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Edible insects for improved food and nutrition security at Kakuma refugee camp

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ABSTRACT

BACKGROUND: Refugee camps are commonly affected by chronic food insecurity and low levels of persistent malnutrition due to reliance on food aid from the international community. Edible insects, rich in nutrients and commonly eaten in many regions in developing countries, could ameliorate this situation by supplying refugees with a locally produced food rich in key nutrients, such as protein, iron and zinc.

OBJECTIVES: The objectives of this study were to conduct a dietary assessment of refugees at Kakuma refugee camp and the host community in Turkana county, Kenya, and to evaluate the acceptance and palatability of a processed food containing house crickets (*Acheta Domesticus*). Dietary histories were collected to elucidate the refugees' past dietary habits, concurrence with current eating habits and history of insect consumption.

METHODS: Food Frequency Questionnaire and 24-Hour Recall were used to assess dietary diversity and daily nutrient intake. A five-point degree of liking scale was used to assess hedonic response to the experimental food, preceded by a dietary history survey on past staple foods and potential history of insect use.

RESULTS: Food shortage affected both the refugees and especially the host community. Dietary quality often did not meet recommendations, and this was especially true in the latter group, whose everyday diet consisted mostly of maize and beans. Poor dietary quality and reliance on coping strategies at the camp exacerbated towards the end of the month due to the once-per-month food distribution schedule. The experimental cricket-based biscuit was rated high on all aspects both by those accustomed to insects in their diet and those with no history of insect use. However, high refusal rates among the Somali clans and South Sudanese Dinka, both ethnic groups with little or no insect use, were recorded.

CONCLUSION: The results demonstrate that a nutrition-specific intervention focusing on the incorporation of edible insects in the diets of refugees and host communities is feasible and wholly justifiable on nutritional grounds. While ethnic origin was found to greatly influence the perception on edible insects, there were no significant differences in hedonic ratings between people with or without a history of insect consumption.

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ABBREVIATIONS

24HR	24-Hour Recall
ANOVA	Analysis of Variance
FFQ	Food Frequency Questionnaire
GAM	Global Acute Malnutrition
GFD	General Food Distribution
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KES	Kenyan Shilling
NGO	Non-Governmental Organization
NRC	Norwegian Refugee Council
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SEQ	Sensory Evaluation Questionnaire
UCPH	University of Copenhagen
UNHCR	United Nations High Commissioner for Refugees
WFP	World Food Programme

1 INTRODUCTION

From nutrition to ecology and animal welfare, edible insects have attracted considerable interest as meat substitutes for fostering more sustainable global food production systems. For developing countries, insects are seen as a potential means of addressing food and nutrition security by providing essential nutrients for growing populations (FAO 2013). Alleviating chronic food insecurity at refugee camps could be one goal of insect research, and one that requires knowledge of diet, tradition and culture regarding insect use among target populations.

While refugee camps provide stability to people who flee their countries of origin, refugees at camps often continue to suffer from low levels of persistent malnutrition (Doocy *et al.* 2011). The basic food commodities provided at refugee camps include cereals, legumes, fortified blended foods, vegetable oil and salt (UNHCR 2007). Since these camps are often located in remote and harsh environments in Africa and Asia, malnutrition rates may be even higher among the locals living in the vicinity of the refugee camp than among the refugees themselves (Salama *et al*. 2004).

In many African and Asian countries insects have been, and continue to be, a traditional and well-regarded food source (FAO 2013). However, insect consumption is often viewed with disgust in western cultures, and this habit may also affect people in developing countries who become more westernized in their tastes and dietary preferences (DeFoliart 1999). Up to date, over 400 species of insects are consumed in Africa, especially in the continent's central and eastern regions, most commonly of the orders *Lepidoptera*, *Orthoptera* and *Coleoptera* (Kelemu *et al*. 2014). Commonly, insect-eating people specialize on a very limited number of species, disregarding other insects as inedible (Evans *et al.* 2015). When trying to encourage the consumption of insects as food, a common strategy is to dampen the ideational disgust to insects by serving them in invisible form, such as by powdering and mixing them in common foods (Yates-Doerr 2014).

There are currently no studies on the consumption and acceptance of insects among refugees. The aim of this MSc thesis is to assess the current state of dietary intake and evaluate the feasibility of incorporating insects in the refugees' diets on a Kenyan refugee camp.

