Chapter 11

The Maasai food system and food and nutrition security

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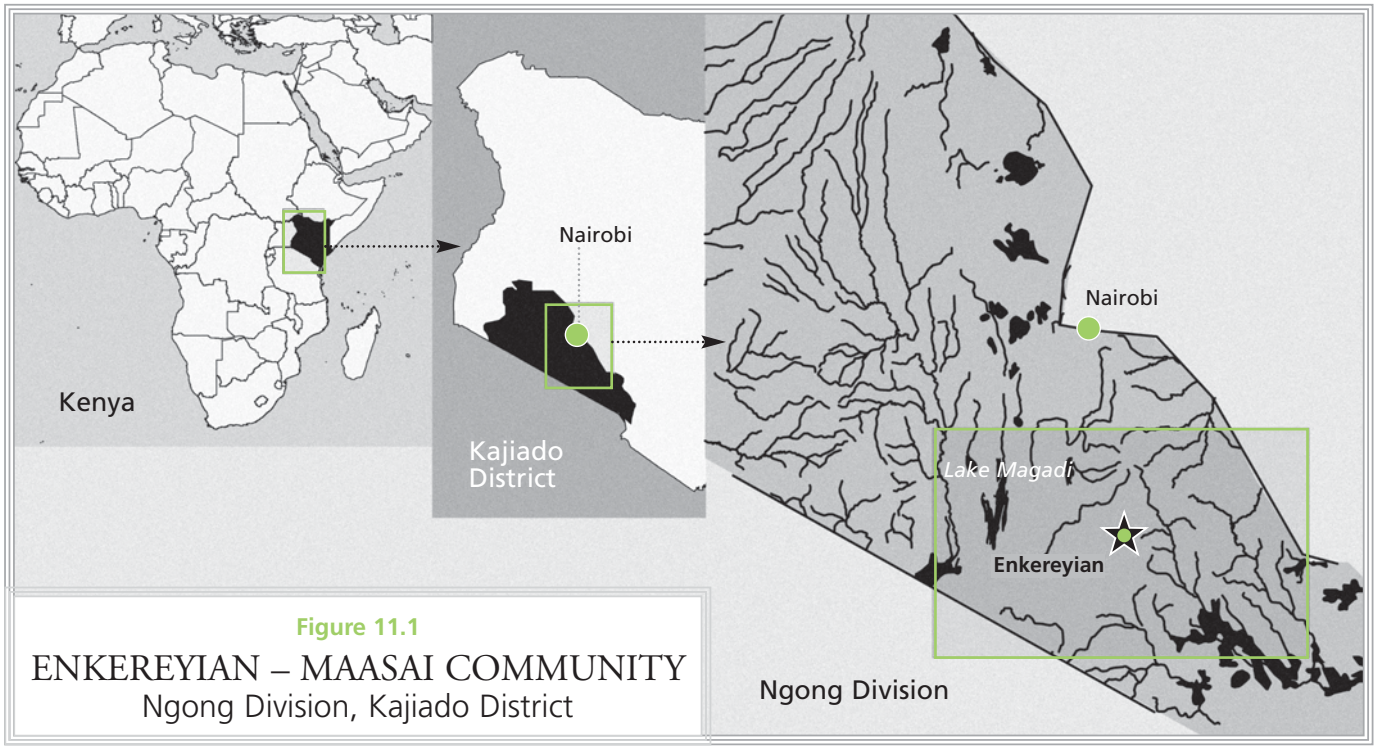

Figure 11.1

ENKEREYIAN – MAASAI COMMUNITY
Ngong Division, Kajiado District

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

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"Our culture and traditional knowledge of our food systems are the pillars of our heritage. Please join us to promote and protect them Thank you very much."

Namuter Ole Leipa

Abstract

Two Kenyan Non-Governmental Organizations, Mainyoito Pastoralist Integrated Development Organization and Rural Outreach Program, undertook a study of traditional food use within the context of a situational analysis of the food security and nutrition problems faced by the Maasai pastoral community of Enkereyian.

Knowledge of traditional foods and information on the cultural, social and temporal context of their consumption was obtained through key informant interviews and gender-segregated focus groups. Species identification and nutrient composition of collected samples of wild fruits and herbal additives to milk and meat-based soups was undertaken.

A cross-sectional dietary survey of 120 households interviewed mothers on issues of food source and decision-making and included a 24-hour recall and three-day food frequency. While milk, blood and meat were found to be the key elements of the traditional diet, these animal-source foods contributed only 7 percent of the current energy intake, with maize and beans the primary staples in a diet that was, overall, energy deficient. Milk and meat were nonetheless the major source of vitamin A (80 percent of intake) and an important contributor of iron (11 percent).

Individual herbs provided appreciable amounts of some micronutrients, while wild fruits were good sources of vitamin C, and the most frequently consumed fruit *iyier* is rich in provitamin A (6.1 mg/100g ß-carotene). Previously collected data indicated prevalence of wasting and stunting above Kenyan averages that were exacerbated by prolonged drought conditions and lifestyle changes.

Within a strategy that increases the availability of animal-source foods through attention to improved water management, re-stocking and pastoralism-related policies, traditional foods can enable the community to meet nutritional, food security and livelihood needs in a more optimal manner.

Introduction

Mainyoito Pastoralist Integrated Development Organization (MPIDO) is an organization whose individual and group members represent Maasai communities in Kenya. MPIDO promotes, facilitates and works to create an enabling environment for serving human rights, including natural resources for sustainable livelihood among pastoralist Maasai society. Accordingly, this case study had an overall goal of improving the health and nutritional status of the Maasai community, while preserving indigenous knowledge (and foods) and conserving the environment. Consequently, the Maasai right to food and sound health can be enabled and their means to livelihood improved.

MPIDO is overseen by an elected Board of Directors. Operations are carried out by the Secretariat in conjunction with the General Committee made up of MPIDO staff and local community members. This project falls within the mandate of the thematic sub-committee on livelihoods. The project was brought to local Elders by the subcommittee who through a community-level consultative process entered into an agreement with the Elders. Two of the Elders, recruited as community-based consultants, acted as key informants. Moreover, through explaining the project to people in the village they played a key

role in mobilizing the community for focus group discussions and gathering herbs and wild fruits. Two field assistants were trained on conducting key informant interviews and focus group discussions, dietary survey administration, and on how to collect plant samples for herbarium identification and laboratory analysis.

Rural Outreach Program (ROP) is also a Kenyan non-governmental organization working to improve the livelihood of rural dwellers. It has a strong focus on promotion of traditional foods and attendant indigenous knowledge, a priority that is foremost in the project. ROP has a strong research unit that provided technical expertise for this study. ROP's capacity and experience in community research and in the science of food and nutrition were essential components of the project.

Research site

Maa-speaking pastoralists in Kenya and the United Republic of Tanzania number approximately one million, some 60 percent of whom live in Kenya (CBS, 2001). Traditionally the Maasai are semi-nomadic pastoralists who migrate within semi-arid lowlands and more humid uplands to obtain water and pasture. The Enkereyian community is located in Ngong Division, Kajiado District, Kenya. The community is approximately 70 km directly south of the city of Nairobi and extends another 50 km towards Lake Magadi (Figure 11.1). Approximately 30 000 inhabitants are distributed in 20 village units and speak exclusively Maa within the community. Approximately 10 percent of the community also speaks Kiswahili, with less than 2 percent also speaking English.

