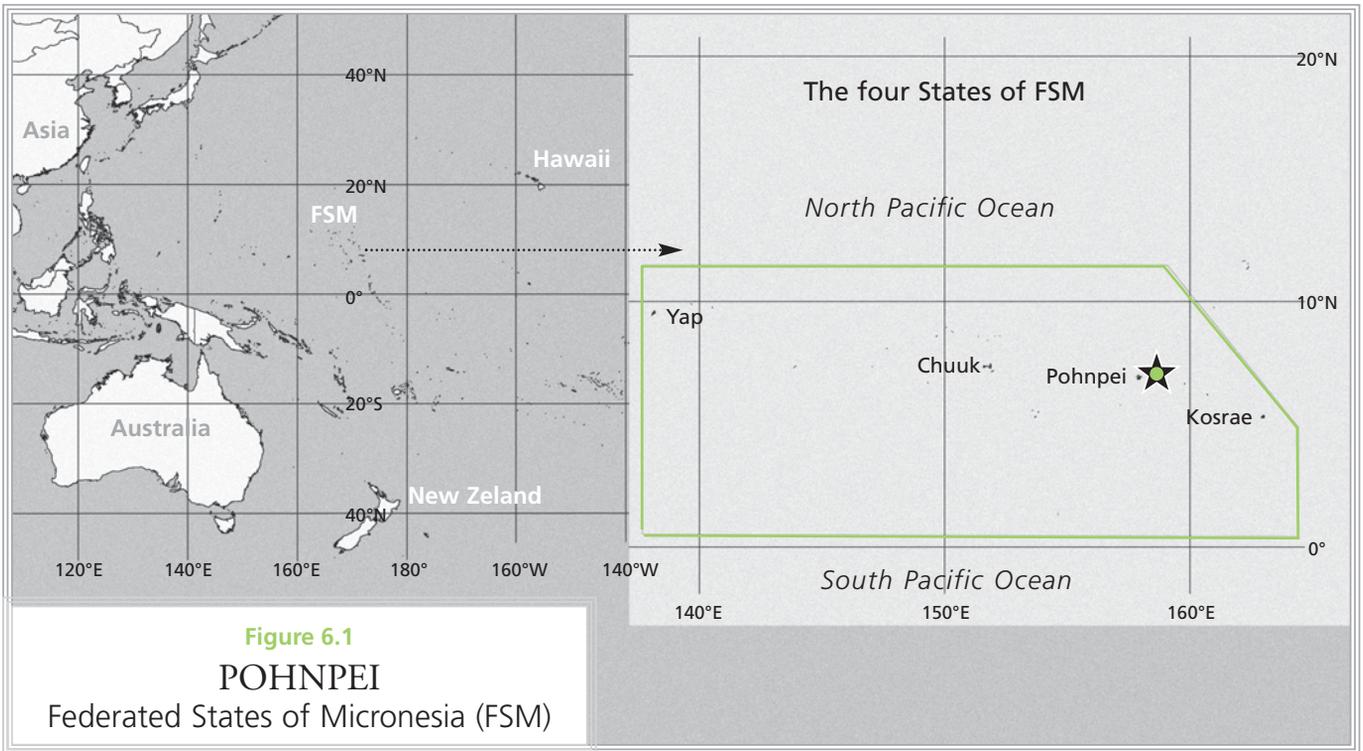




## Chapter 6

# Documentation of the traditional food system of Pohnpei

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Data from ESRI Global GIS, 2006.  
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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  $\geq 126$  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)<sup>3</sup> 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).

<sup>3</sup> 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.

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.<sup>4</sup> 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

<sup>4</sup> 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<sup>5</sup> 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,

<sup>5</sup> 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<sup>6</sup> towards increased consumption of imported foods, including white rice, flour products, sugar, fatty meats (including turkey tail),<sup>7</sup> 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.

<sup>6</sup> Local food is the commonly used term in Micronesia and the Pacific for traditional food.

<sup>7</sup> 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,  $\beta$ -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  $\beta$ -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.<sup>8</sup> Thirty-seven foods and other items were included, including alcoholic beverages,<sup>9</sup> local *sakau* drink (kava),<sup>10</sup> 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 ( $\geq 5$  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).

<sup>8</sup> 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.

<sup>9</sup> 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.

<sup>10</sup> *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**

<b>Survey on traditional food system</b>	
Literature search/related papers	24
In-depth interviews (5 interviewers)	33
Pile sort interviews	7
Informal focus group discussions	29
<b>Total attendance at the 29 meetings</b>	<b>578</b>
<b>Market and agroforestry survey</b>	
Markets surveyed: Mand/Kolonia	3
Agroforestry study interviews	43
<b>Photographic documentation</b>	
Folders categorized by topic	10
Photographs selected	297
<b>Health study – random selection of 47 households (hh)</b>	
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
<b>Dietary assessment – random selection of 47 hh</b>	
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
<b>Survey of factors related to the nutrition/health behaviours and issues</b>	
Interviews	46
<b>Food sample collection for analysis and identification</b>	
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<sup>11</sup> 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

<sup>11</sup> 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.