2 RESEARCH QUESTIONS AND OBJECTIVES

This field study was conducted at Kakuma refugee camp in Northern Kenya in Spring 2016 to assess the refugees' current dietary habits and dietary status and to evaluate whether a species of edible insects, the house cricket (*Acheta Domesticus*), could potentially be introduced to the refugees' diets and thereby improve food and nutrition security at the camp. Additionally, the host community, Kenyans of the Turkana tribe living in the nearby Kakuma town, were included in the study. The main research question was: *How can edible insects improve food and nutrition security at Kakuma refugee camp and the host community?* This was elaborated with the following sub-questions:

- What is the refugees and the host community's current dietary status?
- How have the refugees' dietary habits changed after arrival at the refugee camp?
- Is a processed food containing edible insects considered an acceptable and palatable food by the refugees and the host community?

The corresponding research objectives were:

- To carry out a dietary assessment at Kakuma refugee camp and Kakuma town
- By using data on dietary histories and current diet, to evaluate the refugees' cultural food preferences and current food use
- To evaluate the acceptance and palatability of a processed food containing 10 % powdered crickets among the refugees and the host community

3 BACKGROUND

3.1 Food and nutrition security

3.1.1 Introduction to concepts

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs, and food preferences for an active and healthy life

WFP (2009)

The current definition of food security, quoted above, dates from 1996 and pillarizes the concept in three parts, namely the availability, access and utilization of food:

Food availability:	Sufficient quantities of food are available, including domestic production, imports and food aid
Food access:	Households and individuals are able to obtain a sufficient quantity and quality of food to meet their nutritional needs
Food utilization:	Factors that affect people's capacity to use food resources, such as storage conditions, processing and cooking practices, sanitation, safe drinking water and health status

WFP (2015a)

Historically, *availability*, measured by national food balance sheets or caloric consumption per capita, has been the main determinant of food security (Burchi and De Muro 2012, Barrett *et al.* 2010). Taking a Malthusian view on population growth and increase in food production, an increase in agricultural output has generally been viewed as the main - or the only - tool for boosting food security (Burchi and De Muro 2012). A broader understanding of food security owes much to Amartya Sen's work on poverty when it comes to understanding the socio-economic factors and political disenfranchisement that curtail some people's *access* to food (Barrett *et al*. 2010). Men, for example, are often in a better position to attract gainful employment and hence increase their own assets over women or children, while an increase in women's status is known to have a positive effect on both their and their children's nutritional status (Smith *et al.* 2003). Because caregiver behaviour between parent and child is often viewed

as more familiar territory for women than men, women are likelier than men to allocate a larger share of their resources to their children (UNICEF 2011). *Food utilization*, the newest addition to the concept, emphasizes individual factors that alter people's food-related needs, both the biological aspects (such as health status) but also what Sen calls 'complementary inputs', such as access to health care, clean water, sanitation and basic education (Burchi and De Muro 2012).

Nutrition security, linked but separate from food security, is defined by Ruel (2013) as a state where people have access to a healthy and balanced diet and, additionally, to adequate caregiving practices and a healthy environment (the complementary inputs). Ruel (2013) further argues for keeping the definitions separate to prevent nutritional concerns from diminishing in importance. In practice, there is still a concern that food security may be reduced to its historical definition of putting quantity - availability - over the quality of food.

Temporally, households and individuals may naturally ascend or descend to food security or insecurity. According to Hulme and Shephard (2003), poor households can be characterized as chronically poor or transiently poor. While the chronically poor experience significant asset deprivation for years on end, the transient poor shift in and out of poverty by fluctuations in income, consumption, nutritional status or some other measure of poverty. This is also true for food security - chronically food insecure households or individuals suffer from extended poverty with little or no assets, while the transiently food insecure suffer from short-term fluctuations in availability or access to food (Ruel 2013). It is also worth remembering that, accounting for gender and age differences, not all members of the same household are necessarily chronically deprived and that over time stability varies greatly depending on, for example, weather conditions or economic downturns (Hulme and Shepherd 2003, Ruel 2013).

3.1.2 Malnutrition

Malnutrition is characterized in children by underweight and growth failure and by underweight in adults (Pierre-Louis 2008). Stunting, or low height-for-age, is a characteristic of chronic malnutrition in children, while acute malnutrition leads to wasting, i.e. low weight-for-age (ICAI 2014). Poor nutrition is especially detrimental to children and pregnant and lactating women due to their increased need for essential nutrients, such as vitamin A and zinc (Ruel 2013). Poor maternal nutrition affects the growth and brain development of the foetus, and as many as 45 % of all annual child deaths can be attributed to undernutrition, suboptimum breastfeeding,

stunting, wasting and deficiencies in vitamin A and zinc (Black *et al*. 2013). In emergency situations, the most common deficiencies besides lack of energy and macronutrients are for iron, vitamin A, iodine, niacin, thiamine and ascorbic acid (UNHCR 2007). Recommendations for these core nutrients are shown in Table 1. The recommendations for iron and zinc depend greatly on a person's nutritional status and presence of factors that either inhibit or enhance absorption of these nutrients; the recommendations shown here apply to a situation where bioavailability is relatively low, such as from a monotonous diet lacking in animal-derived foods (Hunt 2002).