The community occupies lands on the floor of the Great Rift Valley at an elevation of 1 200 to 1 500 metres. This semi-arid area experiences seasonal rainfall, with wet seasons typically in April to May and November to December. Within this environment, water is a limited resource with acute water shortages for livestock and household use occurring through at least several months of the year.

A large majority of the population are reported to obtain their livelihood through husbandry of cattle, goat and sheep. Family incomes were supplemented by the sale of milk, livestock and wild products, primarily charcoal and firewood. Wild plant food, primarily fruit and roots and honey as well as medicinal plants added to the diet, provided an important but understudied contribution to diet and health. Previous studies have documented Maasai diet-related ethnobotany and intake patterns (Johns *et al.*, 2000; Maundu, Ngungi and Kabuye, 1999; Nestel, 1989). Government surveys have identified nutrition and health problems in Kajiado District and data from the food systems documentation phase of the Centre for Indigenous Peoples' Nutrition and Environment Food Systems for Health Program provided important background as reported here.

Reduced carrying capacity of the environment for livestock, to a considerable degree related to drought and integration into the market, coincided in leading to increased sale of livestock and reduced herd sizes. The proximity to Nairobi and the extension of peri-urban areas and related markets into Ngong sub-district made purchased food a ready alternative to the consumption of the traditional diet. Dependence on purchased foods without income security, however, resulted in a lack of dietary self-sufficiency. Droughts over the past couple of decades underline a pattern of poverty, food crises and dependence on food relief. Serious food shortages in 1984, 1990–1992, 1996–1997, 2000–2001 and their emergence again in 2004–2005 suggest that the cycle is getting shorter without allowing sufficient time for the community to recover. With the extent of drought experienced in the Maasai territory, undernutrition has been documented with wasting and stunting of more than 10 and 50 percent of Maasai children respectively. Further details on overall nutrition status from a report of a World Vision survey are presented in Table 11.1.

Community water requirements are high and people experienced considerable hardship in travelling long distances (more than 20 km) to look for water for both human and livestock consumption. Women were only able to fetch domestic water using donkeys each carrying 30 litres of water. Five litres of this went to the school and people had only one day to rest before going back to fetch water. This cycle consumed women's time to the degree they were not able to engage in any other

Table 11.1 Nutritional status of children by Z-score and percentage with oedema

Indicators	***Malnutrition** % distribution by gender*			
	Male	***Female***	***Both sexes***	***95%CI****
Wasting (weight-for-height Z-score < -2)	**15.5**	**10.2**	**13.0**	**9.6–17.6**
Moderate (-3 to –2 Z-score)	12.0	8.3	10.3	8.0–13.1
Severe (<-3 Z–score)	3.5	1.9	2.7	1.6–4.5
Oedema	**3.0**	**2.3**	**2.7**	
Underweight (weight for age Z-score < -2)	**33.4**	**25.9**	**30.0**	**25.1–35.7**
Moderate (-3 to -2 Z-score)	26.4	18.4	22.7	19.6–26.1
Severe (<-3 Z-score)	7.0	7.5	7.3	5.5–9.6
Stunting (height for age z-score < -2)	**58.1**	**46.7**	**52.8**	**46.1–60.3**
Moderate (-3 to -2 Z-score)	38.4	33.6	36.2	32.3–40.3
Severe (<-3 Z-score)	19.7	13.1	16.6	13.8–20.0

Source: World Vision Kenya, 2004.
* The 95% confidence interval is for both sexes.

meaningful and productive social and economic activities. During rainy season, both livestock and humans used water from the same earth dams. Water was therefore not clean and many people contracted water-borne diseases, including typhoid. Water contamination also adversely affected human health indirectly through livestock losses and subsequent reduction in food availability.

In addition to their importance for livelihoods, livestock are central to Maasai culture, society and identity. Cattle play a key role in important ceremonies, such as circumcision where blood is drawn. In other ceremonies, skins have a sacred function and cattle are the means of appreciation given to spiritual leaders at the time of the ceremony. In addition, a dowry in the form of cows forms an essential role in cementing links between families; the marriage of a man and woman contributes to traditional economic security and is the foundation into which children enter society. Cattle are an essential part of exchange typical of many other social relationships. Cattle husbandry defines the organization of society; a male Elder heads each household and livestock unit, with a clear differentiation of gender and age-defined roles around milking, grazing and other aspects of pastoralism. Further, traditional forms of healing draw on animal-source diets including milk, soup and blood.

In spite of the limitations of pastoralism for meeting the needs of the Maasai population in the contemporary context, this system continues to make essential contributions to the well-being of both national and local populations. For the latter, it provides a subsistence basis for the majority of the population, and for the former, a large portion of the meat consumed. Therefore, the situation of the Enkereyian community must be considered within a national context. Solutions for its chronic food insecurity and malnutrition depend on improved self-sufficiency and resource management, as well as rational national policies that ensure that the pastoral contribution to meat, milk and charcoal for urban residents is recognized and compensated in a manner consistent with historical authority and events, and present realities. Recently, the Maasai developed a strategic plan and will utilize the research from this project to strengthen women's knowledge and abilities to provide animal source foods for their children.

Objectives

The study aimed to:

1. Identify traditional foods consumed by the Maasai community.
2. Compile selected nutrient composition of traditional foods.

3. Determine the dietary use in the cultural context of the Maasai community.
4. Provide background for a possible health and food-based intervention to improve the health status of the Maasai community.

Methods

Study design

Food habits of the Maasai community were studied in conjunction with the collection and nutrient analysis of plant-based foods commonly used. The study also drew on available literature on nutritional status of the area and nutrient composition of foods. A cross-sectional survey was conducted between August 2004 and January 2005, a period that would normally comprise a dry season followed by short rains. In fact, because of ongoing drought conditions the dry season was more extreme than seasonal averages, and was compounded by the failure of the short rains to arrive.

Data collection

Key informant interviews

Two selected community consultants provided the initial preliminary information on foods consumed and the cultural context under which they are consumed. Further in-depth interviews were conducted with elderly men and women separately. Information collected in key informants interviewed included:

- history of the Maasai people;
- common foods consumed by the Maasai people at different stages of life;
- cultural context of dietary practices;
- list of plant-based food consumed, their use and seasonality.

Focus group discussions

Separate focus group discussions were held for women and men. For the men, discussions focused on general foods and their cultural context. Foods consumed specifically by (adolescent) males, e.g. during circumcisions, were discussed. For the women, foods consumed by infants, young children, and women in general and by pregnant and lactating women in particular were the focus of discussion. In all the discussions, special consideration was given to locally available food additives or adjuncts (herbs) and wild fruits that were commonly consumed.