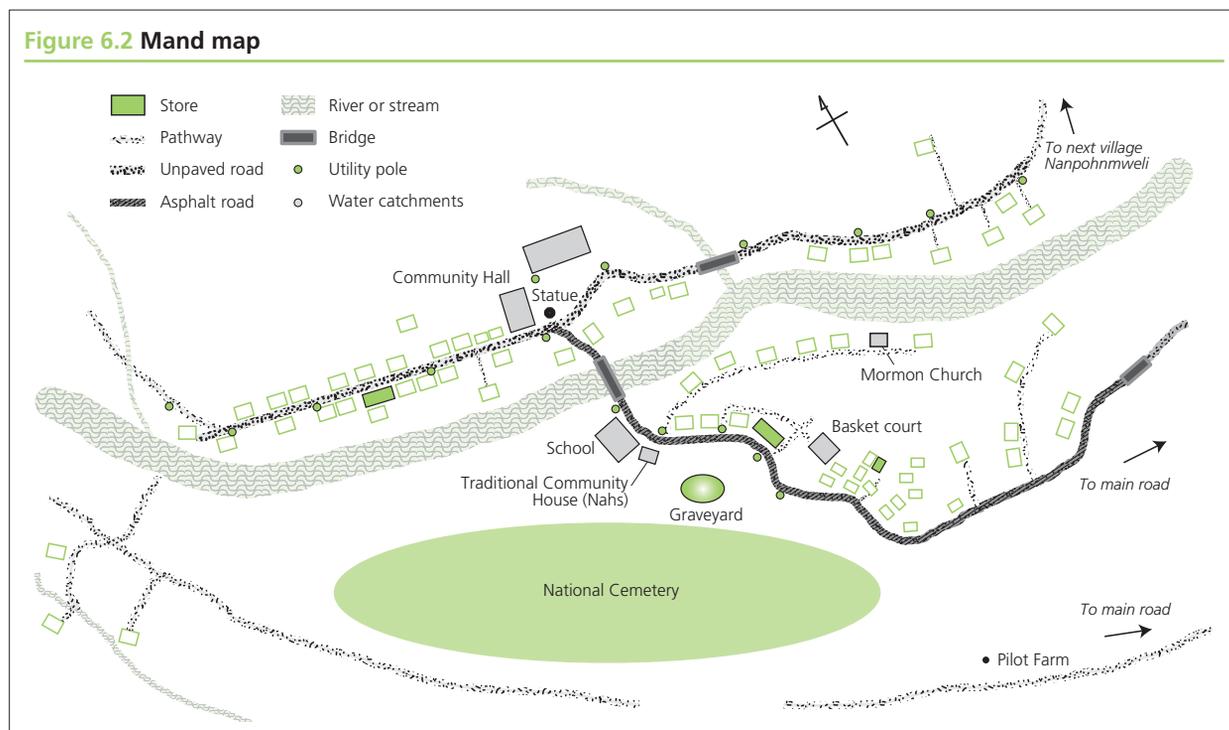
Similar to the larger Pohnpei population, most Mand families' cash income was important for obtaining daily food. The price of local foods was much higher than imported staples (rice at US\$0.30 per pound versus breadfruit at US\$0.50 per pound), with local food prices including peels and inedible parts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



**Table 6.2 Summary of the Mand traditional food list**

<b>Food list items</b>	<b>Number of food items*</b>
<b>Starchy staples</b>	
Arrowroot	1
Banana/cultivars	26
Breadfruit/cultivars	15
Jackfruit	1
Sweet potato/cultivars	6
Tapioca/cultivars	9
Taro, <i>Alocasia</i> /cultivars	2
Taro, <i>Colocasia</i> /cultivars	5
Taro, <i>Cyrtosperma</i> /cultivars	12
Taro, <i>Xanthosoma</i> /cultivars	2
Yam/cultivars	42
<b>Palms</b>	
Coconut/cultivar, <i>Cocos nucifera</i>	6
Mountain palm, <i>Clinostigma ponapensis</i>	1
Oil palm, <i>Elaeis guineensis</i>	1
Palm, <i>Ptychosperma</i> spp.	1
<b>Nuts</b>	
Chestnut	1
Indian almond	1
Red bead	1
Fruits (excluding bananas and pandanus)	23
Pandanus/cultivars	13
Citrus/cultivars	3
<b>Vegetables</b>	
Herbs (basil, garlic vine, lemon grass)	3
Spice (pepper, ginger, turmeric)	3
Local drink: native cinnamon	1
Local drink: hibiscus flower	1
Local drink: <i>sakau</i> 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
<b>Total</b>	<b>381</b>