Table 1. Recommended nutrient intakes[a]

Nutrient	**Women 19-50 y**	**Men 19-50 y**	**Children 4-8 y**
Fat, E%	20-35	20-35	25-35
Protein, g/kg/d	0.66	0.66	0.75
Vitamin A, µg/day[b]	500	600	500
Vitamin B1, mg/d	1.1	1.2	0.9
Vitamin C, mg/d	45	45	35
Iron, mg/d[c]	29	14	9
Zinc, mg/d[d]	4.9	7.0	5.6

[a] Fat is based on FAO (2008), protein on FAO/WHO (2007) and vitamins and minerals on FAO/WHO (2001)
[b] Expressed in retinol equivalents
[c] Based on 10 % bioavailability
[d] Based on moderate bioavailability

In non-emergency situations in developing countries, the prevalence of acute malnutrition, or wasting, is approximately 5 % and possibly considerably higher in emergency situations (Pierre-Louis 2008). A common measure of malnutrition in emergency situations is the prevalence of Severe Acute Malnutrition, defined as weight-for-height that is –3 standard deviations from the population mean[1], while the cut-off point for Global Acute Malnutrition (GAM) is –2 standard deviations (UNHCR 2011). For children aged 6 to 59 months, Mid-Upper Arm Circumference (MUAC) is a rapid emergency screening method for SAM, determined as arm circumference of less than 115 millimetres (UNHCR 2011). On a population level, prevalence of GAM at 15 % or more is considered 'critical' (Save the Children 2008).

Other, non-anthropometric, benchmarks for emergencies are crude mortality and under-five mortality. A crude mortality rate of 0.5/10,000/day and under-five mortality of 1/10,000/day is

[1] Based on WHO growth standards for normal height and weight development in children

considered normal (Pierre-Louis 2008). To be classified as a nutrition emergency, the benchmarks are 1-2 and 2-4 deaths per 10,000 per day.

3.2 Refugees and food security

Refugees, as people who have forcibly had to flee their countries of origin to seek safety elsewhere, are at a clear risk of food insecurity (UNHCR 2007). At refugee camps, which host a significant number of the world's refugees, reliance on external food aid often means that dietary deficiencies continue to occur even in a relatively stable environment (Dye 2007, Doocy *et al*. 2011).

3.2.1 Complex emergencies and post-emergency contexts

[Complex emergencies are] relatively acute situations affecting large civilian populations, usually involving a combination of war or civil strife, food shortages and population displacement, resulting in significant excess mortality

Salama *et al*. (2004)

The post-emergency phase begins when the excess mortality of the emergency phase is under control, and the basic needs (food, water, shelter) have all been implemented

Brent *et al.* (2014)

The above quotations describe two stages of refugee situations, the emergency phase affecting large populations in times of conflict, and the post-emergency phase where people's basic needs for food, water and shelter are met, such as at a refugee camp. These camps, mostly located in Africa and Asia, are commonly characterised by relatively stable environments and low mortality rates and, due to public health measures, water, sanitation and hygiene programmes, food aid and education, mortality rates are often lower than among the host communities surrounding the camps, which are often located in remote areas (Doocy *et al.* 2011, Salama e*t al*. 2004). Low levels of malnutrition commonly persist due to the refugees' reliance on food aid that may fluctuate in quantity and quality (Brent *et al.* 2014).

3.2.2 Food aid at refugee camps

At refugee camps maintained by the United Nations, the responsibility for the acquisition, delivery and distribution of food aid falls under two organisations, the United Nations High Commissioner for Refugees (UNHCR) and the World Food Programme (WFP) (Table 2). The major organisation responsible for resourcing food aid to refugees is the WFP. As per their guidelines, refugees are to receive foods that amount to a daily caloric intake of 2,100 kcal, regardless of the age and gender of the beneficiaries (UNHCR 2007). WFP supplies come in the form of two programmes: General Food Distribution (GFD) and Selective Feeding Programmes that are further divided into Supplementary Feeding and Therapeutic Feeding Programmes (UNHCR 2011). The former are intended to cover the needs of people with increased nutritional needs, such as children and women who are pregnant or lactating, whereas the latter are targeted towards the rehabilitation of severely malnourished individuals. The bulk of food aid, the GFD, consists of cereals, pulses and vegetable oil. Complementary foods are provided by the UNHCR (UNHCR 2007). The distribution of food to the refugees at the camp may be done via an implementing partner; WFP often makes use of NGOs as the last link in the distribution channel (Barrett and Maxwell 2005).