Food sample collection and identification

During the focus group discussions, an inventory of foods, including herbs and wild fruits consumed, was made. Besides the mainstream Maasai traditional foods (animal-source foods), a diversity of herbs and wild fruits were consumed. Of these, 15 herbs and 11 wild fruits were selected for analysis based on their seasonal availability. They were collected and submitted to:

1. The East African Herbarium where their botanical names and respective family group were identified. The leaves, flowers and edible portions of the plants were submitted.
2. The Department of Food Technology and Nutrition laboratories of the University of Nairobi for selected mineral and vitamin analysis. Only the edible portions were submitted for the analyses.

Micronutrient analysis of herbs and fruits

A total of 15 herbs and 11 fruits were selected for analysis for vitamin A, vitamin C, iron, zinc, calcium and selenium. Vitamin A and iron deficiencies are of public health importance in Kenya (Sehmi, 1993; Government of Kenya and UNICEF, 1999). At the global level, zinc deficiency is gaining interest as a potential public health problem. Vitamin C deficiency among young children has been evident in the study area (MPIDO, 2005). Selenium is increasingly being mentioned as an important micronutrient, particularly with the advent of HIV/AIDS. Calcium was considered for analysis as an extra micronutrient.

Herbs and fruits for laboratory analysis were collected over a six-month period, between July 2004 and January 2005. Each herb was collected from three different plants, not more than 500 metres away from each other. The three samples of the same herb were then analysed in duplicate. Because of the scarcity of fruits in the dry season, it was not possible to use the same sampling

method as used for the herbs. Fruits were collected from a single tree and analysed in triplicate.

For fruits and herbs consumed in raw forms, the edible portions were analysed directly. For herbs from which hot water extracts are added to soups or milk, known weights of usable portions were boiled in 100 ml water and their extracts in water were analysed for micronutrients. Computations were subsequently conducted to determine the amounts of nutrients in 100 g of edible portion. The following formula was used:

$$\text{Nutrient per 100g} = \frac{\text{Amount of nutrients in the extract}}{\text{Weight of usable portion}} \times 100$$

Vitamins A and C analyses were carried out using High Performance Liquid Chromatography, and iron, zinc, calcium, magnesium and selenium analyses were conducted by use of Atomic Absorption Spectrophotometry.

Dietary survey

Representatives of 120 households sampled randomly were interviewed during the months of October and December 2004. The mothers were interviewed on issues of food source and decision-making related to food choice, source, preparation and consumptions. A three-day food frequency, which included the source of food and intra-household food distribution (qualitatively), was also administered. Respondents were asked on how many days the pre-listed foods had been consumed in the households. The list was constructed during pre-testing of the dietary survey questionnaire and other foods not on the list could be added during the survey. The household members who consumed the food and the sources were also recorded.

To determine the household energy and nutrient consumption, a 24-hour recall was conducted. Mothers were asked about their food intake. All foods consumed from getting up to going to bed were recorded. To assess the amounts consumed most accurately, the interviewers carried household measures with them to enable the respondents to indicate the most appropriate size or volume. In addition, the cooking pans, spoons and sieves were used to estimate volumes and weights of home-prepared meals, while all the ingredients and their amounts were recorded.

Previous nutritional studies in project area

The nutrient content of major foods consumed, including the composition of meat, milk and blood, are available in the food composition table of Sehmi (1993).

The nutritional status of children in the study area was reviewed from two surveys, one conducted by MPIDO and Ministry of Health (MPIDO, 2004), and the other by World Vision Kenya (2004). The latter, carried out in the months of January and February, 2004, by World Vision's Loodariak Area Development Program, Kajiado District, reported nutritional status of children in Central Keekonyoikie. The survey was conducted during the dry season and at a time when the protracted droughts had just started. As shown in Table 11.1, 13 percent of children were below standards in the weight-for-height category, indicating that a considerable number were acutely malnourished at the time. Moderate wasting was found to be 10.3 percent, which is higher than the average wasting rate in Kenya (6.5 percent). Underweight (weight-for-age) may be an indication of mixed malnutrition (both long term and short term). About 23 percent of the children were found to be moderately underweight, which is quite comparable to the average underweight rate in Kenya (22 percent). Moderate rates of underweight (as low as 5 percent) have been reported in some parts of Kenya, while about 7 percent were found to be severely underweight.

In the subsequent Ministry of Health study, 800 households and 828 children under five years old (6–59 months old having height ranging from 65 to 110 cm) were surveyed in Central Keekonyoikie location at the very start of the drought period. The intent of this cross-sectional survey with random sampling was to describe nutritional status, investigate factors associated with malnutrition in the area and give valid recommendations to be used as a basis for immediate nutrition and/or health interventions. Weight, height and mid-upper arm circumference (MUAC) were measured as indicators of prevalence of wasting and acute malnutrition.

In this sample, 51.4 percent were male and 48.5 percent were female with 5 percent of all children below one year of age. The prevalence of wasting was 22.2 percent, with moderate and severe wasting found to be 14.1 and 8.1 percent respectively. The results of the MUAC measurements showed that 7.6 percent were malnourished (Z-scores less than -2) (data not shown).

The rates of acute malnutrition from both surveys of above 10 percent provided a justification for relief food, especially for the children under five years old. Thus, MPIDO initiated a general food ration programme (providing maize, beans and oil to families on a monthly basis) and supplementary feeding to non-centre young children was provided with a mixture of soya flour, maize and micronutrients.

Although a national survey assessing anaemia and iron, vitamin A and zinc status was conducted in Kenya in 1999 (MPIDO, 2004) no information was available from Maasai areas.

Photos

Photos were taken using a digital camera (3.2 mega pixels) for the study area in general and of the community members as they involved themselves in various activities. Photography of edible portions of the food samples collected – stems, leaves, roots and fruits – are on file with ROP.

Data analysis

Information emerging from key informant interviews and focus group discussions were categorized based on thematic issues of concern. Dietary data were imputed in the Statistical Package for Social Scientists package (Version 11) and analysed in the same package at ROP. Laboratory data were entered into MS-Excel using the same package. Mean micronutrient contents and standard deviations were computed.

Results

Table 11.2 reports species within the Maasai food list, followed by Table 11.3, which gives characteristics of unique Maasai foods. Table 11.4 outlines the source of foods and aspects of food decision-making.

Nutrient profile of basic Maasai traditional foods

Traditionally, the Maasai rely on meat, milk and blood from cattle for protein and energy needs. Thes research study showed that the foods and their by-products were consumed alone or in combinations in differing contexts by differing age groups. Table 11.5 shows the nutrient composition of Maasai meat, blood and milk as reported by Sehmi (1993) and by Foley and Otterby (1978).

Meat was shown to be an important source of energy and protein for the Maasai people. Meat was usually consumed during special occasions: circumcision and marriage ceremonies, among others. Soups, which were usually eaten with added herbs, were prepared whenever meat was available. Meat and bones were boiled in water with herbs. In some cases, herbs were boiled in water first, after which the water extract was added to the prepared soups. Blood was an exceptionally good source of iron and calcium and contributed protein and vitamin A. It was consumed whenever an animal was slaughtered or when a household member lost blood, principally in childbirth and circumcision. The broths (mixtures of blood and milk) were relatively low in protein and iron content. They did, however, provide appreciable amounts of calcium. They were consumed on special occasions that called for the slaughtering of animals.