\* 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	Pinglap name	Part(s) used	Seasonality	Marketed	Source
<b>Starchy staples</b>							
1 <i>Alocasia macrorrhiza</i> (2 var.)	<i>Alocasia taro</i>	ohd	wod	corm	no	no	W
2 <i>Artocarpus altilis/mariannensis</i> (15 var.)	breadfruit	mahi	mei	fruit, nut	yes	yes	C
3 <i>Artocarpus heterophyllus</i>	jackfruit	jackfruit	–	fruit	yes	no	C
4 <i>Colocasia esculenta</i> (5 var.)	<i>Colocasia taro</i>	sawa	sewa	corm, leaves	no	yes	C, W
5 <i>Cyrtosperma chamissonis</i> (12 var.)	giant swamp taro	mwahng	mweiang	corm	no	yes	C
6 <i>Dioscorea</i> spp. (42 var.)	yam	kehp	kehp	tuber	yes	yes	C, W
7 <i>Ipomea batatas</i> (6 var.)	sweet potato	pedehde	pedehde	corm, leaves	no	yes	C
8 <i>Manihot esculenta</i> (9 var.)	tapioca	kehp tunke	dapiohka	cassava, tuber	no	yes	C
9 <i>Musa</i> spp. (26 var.)	banana	uht	wis	stem, bud	no	yes	C, W
10 <i>Tacca leontopetaloides</i>	arrowroot	mwekimwek	mwekemwek	tuber	no	no	C, W
11 <i>Xanthosoma sagittifolium</i> (2 var.)	<i>Xanthosoma taro</i>	sawahhawai	sewah seipen	corm	no	yes	C
<b>Coconut and other palms</b>							
1 <i>Clinstigma ponapensis</i>	mountain palm	kotop	kedei	heart	no	no	W
2 <i>Cocos nucifera</i> (6 var.)	coconut	nih	ni	nut, juice, husk, embryo, inflorescence, heart	no	yes	C, W
3 <i>Elaeis guineensis</i>	oil palm	apwuraiasi, nihn aprika	apwuraiasi	meat embryo	yes	no	W
4 <i>Ptychosperma</i> spp.	palm	kedei	kedei	heart	no	no	W
<b>Fruits and nuts</b>							
1 <i>Adenanthera pavonina</i>	red bead	kaikes	kaikes	nut	yes	no	W
2 <i>Ananas comosus</i>	pineapple	pweinaper	pweinaper	fruit	yes	yes	C
3 <i>Annona muricata</i>	soursop	sei	sei	fruit	yes	yes	W
4 <i>Averrhoa carambola</i>	carambola, star fruit	ansu	ansu	fruit	yes	yes	C, W
5 <i>Carica papaya</i>	papaya	memiap	keiniap	fruit, seed	no	yes	C, W
6 <i>Chrysophyllum cainito</i>	star apple	star apple	–	fruit	yes	no	C
7 <i>Citruillus vulgaris</i>	watermelon	sihka	wedamelon	fruit	no	yes	C
8 <i>Citrus aurantifolia</i> (3 var.)	citrus	karer, peren	karer	fruit, leaves	yes	yes	C, W
9 <i>Crataeva speciosa</i>	garlic pear	apus, apuch	–	fruit	yes	no	C
10 <i>Eugenia jambos</i>	rose apple, bell apple	apel en wai, apelik	apolsikisik	fruit	yes	yes	C
11 <i>Eugenia stelechantha</i>	jungle apple	kirekinwel	apol in wai	fruit	na	no	W
12 <i>Ficus tinctoria</i>	native fig	nin	nin	berry	yes	no	W
13 <i>Inocarpus fagifer</i>	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 <i>Mangifera indica</i>	mango	kehngid	kehngid	fruit	yes	yes	C, W
15 <i>Morinda citrifolia</i>	Indian mulberry, noni	weipwul	uhpwul	fruit, leaves	no	yes	W
16 <i>Nephelium lappaceum</i>	rambutan	rambutan	–	fruit	yes	no	C
17 <i>Pandanus tectorius</i> (13 var.)	pandanus fruit	kipar, deipw	kipar	fruit, seed	yes	yes	C, W
18 <i>Pangium edule</i>	false durian	duhrien (false)	duhrien (false)	fruit	yes	no	W
19 <i>Passiflora edulis</i>	giant passion fruit	pwompwompw en wai	pwompwompw	fruit	yes	no	C
20 <i>Passiflora foetida</i>	passion fruit	pwompwompw	pwompwompw	fruit	yes	no	W
21 <i>Persea Americana</i>	avocado	apakahdo	–	fruit	yes	yes	C
22 <i>Pouteria campechiana</i>	canistel, egg fruit	kanisutel	–	fruit	na	no	C
23 <i>Psidium guajava</i>	guava	kuahpa	kuahpa	fruit	yes	no	C, W
24 <i>Saccharum officinarum</i>	sugar cane	sehu	seu	stem	no	yes	C
25 <i>Spondias dulcis</i>	golden apple, Polynesian plum	doismango	–	fruit	yes	no	W
26 <i>Syzygium malaccensis</i>	mountain apple, Malay apple	apel en pohnpei	apol in pohnpei	fruit	yes	yes	C, W
27 <i>Terminalia catappa</i>	Indian almond	dipwoapw	dipwoapw	nut	yes	no	C, W
28 <i>Theobroma cacao</i>	cocoa fruit	kakau	kekau	fruit	yes	no	C

**Vegetables**

1 <i>Allium cepa</i>	spring onion	nengi	nengi	leaves	no	yes	C
2 <i>Allium schoenoprasum</i>	leek	nira	lihk	leaves	no	yes	C
3 <i>Alternanthera sissoo</i>	Brazilian spinach	spinach	spinis	leaves	no	no	C
4 <i>Asplenium nidus</i>	bird's nest fern	tehnik	sehlik	leaves	no	no	W
5 <i>Brassica chinensis</i>	Chinese cabbage	napa	cabbage	leaves	no	yes	C
6 <i>Capsicum annuum</i>	chili pepper	sele	sele	leaves, fruit, stem	no	yes	C, W
7 <i>Capsicum annuum</i>	bell pepper	bell pepper	bell pepper	fruit	no	yes	C
8 <i>Cnidoscolus chayamansa</i>	chaya	taya	chaya	leaves	no	no	C
9 <i>Cucumis sativus</i>	cucumber	kiuhri	kiuhri	fruit	no	yes	C
10 <i>Cucurbita pepo</i>	squash, zucchini	iuhnawo	–	fruit	no	yes	C
11 <i>Cucurbita moschata</i>	pumpkin	pwengkin	pwengkin	fruit	no	yes	C
12 <i>Gynura crepidoides</i>	Okinawa spinach	spinat	spinis	leaves	no	no	C
13 <i>Hibiscus esculentus</i>	okra	okira	okira	fruit	no	yes	C
14 <i>Hibiscus manihot</i>	leafy green	bele	bele	leaves	no	no	C
15 <i>Ipomoea aquatica</i>	kangkong, swamp cabbage	kangkong	kangkong	leaves, stem	no	yes	C, W
16 <i>Lagenaria siceraria</i>	bottle gourd, squash	bottle gourd	ungau	fruit	no	yes	C
17 <i>Lycopersicon esculentum</i>	tomato	domado	domado	fruit	no	yes	C