Table 2. Food aid

WFP commodities
Cereals
Edible oil
Pulses
Fortified blended foods
Iodized salt
Sugar
(High-energy biscuits)
UNHCR commodities
Complementary foods
Therapeutic foods
(Spices, condiments, tea)
Non-food items

3.2.3 From traditional foods to food aid

Traditional foods have a history of use in the communities eating them, and those communities have shared local knowledge on their cultivation and preparation (Onimawo 2010). The maintenance of traditional food habits and the provision of culturally acceptable foods to refugees is one of the goals of the aid agencies as specified in UNHCR (2007). While discontent with the quantity of food aid is often the main complaint, refugees may also feel that the international food aid does not meet their dietary preferences and that receiving the same food commodities over time makes the diet overly bland (UNHCR 2012). For these reasons, refugees often barter or trade off a portion of the food aid to obtain other, more desirable foods or non-food items - generally a beneficial practice that can increase dietary quality and diversity (Pierre-

Louis 2008). Additionally, refugees may rely on casual employment and small-scale farming to add to the food rations (UNHCR 2012).

Maintaining a diverse diet that also provides adequate micronutrients is often challenging for the refugees due to a lack of cultivable land and resources, while procurement and distribution of fresh foods is often logistically unfeasible for the aid agencies (Dye 2007). Because of this, micronutrient fortification of foods is a common nutrition strategy at refugee camps that has been shown to reduce malnutrition rates in contexts where maintaining a diverse diet is difficult (Dye 2007, Style e*t al*. 2013). Naturally, these fortified foods may bear little semblance to the refugees' traditional foods. Kodish *et al.* (2011) highlight how timely communication between the donors and the refugees - such as proposed health benefits and knowledge of ingredients - and culturally appropriate marketing strategies are needed for successfully incorporating novel foods in people's diets.

3.3. Edible insects for food security

Insects are a highly nutritious food source, ecologically superior to traditional livestock such as cattle and swine, and a traditional source of livelihoods in many parts of the developing world (FAO 2013). This chapter looks at the nutritional and ecological benefits of insect consumption, while the social and cultural aspects that may pose significant barriers to the practice are the subject of the next chapter.

3.3.1 Nutrient content

In developing countries, diets contain an average of 45 grams of protein per day, only 15 g which come from animal sources. In developed countries, the corresponding figure stands at 95 g/d, 60 % from animal sources (Tabassum-Abbasi *et al*. 2015). Regarding micronutrients, the lack of iron and zinc are core problems, with an estimated 40 % of children in developing countries being anaemic (Zielińska *et al*. 2015). Insects are rich in high-quality protein and micronutrients and can thus provide an alternative to meat as a source of nutrients (FAO 2013). Many species are also relatively high in calories, saturated fat and sodium compared to livestock, not necessarily negative aspects for food insecure populations in developing countries (Payne *et al.* 2015). Additionally, different species and even developmental stages of the same insect may vary considerably in terms of nutrient content (FAO 2013).

The nutrient content of the adult house cricket (*Acheta Domesticus*) based on two studies is shown in Table 3 on a dry weight basis. *A. Domesticus* is rich in protein, fat and energy. Adult cricket's moisture content is approximately 70 %. Iron and zinc were analysed at 6.3 mg/100 g and 21.8 mg/100 g dry weight (Finke 2002).

Table 3. Nutritional content of A. *Domesticus*, converted to dry basis (g/100g)

Protein	**Fat**	**Carbohydrate**	**Fibre**	**Ash**	**Energy (kcal/100g)**	**Source**
45.1	19.2	16.4	11.9	7.3	419	Yhoung-Aree *et al*. (2004)[a]
66.6	22.1	–	32.5	3.6	455	Finke (2002)

[a] based on the edible portion, calculated as 91 %

Zielińska *et al*. (2015) found similar results for two other *Orthoptera* species, *Gryllodes sigillatus* and *Schistocerca gregaria* with protein at 70.0 % and 76.0 %, fat at 18.2 % and 13.0 %, respectively. Protein quality was deemed satisfactory overall. Insect fats may also surpass beef and pork meat in quality by providing mostly unsaturated fatty acids. *G. Sigillatus* was found to contain 33.7 % unsaturated fatty acids, 34.3 % monounsaturated and 31.9 % polyunsaturated fatty acids (Zielińska *et al*. 2015).

