried and used for a variety of purposes
13	*Gallus gallus*	Chicken eggs	akwa okuko	–	X	4	4	Boiled and eaten
14	*Hyaenidae*	Hyena	edi	–	X	1	1	Boiled, rsted & eaten with other fds.
15	*Meleagris gallopavo*	Turkey	tolotolo	X	X	4	4	Boiled, fried, roasted or dried and used for a variety of purposes
16	*Meleagris gallopavo*	Turkey eggs	akwa tolotolo	X	X	4	4	Boiled or fried and used for a variety of purpose
17	*Munida meleagris*	Guinea fowl	ogazi	–	X	4	4	Boiled, fried roasted or dried and used for a variety of purposes
18	*Munida meleagris*	Guinea fowl eggs	akwa – ogazi	–	X	4	4	Boiled and eaten as a snack
19	*Oryctolagus cuniculus*	Rabbit	ewi	–	X	3	2	Boiled, fried roasted or dried and used for a variety of purposes
20	*Sciuridae* spp.	Squirrel	osa, Uze	–	X	3	2	Boiled, roasted and eaten with other foods
21	*Squamata* spp.	Snake	agwo	X	X	1	1	Boiled, roasted and eaten with other foods
22	*Sus scrofa* (2 var.)	Bush pig, Pig	ezi ohia, ezi	–	X	2	3	Boiled, roasted and eaten with other foods
23	–	Cow skin	kanda	X	X	3	4	Boiled, roasted or dried and eaten with other foods
24	–	Wild pigeon	okwa	–	X	2	3	Boiled, roasted and eaten with other foods
25	–	Wild pigeon	apa	–	–	2	3	Boiled and eaten

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
26	–	Local pigeon	ndo	–	–	2	3	Boiled and eaten
27	–	Grass cutter	nchi	–	–	3	4	Boiled and eaten
28	–	Monkey	Enwe	–	X	4	3	Boiled and eaten
	Fish							
1	*Astacus*	Crayfish	usha	–	X	4	4	For soups and other food preparation
2	*Chana obscurus*	Snake – like fish	efi	X	–	4	4	For soups and other food preparation
3	*Cudanonantas*	Crab	igbeni, nshiko	X	–	3	3	For soups and other food preparation
4	*Distichodus rostratus*	Grass eater	ejo	X	–	4	4	For soups and other food preparation
5	*Gymnarchus niloticus*	Trunk fish	asa	X	–	4	4	For soups and other food preparation
6	*Teterotis niloticus*	–	okpo	X	–	4	4	For soups and other food preparation
7	–	–	bonga	X	–	3	4	For soups and other food preparation
8	–	–	elili	X	–	4	4	For soups and other food preparation
9	–	–	igboboelem	X	–	4	4	For soups and other food preparation
10	–	Cat fish	Ishi	X	–	4	4	For soups and other food preparation
11	–	–	oshisho manu	X	–	2	3	–
12	–	–	pii (oshuasa)	–	X	3	3	–
	Insects/larvae							
1	*Cleptera grylligaee*	Beetle	ebe	–	X	2	4	Roasted
2	*Termitidae* (2 var.)	Termite	aku – mkpu, aku – mbe	X	X	3	3	Fried or steamed
3	*Larvae* (3 var.)	Larvae (palm, raffia palm)	akpa – nkwu, akpa – ngwo, nzam	X	X	2	3	Roasted
4	Cricket	–	abuzu	–	X	3	4	Roasted
5	Locust	–	wewe, igurube	–	X	3	3	Roasted
	Soup condiments/ thickeners							
1	*Aframomum danielli*	–	olima	X	X	4	2	Used for soups and for lactating mothers
	Aframomum melegueta	Grain of paradise	ose oji	X	–	4	1	Hot spice for soup for lactating mothers
2	*Afzelia Africana*	Timber plant	akparata	–	X	4	3	A soup thickener
3	*Brachystegia eurycoma*	Black timber	achi	–	X	4	3	A soup thickener

Continued

Table 12.1 *(continued)* **Igbo traditional food** *(220 species/varieties)*

	Scientific name	English/ common name	Local name	Seasonality		Appreciation Score 1–4 (4= highest)		Preparation
				Rainy	Dry	Mother	Children	
4	*Capsicum frutescens*	Pepper (Africana)	ose – igbo	X	–	3	1	For preparing all traditional dishes
5	*Citrillus vulgaris*	Melon seed	ogiri egusi	–	–	4	3	A soup thickener
6	*Detarium macrocarpum*	Detar plant	ofo	–	–	4	3	Used as soup condiment
7	*Hippocratea welwischtii*	Local onion	obulungbede	X	X	4	2	Bark of root scrapped and used to flavor soup
8	*Mucuna flagellipes*	Velvet bean	ukpo/ibaa	–	X	4	3	A soup thickener
9	*Myristica fragrans*	Nutmeg	ehuru	–	X	4	2	For flavoring soup and peanut butter
10	*Parkia biglobosa*	Africana magi	ogiri ugba	–	X	3	1	A fermented product used for traditional soup
11	*Piper guineense*	Black pepper	uziza	X	–	4	1	Hot spice for soup for lactating mothers
12	*Prosopsis vitex*	Africana magi	okpei	–	X	4	3	Used for flavouring soups
13	*Ricinus communis*	Castor oil	ogiri igbo	–	X	3	2	A fermented product used for traditional soup
14	*Vitex doniana*	–	ushakirisha	–	X	4	2	Used for nsala or white soup
15	*Xylopia aethiopica*	–	uda	–	X	4	1	Hot spice for boiling meat, for lactating mothers to clear womb
	Oils							
1	*Arachis hypogea*	Groundnut oil	mmanu opapa	–	X	3	3	For cooking
2	*Cocos nucifera*	Coconut	mmanu akuoyibo	X	X	3	2	For cooking
3	*Elaeis guineensis*	Palm oil	mmanu akwu	–	X	4	4	For cooking many traditional dishes
4	*Elaeis guineensis*	Palm kernel	ude – aku	–	X	2	1	For preparing local creams and medicines
	Beverages							
1	*Cocos nucifera*	Coconut water	mmiri akuoyibo	–	X	4	4	For drinking, oral rehydration and antidote
2	*Cocos nucifera*	Coconut milk	miliki akuoyibo	X	X	4	2	For food preparations
3	*Elaeis guineensis*	Palm wine	mmanya	X	–	4	4	A local beverage

– No data.