*Continued*

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

Scientific name	English/common name	Pohnpei name	Pinglap name	Part(s) used	Seasonality	Marketed	Source
18 <i>Momordica charantia</i>	bitter gourd	bitter gourd	-	fruit	no	yes	C
19 <i>Moringa oleifera</i>	drumstick, moringay	drumstick	-	leaves	no	no	C
20 <i>Ocimum basilicum</i>	basil	basil	kediring	leaves	no	no	C
21 <i>Psophocarpus tetragonolobus</i>	winged bean	winged bean	-	leaves, fruit	no	no	C
22 <i>Raphanus sativus</i>	Oriental radish	daikon	daikon	root, leaves	no	yes	C
23 <i>Sauropus androgynus</i>	sweetleaf bush	katuk	katuk	leaves	no	no	C
24 <i>Solanum melongena</i>	eggplant	nasupi	eggplant	fruit	no	yes	C
25 <i>Vigna sesquipedalis</i>	beans	pihns	pihns	legumes	no	yes	C
<b>Other plants: drinks/spices</b>							
1 <i>Cinnamomus carolinense</i>	native cinnamon	madeu	madeu	bark	no	yes	C, W
2 <i>Curcuma longa</i>	turmeric	kisinoang	oang	root, leaves	no	no	C, W
3 <i>Cymbopogon citratus</i>	lemon grass	lemon grass	saineroil	leaves	no	no	C
4 <i>Hibiscus rosa-sinensis</i>	hibiscus	keleu en wai	keleu in wai	ornamental flowers	no	no	C
5 <i>Ocimum basilicum</i>	basil	kadiring, basil	kediring	leaves	no	no	C
6 <i>Piper methysticum</i> (2 var.)	kava	sakau	sekau	root	no	yes	C
7 <i>Piper nigrum</i>	pepper corns	pepper en pohnpei	pepper in pohnpei		no	yes	C
8 <i>Zingiber officinale</i>	ginger	sinter	sinter	root	no	no	C
9 <i>Mansoa alliacea</i>	garlic vine	garlic vine	garlic vine	leaves	no	no	C
<b>Fish</b>							
1 <i>Abudefduf sordidus</i>	black-spot sergeant	peikopw	peikopw	-	no	yes	W
2 <i>Acanthocybium solandri</i>	wahoo	ahl	ahl	-	no	yes	W
3 <i>Acanthurus gahhm</i>	surgeonfish	tamwarok	koahlau	-	no	yes	W
4 <i>Acanthurus lineatus</i>	bluebanded surgeonfish	wakapw	pilehn	-	no	yes	W
5 <i>Acanthurus triostegus</i>	convict tang	letepwek	koalau	-	no	yes	W
6 <i>Acanthurus xanopterus</i>	yellowfin surgeonfish	pakas	pekas	-	no	yes	W
7 <i>Acanthurus guttatus</i>	white-spotted surgeonfish	parapar en lik	parapar	-	no	yes	W
8 <i>Aphareus rutilans</i>	silvermouth, lehi	lol imwin pwadaik toantol	lol	-	no	yes	W
9 <i>Bolbometopon muricatus</i> (2 var.)	humphead parrotfish	kemeik, tamwais	kemeik	-	no	yes	W
10 <i>Caranx ignobilis</i>	giant trevally	oarong pil	arong	-	no	yes	W
11 <i>Caranx melampygus</i>	bluefin trevally	oarongen	arong	-	no	yes	W
12 <i>Caranx sexfasciatus</i> (2 var.)	bigeye trevally, jack fish	oarong maswelek, oarongenpwong	masepwelepwek, arong	-	no	yes	W
13 <i>Carassius auratus</i>	small fresh water fish	palaiou	palaiou	-	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 <i>Carcharhinus amblyrhynchos</i>	gray reef shark	pakoahn nan madau	pakoa	-	no	no	W
15 <i>Carcharhinus melanopterus</i>	blacktip reef shark	pelenges	pelenges	-	no	no	W
16 <i>Cephalopholis argus</i> (2 var.)	bass-grouper, peacock grouper	mwoalusulus, mwoalus	kali	-	no	yes	W
17 <i>Cephalopholis miniata</i>	coral grouper	mwoalusulus weitahta	soakohar	-	no	yes	W
18 <i>Cetoscarus bicolor</i>	bicolor parrotfish	weloir	kidi	-	no	yes	W
19 <i>Chaetodon auriga</i>	butterfly fish	lierpwater	lidenpwares	-	no	yes	W
20 <i>Chanos chanos</i>	milkfish	kih	lahd	-	no	yes	W
21 <i>Chellinus trilobatus</i>	triptail wrasse	poros	poros en merer	-	no	yes	W
22 <i>Chellinus undulatus</i> (2 var.)	humphead wrasse	merer, pahini poken	merer	-	no	yes	W
23 <i>Coryphaena hippurus</i>	mahimahi, dolphin fish	kohko	soapoahr	-	no	yes	W
24 <i>Ctenochaetus striatus</i>	striped bristletooth	doarop	doarop	-	no	yes	W
25 <i>Echidna polyzona</i>	salt water eel	lapwed	rap	-	no	yes	W