3.3.2 Ecological sustainability

Rising concerns over the ecological pressures that agriculture exerts on land, increasing global demand for animal protein, and the continuing growth of the world population call for improvements in global food production systems (Lang and Heasman 2004). One of the reasons for promoting insects as human food is their ecological sustainability. While greenhouse gas emissions, water pollution, biodiversity loss and deforestation owe much to agriculture and livestock rearing, edible insects emit only a fraction of the greenhouse gases of livestock, are very efficient in converting feed to edible matter and require only little water and space (Byerlee *et al*. 2013, FAO 2013). While Lundy and Parrella (2015) cast some doubt on the feasibility of rearing crickets on low-quality diets, insects still seem to be many times more efficient than livestock at converting feed to edible matter, especially when taking into account that the edible portion of insects is generally very high (FAO 2013). Oonincx (2010) found insects to be a significantly climate-friendlier choice than livestock with respect to the emission of greenhouse gases and ammonia.

3.4 Food, culture and insect consumption

3.4.1 Culture, meals and food choice

Culture is the main determinant of food choice and modulates all else - the availability, prices and our general attitude toward foods all depend on cultural factors (Rozin 2006). While climate naturally sets boundaries on what can be grown and consumed feasibly in a specific area, cuisines are largely formed by cultural factors. These culture-wide food preferences are transmitted to children who then become socialized in their native cuisines and quickly learn which foods are appropriate, as well as the rhythm of meals, portion sizes and the social implications of food culture (Rozin 1996). Traditional foods are a part of these food cultures and, commonly, taste is commonly the major characteristic that separates them from other foods or, in the words of Guerrero e*t al*. (2009), 'tradition is tasteful'.

Some factors other than culture that affect food culture are listed in Table 4. To some degree, these not only stem from underlying cultural characteristics, such as in case of religious taboos, but also from individual factors as they relate to a person's life course: past experiences and self-image that shape people's personal values, attitudes, social position and education. The product-specific factors, however, are not related to people at all, but on the products themselves. These can be further divided into two categories: intrinsic characteristics that cannot be changed without altering the physical food product (taste, vitamin content, size), and extrinsic characteristics that can be freely manipulated (price, packaging, product information) (Wilkinson and Tijskens 2001).

Table 4. Food choice. Based on Urala and Lähteenmäki (2008)

Factor	**Examples**
Product-specific	Familiarity, price, ease of use
Demographic	Age, gender, education, profession
Psychological	Attitudes (on health, safety, etc.), beliefs, values
Social and economic	Social status, income
Religious	Food taboos, religious codes

Besides asking *what* people are eating, the *when, where* and *with whom* form the social context of meals (Kjærnes *et al.* 2001). In Douglas and Nicod's (1997) terminology, a *structured (food)*

event is a social occasion with rules concerning time, place and the sequence of actions and the food is eaten as a *meal*, whereas *food events* refer to any type of eating, including unstructured events termed *snacking*. Based on these considerations, Kjærnes *et al*. (2001) classified 'eating events' into four types based on the level of social interaction (Table 5). Individual meals may be had either at home or alone in public; social meals include family meals, at-home meals with friends and public eating in company. Meals and mealtimes are at the intersection of public and private (domestic) lives, and a similar distinction exists between social and individual eating, with the dissolution of regular meal patterns generally associated with the individualisation of eating (Kjærnes *et al*. 2001). Clearly a domestic meal shared by the family is a distinct social situation as opposed to a quick lunch or 'street food' eaten in public. In addition to sharing and eating the food, the acquisition of the ingredients and the preparation of the meal are also part of the social context (Kjærnes *et al.* 2001).

Table 5. The social context of eating (abridged from Kjærnes *et al.* 2001)

	Private	**Public**
Individual	Eating takes place in the home by oneself	Individual snack on the street or lunch at work; individual meal at a restaurant
Social	Family meal in a home; a meal with friends in a private home	A meal at a restaurant with company; lunch with colleagues

Anderson (2014) remarks on how food is used as a communication tool - for individuality and solidarity, class, ethnicity and other social positions. Sharing a family meal is deeply important in cultures all over the world. And while food creates solidarity and similarity, it can also separate by excluding those who do not belong in the same social, ethnic or religious group. Among migrants, food habits may persist for a long time - or they may disappear as people adjust to the food choices of the majority culture (Anderson 2014).