Milk was also shown to be an important food for the Maasai. According to Maasai Elders, milk consumption patterns have changed only minimally over time, as compared to blood consumption. Milk and milk products were consumed any time of the day by all age groups, although these products were highly recommended for young children. There were four categories of milk products consumed:

- Fresh milk – obtained from the cow and ingested without being boiled. All people drank milk whenever it was available.
- Sour milk (*kule naisamis*) – made by fermenting the fresh milk for a day (mostly overnight) at room temperature. Young boys, not yet at the circumcision age, were common consumers.

Table 11.2 Maasai traditional food *(35 species)*

	Scientific name	*English/common name*	*Maasai name*	*Seasonality*
	Grains, legumes & nuts			
1	*Oryza sativa*	Rice	ormushele	–
2	*Pennisetum typhoides*	Bulrush millet	–	–
3	*Sorghum bicolor*	Sorghum	–	–
4	*Vigna subterranea*	Bambara groundnut	–	–
5	*Zea Mays*	Maize, maize meal	irpaek, orgali	–
6	–	Beans	impoosho	–
7	–	Chapati (without fat)	enchapati	–
8	–	Chapati (with fat)	enchapati	–
9	–	Peas	mpoosho	–
10	–	Unimix	enkurma doikempe	–
11	–	Maize and bean mixture	olkeseri	–
	Roots and leafy vegetables			
1	*Brassica oleracea* var. (2 var.)	Kales, cabbage	mbenek, mpuka	–
2	*Brassica oleracea* var.	–	–	–
3	*Ipomoea longituba*	Root	enchiliwa	June–December
4	*Ipomoea batatas*	Sweet potato	enkwashe oorkokoyo	–
5	*Manihot esculenta*	Cassava	–	–
6	*Solanum tuberosum*	Irish potato	inkwashen	–
	Wild fruits			
1	*Acacia drepanolobium*	Whistling thorn	eluai	–
2	*Acacia tortilis*	Umbrella thorn fruit	sagararam	September–November
3	*Balanites aegyptiaca*	Desert date	ilokua	November–December
4	*Carissa edulis*	Natal plum	lamuriak	May–July
5	*Grewia bicolor*	White leaved raisin	ositeti	July–August
6	*Grewia tembensis*	–	iyier	September–November
7	*Rhus natalensis*	Kwazul natal rhus	olmisigiyoi	May–July
8	–	–	ilpupuo	June–July
9	–	–	iltipaila	August–September
10	–	–	irkisubub	January–April
11	–	–	olokwa	–
	Herbs			
1	*Acacia kirki*	Flood-plain thorn, flood-plain acacia	olerai	March–December
2	*Acacia nilotica*	Arabic gum tree, babul	olkiloriti	January–December
3	*Acacia nubia*	–	oldepe	–
4	*Acacia senegal*	Gum arabic, Senegal gum	olibilie	January–August
5	*Albizia amara*	Bitter albizia	olperelong'o	January–December
6	*Lannea schweinfurthii*	False marula	olpanti	–
7	*Mystrolyxon aethiopicum*	–	olgdonga	–

Continued

Table 11.2 *(continued)* **Maasai traditional food** *(35 species)*

	Scientific name	*English/common name*	*Maasai name*	*Seasonality*
8	*Osyris lanceolata santalaceae*	Transvaal sumach, rock tannin-bush	olosesiae	January–October
9	*Salvadora persica*	Toothbrush tree	oremit	–
10	*Secamone punctulata*	–	osimantel	May–December
11	*Sterculia africana*	African star chestnut	olkarasha	January–December
12	*Vatovaea pseudolablab*	–	olkalei	January–October
13	*Ximenia americana*	False santalwood	olamai	March–November
14	–	–	olkimitare	–
15	–	–	olpupuoi	March–December
	Animal products			
1	*Bos taurus*	Cow meat	inkiri enkiteng	July
2	*Bos taurus*	Cow blood	osarge	July
3	*Bos taurus*	Cow broth (blood & milk)	nailanga	–
4	*Bos taurus*	Cow milk, not boiled, boiled	kulenairoua, kulenayiara enkiteng	January–December
5	*Bos taurus*	Cream	engorno	–
6	*Bos taurus*	Sour milk	kule naisamis	–
7	*Bos taurus*	Yoghurt	kule naoto	–
8	*Bos taurus*	Cow colostrum	isikitok	–
9	*Capra hircus*	Goat meat	inkiri enkine	April, August, December
10	*Capra hircus*	Goat blood	osarge lenkine	–
11	*Capra hircus*	Goat milk	kule enkine	June–August
12	*Capra hircus*	Goat broth (blood & milk)	nailanga	–
13	*Ovis aries*	Sheep meat	enkirongo	–
14	*Ovis aries*	Sheep milk	kule engerr	–
15	–	Porridge with blood	osaroi	–
16	–	Liquid fat	eilata	–
17	–	Lean dried meat in solidified fat	olpurda	–
	Fish			
1	–	Fish (small)	osinkiri kiti	–
2	–	Fish (large)	osinkiri sapuk	–
	Others			
1	*Saccharum officinarum*	Sugar	esukari	–
2	–	Cooking oil	eijata	–

– No data.

Table 11.3 Maasai traditional food characteristics

Traditional food item	*Comments: characteristics and use*
Basic traditional foods	
Eilata (liquid fat)	Available whenever animals are slaughtered
Inkiri (meat)	Cow, goat and sheep meat consumed mostly during ceremonies
Kulenairo (milk fresh)	Used to make tea and drank "as is"
Kulenaoto (milk sour)	Fermented overnight. Consumed mostly by pre-circumcised boys
Lean dried meat in solidified fat	Consumed together; can keep 6 months after animal slaughtered
Nailanga (blood + milk)	Red in colour and consumed mostly during ceremonies
Osarge (blood)	Drunk directly as soon as possible when from the animal
Osaroi (porridge + blood)	Blood is added to the porridge during preparation and is considered nutritious
Herbs[1]	
Olamai (*Ximenia americana*)	The stem prepared as oldebe and also used as an appetite stimulant
Olbiliel (*Acacia senegal*)	The roots are boiled in water until the water colorizes (red). The colored extract in water is then added to children's milk
Oldebe (*Acacia nubia*)	The stems are boiled in the soup until the soup colorizes. The soup is then consumed. Oldebe is a good appetite stimulant
Olerai (*Acacia kirki*)	The bark is boiled in water and the extract given to children for re-hydration and to women who have just given birth (for womb cleansing)
Olgdonga (*Mystrolyxon aethiopicum*)	The stems and leaves are boiled in water and added to soup for all age groups
Olkalei (*Vatovaea pseudolablab*)	The roots are consumed directly. It is consumed basically as food and no specific function attached
Olkarasha (*Sterculia africana*)	Roots are directly consumed by particularly the herdsmen. It is succulent in nature
Olkiloriti (*Acacia nilotica*)	Stem prepared as oldebe (boiled in soup until it colorizes) and also used as an appetizer
Olkimitare	Mostly herdsmen to quench thirst chew the roots directly. Most liked by male children who have just started to herd cattle
Olosesiae (*Osyris lanceolata*)	Roots are boiled in water until the water colorizes. The extract is then added to milk given to children. Believed to prevent cold and promote weight gain in children
Olpanti (*Lannea schweinfurthii*)	The roots are boiled in water and resultant extract in water added to children's milk
Olpelorong'o (*Albizia amara*)	The stem is boiled in water until the water colorizes. It is believed to promote growth in children of over 3 years of age
Osimantel (*Secamone punculata*)	Roots are boiled in water and added to children milk. It is believed to prevent cold
Fruit	
Eluai (*Acacia drepanolobium*)	Very seasonal and consumed mostly by children and women
Enchiliwa (*Ipomea longituba*) (root)	Consumed directly. It resembles Irish potatoes in look and is succulent
Ilpupuo	Very seasonal and consumed mostly by children and women
Iltipaila	Very seasonal and consumed mostly by children and women
Ilukwa (*Balanites aegyptiaca*)	Very seasonal and consumed mostly by children and women
Irkisubub	Very seasonal and consumed mostly by children and women
Iyier (*Grewia tembensis*)	Very seasonal and consumed mostly by children and women
Lamuriak (*Carissa endulis*)	Very seasonal and consumed mostly by children and women
Olmisigiyoi (*Rhus natalensis*)	Very seasonal and consumed mostly by children and women
Ositeti (*Grewia bicolor*)	Very seasonal and consumed mostly by children and women
Sagararam (*Acacia tortilos*)	Very seasonal and consumed mostly by children and women