Table 12.2 Nutrient composition of selected Igbo traditional foods *(per 100 g fresh edible portion)*

Food	Moisture	Energy		Protein	Fat	CHO	Fibre	Ash	Vit A (RE)	Thiamin	Riboflavin	Niacin	Folate	Vit C	Calcium	Phosphorus	Iron	Zinc
	g	kcal	kJ	g	g	g	g	g	μg	mg	mg	mg	μg	mg	mg	mg	mg	mg
Legumes nuts and seeds																		
Black pepper seed	10.5	324	1 354	3.4	0.2	77.1	4.2	4.6	38.6	0.08	2.3	1.0	3	14.4	254.6	533.2	5.7	3.7
Castor oil seed	39.7	337	1 409	27.4	18.9	14.3	0.3	1.2	54.1	0.14	1.83	1.7	5	25	517.5	450.1	15.3	4.2
Ehulu seed	15.6	321	1 342	3.8	0.2	76.0	1.3	3.1	–	–	–	–	–	–	55.8	549	13.3	2.8
Olima seed	29.2	272	1 137	14.7	0.1	53.1	1.1	1.8	–	–	–	–	–	–	5.4	21.6	12.0	1.8
Pumpkin seed	60.3	121	506	4.8	2.6	19.6	2.1	0.6	29.9	0.37	1.94	1.7	12	1.6	170.5	626.1	3.7	1.4
Seeded herb	56.7	140	585	3.9	0.1	30.8	4.4	4.1	44	0.24	0	3.8	7	4.7	166.8	125.3	3.4	2.4
Uda seed	42.7	247	1 032	3.6	12.4	30.2	6.8	4.3	53.8	0.27	0.34	0.9	10	1.8	–	–	–	–
Vegetable and mushroom																		
Black pepper leaf	67.6	114	477	16.9	1.3	8.7	3.1	2.4	19.4	0.14	0.91	0.7	5	11.7	245.8	13.7	6.4	1.2
Bitter leaf	62.1	154	644	14.6	2.1	19.2	0.4	1.6	31.2	0.13	0.56	0.6	4	8.6	278.3	228.4	3.4	2.2
Cam wood	56.3	144	602	3.5	0.8	30.8	4.8	3.8	29.9	0.37	1.94	1.7	12	1.6	5.3	126.2	9.0	0.9
Ero awaga	67.4	130	543	4.6	1.6	24.2	1.6	0.6	4.1	0.22	0.42	4.5	7	2.3	20.5	240.9	11.2	1.7
Water leaf (wild)	56.7	163	681	22.7	0.1	17.9	1.2	1.4	31.2	0.39	0.28	2.0	13	38.4	114.4	152.9	1.6	114
Water leaf	70.2	74	309	2.4	0.8	14.2	1.0	1.8	–	–	–	–	–	–	89	128.2	1.6	114
Uncommon vegetables																		
Agbolukwu	71.1	107	447	7.9	0.4	18.0	1.7	0.9	18.9	0.28	0.36	3.0	0	4.48	529.0	188	2.0	1.3
Agili ezi	57.9	160	669	6.4	0.3	33.0	0.7	1.6	–	–	–	–	–	–	4.1	15.7	5.4	1.1
Alice mose	65.7	121	506	14.8	0.7	13.9	2.1	2.9	–	–	–	–	–	–	380.9	127.8	11.1	1.6
Aluluisi	36.0	319	1 333	4.6	1.2	72.4	1.6	3.4	55.5	0.09	0.93	1.2	3.0	18.0	657.6	338.3	9.5	3.3
Anya-azu	66.4	131	548	12.8	1.3	17.1	0.6	1.8	25.7	0.18	1.1	1.5	6	22.9	166.2	134.6	14.6	1.0
Awolowo weed	47.3	192	803	9.6	0.4	37.4	2.1	3.2	69.5	0.17	0.52	2.4	6	30.8	582.1	326.2	5.8	2.5
Azei	60.8	117	489	4.2	0.4	24.1	6.3	4.2	6.9	0.18	0.36	1.1	6	2.9	43.4	85.0	11.9	1.0
Bush marigold	52.9	181	757	6.8	0.6	37.0	0.9	1.8	–	–	–	–	–	–	473.4	235.6	5.4	2.4
Flame tree	44.0	212	886	8.6	0.3	43.7	0.8	2.6	28.3	1.3	0.54	2.0	44	31.5	76.1	33.8	5.4	2.4
Hog weed	65.9	121	506	8.6	0.2	21.3	1.6	2.4	19.4	0.69	0.86	1.1	23	16.4	65.7	233.8	2.1	1.8
Ifulu nkpisi	46.0	192	803	6.8	0.2	40.7	2.1	4.2	69.5	0.32	0.54	3.7	11	54.4	260.4	131.5	9.4	1.1
Ilenagbelede	32.9	210	878	16.4	1.4	32.9	4.6	1.4	32.7	0.36	0.94	1.2	12	16.1	367.4	405.2	9.9	3.3

Continued

Table 12.2 *(continued)* **Nutrient composition of selected Igbo traditional foods** *(per 100 g fresh edible portion)*

Food	Moisture	Energy		Protein	Fat	CHO	Fibre	Ash	Vit A (RE)	Thiamin	Riboflavin	Niacin	Folate	Vit C	Calcium	Phosphorus	Iron	Zinc
	g	kcal	kJ	g	g	g	g	g	μg	mg	mg	mg	μg	mg	mg	mg	mg	mg
Uncommon vegetables *(continued)*																		
Ikpo kpo	61.6	130	543	2.8	0.4	28.7	2.8	3.7	28.3	0.29	0.43	2.6	1	3.6	263.3	84.0	2.7	2.3
Inine	77.8	109	456	15.4	1.2	9.1	1.5	1.2	64.5	0.15	0.04	13	20	1.2	91.1	137.7	2.0	0.8
Isii osisii	59.3	135	564	3.4	0.9	28.3	4.3	3.8	33.5	0.22	0.13	0.8	7	1.7	32.7	252.8	1.9	0.8
Isi-udele	44.6	211	882	4.8	0.2	47.6	2.1	1.3	4.1	0.22	0.42	4.5	7	2.3	330.9	267.1	10.3	1.8
Lemon grass	47.7	204	853	4.3	0.4	45.8	0.4	1.4	18.2	0.21	0.9	1.2	7	16.1	118.5	154.1	2.7	2.7
Local onion	56.4	142	594	3.8	0.6	30.4	5.2	3.6	41.8	0.57	0.3	2.0	20	2.9	56.9	145.6	6.5	1.2
Mgbidi mgbi	69.7	113	472	2.9	0.1	25.2	1.2	0.9	–	–	–	–	–	–	584	127.3	2.3	3.7
Mint	56.7	147	614	7.3	0.7	27.8	3.9	3.6	–	–	–	–	–	–	488.7	18.8	1.0	1.5
Nghotoncha	49.9	166	694	4.7	0.8	35.1	3.6	5.9	–	–	–	–	–	–	471.6	171.6	7.3	1.2
Nigero plant	56.7	146	610	8.9	0.5	26.4	3.9	3.6	–	–	–	–	–	–	42.7	143.5	5.0	0.8
Obi ogbene	69.5	106	443	4.8	1.2	18.9	1.0	4.6	44.0	0.28	1.10	2.0	9	30.3	326.5	122.0	3.2	1.4
Obu aka enwe	38.4	230	961	6.9	0.3	50.0	1.6	2.6	18.9	0.28	0.36	3.0	0	4.48	42.3	431.1	4.9	1.8
Ogbunkwu	18.6	249	1 041	2.1	0.1	60.0	12.3	6.9	0.0	0.12	0.0	1.0	0	0.0	110.6	198.1	3.5	2.0
Ogume okpe	41.2	230	961	6.8	0.8	49.0	1.1	2.1	20.5	0.35	1.7	3.8	16	58.0	162.3	332.9	7.7	2.7
Onunu gaover	35.4	248	1 037	3.3	0.1	58.5	0.9	1.8	6.8	0.42	0.32	1.6	0	10.6	152.4	389.8	8.6	3.1
Onunu iluoygbo	69.3	102	426	2.4	0.6	21.8	1.4	4.5	30.9	0.62	0.11	1.6	0	3.6	117.5	88.2	2.4	1.7
Otulu ogwai	42.5	206	861	6.9	0.4	43.7	3.1	3.4	35.9	1.62	0.58	1.8	0	22.8	198.4	417.1	5.75	2.6
Pumpkin	69.0	125	523	22.8	2.8	2.2	1.8	1.4	–	–	–	–	7	–	147.4	130.2	0.3	0.8
Senna plant	58.4	159	665	6.8	0.6	31.5	0.9	1.8	51.7	0.45	1.4	1.3	15	18.6	314.3	307.3	6.2	1.5
Ugbfoncha	57.2	140	585	8.6	1.1	23.8	2.4	6.9	30.4	0.24	0.6	1.4	0	26.4	295.5	231.5	4.5	1.9
Ujuju	58.1	148	619	8.3	1.2	25.9	2.1	4.4	16.0	0.23	0.87	1.3	8	18.4	3.3	176.0	1.6	0.8
Utazi	56.7	172	719	18.0	4.8	14.2	3.6	2.7	20.4	0.3	0.82	0.2	0.0	0.3	258.6	204.9	8.1	1.4
Meat																		
Canda (skin)	38.4	320	1 338	28.3	16.8	13.9	0.0	2.6	30.9	0.62	0.11	1.6	0	3.6	8.15	160.0	5.4	2.0
Snail	65.7	126	527	10.6	1.2	18.2	0.0	4.3	–	–	–	–	–	–	204.8	161.6	5.8	1.0

– No data.