3.4.2 Insect consumption worldwide

While often aversive to western consumers, insects have been eaten by humans since prehistoric times and the practice remains common in many cultures around the world (Tabassum-Abbasi *et al*. 2015, DeFoliart 1999). From the economically highly developed Japan to many developing countries in Asia (Thailand, Cambodia), Africa (Congo, Kenya) and Latin America (Mexico),

countries worldwide provide examples of food cultures that regard insects as highly desirable foods (FAO 2013). Against this backdrop, DeFoliart (1999) urges a caution against dietary westernization, i.e. the erosion of traditional food cultures and the adoption of western food habits that may eject barriers against insect-eating in people that have previously engaged in it. While in some countries, such as Thailand, insects are consumed by both rural and urban people, in many countries the practice is more restricted to rural populations (DeFoliart 1999, Yhoung-Aree *et al*. 2004).

In a review on worldwide inset consumption, Tabassum-Abbasi *et al*. (2015) state that over 2,000 species of insects continue to be eaten in over 80 countries around the world. On the African continent, over 470 species of insects are eaten, most commonly from the taxonomic orders *Lepidoptera* (moths, butterflies), *Orthoptera* (grasshoppers, crickets) and *Coleoptera* (beetles). The practice is most common in the central African region, where there were 256 recorded species, and rarest in Northern Africa with only 8 consumed species, according to Kelemu *et al*. (2015). The central region covers countries such as the Democratic Republic of the Congo (DRC), Congo, Nigeria, Central African Republic and Zambia. In DRC, for example, locusts, grasshoppers and moths are consumed. In Eastern Africa, contemporarily consumed insects include locusts (*Locusta migratoria migratorioides*) and ants (*Carebara lignata*) in regions of Sudan and South Sudan, grasshoppers (*Ruspolia differens*) and ants (*Carebara vidua*) in Kenya and *Schistocerca gregaria*, the desert locust, in Somalia (Kelemu *et al.* 2015). Crickets (*Gryllus bimaculatus*) are used as food in some parts of Kenya and South Sudan.

Culinary techniques for insects include some commonly used food preparation methods, such as roasting and baking. For example, in Thailand house crickets (*Acheta Domesticus*) are gathered in the night or in the morning when they are less active, de-winged, have their internal organs removed and can then be roasted, baked or deep fried (Yhoung-Aree *et al*. 2004). House crickets are easy to farm, can produce 6 to 7 generation per year, eat a range of organic materials and ideally live in high temperatures between 28 and 30 °C (Makkar *et al*. 2014).

3.4.3 Aversion to edible insects

'*The last and critical step in promoting insects as food is getting people to eat them*'

Paul Rozin according to Jansson and Berggren (2015)

In western societies, the consumption of insects as human food is often viewed as disgusting or even primitive behaviour (Jansson and Berggren 2015). This is in spite of people eating many other foods that bear similarity to insects, such as snails and shrimp. Paul Rozin, a much-cited psychologist with a long history of research on food choice, attaches disgust to human's cultural evolution: disgusting foods are those that are rejected on ideational grounds to create distance between humans and their animal-nature (Rozin 2006). Furthermore, even in those countries where some insect species are a well-regarded food, people commonly limit themselves to a limited number of species and may find the idea of eating any other insects deeply distasteful (Evans *et al*. 2015).

A report on insect consumption worldwide by FAO (2013) emphasizes availability and learning as crucial factors affecting insect acceptance. The form in which insects are served to different consumers is also vital. For example, chocolate-covered bees and ice lollies with whole insects have been created to be visually appealing insect foods (Jansson and Berggren 2015). To decrease people's ideational disgust on consuming whole insects, foods such as protein bars and muffins with powdered insects have been made (Yates-Doerr 2015, Jansson and Berggren 2015). Such foods, bordering the line between the exotic and the familiar, are likely to appear more palatable to consumers than whole, visible insects.

4 RESEARCH LOCATION

4.1 Horn of Africa

The Horn of Africa refers a group of countries in Eastern Africa that includes Somalia, Ethiopia, Sudan, South Sudan and Kenya (SDC 2016). A drought-prone area characterized by food insecurity, the population relies heavily on subsistence farming, with 15 to 20 million people being nomadic herders (ICAI 2013a). There are over 10 million food insecure people and 1.7 million refugees in the region (ECHO 2016). While the environmental challenges are common to all the states, the political contexts are varied. Sudan and South Sudan, which seceded as its own

independent state in 2011, have experienced decades of civil war, with the Darfur region in Sudan being the centre of the worst conflicts (ICAI 2013b). Somalia has not had an effective government in over two decades and the terrorist group Al-Shabaab is responsible for continuing conflicts and violence in the south of the country (ICAI 2013a). Kenya and Ethiopia are the most economically developed states in the region.