26 <i>Elagatis bipinnulatus</i>	rainbow runner	mwunseik	mwahseik	-	no	yes	W
27 <i>Epibulus insidiator</i>	slingsaw wrasse	malekelek	nein lipehden	-	no	yes	W
28 <i>Epinephelus coeruleopunctatus</i> (2 var.)	snowy grouper sammenip	mwanger en nanipil,	widir	-	no	yes	W
29 <i>Epinephelus fasciatus</i>	black-tipped grouper	senser	widir	-	no	yes	W
30 <i>Epinephelus macrospilos</i>	black-spotted grouper	mwanger pwet	widir	-	no	yes	W
31 <i>Epinephelus malabaricus</i>	giant grouper	mwanger ripwiripw	deiahwe	-	no	yes	W
32 <i>Epinephelus merra</i>	honeycomb grouper	widir en pohm mad	kahlenwo	-	no	yes	W
33 <i>Epinephelus morrhua</i>	narrow curve-banded grouper	kilo en pohmwol	lol	-	no	yes	W
34 <i>Epinephelus polyphkadion</i>	marbled grouper	mwanger en nanmamw	widir	-	no	yes	W
35 <i>Epinephelus septemfasciatus</i>	seven-banded grouper	maud, deiahwe	widir lap	-	no	yes	W
36 <i>Etelis carbunculus</i>	ehu	lol, loi	lol	-	no	yes	W
37 <i>Etelis coruscans</i>	onaga	lol maswalek	lol	-	no	yes	W
38 <i>Euthynnus affinis</i>	kawakawa	sidaudau	sidaudau	-	no	yes	W
39 <i>Gerres abbreviatus</i>	silverfish	kasapal	kesepal	-	no	yes	W
40 <i>Gerres oyena</i>	oyena mojarra	mwomwin leng	kesepal	-	no	yes	W
41 <i>Grammatocynus bilineatus</i>	double-lined mackerel	kapou	pweir	-	no	yes	W
42 <i>Gymnosarda unicolor</i> (2 var.)	dogtuna, dogtooth tuna	manguro, sileu	ail	-	no	yes	W
43 <i>Gymnothorax javanicus</i>	moray eel	lapwed eh n nam	siloangoalong	-	no	yes	W
44 <i>Hemiramphus guoyi</i>	half beak	pwuwas	-	-	no	yes	W
45 <i>Hipposcarus longiceps</i>	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	Pinglap name	Part(s) used	Seasonality	Marketed	Source
46 <i>Hirundichthys oxycephalus</i>	flying fish	mwahmw pihir	menger	–	no	yes	W
47 <i>Istiophorus platypterus</i>	sailfish	dekilahr sike tehlap powe	dekilahr serek	–	no	yes	W
48 <i>Katsuwonus pelamis</i>	skipjack tuna	kasuwo	lesapwil	–	no	yes	W
49 <i>Kyphosus cinerascens</i>	highfin rudderfish	keriker, kertakai, kerilel	limwilimw, leseneke	–	no	yes	W
50 <i>Leiognathus equulus</i>	common slipmouth	sengiseng	sengiseng	–	no	yes	W
51 <i>Lethrinus harak</i>	blackspot emperor	samwei pwet	samwei	–	no	yes	W
52 <i>Lethrinus kallopterus</i>	orangefin emperor	ikiepw	ewih rar	–	no	yes	W
53 <i>Lethrinus lentjan</i>	snapper	medi	medi	–	no	yes	W
54 <i>Lethrinus microdon</i>	white snapper	kadek	samwei	–	no	yes	W
55 <i>Lethrinus ramak</i>	yellowstripe emperor	samwein pohn rar	samwei rar	–	no	yes	W
56 <i>Lethrinus xanthochilus</i>	yellowlip emperor	moadi	medi	–	no	yes	W
57 <i>Liza vaigiensis</i>	yellowtail mullet	ikimweni	kepase	–	no	yes	W
58 <i>Lutjanus argentimaculatus</i>	river snapper	asimel	asimel	–	no	yes	W
59 <i>Lutjanus bohar</i>	red snapper	kihr, kihr en eiwel	kehu	–	no	yes	W
60 <i>Lutjanus fulvus</i>	flametail snapper	ikem	ikem	–	no	yes	W
61 <i>Lutjanus gibbus</i>	humpback snapper	pwahlahl	pwahlahl	–	no	yes	W
62 <i>Lutjanus kasmira</i>	snapper	tehnseu	samwei	–	no	yes	W
63 <i>Lutjanus monostigmus</i>	onespot snapper	pwehu	inahme	–	no	yes	W
64 <i>Lutjanus rivulatus</i> (2 var.)	scribbled snapper	ikem en asimel, kihrsal	asimel, kihr	–	no	yes	W
65 <i>Lutjanus semicinctus</i>	half-barred snapper	inahme	pwehu	–	no	yes	W
66 <i>Makaira nigricans</i>	Pacific blue marlin	dekilahr	dekilahr	–	no	yes	W
67 <i>Monotaxis grandoculus</i>	bigeye emperor	masokod	masamas	–	no	yes	W
68 <i>Mulloidides flavolineatus</i>	yellowstripe goatfish	dingmoa	epil	–	no	yes	W
69 <i>Myripristis bernardi</i>	bigscale soldierfish	mwuhn weitahta	medeu	–	no	yes	W
70 <i>Naso lituratus</i>	orangespine unicornfish	pwulangkin	pwilaksoal	–	no	yes	W