Table 12.3a Key micronutrient-rich traditional foods by food groups / species

Food group/species	*Local name*	*Scientific name*	*Major micronutrient(s)*
Cereals			
Yellow maize	Oka	*Zea mays*	ß-carotene
Starchy roots/tubers			
Sweet potatoes	Ji nwannu	*Ipomaea batatas*	Iron, ß-carotene
Three leaf yam	Ona	*Dioscorea dumentorum*	Iodine, ß-carotene
Yellow yam	Ji Oku/Okwu	*Dioscorea cayenensis*	ß-carotene, iodine, iron
Starchy fruits			
Banana	Unele, Ogede	*Musa sapientum*	Zinc, folate, iron, ß-carotene
Plantain	nba/jioko Obughunu	*Musa paradisiaca*	Zinc, folate, iron
African bread fruit	Ukwa	*Treculia africana*	Iron, zinc
Legumes/nuts & seeds	All legumes/nuts	*All legumes/nuts*	Iron, zinc, copper
Cashew	Mkpuru/Mkpulu cashew	*Anacardium occidentalis*	Iron, zinc
All fruits	Mkpulu Osisi	All fruits	Iron, zinc, carotenoids, copper, selenium, vitamin C, vitamin E
Palm fruit	Aku	*Elaeis guineensis*	ß-carotene
All vegetables	Akwukwo nni	All vegetables	Iron, zinc, carotenes
Mushroom	Ero/elo	Not yet properly identified	Iron, copper, zinc
All animal foods	*See Table 12.1*	*See Table 12.1*	Iron, zinc, vitamin A

List of key micronutrient-rich traditional foods

The list of key micronutrient traditional foods according to food groups and dishes is presented in Tables 12.3a and 12.3b, respectively. Traditional foods/diets of the Igbo culture area were found to be rich in ß-carotene, iron and zinc. With 95 percent of Nigerians using iodized salt, it is expected that sufficient iodine was present in the diet. Unfortunately, deficiency of several nutrients still exists. The major source of ascorbic acid in the diet was fruit. However, fruits were not eaten in conjunction with meals, but consumed between meals as snacks (Okeke and Nnayelugo, 1989).

Patterns of harvest, storage and preparation of key traditional foods

Key traditional foods in the Igbo culture area were found to be yam, cassava, cocoyam, maize, legumes and vegetables. Cereals and starchy staples were also very important foods, and dishes were named after them, for example, *nni ji* (yam *fufu*), *nni akpu* (cassava *fufu*), *nni oka* (maize/corn *fufu*). Their accompanying sauces were named after the major vegetable or ingredient used, e.g. *Onugbu* (bitterleaf) soup, *okazi* (*Gnetum* spp.) soup, *oha* (*Pterocarpus soyauxili*) soup, *egusi* (melon), *ogbono* (dikannt), *achi* (*Brachystegia eurycoma*) soup, etc. Yam was viewed as a man's crop, where a man who owns a certain number of yam barns is known as "Diji". Important festivals are linked to yam, such as the New Yam Festival. During the 2005–2006 research period, Igbo researchers documented the following food descriptions.

Yam: The white yam, which is produced in the largest quantity, is planted from the months of January to March, while the yellow yam (*D. cayenensis*) can be planted in December. In some communities mounds are made, while in others holes are dug in the ground for yam planting. The planting, staking and tending of yam are labour-intensive activities. Harvesting is done from July to October and into

November for the yellow yam. Harvesting is also labour intensive and care is taken not to bruise or break the yam tubers. Yams are prepared in a variety of ways. They can be boiled, baked, roasted and eaten with fresh palm oil (*Ji nmanu*), or fried and eaten with a sauce. Roasted yam with palm oil is popular in most urban centres.

Yam can be incorporated into other dishes, e.g. legume pottages, *ayaraya ji* and yam pottage. The most popular form of preparation of yam is the pounded yam, prepared by peeling, slicing, boiling and pounding the yam with mortar and pestle into smooth, slightly elastic dough. The white or yellow yam is usually better than the water yam for this purpose. The pounded yam is consumed with traditional soups/sauces. A special delicacy is pounded yam and *nsala soup* (white soup or pepper soup). This is used for feeding lactating women in the first few days after birth. The hot spices in the *nsala* soup are believed to help purify and cleanse the system of the nursing mother.

Table 12.3b Key micronutrient-rich traditional food dishes

Traditional soups/dishes	*Description/composition/major ingredients*	*Major micronutrients*
(Ogbono, egusi, bitter leaf vegetable soups /sauces) Banga or palm fruit soup	Vegetables, meat/fish, crayfish, pepper, palm-oil, condiments (melon/dikanut/cocoyam/other soup thickeners)	Iron, ß-carotene, zinc
Ayaraya oka	Corn mixed with pigeon pea, vegetable, oil bean, palm oil, pepper	Vitamin A, iron, zinc
Achicha	Dried cocoyam mixed with pigeon pea, oil bean, palm oil, green leafy vegetables	Iron, zinc, ß-carotene, vitamin C
Moimoi	Wet or dry milled dehulled cowpea paste mixed with palm oil, pepper, onion, crayfish, pieces of meat, fish or egg (optional), steamed into a pudding	Iron, zinc, ß-carotene, folate, copper
Akara	Wet or dry milled dehulled cowpea paste, whipped and mixed with pepper, onion, salt and deep fried in balls in vegetable oil	Iron, zinc
Yam pottage	Yam cubes boiled with palm oil crayfish, fish (optional), green leafy vegetables	Iron, ß-carotene
Ukwa (Afuoka)	Breadfruit mixed with corn, pieces of fish or meat, bitterleaf, salt, pepper	Iron, zinc, ß-carotene
Utipiri	Corn mixed with Ugboguru (pumpkin leaf), oil bean, and pepper, salt	Iron, zinc, ß-carotene
Bean pottage	Cowpea or other legumes mixed with palm oil, salt, pepper, onion,	Iron, zinc, ß-carotene
Okpa	Bambara ground nut flour paste mixed with palm oil, pepper, salt and spices (optional)	Protein, iron, niacin, magnesium, ß-carotene
Okpa fufu and soup	Okpa fufu is a gelatinized dough made from bambara flour and eaten with traditional soups/sauces	Iron, zinc ß-carotene
Ukpo-ogede	Dried plantain flour, over ripped plantain paste, palm oil, pepper, salt	ß-carotene, iron, zinc
Igbangwu-Oka	Parboiled dried maize wet milled and mixed with palm oil, pepper, onion, crayfish, fermented oil bean, green leafy vegetable and steamed into a pudding. Termites are added in some areas	ß-carotene, iron, zinc
Native/local Salads	Dried cassava slices mixed with palm oil, leaf green vegetable (*Solanum* spp. or *Gnetum* spp.). Dried cassava slices mixed with fermented oil bean seed slices with or without leafy green vegetable, palm oil, salt, pepper. Raw *Gnetum* spp. Slices mixed with palm oil. Note: In all the above. varieties of salad, the palm oil maybe mixed with "trona" (*akanwu*, in Igbo) or potash to produce a yellow paste *ncha* (soap) Also crayfish, pieces of cow skin (*kpomo/kanda*) are added	ß-carotene, iron, vitamin C, zinc
Otunke or alibo agworoagwo	Cracked dry cassava/yam chips, soaked, steamed and mixed with Ugboguru (pumpkin leaf), okro, arira (*Corchorus olitorious*), ukpaka (fermerted oil bean slices), palm oil, salt, and pepper	ß-carotene, iron, zinc, copper, vitamin C, iodine
Agbalatui	Osu (*Pleurotus* spp.) + melon (egusi), pepper, and salt molded into patties which are cooked and eaten as meat substitutes or snacks	Iron, zinc, copper