Much of the conflicts between the south and the north in Sudan in previous years were religious in nature, the northern tribes being mostly Muslim (such as the Nuba) and Arab (Al-Fur) in origin, while the Dinka and Nuer in the now-independent South Sudan are Christian with African origins (Neufeld Redekop 2011). Contrary to this patchwork of ethnicities, Somalia and its clans are remarkably homogenous both ethnically, culturally and linguistically, with only the Bantu minority in Southern Somalia (Jubaland) being distinct from ethnic Somalis (Stranglio 2012). The major clans of Somalia, Dir, Isaaq, Darod and Hawiye, are nomadic herders, while the Rahanweyn and the Bantu are agriculturalist (Stranglio 2012).

A significant number of refugees in the Horn of Africa have sought asylum in Kenya. The largest refugee camp in the world, Dadaab, is located in eastern Kenya and hosts over 400,000 people from Somalia (UNHCR 2015b). Kakuma in Northwestern Kenya is home to approximately 190,000 refugees, mostly from South Sudan and Somalia.

4.2 Kakuma refugee camp

4.2.1 Demographics

Founded in 1992 to host Sudanese asylum-seekers fleeing to Kenya, Kakuma refugee camp has grown from the initial 23,000 to over 190,000 inhabitants in spring 2016 (WFP 2014, Jamal 2000, UNHCR 2016). At the same time, the refugee camp has spread from one camp (now called Kakuma 1) to four camps (see Appendix 2 for a map of the refugee camp). The residential areas are further divided into zones and blocks. To decongest the camps, UNHCR and the Turkana government reached an agreement in 2015 to set up new camps at the nearby Kalobeyei, although these plans have not been realized (NRC 2016).

In spring 2016, half of the refugees were South Sudanese. Somali constitute 28.5 % and Sudanese and Congolese (DRC) 5 to 6 %, followed by other nationalities (UNHCR 2015b). An

ethnic and age-class summarization is presented in Table 6. Over half of the refugees (56 %) are under the age of 18. Compared to previous year, there has been an influx of South Sudanese asylum-seekers and a small decrease in the number of Somali at the camp (UNHCR 2015b).

Table 6. Refugees at Kakuma in May 2016 by age group and nationality[a] (UNHCR 2016a)

	0-4 y	**5-11 y**	**12-17 y**	**18-59 y**	**60+ y**	**%**
SSD	13,792	26,941	21,444	36,057	1,481	52.1
SOM	7,496	11,149	8,498	26,257	1,071	28.5
SUD	752	1,645	2,196	5,962	33	5.5
DRC	901	2,212	1,439	4,433	63	5.2
ETH	1,035	1,181	910	4,343	74	3.9
Others	2,324	1,772	1,107	4,790	98	4.7
Total	26,300	44,900	35,594	81,842	2,820	100 %

SSD = South Sudan, SOM = Somalia, SUD = Sudan, DRC = Democratic Republic of the Congo, ETH = Ethiopia
[a] Regarding gender, 53.8 % of the refugees are men and 46.2 % women. In the 60+ age group, 2/3 are women (UNHCR 2015b)

4.2.2 Food, land and livelihoods

In general, food security in Kenya is constrained by high input costs, dysfunctional markets, inappropriate land use management and vast post-harvest spoilage, especially in the semi-arid and arid areas (WFP 2014). Global Acute Malnutrition (GAM) and Severe Acute Malnutrition (SAM) rates at Kakuma refugee camp in 2015 were at 20.5 % and 11.1 %, a sharp rise from the GAM rate of 7.9 % in 2013 and likely due to the influx of South Sudanese asylum-seekers (UNHCR 2014, UNHCR 2015a)[2]. Anaemia is a major public health concern, as two out of every three children are anaemic (WFP 2014). Among the local Turkana, even higher rates of malnutrition have been reported, with a GAM rate of 28.7 % in the west of the county (UNHCR 2014). At the refugee camp, crude mortality and underage mortality rates stood at 0.2/10,000/day and 0.07/10,000/day in 2016 (UNHCR 2016b).