[1] Those herbs and fruits with no scientific names could not be identified at the East African Herbarium.

- Yoghurt (*kule naoto*) – milk was fermented for about four days and stored in airtight containers. It resembled the conventional yoghurt. All age groups took this milk.
- Cow colostrum (*isikitok*) – when still thick and yellow in colour, this was considered nutritious and mostly given to young children, particularly boys. Adults did not take colostrum unless it was mixed with herbs.

The research found that fresh milk was an important source of protein, energy and calcium among these people. Yoghurt in the Maasai community may have other functional health benefits as a result of the probiotic microorganisms present. Cow colostrum was shown as an important source of protein and vitamin A, especially for children.

It was a common practice to add herbs to fresh or boiled milk for various reasons. These additions were generally considered nutritious and possessing medical functions; it was widely believed that additions of herbs to milk help children to fight diseases.

Nutrient composition of herbs

Herbs were added for flavour and/or for nutrition and medical functions in mainstream Maasai food, such as meat, blood, soup and milk. Some herbs were boiled in water directly and added to milk or soups, while

Table 11.4 Aspects of Maasai food sourcing and decision-making

Aspects	*Respondents (n=120)*
Predominant source of food	Own (50%), Purchases (45.7%) Relief (3.2%) Other (1.1%)
Under what circumstance is food bought[1]?	Depends fully on purchase (32.0%), During unfavourable weather (52.1%), When has money or can afford (69.2%)
Who makes the decisions on source of food?	Husband (42.6%), Wife (26.6%), Both (17.0%), Other (13.0%)
Who decides on how food is prepared?	Wife (96.2%), Husband (1.1%), Both (1.1), Other (5.3%)
Who decides on intra-household food distribution?	Wife (93.6%), Husband (2.1%), Other (4.3%)

[1] The percent figures do not add-up to 100% because of the multiple responses in the question asked.

Table 11.5 Nutrient composition of cow and goat meat, blood, milk and milk products *(per 100g edible portion)*

Foods	*Energy*		*Protein*	*Fat*	*Ash*	*Iron*	*Calcium*	*Vitamin A*	
								Retinol	*Carotene*
	kcal	*kJ*	*g*	*g*	*g*	*mg*	*mg*	*IU*	*µg*
Cow's blood[1]	95*	397	13.75	0.90	–	18.75	242	–	–
Cow's broth[1] (blood + milk)	46	192	0.94	–	–	1.69	133	–	–
Cow colostrum[2]	–	–	14.0	6.7	1.1	–	260	940–1 230	–
Cow's meat[1]	214*	895	24.40	12.75	–	3.56	313	–	–
Cow's milk[1]	73*	305	3.42	4.03	1.0	1.81	181	27	80.00
Cow's milk yoghurt[1]	74*	309	3.7	4.75	0.8	0.2	149	102	–
Goat blood[1]	78*	326	3.80	3.85	–	27.19	350	–	–
Goat broth[1] (blood + milk)	37*	155	2.08	2.30	–	1.53	297	–	–
Goat meat[1]	166*	694	15.43	10.00	–	2.16	45	0	–
Goat milk[1]	69*	288	3.48	3.48	–	0.9	180	32	0.00

[1] Sehmi, 1993.
[2] Foley and Otterby, 1978.
* Calculated.
– No data.

some were consumed "as is". Some of the herbs commonly used had attributed hypolipidemic and antioxidant properties, thus offering one explanation for the low incidence of heart disease despite high consumption of animal-source foods. The herbs were prepared and consumed in different forms. Almost all herbs were available throughout the year although their availability most likely improves during the wet seasons, and they were generally consumed in a specific season (as shown in Table 11.2). Table 11.6 shows the use and nutrient composition of some commonly used herbs.

Table 11.6 Micronutrient composition of commonly consumed herbs, leafy vegetables, roots and wild fruits *(per 100g edible portion)*