The water yam (*D. alata*) is less sugary and is frequently used by diabetics. It can also be grated, mixed with salt, pepper and onion and fried in balls in vegetable oil in some communities. Yam flour is also prepared and used to make yam *fufu* (more popular in the Yoruba culture than the Igbo). As yam is mainly consumed fresh, it is stored in the fresh form in barns. It is a highly perishable food crop and, therefore, is stored in a cool and airy environment. Constant inspection of the yams in the barn and storage places in the homes is necessary to discard spoiled yams. It is important to note that in the rural areas yam peels are sun dried alongside the fleshy tuber and milled for consumption, thereby yielding a high dietary fibre product.

Cassava (*Manihot esculenta* Crantz)**:** Its importance as a high-energy food (providing over 70 percent of daily energy) can be deduced from the various names given to it, e.g. "Man power", "Number one" and "Six to Six". It is planted between March and June. Harvesting occurs approximately 6–18 months after planting depending on the type. Only the bitter variety of cassava is popular in the Igbo culture area. Its cultivation and harvest is less tasking than that of yam. Cassava has several advantages as a food crop. According to Ihekoronye and Ngoddy (1985) cassava provides high returns in calorie value per effort and resources invested. It grows relatively well in poor soils and under dry conditions and is, therefore, highly valued as a safeguard against the risk of failure of other staples food crops. On the other hand, cassava tubers are extremely perishable since their edible roots are not organs of dormancy. It also contains two cyanogenic glycosides: linamarin and lotaustralin, which hydrolyse in the presence of the enzyme linamarase to release hydrogen cyanide. The prussic acid concentration is highest in the bitter varieties of cassava, which is found in the Igbo culture area (FAO, 1989).

One of the ways of making cassava for human consumption is through fermentation. In the Igbo culture area, cassava is soaked in water in a container or swamps by the river for a minimum of three or four days to allow it to ferment. The fermented tuber is then washed through a sieve to remove the unfermented midrib and fibres. The slurry is put in a bag and the water is expressed. The resulting meal is referred to as *akpu* (Ihekeronye and Ngoddy, 1985). This is cooked in water for about 10–15 minutes to gelatinize, pounded in a mortar, moulded into balls and dropped into the cooking water for another 10–20 minutes. It is then pounded alone or in combination with yam or cocoyam, as is done in some Igbo communities. The resulting dough is eaten with soup/sauce. It can also be processed into *gari*, another popular form. The cassava is peeled and grated, and the grated mash is put in a bag and allowed to ferment for at least 24 hours, during which time the water is removed by hydraulic press. Then the hydraulic-pressed cassava is dried and then sifted to remove fibre and other unwanted materials. The sifted meal is toasted in a large, hot frying pan and cooled before storing.

A popular product of cassava is known as *abacha* (tapioca), which can be dry or in wet slices. The wet slices are eaten with coconut or groundnuts as a snack or incorporated into bean dishes. The dry slices are used to prepare African salad (*abacha ncha*). *Abacha* is prepared by peeling and slicing the cassava tuber and cooking it in boiling water. Cooked cassava are sliced into desirable sizes and allowed to remain in water for another 12–24 hours before consumption. During the soaking, the water is changed at least twice. Wet slices remain wet, while some slices are dried in the sun to produce dry slices.

Cassava is also processed into raw chips simply by peeling, cutting, soaking for 24 hours, washing and then sun drying. Dry cassava chips are milled into flour (*alibo*) and used to make *fufu*. *Fufu* is made by pouring the flour into hot water and stirring it continuously until gelatinized elastic dough is obtained. This again is eaten with traditional soups/sauces. The dried cassava chips could also be cracked and used in preparing a traditional dish referred to as *otunke* or *alibo agworoagwo*. Cassava is highly perishable. A day or two after they are harvested, the tubers begin to deteriorate rapidly. They develop vascular discolouration, which make the roots unpalatable and unsuitable for subsequent processing. Cassava can be stored as fermented cassava meal in containers, as *gari*, dried cassava chips and flour. In these forms, cassava can be preserved for a long time.

Cocoyam: Two major species of cocoyam, *Colocasia* spp. and *Xanthosama* spp., were documented. Mainly women in Igbo culture area produce this crop. Cocoyam is planted from March to June and harvested in November/December. Indian cocoyam (or cocoindia) a *Colocasia* spp. is planted in March and can be harvested as early as July/August/September. Cocoyam grows well in wet, damp or shady places.

The *Xanthosama* spp. can be boiled or roasted like yams. The *Colosacia* spp. requires prolonged heating (6–12 hours) before they can be consumed. This is because of their high level of raphides (slender, sharp irritant crystals formed from calcium oxalate monohydrate). They are cooked and pounded into *fufu* and consumed with traditional soups/sauces. Some (*ede-ofe*) are used as thickening agents in a popular traditional soup/sauce *ofe onughu* (bitter-leaf soup). This is a popular and important soup/sauce among the Igbos and is served at very important functions. Cocoyams are also prepared in the form of dried chips (*Abacha*). *Abacha* is produced by prolonged cooking, slicing and sun drying of the food crop. It is a very popular food in Enugu State. Cocoyams are mainly stored as dried chips. These are placed in cool, dry places or over the fireplace and taken when needed, especially during the lean planting season.

Maize (*Zea mays*): The major cereal of the Igbo culture area is maize/corn. This is a highly valuable food that provides a substantial amount of the total energy of the Igbo people. Three types of corn are common in this area: white, yellow and variegated. Corn is planted at the beginning of the rains in March/April and harvested between June and August. It is a reliable source of food during seasons of food scarcity, particularly in the months of March and June. Corn is either boiled or roasted in the fresh form and eaten with coconut or local pears (*Dacryodes edulis*). Additionally, it can be ground to prepare *Ukpo oka* or *Igbangwu* (see Table 12.1). These are becoming popular snack foods in the Igbo culture area and others parts of Nigeria.