71 <i>Naso unicornis</i> (2 var.)	bluespine unicornfish	pwilak, pwulak	pwilakemei, pwulak	–	no	yes	W
72 <i>Naso vlamingii</i>	bignose unicornfish	kitik	monomon	–	no	yes	W
73 <i>Ophiocara porocephala</i>	mangrove swamp fish	sopwou	sopwou	–	no	yes	W
74 <i>Ostracion cubicus</i>	cube trunkfish	kohpwa	kohpwa	–	no	yes	W
75 <i>Paraglyphidodon melas</i>	damsel fish	toik	soik	–	no	yes	W
76 <i>Parupeneus barberinus</i>	dash-and-dot goatfish	mwomw pohn mwei toal ni pwadaike	mwedel	–	no	yes	W
77 <i>Parupeneus cyclostomus</i> (2 var.)	goatfish	mwomwalis, mwompwou	mwedel, mwompwou	–	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 <i>Parupeneus indicus</i>	goatfish	iomo	mwedel	-	no	yes	W
79 <i>Plectorhinchus chaetodonoides</i>	harlequin sweetlips	koahng, kehng	koil, dehn	-	no	yes	W
80 <i>Plectorhinchus goldmanni</i>	goldman's sweetlips	koahng, kehng	koil, dehn	-	no	yes	W
81 <i>Plectorhinchus obscurus</i>	giant sweetlips	koahng, kehng	kakarpil	-	no	yes	W
82 <i>Plectorhinchus orientalis</i>	oriental sweetlips	koahng, kehng	koil, dehn	-	no	yes	W
83 <i>Plectorhinchus picus</i>	spotted sweetlips	koahng mweimwei	dehn	-	no	yes	W
84 <i>Plectorhynchus celebicus</i>	sweetlips porgy	kakerepil, koail	koil	-	no	yes	W
85 <i>Plectropomus areolatus</i> (2 var.)	giant coral trout	ewen sawi, oawen sawi	sawi	-	no	yes	W
86 <i>Plectropomus laevis</i>	saddleback grouper	oawen sawi	sawi	-	no	yes	W
87 <i>Pristipomoides argyrogrammicus</i>	blueline gindai	mesarar	kihr	-	no	yes	W
88 <i>Rhinecanthus aculeatus</i> (2 var.)	triggerfish	lioli, pwuhpw	liolu, pwupw	-	no	yes	W
89 <i>Ruvettus pretiosus</i>	castor-oil fish	deikenipng	deikenepng	-	no	yes	W
90 <i>Sargocentron spiniferum</i>	long-jawed squirrelfish	sara sike weitahta	sera	-	no	yes	W
91 <i>Sargocentron tiere</i>	blue-lined squirrelfish	sara weitahta	sehwoh wahu	-	no	yes	W
92 <i>Scarus frontalis</i>	tan-faced parrotfish	mahu toal	mahulik	-	no	yes	W
93 <i>Scarus ghobban</i>	blue-barred parrotfish	lidoi mahu	senidinid	-	no	yes	W
94 <i>Scarus gibbus</i>	gibbus parrotfish	mahulik	mahu soal	-	no	yes	W
95 <i>Scarus rubroviolaceus</i> (2 var.)	parrotfish type, redlip parrotfish	lidoi, mahu pwur	ioel, mahu	-	no	yes	W
96 <i>Scomberoides lysan</i>	leatherback	sarduwa	sarduwa	-	no	yes	W
97 <i>Selar crumenophthalmus</i>	bigeye scad	pedihdi	pedihdi	-	no	yes	W
98 <i>Seriola dumerili</i>	greater amberjack	arong seik	mwahseik	-	no	yes	W
99 <i>Siganus argenteus</i>	forktail rabbitfish	umwule	mwomwone	-	no	yes	W
100 <i>Siganus doliatus</i>	rabbitfish	pwerinmwomw	mehlau	-	no	yes	W
101 <i>Siganus puellus</i>	rabbitfish	mahr	mahr	-	no	yes	W
102 <i>Siganus punctatus</i>	gold-spotted rabbitfish	palapal	palapal	-	no	yes	W
103 <i>Siganus</i> spp.	forktail rabbitfish	ilek	ilek	-	no	yes	W
104 <i>Siganus vulpinus</i>	rabbitfish	kompani	palapl ongong	-	no	yes	W
105 <i>Sphyaena barracuda</i>	great barracuda	suhre, sarau	suhre	-	no	yes	W
106 <i>Sphyaena genie</i>	blackfin barracuda	sarau	sarau	-	no	yes	W
107 <i>Thunnus albacares</i>	yellowfin tuna	karangahp	pweipwei	-	no	yes	W
108 <i>Triaenodon obesus</i>	whitetail reef shark	pakoa	pakoa	-	no	yes	W
109 <i>Valamugil sehelii</i>	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 <i>Variola albimarginata</i>	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 -	-	pidakilik	-	-	no	yes	W
<b>Other seafood</b>							
1 <i>Anadara antiquata</i>	shellfish, antique ark	lipwei	lipwei	-	no	yes	W
2 <i>Brachyrcerus latro</i>	coconut crab	emp	epup	-	no	yes	W
3 <i>Chelonia mydas</i>	green turtle	kalahp (wehi)	kalahp (wei)	meat, eggs	no	yes	W