	Food items	*ß-carotene*	*Vit C*	*Iron*	*Zinc*	*Selenium*	*Calcium*
		mg	*mg*	*mg*	*mg*	*mg*	*mg*
	Herbs						
1	Olamai[1]	0.0 ± 0.0	2.2 ± 0.0	0.2 ± 0.0	0.2 ± 0.02	0.3 ± 0.0	9.3 ± 0.3
2	Oldepe[1]	0.0 ± 0.0	3.8 ± 0.0	0.4 ± 0.1	0.2 ± 0.04	6.5 ± 0.2	19.0 ± 0.5
3	Olerai[1]	0.0 ± 0.0	0.1 ± 0.0	3.1 ± 0.2	6.1 ± 0.2	2.6 ± 0.1	78.4 ± 2.1
4	Olgdonga[1]	0.0 ± 0.0	0.03 ± 0.01	9.3 ± 0.5	1.7 ± 0.1	1.3 ± 0.1	9.6 ± 0.3
5	Olibilie[1]	0.0 ± 0.0	2.8 ± 0.0	0.3 ± 0.0	0.3 ± 0.0	0.03 ± 0.0	10.1 ± 0.2
6	Olkalei[1]	0.02 ± 0.01	14.7 ± 0.3	2.3 ± 0.4	1.6 ± 0.0	2.6 ± 0.2	692.7 ± 47.7
7	Olkarasha[1]	0.0±0.0	8.6 ± 0.8	4.6 ± 1.4	3.1 ± 0.0	0.3 ± 0.0	1729.2 ± 32.5
8	Olkiloriti[1]	0.0 ± 0.0	6.8 ± 0.0	0.1 ± 0.02	0.5 ± 0.01	0.2 ± 0.0	4.7 ± 0.6
9	Olkimitare[1]	0.0 ± 0.0	25.4 ± 1.03	2.1 ± 0.4	15.5 ± 1.7	4.1 ± 1.1	750.0 ± 46.9
10	Olosesiae[1]	0.0 ± 0.0	0.2 ± 0.01	7.5 ± 0.3	4.9 ± 0.1	5.3 ± 0.3	42.6 ± 1.5
11	Olpanti[1]	18.0 ± 0.0	1.3 ± 0.0	0.3 ± 0.0	0.3 ± 0.01	2.1 ± 0.0	12.4 ± 0.5
12	Olperelong'o[1]	0.0 ± 0.0	0.0 ± 0.0	2.3 ± 0.0	0.04 ± 0.0	0.3 ± 0.0	5.2 ± 0.3
13	Olpupuoi[1]	0.1 ± 0.01	2.1 ± 0.0	0.3 ± 2.4	0.2 ± 0.0	1.6	9.9 ± 0.6
14	Osimental[1]	85.6 ± 0.0	3.9 ± 0.0	2.1 ± 0.1	0.5 ± 0.0	0.9 ± 0.0	15.10 ± 0.13
	Leafy vegetables						
1	Cabbage[2]	100.0	47.3	1.4	–	–	38.3
2	Kale[3]	2523.0	133.5	1.3	–	–	100.0
	Roots and wild fruits						
1	Eluai[1]	0.5 ± 0.01	65.9 ± 0.6	1.3 ± 0.0	1.6 ± 0.0	10.0 ± 1.7	47.9±12.6
2	Enchiliwa[1]	0.01 ± 0.01	9.4 ± 0.5	0.6 ± 0.0	0.0 ± 0.0	5.0 ± 0.8	146.5 ± 10.0
3	Ilpupuo[1]	0.1 ± 0.00	5.8 ± 0.3	34.7±0.0	3.1±0.0	12.5±	593.8 ±
4	Iltipaila[1]	0.0 ± 0.0	154.4 ± 2.0	3.1	–	0.0±0.0	6.8
5	Ilugua[1]	0.0 ± 0.0	147.0 ± 0.5	1.3 ± 0.0	–	2.5 ± 0.0	122.6±11.5
6	Irkisubub[1]	0.0 ± 0.0	23.4 ± 0.0	6.4 ± 0.9	2.7 ± 0.2	1.6 ± 0.0	45.3 ± 2.2
7	Iyier[1]	6.1 ± 0.1	60.9 ± 0.5	2.5 ± 0.0	0.0 ± 0.0	11.0 ± 0.7	157.9 ± 1.2
8	Lamuriak[1]	0.2 ± 0.0	54.1 ± 0.2	4.7 ± 0.6	5.7 ± 0.6	10.0 ± 0.0	215.0 ± 0.0
9	Olmisigiyoi[1]	0.2 ± 0.01	33.6	1.3	0.0 ± 0.0	25.0 ± 0.0	170.8 ± 16.0
10	Ositeti[1]	0.2 ± 0.01	17.3 ± 0.5	4.1 ± 0.0	0.0 ± 0.0	37.5 ± 2.1	418.1 ± 12.0
11	Sagararam[1]	0.1 ± 0.0	762	0.0 ± 0.0	4.4	0.0 ± 0.0	36.9

[1] Analysed at the University of Nairobi.
[2] Sehmi, 1993.
[3] Shore, 1998.
– No data.

The herbs consumed were found to generally not be important as sources of ß-carotene. Only *osimantel* and *olpanti* contained much ß-carotene. *Olpanti* contained 18 mg/100g while *osimantel*, comparing favourably with cabbage, contained 85.6 mg/100g. *Oikimitara*, *olkalei* and *olkiloriti* were relatively important as sources of vitamin C, but did not compare favourably with the common vegetables, such as kales and cabbages. *Olosesiae*, *olgdonga* and *olkarasha* were relatively good sources of non-haeme iron. *Olosesiae* provided zinc. *Olerai* and *olkimatara*, *olosesiae* and *oldebe* provided relatively high levels of selenium. *Olkimatara* and *olkarasha* contained relatively high levels of calcium – higher than kales and cabbages.

It seems that *olkimatara*, *olosesiae* and *olkarasha* were the most important single herbs in providing a variety of important micronutrients. *Olkimatara* provided vitamin C, zinc, selenium and calcium. *Olosesiae* on the other hand provided iron, zinc and selenium at the same time. *Olkarasha* contained appreciable levels of iron and calcium.

Wild fruits and roots consumed

Wild fruits and roots were consumed mostly by women and children and were highly seasonal, with many having increased availability during and immediately after rainy seasons. Many of these fruits, which were not as sweet as cultivated fruits, can be bitter and were often unpalatable to non-Maasai. Though many were small-sized, they were nevertheless consumed in large quantities by children and women, and were, therefore, a significant source of micronutrients during their months of availability. Table 11.6 details the nutrient composition of several wild fruits consumed in the Maasai community.

As in the case of herbs, many fruits were found to be insignificant sources of vitamin A. Edible portions of *iyier*, however, contained 6.13 mg/100 g of ß-carotene while other fruits provided negligible amounts. All the fruits provided at least some vitamin C, with *sagararam* (which is also consumed by goats) exceptionally high (762 mg/100 g). By comparison, orange contains 60 mg/100 g of vitamin C (Sehmi, 1993). *Iltapaila* contained about twice the amount of vitamin C in oranges while *iyier* and *lamuriak* had amounts comparable to oranges. *Ilpupuo* had high amounts of iron and was not comparable to other fruits. *Sagararam* and *lamuriak* had higher levels of zinc relative to other fruits. All fruits analysed contained at least some selenium except for *iltipaila* and *sagararam*. *Ositeti* and *olmisigiyo* had, however, the highest content of selenium. All fruits had calcium in some amounts except for *iltipaila*, with *ilpupuo* and *ositeti* containing relatively higher amounts. No single fruit provided appreciable amounts of more than two micronutrients. *Ilpupuo* contained iron and calcium although the bio-availability of the former is unknown; *ositeti* contributed both selenium and calcium. *Sagararam* can be relied on as a relatively good source of vitamin C and zinc.

Food consumption patterns in the Maasai life-cycle

Birth to two years

Breastfeeding was the norm up to two years of age. In addition to breastmilk, young children were fed cream from cow's milk commonly known as *engorno*. The cream was extracted by boiling milk and leaving it to stand for the cream to separate, after which it was scooped from the top and given to young children. A common practice of adding burnt donkey dung to the cream before boiling and feeding to young children (most common at three months of age) was believed to help prevent cold and pneumonia. Fresh milk was also given, but rarely without additives. It was common to add herbs, which were first boiled separately in water and the resultant extract added to milk. The herbs were added for nutrition as well as medical functions as described above. Most of the herbs were roots, and are believed to be growth stimulators, dewormers, rehydrators and anti-diuretics, among other functions. Herbs formed an important part of young children's diets.