Dry maize kernels can also be ground into meal and used to prepare gelatinized dough known as *nni/nri oka*, which is eaten with traditional soups/sauces. Dry maize can also be processed into maize gruel (pap), popularly known as *akamu*, which is a traditional weaning food and is also consumed by all population sub-groups. It is prepared by soaking dry maize/corn in water for at least 48 hours. The soaked grain is milled and washed through a sieve. The slurry obtained is put in a cloth bag and the water is pressed out. The resulting paste is *akamu*. The gruel is made by pouring boiling water into the slurry of the *akamu*. Sugar, milk, soybean flour and crayfish can be added to enrich it. Maize gruel is high in moisture and of low nutrient density. There are other recipes based on maize, for example, *akara oka*, *akara* and *agidi*. Maize cobs are normally stored over the fireplace. There, the heat and smoke from the fire keep the moisture content low and repel insects. Maize grains are also sun dried prior to storage. They can be stored in plastic containers after drying or put in hermetically sealed clay pots with pepper added.

Legumes: Although there are numerous indigenous legumes to the Igbo culture area, the black-eyed cowpea (*Vigna unguiculata*) is most commonly consumed, as well as pigeon pea (*Cajanus cajan*), *akidi* (*Vigna* spp.), African yam bean (*Sphenostylis stenocarpa*) and groundbean (*Kertingiella geocarpa*) *akidi ani*. However, the bambara groundnut has now assumed a prominent place in Igbo areas and in many large cities. The bambara groundnut seed is milled and sieved several times to produced the flour, which can be used in several ways. It is mainly used in preparing a form of pudding *okpa*, a popular meal and snack. It can be eaten with maize gruel, soaked *garri* or alone. Some people cut cooked *okpa* into small pieces and mix it with steamed vegetables and pepper and onion sauce. Bambara groundnut flour can be used to produce a gelatinized cooked dough or *fufu*. This, like cassava/yam *fufu*, is eaten with traditional soups/sauces. The flour can be incorporated into other dishes to enrich them or used in making sauce for eating yam or cocoyam. Bambara groundnut in the fresh form can be boiled and eaten alone as a snack. It can also be roasted and eaten as snack. Some of the popular dishes prepared with pigeon pea are *ayaraya oka* (pigeon pea and corn); *ayarayaji* (pigeon pea and yam) and *abacha* (pigeon pea and dried cocoyam chips) (Table 12.4). Fermented oil bean seeds are added to these as a supplement. Occasionally, the seeds are roasted, ground and sieved for making sauces and soups that go with yam or cassava *fufu*.

Akidi is a traditional cowpea variety. It is consumed as fresh pods and as dried seeds. Others are *olaludi* and *apama*. The major characteristics of these are their small seed sizes and shiny seed coats. Fresh *akidi* is used as a vegetable in the preparation of many dishes, e.g. yam pottage, *ayaraya*, and *achicha*. The dried ones are used as grains to replace pigeon pea in some of these traditional dishes. It can also be boiled and added to tapioca salad. *Akidi* is planted in April/May and harvested in June–July.

African yam bean is inter-planted with yam in April–June and supported on the same stake used for yams. It has a long growing season, with seeds maturing in 150 to 300 days (Ezueh, 1984). In most communities, it is boiled and eaten with other staples (yam, plantain, cassava, corn/maize, etc.). It is also roasted and eaten with palm kernel. This is a popular snack food sold particularly in the Enugu/Nsukka area. The African yam bean is usually cooked overnight because it is hard to cook. Hence, traditionally, *akanwu* (sodium sesquicarbonate, $Na_2 CO_3 NaHCO_3 2H_2O$) is used to reduce cooking time, a practice that needs to be discouraged since it destroys B vitamins (Edijala, 1980), which have been found to be lacking in the diets of the people (Nnanyelugo *et al.*, 1984). The African yam bean is stored in its pod over the fireplace. The seeds can also be put in sacks, bags, calabashes and basins.

Akidi ani (groundbean) is an important under-explored legume. It develops pods under the ground similar to groundnuts (*Arachis hypogea*) and bambara groundnuts (*Vigna subterranean*). It is however, confined to a few communities. It is planted in July/August and harvested in November/December. Ground bean can be boiled or roasted and eaten alone or in combination with staples such as plantain, yam, cocoyam, rice, sweet potato, cassava and maize.

Oil bean seed (*Pentaclethra macrophylla*): This is an important food crop in the Igbo culture area. As a delicacy, it is consumed in the fermented form and is known as *ugba* or *ukpaka*. This fermented product is obtained by boiling the oil bean seed overnight, after which it is dehulled by hand and then the cotyledon is sliced. The sliced cotyledons are boiled again for about 2 hours, washed in water and put in a covered basket and left in a warm environment to ferment for at least 12 hours. Fermentation can be prolonged depending on the temperature of the environment. The fermented slices can be eaten alone or in combination with other foods as described earlier. The delicacy prepared with this food is *ugba agworoagwu* – *ugba* mixed with palm oil, pepper, salt and *akanwu* (*trona*). Variations to the food were noted as crayfish, fish, cowskin (*kpomo* or *canda*), cassava slices, solanum leaf or various fruits being added. Ugba is used for several social activities such as marriage, naming ceremonies and union meetings. They are sold and served in hotels and other eating houses popularly known as "*Ugba* joints". It is a tree plant and the seeds are picked or harvested between August and November. The seeds are stored in containers until ready for use.

Vegetables abound in the Igbo culture area. However, there are community peculiarities in terms of the types and form in which vegetables are consumed. For example, *okazi* (*Gnetum africanum*) and *achara* (*Pennisetum* spp.) are typical of Igbos from Imo and Abia States, while bitterleaf (*Vernonia amygdalina*) is most popular in Anambra State. The Igbos in the Enugu and Delta States sprinkle vegetables on their food. A lot of uncommon vegetables were found to be consumed in the Delta area. Some of them grow as weeds around the homesteads and farmlands. It is also interesting to note that most of these uncommon vegetables are used in small quantities and ground before use in preparing soup. Most of them are used because of their medicinal value.

Most vegetables are cooked before eating either by steaming or cooking in soups/sauces, with the tendency of overcooking them. Only a few traditional vegetables are eaten raw. They include *anara* leaf (*Solanum* spp.) and *okazi* (*Gnetum africanum*), and are used in making native salads. The bitter leaf is chewed raw after the leaves have been washed several times to reduce its bitter taste. Bitter leaf chewing is

Table 12.4 Nutrient composition of selected Igbo traditional recipes *(mean ± SD per 100 g edible portion)**

Food	Moisture g	Energy kcal	Energy kJ	Ash g	Fat g	Protein g
African Bread fruit	47.36 ± 0.2	242	1 015	3.6 ± 0.6	10.1 ± 0.2	11.9 ± 0.2
Cassava	53.3 ± 0.1	179	750	1.4 ± 0.0	0.01 ± 0.0	0.6 ± 0.0
Cassava strips & black cowpea	50.14 ± 0.3	212	891	1.8 ± 0.6	4.5 ± 0.0	3.4 ± 0.1
Plain bambara pudding	57.75 ± 0.4	165	692	1.7 ± 0.6	0.9 ± 0.0	14.6 ± 0.02
Dried cocoyam & pigeon pea	49.72 ± 0.2	211	885	2.0 ± 0.1	3.98 ± 0.01	2.78 ± 0.02
Dried cocoyam pudding	51.83 ± 0.45	182	763	2.2 ± 0.0	0.00	0.57 ± 0.05
Melon & grain millets & okazi	64.81 ± 0.25	153	641	3.7 ± 0.10	5.98 ± 0.05	5.14 ± 0.01
Steamed maize pudding with vegetables	47.25 ± 0.50	214	896	4.8 ± 0.06	5.8 ± 0.06	6.49 ± 0.05
Dika nut	65.22 ± 0.22	151	635	0.4 ± 0.07	3.1 ± 0.05	3.34 ± 0.04
Banga soup	76.04 ± 0.4	112	469	1.7 ± 0.01	5.0 ± 0.01	4.03 ± 0.02
White soup	56.25 ± 0.1	182	764	5.25 ± 0.06	7.00 ± 0.06	5.38 ± 0.03
Bambara pudding	44.28 ± 0.2	246	1 033	3.84 ± 0.04	8.91 ± 0.03	10.36 ± 0.04
African yam bean & fermented oil bean seed pottage	55.42 ± 0.4	170	714	3.12 ± 0.05	2.05 ± 0.02	6.55 ± 0.26
Cowpea & fermented oil bean seed pottage	52.6 ± 1.18	207	867	1.71 ± 0.1	5.0 ± 0.02	7.92 ± 0.3
Dried cassava fufu	54.85 ± 0.06	177	741	0.68 ± 0.25	0.05 ± 0.01	0.27 ± 0.01
African yam bean & wet cassava & garden egg leaves	55.37 ± 0.20	168	707	3.35 ± 0.07	1.32 ± 0.05	3.48 ± 0.05
Unripe and ripe plantain pudding	54.38 ± 0.00	192	804	1.60 ± 0.00	3.42 ± 0.12	2.05 ± 0.12