4 <i>Eretmochelys imbricata</i>	hawksbill turtle	sapwake (wehi)	sapwake (wei)	meat, eggs	no	yes	W
5 <i>Gafrarium tumidum</i>	shellfish	kemei	-	-	no	yes	W
6 <i>Geocarcordea natalis</i>	red crab, 2-3 types	pworu	rokumw	-	no	yes	W
7 <i>Hippopus hippopus</i>	shellfish, giant clam	pahsu	pahsu	-	no	yes	W
8 <i>Lambis lambis</i>	shellfish	lahg	leiang	-	no	yes	W
9 <i>Matapanaeus moyebi</i>	shrimp, female	likedepw	likedepw	-	no	yes	W
10 <i>Octopus aculaetus</i>	octopus	kihs	kihs	-	no	yes	W
11 <i>Palaemon serrifer</i>	freshwater shrimp	lur	lur	-	no	yes	W
12 <i>Panillurus</i> spp.	lobster	uhrena	wirehna	-	no	yes	W
13 <i>Scylla serrata</i>	mangrove crab	elimoang	elimoang	-	no	yes	W
14 <i>Sepiodenthis lessoni</i>	squid	nuhd	nuhd	-	no	yes	W
15 <i>Sticropus japonicus</i>	sea cucumber variety	loangon	loangon	-	no	yes	W
16 <i>Tridacna maxima</i>	shellfish, clam	sile	sile	-	no	yes	W
17 <i>Trochus niloticus</i>	shellfish, trochus	sumwumw	deakasingai	-	no	yes	W
18 <i>Turbo argyrostomus</i>	shellfish	komis	komis	-	no	yes	W
19 <i>Turbo petholatus</i>	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
<b>Meat</b>							
1	<i>Bos taurus</i>	cattle	kou	kou	no	yes	D
2	<i>Bubalus bubalis</i>	carabao, water buffalo	karapahu	kerabahu	no	yes	D
3	<i>Canis familiaris</i>	dog	kidi	kidi	no	yes	D
4	<i>Capra hircus</i>	goat	kout	kuhs	no	yes	D
5	<i>Cervu elaphus</i>	deer	tie	sie	no	yes	W
6	<i>Sus scrofa</i>	pig	pwihk	koaso (pwihk)	no	yes	D
<b>Birds</b>							
1	<i>Anous stolidus</i>	brown noddy tern (big)	paret	dopwohk	no	no	W
2	<i>Anous stolidus</i>	brown noddy tern (small)	paret (atet)	rehn	no	no	W
3	<i>Aplonis opaca</i>	Micronesian starling	siohk	sioahk	no	yes	W
4	<i>Aythya fuligula</i>	duck	tehk	deki	no	no	D
5	<i>Ducula oceanica</i>	pigeon	mwuroi	mwuroi	no	yes	W
6	<i>Egretta sacra</i>	Pacific reef heron	kewelik	kulap	no	no	D, W
7	<i>Fregata minor</i>	great frigate bird	kasap	kesap	no	no	D, W
8	<i>Gallinula kubaryi</i>	Caroline Islands ground dove	peluhs	peluhs	no	no	W
9	<i>Gallus domesticus</i>	chicken	malek	malek	no	yes	W
10	<i>Gallus domesticus</i>	jungle fowl	malek en wel	malek in wel	no	yes	D, W
11	<i>Gygis alba</i>	fairy tern	kahke	keake	no	no	W
12	<i>Myzomela rubrata</i>	Micronesian honeyeater	pwiliet	pwilied	no	no	W
13	<i>Phaethon lepturus</i>	white-tailed tropic bird	sikh	sik	no	no	W
14	<i>Ptilinopus porphyraceus</i>	crimson crowned fruit dove	kiniwed	kiniwed	no	no	W
15	<i>Sula sula</i>	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	β-carotene		β-carotene equivalents <sup>2</sup>		RE <sup>3</sup>	RAE <sup>4</sup>	Lutein	Zeaxanthin	Total carotenoids	Riboflavin	Zinc	Iron
		μg	μg	μg	μg								
<b>Banana</b>													
Utin Iap, 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	–	–
<b>Giant Swamp Taro<sup>1</sup></b>													
Mwahng Tekatek	Yellow	4 486	*	*	4 486	748	374	1 548	*	–	–	63.0 <sup>5</sup>	0.2
Weitahta, cooked													
Mwahng en Wel, cooked	Yellow	2 930	2040	*	3 950	658	329	130	<10	2940	–	36.0 <sup>5</sup>	3.2
<b>Breadfruit<sup>1</sup></b>													
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	–	–	–
<b>Pandanus</b>													
Unidentified variety, ripe, raw	Orange	270	30	–	285	48	24	350	370	5 340	–	–	–
<b>Rice</b>													
White, cooked	White	0	0	–	0	0	0	0	0	0	0.01	0.6	0.3
<b>Flour, wheat</b>													
White, plain	White	0	0	–	0	0	0	0	0	0	0.03	0.6	1.3
<b>Sugar</b>													
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 β-carotene equivalents (content of β-carotene plus half the content of α-carotene and β-cryptoxanthin).