After circumcision

Before circumcision, girls and boys consumed the general diet consumed by adults. Children, however,

were particularly good gatherers and consumers of wild fruits. They gathered many kilograms of wild fruits at their own leisure, particularly when they took animals for grazing. They shared their "harvest" mostly with their mothers and sisters. Male adults considered fruits as food for children and women, and consumed relatively little.

Immediately post-circumcision – 12 to 13 years for girls and 15 to 16 years for boys – special foods were provided. For girls, a mixture of sour milk and fresh blood (*osaraoi*) was given. Until several months after circumcision, these young people were not allowed to drink plain water – they were encouraged to add milk to it before drinking. Dry meat in solid animal fat (*olpurda*), fresh milk and liquid fat in blood were all commonly consumed. A number of herbs were also consumed. Following circumcision boys were encouraged to drink yoghurt and blood daily, on an hourly basis or whenever hungry. Dried meat, which had been stored in rendered fat and a mixture of fresh milk and blood, was given. For girls, drinking water without adding milk was discouraged. Post-circumcision, boys were officially called the "*morans*" and their official foods were fresh milk, fermented milk (equivalent to yoghurt) and meat (*inkiri*) in large amounts. The use of herbs in soups or consumption "as is" was common and a relatively wider variety of herbs was used by boys in comparison to the girls.

Adults

In general, adults (men and women) consumed a variety of staple traditional foods (meat, blood, soup and milk), as well as foods common among Kenyans such as *ugali* (maize meal), *githeri* (a mixture of maize and beans), kales, cabbages, and beans. Special recommendations pertained to pregnant and lactating women.

Pregnant women

Particular parts of meat were earmarked during slaughter for pregnant women, including the liver and kidney. Dried meat in solid fat and fresh and fermented milk were also given at this stage. The use of herbs was also common and women were encouraged to eat various recommended wild fruits and roots.

Postnatal and lactating women

Immediately after delivery, women were given:

- liquid fat for cleansing;
- concentrated solution of water and sugar for energy;
- fresh blood and milk;
- porridge with blood added;
- fresh milk;
- soup with various types of herbs.

Changing food consumption patterns of the Maasai of Enkereyian

In recent years, members of the community have grown dependent on food produced in other areas, a pattern that is more pronounced during the protracted droughts. During drought, animals were spared as sources of food, and migration to areas with green pastures was inevitable. In many instances, animals were sold at "throw away" price, with the money obtained being used to buy more conventional foods, purchased at shops or markets.

The dietary survey in this project was conducted during the drought season. Under these exceptional conditions, it was found that about half of the households depended on their own food sources, and close to half of the other respondents (45.7 percent) purchased food. During this particular time, MPIDO was distributing food (maize, beans and cooking oil) as a general ration in addition to a commercial pre-cooked mixture of maize, soya beans combined with mineral premixes supplied by a local company.

About 3 percent of households depended on the relief offerings as their predominant sources of food. The greatest determinant for the purchase of food was the availability of money irrespective of the season. Husbands, who usually were in better position to work and earn income, were the primary decision-makers on the sources of food. However, their wives determined how food should be prepared and distributed among the household members. This is a common pattern in other communities in rural Kenya.

Maize and white potatoes were the most important energy sources for the Maasai community. The latter was purchased, while the former was obtained from

Table 11.7 Nutrient composition of foods mentioned in Maasai 24-hour recalls *(per 100 g fresh weight)*

Food	Preparation	Energy		Protein	Retinol	Carotene[2]	Vitamin A	Iron
		kcal	kJ	g	IU[1]	µg	RE - µg[3]	mg
Maize, white	Consumed mixed with beans in main meals (lunch and supper)	358	1 496	10.3	0	0	0.0	4.5
Ugali (maize meal)	Consumed as porridge snack or main meals	373	1 559	12.4	0	0	0.0	2.3
Beans	Consumed mixed with beans in the main dishes. Sometimes consumed with ugali and chapatti	323	1 350	19.3	0	10	0.8	8.8
Chapatti	Made of wheat and consumed in the main meals	340	1 421	8.0	0	0	0.0	2.3
Unimix[4]	Given to young children in form of porridge	400	1 672	14.0	2 300	0	2 300	8
Cabbages	Vegetable	14	59	1.8	0	100	8.3	1.4
Millet (porridge)	Consumed as a snack	398	1 664	13.0	0	25	2.1	135
Milk	Used to make tea for breakfast and main meals	72.5	303	4.0	27	80	33.7	1.8
Sugar	Added to tea or porridge	375	1 568	0.0	0	0	0.0	0
Rice	Consumed mostly in main meals	357	1 492	6.3	0	0	0.0	1.5
Potatoes	Consumed mostly in main meals	81	339	2.0	0	26	2.2	1.4
Cooking oil	Consumed mostly in main meals	900	3 762	0.0	0	0	0.0	0
Meat	Consumed mostly in main meals	220	920	30.0	24	0	24	3
Kale	Consumed mostly in main meals	54	226	4.1	0	900	75.0	2.2

Source: Sehmi, 1993.
1 IU = International Unit (1 IU = 0.33 µgRE).
2 12 µg carotene = 1 µgRE.
3 RE = Retinol Equivalents.
4 Pre-cooked mixture of maize, soya beans and mixed with mineral premixes supplied by a local company.

the relief supply. Predominant sources of proteins were beans and milk, with the former obtained from relief supply while the latter was produced by the household. Meat was consumed at least once in three days by about 70.2 percent of the households, while most households rarely consumed blood. Herbs (gathered), even during the drought, were consumed with *eremit*, *olerai* and *olamai*[35] at least once in three days. Three wild fruits were mentioned with *iyier* being the most commonly consumed. Kales (purchased) were consumed at least once in three days by about half of the households interviewed. Fish, peas, sweet potatoes, groundnuts, sorghum and cassava were rare foods in the Maasai community.

It appeared that despite the protracted drought and attendant practice to spare animals, milk and meat were still highly consumed. However, animals were spared as a source of blood for normal consumption. At the time of data collection, relief food was an important food source.

Nutrient intake

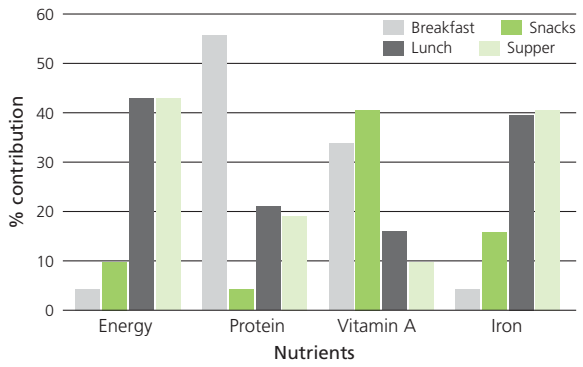
Food taken in the last 24 hours

In total, 14 major different foods (Table 11.7) were consumed, as recorded with 24-hour recalls.

The respondents did not mention herbs. This could be explained by the fact that men were the common consumers of herbs, and that most common herbs consumed during the dry season were the succulent ones. Men mostly consumed these to reduce thirst during herding. Anecdotal data, however, showed that the herb, *oremit*, was commonly used in milk tea in the breakfast meals throughout the year. Fruits were also not mentioned. Children consumed most fruits and this intake was not captured in the 24-hour recall. During the wet season, however, when fruits were in plenty, children always brought them home to share with their mothers.