* Analyses in duplicate or triplicate.

popular with the Igbos from Anambra State. Apart from the bitter leaf, all other vegetables can be used directly without any form of processing. Vegetables are most often consumed fresh, while some are preserved by sun or shade drying. Dried vegetables are used when they are not in season. Before use, they are soaked and washed in water. Dried vegetables are stored in bags or containers until ready for use.

Preferences of family members (mothers and children) described in 2005–2006

Starchy roots, tubers and fruits

Yams are especially popular with children when boiled and eaten with palm oil, cooked as pottage without greens or incorporated into bean pottage. Adults, on the other hand, like yam especially as pounded yam eaten with soups/sauces. Children also enjoy sweet potato because of the sweet taste, while adults believe it can cause worms (worm infestation). The three-leaf yam (*ona*) is liked and well known by adults, whereas children report not liking them and are not familiar with them. Cassava and their products are enjoyed and eaten by all members of the family. However, there are preferences in the soups/sauces used: ripe plantain, especially in the fried or boiled form, is preferred by children, while adults prefer green plantain either roasted or used in preparing plantain pottage.

Cereal

Cereals and cereal products have a special place in children's food preferences. They are fond of pap, *agidi*, *igbangwu* and rice in any form. Adults eat these foods but regard rice as "bird food".

Legumes

Legume dishes were reported to be liked by everyone in the family. However, children highly enjoy *okpa*,

Fibre g	CHO g	Iron mg	Copper µg	Zinc µg	Phosphorous mg	Vit A RE µg	Vit C mg	Folic acid µg
1.2 ± 0.5	25.99 ± 0.0	0.6 ± 0.01	2.3 ± 0.03	0.3 ± 0.03	14.2 ± 0.2	7.7 ± 0.02	14.5 ± 0.06	7.1 ± 0.02
0.6 ± 0.2	44.21 ± 0.1	0.6 ± 0.0	3.4 ± 0.0	0.2 ± 0.01	12.9 ± 0.1	3.9 ± 0.02	4.6 ± 0.01	3.1 ± 0.04
0.5 ± 0.0	39.73 ± 0.1	0.6 ± 0.2	3.1 ± 0.01	0.3 ± 0.01	14.0 ± 0.06	11.2 ± 0.01	21.4 ± 0.01	11.2 ± 0.02
0.3 ± 0.1	24.7 ± 0.03	0.3 ± 0.2	3.4 ± 0.05	0.25 ± 0.0	13.8 ± 0.0	1.93 ± 0.01	8.0 ± 0.01	3.06 ± 0.01
0.35 ± 0.0	41.13 ± 0.01	0.3 ± 0.01	3.4 ± 0.01	0.2 ± 0.02	13.6 ± 0.47	5.42 ± 0.03	8.96 ± 0.05	5.45 ± 0.00
0.43 ± 0.05	45.0 ± 0.02	0.44 ± 0.1	3.38 ± 0.03	0.32 ± 0.0	15.3 ± 0.02	11.42 ± 0.02	2.6 ± 0.01	2.76 ± 0.10
0.7 ± 0.32	19.68 ± 0.02	0.6 ± 0.01	3.1 ± 0.01	0.28 ± 0.01	15.89 ± 0.78	9.56 ± 0.01	25.2 ± 0.01	12.14 ± 0.0
1.69 ± 0.03	34.02 ± 0.03	0.32 ± 0.01	3.25 ± 0.03	0.25 ± 0.02	14.9 ± 0.26	9.27 ± 0.02	14.2 ± 0.12	5.04 ± 0.04
0.35 ± 0.01	27.64 ± 0.03	0.4 ± 0.01	4.0 ± 0.05	0.31 ± 0.00	14.2 ± 0.01	5.86 ± 0.02	29.3 ± 0.06	18.67 ± 0.01
0.48 ± 0.00	12.77 ± 0.02	0.44 ± 0.00	3.4 ± 0.05	0.35 ± 0.05	14.5 ± 0.33	8.72 ± 0.03	18.92 ± 0.01	6.53 ± 0.01
1.58 ± 0.26	24.54 ± 0.03	0.45 ± 0.01	4.06 ± 0.05	0.23 ± 0.02	15.7 ± 0.06	6.25 ± 0.05	16.32 ± 0.2	7.64 ± 0.01
1.28 ± 0.26	31.33 ± 0.01	0.77 ± 0.03	3.1 ± 0.28	0.15 ± 0.03	16.5 ± 0.18	8.18 ± 0.01	17.2 ± 0.40	6.4 ± 0.10
1.34 ± 0.17	31.52 ± 0.04	0.74 ± 0.00	3.5 ± 0.43	0.1 ± 0.03	13.8 ± 0.06	5.79 ± 0.00	14.0 ± 0.06	7.33 ± 0.02
0.14 ± 0.00	32.63 ± 0.11	0.23 ± 0.00	3.1 ± 0.10	0.20 ± 0.01	13.6 ± 0.00	7.79 ± 0.20	18.4 ± 0.01	6.97 ± 0.02
0.12 ± 0.06	44.01 ± 0.01	0.45 ± 0.01	3.1 ± 0.01	0.16 ± 0.02	13.2 ± 0.35	3.94 ± 0.02	5.02 ± 0.10	6.99 ± 0.01
0.71 ± 0.01	35.77 ± 0.01	0.56 ± 0.01	3.5 ± 0.03	0.15 ± 0.01	16.9 ± 0.31	6.16 ± 0.05	14.4 ± 0.05	6.06 ± 0.01
0.26 ± 0.05	38.29 ± 0.03	0.3 ± 0.00	3.1 ± 0.00	0.14 ± 0.00	14.0 ± 0.06	6.40 ± 0.00	9.13 ± 0.01	5.87 ± 0.02

moi moi and *akara*, especially since they are bought as snack foods.

Vegetables

Children referred to in this study generally did not like vegetables and would avoid dishes with a lot of them included. There are some vegetables that children prefer because of certain qualities they possess. For example, children like *arira* (*Corchorus olitorius*) *kerenkere* (*Corchorus* spp.), *ujuju* (*Myrianthus arboreus*) and *anyazu* (*Psychotria* spp.), where they are available, because of their viscous or drawing consistency and sweet taste. They also do not like vegetables with a bitter taste (e.g. bitter leaf) or strong smell (*nchuanwu*, *Ocimum gratissimum*). Mothers, on the other hand, highly enjoy vegetables in any form.