3 Retinol Equivalents (conversion factor 6:1 from β-carotene equivalents to RE).

4 Retinol Activity Equivalents (conversion factor 12:1 from β-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, Khep Pwetpwet or Kororo
7	Yam cultivar, Khep Toantoal or Khep 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  $\beta$ -carotene<sup>12</sup> in the world (Table 6.4). Karat banana, unique for its

<sup>12</sup>  $\beta$ -carotene is the most important of the provitamin A carotenoids contributing to vitamin A status.

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<sup>13</sup> 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

<sup>13</sup> 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**

<i>Order of like/consumption/ease of growing</i>	<i>Order of priority for promotion</i>	<i>Order of like/consumption/ease of growing</i>	<i>Order of priority for promotion</i>
<b>Banana (uht, wis)</b>		<b>Nut</b>	
1 Taiwang	1 Utin lap, Utimwas	1 Chestnut (mworopw)	1 Chestnut (mworopw)
2 Sendohki (Kudud)	2 Karat	2 Indian almond (dipwopw)	2 Indian almond (dipwopw)
3 Karat	3 Akadah, Akadah Weitah	3 Red bead (kaikes)	3 Red bead (kaikes)
4 Akadah, Akadah Weitah	4 Karat en lap, Taiwang	<b>Vegetable</b>	
5 Utin lap, Utimwas	5 Sendohki (Kudud)	1 Cabbage	1 Kang kong (se kang kong)
6 Mangat, Ihpali	6 Mangat, Ihpali	2 Chaya leaves (se chaya)	2 Chaya leaves (se chaya), katuk (se katuk)
7 Karat en lap		3 Pele leaves (se pele)	3 Pele leaves (se pele)
<b>Giant swamp taro (mwahng, mweiang)</b>		4 Spinach (se spinis)	4 Spinach (se spinis)
1 Mweiang Pwiliet	1 Smihden	5 Chilli pepper leaves (se sele)	5 Cabbage
2 Sounpwong Wenu	2 Mweiang Seria	6 Kang kong (se kang kong)	6 Chilli pepper leaves (se sele)
3 Mweiang Saleng Walek	3 Nein Sehm	7. Katuk (se katuk)	7 Pumpkin tips (se pwengkin)
4 Mweiang Tekatek	4 Nein Silingden	8 Pumpkin tips (se pwengkin)	8 Sweet potato leaves (se pedehde)
5 Smihden	5 Nein Aikem	9 Sweet potato leaves (se pedehde)	9 Taro leaves (se sawa)
6 Mweiang Seria	6 Nein Pisep	10 Taro leaves (se sawa)	10 Tapioca leaves (se dapiohka)
7 Nein Sehm	7 Mweiang Pwiliet	11 Tapioca leaves (se dapiohka)	
8 Nein Silingden	8 Mweiang Saleng Walek	<b>Fruit</b>	
9 Nein Aikem	9 Mweiang Tekatek	1 Papaya (memiap, keiniap)	1 Papaya (memiap, keiniap)
10 Nein Pisep	10 Sounpwong Wenu	2 Pineapple (pweinaper)	2 Pineapple (pweinaper)
<b>Taro, colocasia (sawa)</b>		3 Citrus (karer, karertik)	3 Citrus (karer, karertik)
1 Sawa Toal	1 Pasdohra	4 Soursop (sei)	4 Soursop (sei)
2 Sawa Weisasa	2 Sawa Mweiang	5 Mango (kehngid)	5 Guava (kuahpa)
3 Sawa Mweiang	3 Sawa Toal	6 Mountain apple (apel en pohnpei)	6 Mango (kehngid)
4 Sawa Kororo (Pakoh)	4 Sawa Weisasa	7 Guava (kuahpa)	7 Mountain apple (apel en pohnpei)
5 Pasdohra	5 Saipan	8 Rose apple (apel en wai)	8 Rose apple (apel en Wai)
6 Sawa Saipan	6 Sawahn Hawaii	9 Passion fruit (pwompwompw)	9 Passion fruit (pwompwompw)
7 Sawahn Hawaii	7 Sawa Kororo (Pakoh)		

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*<sup>14</sup> 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<sup>15</sup>

<sup>14</sup> 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.

<sup>15</sup> 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	B-carotene equivalents-µg	Vitamin C mg
<b>Female adult intake</b>							
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%
<b>Child intake</b>							
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

	<i>n</i>	Protein		Total Vitamin A			Vitamin C	
		Mean intake <i>g</i>	Meeting RDI <sup>1</sup> <i>n</i> (%)	Mean intake <i>μgRE</i> <sup>3</sup>	Meeting RSI <sup>2</sup> <i>n</i> (%)	Mean intake <i>mg</i>	Meeting RNI <sup>4</sup> <i>n</i> (%)	
<b>Female adults</b>								
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)	
<b>Children</b>								
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)	

<sup>1</sup> Recommended Dietary Intake; <sup>2</sup> Recommended Safe Intake; <sup>3</sup> Retinol Equivalents; <sup>4</sup> 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  $\mu$ g 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), 16–19 g (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.<sup>16</sup> 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).<sup>17</sup> White-fleshed banana cultivars were more commonly consumed (36 percent) than the yellow-fleshed banana

<sup>16</sup> Fat intake should supply a minimum of 15 percent of total energy, but should not exceed 30–35 percent (WHO/FAO, 2002).

<sup>17</sup> 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,<sup>18</sup> 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.

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<sup>19</sup> and were encouraged to breastfeed, give colostrum, “exclusively breastfeed”<sup>20</sup> 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*)<sup>21</sup> at six months of

<sup>19</sup> Health officials report that around 90 percent of deliveries in Pohnpei are carried out in Pohnpei State Hospital.

<sup>20</sup> Exclusive breastfeeding refers to giving breastmilk only, not even water, for the first six months.

<sup>21</sup> The term in the Pingelapese language for the first solid food given to an infant is *kepeloal*.

<sup>18</sup> Turkey tail is literally the tail of the turkey (see footnote 7).

**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)**

	n	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	(%)
<b>Male</b>												
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)
<b>Females</b>												
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 *kepeloa* at five months and one at seven months. The foods reported as *kepeloa* for these infants were grated, boiled green banana (n = 3), ripe *karat*<sup>22</sup> (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)<sup>23</sup> data for Mand. Weight and height measurements were taken for 167 adults of the randomly selected households.<sup>24</sup> There were two bed-ridden adults for which height and weight could not be measured.

A high prevalence of overweight<sup>25</sup> 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.

<sup>22</sup> *Karat* (a banana cultivar) is a traditional infant food of Pohnpei. See section on scientific identification.

<sup>23</sup> BMI = weight in kg divided by height in meters squared.

<sup>24</sup> Measurements were also taken for 30 additional adults not in the randomly selected households, but these data are not included in the analyses.

<sup>25</sup> 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
<b>1–5 years old</b> (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
<b>6–10 years old</b> (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
<b>11–14 years old</b> (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<sup>26</sup> 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

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

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).<sup>27</sup> 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<sup>28</sup> (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 ( $\geq 126$  mg/dl),<sup>29</sup>

<sup>27</sup> 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  $\geq 160/95$  (systolic/diastolic).

<sup>28</sup> 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.

<sup>29</sup> Levels of FBS were classified as: normal <126 mg/dl, and abnormal  $\geq 126$  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)**

	n	Mean FBS		Minimum FBS mg/dl	Maximum FBS mg/dl	Normal range		Abnormal range <sup>1</sup>		New cases (total=37)
		mg/dl	(sd)			n	(%)	n	(%)	
<b>Males</b>										
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
<b>Females</b>										
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

<sup>1</sup> Abnormal FBS defined as  $\geq 126$  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.<sup>30</sup> 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  $\mu\text{g}$  /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

<sup>30</sup> 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**

<i>Reasons first given by Working Group</i>	<i>Further comments on these reasons after analysis by Working Group</i>
1 Negligence ( <i>soukautih</i> ), 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 ( <i>Piripirin mweiet</i> ).	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 ●

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