35 Scientific names are given in Table 11.2.

Figure 11.2 Contribution of adult breakfast, snacks, lunch and supper to daily energy and nutrient intake



Adult nutrient intake per day

Daily energy, protein, vitamin A, and iron intake based on 24-hour recall data are shown in Table 11.8. When these values were compared with the recommended intakes for Kenyans as reported by Sehmi (1993), energy (for adults) and vitamin A consumption were low, while protein and iron intakes were in excess of the recommendations. A minimum energy intake of 2 100 kcal and 1 550 kcal is required per day for adults and children respectively.

A minimum intake of about 41 g and 18 g protein for adults and children respectively is recommended. For vitamin A, about 750 µgRE is recommended for non-pregnant female and male adults, while at least 500 µgRE is required for young children. At least 10 mg of iron and 28 mg of iron intake per day is recommended for young children and adults, respectively.

Common traditional foods (milk and meat) contributed only 6.2 percent to the energy consumed. Milk, however, contributed a higher proportion of the vitamin A intake. Milk also contributed about a tenth of the iron intake. Under the extreme drought conditions of the study period purchased or donated non-traditional foods in turn provided 93.8 percent of energy. Under more favourable conditions cooking oil, which made up more than half of the caloric intake, would be consumed only during ceremonies and in the preparation of chapattis. Chapattis in turn would normally only be consumed with meat or vegetable stews.

Table 11.8 Energy and nutrient consumption per adult per day *(total consumption divided by total number of household members)*

Nutrient	*Average quantity consumed per person per day*	*Quantity (% of total average)*	
		Milk	*Meat*
Energy *(Kcal)*	1 623	87.4 (5.4)	24.1 (1.5)
Protein *(g)*	126	4.7 (3.9)	3.3 (2.6)
Vitamin A *(RE)*	23	17.8 (77.5)	0.8 (3.4)
Iron *(mg)*	23	2.2 (9.6)	0.3 (1.4)

Table 11.9 Maasai food consumption pattern based on 3-day food frequency

Food	*Mean frequency*	*% households that consumed food item*	*Most common source of food item*
Maize	2.6	96.8	Gift (relief)
Milk	2.5	86.2	Own
Beans	2.4	88.3	Gift (relief)
Irish potato	1.9	84.0	Purchase
Porridge	1.6	63.8	Purchase
Cabbage	1.5	76.6	Purchase
Meat	1.3	70.2	Own
Kales	1.1	50.0	Purchase
Millet	0.8	33.0	Purchase
Sweet potato	0.8	9.6	Purchase
Peas	0.5	17.0	Purchase
Large fish	0.1	4.3	Purchase
Blood	0.1	3.2	Own
Groundnut	0.1	3.2	Own (2.1%)
Sorghum	0.04	2.1	Purchase
Cassava	0.01	1.1	Purchase
Herbs			
Oremit	2.5	70.0	Gathered
Olamai	1.0	40.0	Gathered
Olerai	0.8	30.2	Gathered
Olkiloriti	0.3	20.5	Gathered
Olperrolong	0.2	40.1	Gathered
Wild fruits			
Iyier	1.5	55.2	Gathered
Ilpupuo	0.8	25.3	Gathered
Olokwa	0.7	29.2	Gathered

As shown in Figure 11.2, most energy was obtained from the lunches and suppers. Most protein came from the breakfast meals while vitamin A was predominantly obtained from breakfast and snacks. Iron was mostly obtained from the lunches and suppers.

Results for the three-day food frequency (Table 11.9) likewise supports a pattern of maize, milk and beans as the main staples, with white potato, cabbage and kale and meat completing the diet of the majority of households. *Oremit* was the only herb used on a daily basis by the majority of households, and during the study period most households consumed the fruit *iyier*.

Conclusions

Meat, milk, blood, and soups were the basic traditional foods of the Maasai of Enkereyian, while herbs were either added to them or consumed directly. Meat, milk and blood provided an important (but decreasing) source of energy and nutrients. Wild non-domesticated fruits were mostly consumed by children and women. More recently, however, the Maasai have increasingly depended on food produced by others, especially during the protracted droughts. During droughts, the consumption of milk, meat, blood and herbs became rare and the availability of highly seasonal wild fruits diminished. Development agencies provided relief food, which became an important source of energy and nutrients during the drought period. Even in the absence of drought, other non-traditional foods were bought, prepared and consumed.

The contribution of traditional diets to energy and nutrients is declining rapidly. Young community members consequently lose the indigenous knowledge on food use and rely more on the conventional Kenyan foods. If some measures are not put in place, complete loss of traditional food practices appears inevitable. This is highly evident with the gradual loss of elder members of the Maasai community who carry most of this people's indigenous knowledge.

Maasai pastoralists living in changing socio-economic circumstances could achieve food security and optimal nutrition and health through: (1) effective management of the pastoral production system; (2) sustainable use of environmental resources including water; (3) nutritionally and culturally appropriate use of purchased foods; and (4) an informed and responsive policy framework. Improving the dietary intake and anthropometric measurements of young children is also a target. In recognition of the cultural importance of livestock (cattle, goats and sheep), increasing family access and use of animal source foods is crucial. Indicators for project success would be biological (anthropometry and dietary), interview (food security and physical activity) and process (activities and workshops evaluated by participants).

Preservation and maintenance of the Maasai traditional indigenous food-based knowledge can be done through continuous education of young members of the community about their traditional food systems and their cultural contexts. There is also a need to integrate the existing health and nutrition interventions with traditional food promotion. Strategies and programmes can increase the availability and consequently the consumption of animal source foods. Such efforts must address the problem of access to water and can involve restocking activities with small animals (goats and sheep) targeted at the most vulnerable households.

Further research could study the effect of traditional diets and Maasai child-feeding practices on simple nutrition indicators, such as anthropometry, psychosocial status and general health condition. This can be used to demonstrate the importance of traditional diets and child-feeding practices, and it can act as a pilot that can be replicated elsewhere among other Maasai and beyond.

Pastoralists of Kajiado District struggle to meet their basic nutrition and subsistence needs within a challenging physical environment. Poverty and malnutrition, stemming from historical determinants of land access and land tenure, are compounded by the progressive deterioration of pastures and other aspects of the biophysical environment, and potentially from integration of pastoralists into the market economy as an immediate adaptive response. Reduction in the

consumption of milk, meat and other traditional foods adversely affects nutrition and food security. Limited income-generating alternatives such as charcoal-making and firewood sales have adverse environmental consequences, ultimately reducing the quality of pastures, the availability of wild foods, the productivity of pastoralism, and the well-being of the majority of the community.

This case study in the Food Systems and Health Program of the Centre for Indigenous Peoples' Nutrition and Environment revealed that the Maasai people had diverse foods and indigenous knowledge on preparation and use of the foods. These resources can be incorporated into strategies that would enable the community to meet their nutritional, food security and livelihood needs in a more optimal manner ●

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