Fruits

Children express a great liking for a variety of fruits, unlike the adults. Traditional fruits particularly liked by children are *utu* (*Landolphia owariensis*), *udala* (*Chrysophyllum albidum*), *icheku* (velvet tamarind, *Dialium guinense*) *ube* or pears (*Dacryodes edulis*) and *ube okpoko* (*Canarium schweinfurthii*). They do not like bush mango (*Irvingia* spp.) because of its very strong smell, while mothers and other adults really enjoy this fruit.

Soups/sauces

Children like most soups/sauces except *egusi* (melon) and bitterleaf soups. *Egusi* and bitterleaf soups are very important soups/sauces in the Igbo culture area. They are used for entertaining guests at different functions. Palm fruit pulp soup, popularly known as *banga* soup or *ofe akwu*, is a special soup of the Anambra and Delta Igbos, but is gradually becoming very popular everywhere. It can be made using a variety of staples and is enjoyed by all.

Animal foods

Meat, fish and poultry are enjoyed by children, although these are given to them in small quantities. Children are given milk and milk products mostly when they are very young. They also like other traditional animal foods like beetle, cricket, termites, snails, rabbit, squirrel larvae and snail eggs. Mothers also like animal foods. *Nchi* is one of the cherished bush meats used in the local cuisine. In some Igbo communities, it is forbidden for pregnant women because it is said to prolong labour. The termite is a cheap source of protein, which is cherished by childen and some adults. It is usually roasted and eaten alone or steamed and included in some traditional food preparations, such as *ikpo-oka* (corn pudding).

In the past, children and mothers were denied these animal foods. However, with increasing awareness of the nutritional needs of these vulnerable groups, such taboos are followed less strictly. Their limited consumption now could be attributed to availability and cost. There are also certain animals that are still prohibited for spiritual or cultural reasons, e.g. hyena, snakes, snails, etc.

Foods readily available, as described in the research period

The most readily available traditional staple in the Igbo culture area is cassava (*Manihot esculenta*). It is a staple that is found in one processed form or another in every household, irrespective of social status and season of the year. Other staples that are available year-round may not be seen in some households because of their high cost, e.g. yam and plantain. Among the cereals, maize appears to be the most readily available, since most households produce maize. Thus, it can be found in wet or dried form depending on the season.

The most readily available legume is the cowpea (*Vigna unguiculala*). This can be found in every community and local market in larger quantities than the indigenous ones. The production of traditional legumes is low.

Fruits and vegetables abound in the Igbo culture area but are highly seasonal. However, vegetables such as bitter leaf, *Amaranthus* (green), *okazi* (*Gnetum* spp.) and pumpkin (*ugu*) are available year-round, but are expensive during the dry season. Among the vegetables used less frequently *obiogbome* (*Peptadentia* spp.), *anya-azu* (*Psychotria* spp.), *kpugbum* (*Chromolaena odorata*), *ujuju* (*Myrianthus arboreus*), *ulumiri* (*Spathodea campanulata*), *Olili* (*Brillantaisia merrenia* spp.) *aluluisimmo* (*Husolandia opprosita*) and *okpanwaokuko* (*Aduraria chamae*) are said to be available throughout the year. These are mainly obtained from the wild except *Merremia* spp., *Spathodea campanulata* and *Psychoria*, which are found in home gardens. Bananas and citrus fruits, particularly oranges, are the most readily available fruits.

Most nuts and seeds are available throughout the year, since they are usually dried and preserved.

Table 12.5 Cost of meeting iron requirements with some traditional Igbo recipes

Food	Serving[a] portion (g) Children	Serving[a] portion (g) Women	mgFe/100g[a]	Cost/100g[b] (₦)	Cost of meeting the iron requirement for children (8mg) (₦)
Bean Pottage	275	600	2.27	15.0	52.86
MoiMoi	200	350	2.70	5.0	14.81
Okpa	225	450	2.27	10.0	35.24
Akara	100	150	2.85	10.0	28.07
Igbangwu	250	375	2.48	5.0	16.13
Cassava and Egusi soup	300	600	2.04	20.0	78.43
Cassava and Bitterleaf	325	625	1.90	20.0	84.20
Cassava and Okro soup	325	650	1.69	20.0	94.67

[a] Madukwe and Ene-Obong, 2006.
[b] Okeke and Eze, 2006.
US$ 1 ≈ ₦127 (Oct, 2007).

The oil bean seed, groundnuts, melon and *dikanut* are always available, although they may be expensive at times.

The animal foods, meat, fish, poultry and eggs are available but very expensive. Bush animals are not readily available because of limited forest for hunting and the migration of men to the cities. Insects and larvae are available, but only children in the rural communities collect them for food.

Cost of foods

The nutritive cost of some basic staples to provide 20 g protein and 4.2 MJ of energy (necessary to meet the need of a pre-school child) was determined (King *et al*., 1984; Okeke and Eze, 2006). The data showed that maize was the cheapest staple providing energy for the child, while frozen fish and cowpea were the cheapest in providing protein. Table 12.5 shows the cost of providing a pre-school child's requirement for iron. Here, *moi moi* (a bean-based recipe) was the cheapest (₦14.80), followed by *igbangwu* (₦16.13), a maize-based pudding. The cassava and soup/sauce recipes were more expensive (₦78 to ₦95) as sources of iron for children. This was probably because of bulk and high moisture content.

Dietary evaluation

Infant-feeding practices reported by Igbo researchers

Breastfeeding was found to be the traditional method of feeding infants in the Igbo culture area, with over 90 percent of Igbo mothers breastfeeding their infants. However, exclusive breastfeeding was not fully accepted by Igbo mothers, since they would not stop giving water to the infant. About 95 percent of mothers had given their infants colostrum. Most mothers (62 percent) stopped giving their children breastmilk between the age of 15 and 17 months; 18 percent stopped between 21 and 25 months, while 3.5 percent breastfed beyond 25 months.

Apart from maize gruel (pap), complementary foods were generally those foods consumed by adults in these communities. They were introduced before four months of age or later. Foods considered good for infants were *akara*, *ukwa* (African breadfruit), *ukpo oka*, African yambean, plantain pottage and boiled plantain and *ujuju* soup. Fruit was rarely given. Other milks fed to children included powdered milk, soy milk and liquid whole cow's milk, and 31.7 percent gave their children commercial cocoa-based beverages.

Contribution of traditional foods to nutrient intake

Using the weighed food intake method, the nutrient intake of traditional foods and their contribution to total energy and nutrient intake were calculated. The traditional diet of the Igbo culture is plant-based, with little contribution made by meat and their products. Simple processing (e.g. fermentation) and cooking methods (e.g. steaming, baking and roasting) were used in preparing traditional foods.

Traditional foods/diets are high in moisture content as shown by the proximate composition in Tables 12.2, 12.3a and 12.3b (in most cases above 50 percent), bulky and of low energy and nutrient densities. However, traditional foods contributed over 90 percent of the energy intake of rural communities in Igbo culture area. There are community variations in the contribution of specific food groups. In the Anambra area, starchy roots and tubers, nuts and seeds made substantial contributions to energy intake, while in Enugu area, starchy roots and tubers, legumes and cereals significantly contributed to the intake of energy. The bulk of ascorbic acid came from vegetables in Anambra area (34 to 62 percent), while in Enugu area, much of the ascorbic acid (51 to 58 percent) came from starchy roots and tubers. Red palm oil was used in preparing most traditional dishes and recipes and thus is the major source of ß-carotene, a precursor of vitamin A. It contributed 70 to 80 percent of vitamin A.

Although traditional foods/diets made substantial contributions to nutrient intakes of the Igbo culture area, they did not adequately meet the needs for energy, calcium, riboflavin and niacin. The adequacy of vitamin A and protein intake from the traditional diet needs to be interpreted with caution, since the diets are plant-based and, therefore, likely to be of low bio-availability and digestibility (Madukwe and Ene-Obong, 2006).

In considering the significance of traditional Igbo foods to food sources of nutrition of the population, a calculation was made of the percent of energy in the daily diet derived from locally available foods. This percentage was 97 percent for children zero to two years of age, 92 percent for children three to five years of age, 95 percent for children 6 to 12 years of age, and 96 percent for mothers (Okeke *et al.*, in press).

Nutritional status

In the Ede-Oballa community, stunting was found in 38.6 percent of males and 31.8 percent of females, close to the national level of 42 percent (Maziya-Dixon *et al.*, 2004). Wasting was found to be 14 percent and 12 percent in males and females, respectively. Undernutrition was more prevalent in children under two years of age with about 84 percent of children undernourished compared to 16 percent of children two to five years of age. There was no prevalence of under-nutrition in children between 6 and 12 years of age.

Food attributes/card sorts

The general perception of food among the Igbos was that it gives blood and nourishment. Foods that were believed to give blood included animals, legumes, some seeds and vegetables. This was shown by all the communities studied. Plantain (*Musa paradisiaca*) was believed to be rich in iron and is a blood-giving food. Also in one community, honey was mentioned as food that provided blood. In these communities, iron-giving foods and body-building food were synonymous with blood-giving foods. Igbo people have good knowledge of foods rich in energy since most carbohydrate and fatty foods were sorted for energy. These included cereals, starchy roots, tubers, fruits and their products, vegetable oils and oily seeds like groundnuts. In some cases, fruits (pawpaw) and vegetables (cucumber, *utazi*, and carrots) were included.

Perception of specific mineral and vitamin-rich foods was interesting and worth noting. *Natron trona* (*akanwu*), a sodium salt, was thought to be rich in calcium. Palm oil and vegetable oil were also perceived to give calcium. Calcium is correctly associated with strong bones by the Igbos but it appears that their knowledge of its food sources was lacking. Cowskin (*canda/kpomo*) was incorrectly mentioned in one of the communities as being associated with helping to build bones. Interestingly, they had little difficulty identifying vitamin A rich foods associated with improvement of the eyes. In this regard, fruit, vegetables and palm oil were mentioned. A general lack of knowledge of fibre-rich foods was observed in most Igbo communities. Only mango, orange and *achara* (*Pennisetum* spp.) were mentioned in two of the communities visited.

Igbo concepts of cold and hot food were noted. Cold foods were those that keep the body cool and calm. Such foods included paw-paw, African breadfruit, pap, waterleaf, onion, tomatoes, pumpkin, *utazi* leaf (*Piper guineense*) *osu* (*Pluerotus* spp.), dry *okro*, coconut, avocado, pear and *nchuanwu* (*Ocimum viridias*). Hot foods on the other hand were those that keep the body hot or warm. They included *uziza* seed (*Piper guineense*), ginger, hot pepper, *nmimi* (*Dennettia tripetala*) alligator pepper (*Aframomun melegueta*) *uda* (*Xylopia aethiopipa*) and *efu* (*Monodora myristica*). Thus, hot foods consumed by the Igbos were mainly hot spices, while cold foods were those that do not cause any “disturbance” in the body after consumption.

Conclusions

The Igbo were shown to have knowledge of an extensive and diverse food system that contains all the necessary nutrients for human nutrition. Despite this, the research study showed that there was considerable undernutrition, particularly in children. Education and agricultural sustainability were seen as major interventions that would help communities develop their resources within the local cultural context to provide better advantages for health. Food processing technology would also assist to lighten women’s work. This research has provided the opportunity for understanding the food system, and its nutritional potential, as well as the cultural definitions to make more high-quality foods available, accessible and acceptable. With concerted effort, food security can be improved by empowerment of the local community members to take best advantage of what they have in their local environment.

Intervention strategies are suggested to address protein-energy malnutrition and micronutrient deficiencies as devastating public health problems in the Igbo culture area, and in Nigeria generally. In addition to provisioning of protein foods, micronutrient deficiencies need to be specifically addressed through multiple measures, including consumer education, social marketing, widespread distribution of supplements, fortification of staple foods and the continued iodization of salt. For maximum effectiveness, interventions must be inter-sectoral, involving the health, agriculture, education, information, media and planning sectors.

Improving access to protein foods (legumes, bush food, etc.) for young children, and improving access to micronutrients through the local food system, as well as the health care system, will contribute greatly to the control of childhood infections, improved child survival and improved women's health, thereby contributing to overall national development ●

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Species Index – Indigenous Peoples' food systems species by scientific name

Species listed in this index, and cross-referenced in chapter tables and text, were checked, modified in some cases and confirmed by experts at the Food and Agricultural Organization of the United Nations, Rome, June 2008.

(*Scientific name* / Case study / Table number)

Birds

Fish, seafood & marine mammals

Fruits, nuts and seeds

Grains

Insects, mollusks and larvae

Land animals (including amphibians and reptiles)

Legumes

Miscellaneous (including drinks, herbs, condiments, spices, mushrooms)

Vegetables
(including roots, tubers, leaves, bark)

Subject Index

Note:
page numbers in *italics* refer to figures,
those in **bold** refer to tables.

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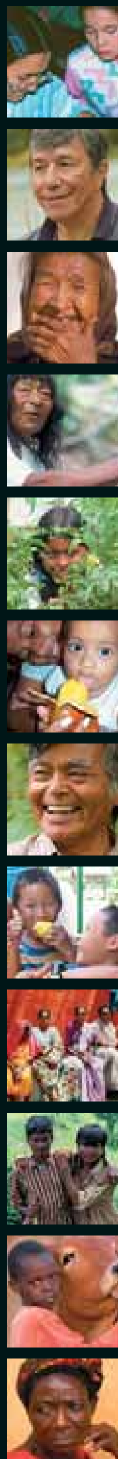

Indigenous Peoples' food systems:

the many dimensions of culture, diversity and environment for nutrition and health

Food systems of Indigenous Peoples who retain connection to long-evolved cultures and patterns of living in local ecosystems present a treasure of knowledge that contributes to well-being and health, and can benefit all humankind. This book seeks to define and describe the diversity in food system use, nutrition and health in 12 rural case studies of Indigenous Peoples in different parts of the world as a window to global Indigenous Peoples' circumstances. A procedure for documenting Indigenous Peoples' food systems was developed by researchers working with the Centre for Indigenous Peoples' Nutrition and Environment (CINE) at McGill University, Canada, and the FAO. The procedure was adapted and applied in case studies located in Canada, Japan, Peru, India, Nigeria, Colombia, Thailand, Kenya, and the Federated States of Micronesia. The collective intent of this documentation is to show the inherent strengths of the local traditional food systems, how people think about and use these foods, the influx of industrial and purchased food, and the circumstances of the nutrition transition in indigenous communities. This research was completed with both qualitative and quantitative methods by Indigenous Peoples and their academic partners in the context of the second International Decade of the World's Indigenous Peoples, and the Declaration of the Rights of Indigenous Peoples adopted in 2007 by the General Assembly of the United Nations

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