Employment opportunities at the camp are scarce. Income-generating activities for women at the camp include cooking and selling food for markets and restaurants at the camp, cleaning and fetching firewood. Jobs for men include small-scale business-keeping, waiting, transport services

[2] The anthropometric data cannot be presented here, because the UN reports on nutritional assessments at Kakuma only present the change in SAM/GAM rates over the years, not the data the results are based on.

and work in carpentry or mechanics (WFP 2014). Education opportunities for children consist of pre-schools (25 % enrollment rate), elementary schools (65 %) and secondary education (2 %) (UNHCR 2015a). Eking out a livelihood from animal husbandry or agriculture is impossible or unfeasible due to restrictions on the refugees' rights in Kenya and the inhospitable climate (Jamal 2000). Regular droughts and famines are part of life in Turkana county (IRC 2011). Kenyan refugee policy offers very limited opportunities for refugees to integrate into the wider economic and social life in the country (WFP 2014). The fragile security situation seriously undermines the capacity for refugees to be resettled in their countries of origin (UNHCR 2015c).

Among the local Turkana living in Kakuma town and the surroundings, food security is even more compromised than for the refugees. While there have been some tensions over locals begrudging the refugees over the services provided to the latter, the locals also benefit from the refugees greatly by having access to the markets at the camp, both as buyers and sellers of foods (IRC 2011, WFP 2014). In fact, the poorest Turkana, who commonly have no livestock, crops or disposable income, rely largely on the sale of charcoal and fuelwood as their main livelihood, with the refugee camp being an important marketplace (WAC 2015). Nearly 90 % of people in Turkana county live below the poverty line (Katindi 2013).

4.3 Food aid and markets

This chapter details how the refugees procure food at the camp. Most of the data is gathered from reports by UN agencies. When no source is cited, the data is based on personal observations and interviews at the camp.

4.3.1 Food aid programmes

The General Food Distribution (GFD) for a single-person household in April 2016 consisted of 6.3 kg of cereals, 1.8 kg of pulses (peas), Corn-Soya Blend (CSB+) (1.2 kg), vegetable oil (1.05 kg) and salt dealt out on the first week of the month. Larger households received the same amount of CSB, peas and oil multiplied by headcount, while the amounts of maize and sorghum were slightly higher (see page 20). Additionally, the refugees received cash via a mobile pay system (*bamba chakula*, 'food airtime') for purchasing foods at the camp's markets at the end of the month. Single-person households received 500 KES (4.40 EUR) monthly, households larger than that 300 KES, multiplied by headcount. Pregnant mothers and children under the age of four

received an additional allotment, CSB++. Both the CSB+ and CSB++ are maize and soya blends fortified with vitamins and minerals and prepared as porridge. The terms 'Supercereal' and 'Supercereal Plus' are also used. Here in the thesis they are referred to as CSB+ and CSB++, which was also the terminology used at the refugee camp.

Due to budget cuts, the GFD underwent changes in 2015 compared to the quantities in 2014 (Table 7). The amount of cereals had been reduced from 12.6 kg/month to 6.3 kg/month, or from 420 g/day to 210 g/day, reducing overall food quantity over 30 %. *Bamba chakula* was introduced to increase access to fresh foods (WFP 2015b). Additionally, the distribution cycle was reduced from bimonthly to once-per-month distributions at the first week of every month.

Table 7. Existing food programmes at Kakuma refugee camp in 2014. Abridged from UNCHR (2014)

Programme	**Food basket (g/day)**	**Energy (kcal/day)**	**Beneficiaries**	**Responsible partner** [a]
General Food Distribution (GFD)	Cereals 420 Pulses 60 Supercereal 40 Veg. oil 35 Salt 5	2,100	Everyone regardless of age or gender	World Vision NRC
Blanket supplementary feeding (BSFP)	Supercereal Plus 215	846	Young children 6-23 months	IRC
School Meals programme (SMP)	Supercereal 80 Veg. oil 10	445	School children	LWF
SMP - take home rations	Sugar 500 g/month	66	School children	LWF
Food for Training (FFT)	Cereals 130 Pulses 30 Veg. oil 10 Salt 5	667	People in vocational training	St. Claire Don Bosco
MCH & N	Supercereal, 80 Veg. oil, 10	433	Pregnant and lactating mothers	IRC
Supplementary Feeding	Supercereal 250 Veg. oil 25	1,160	Children < 5 years	IRC
Outpatient Therapeutic Programme, SAM	150 g sachets per child	550 kcal/100g	Malnourished patients	IRC
Hospital feeding	Cereals 420 Pulses 60 CSB+ 40 Veg. oil 35 Salt 5	2,100	Hospitalized patients	IRC
Special cases (TB, HIV)	CSB+ 40 Veg. oil 10	648	People with increased nutritional needs	IRC
Food for Assets	Cereals 375 Pulses 60 Veg. oil 30 Salt 5	1,733	Host communities	TRP

[a] NRC = Norwegian Refugee Council, IRC = International Rescue Committee, LWF = Lutheran World Federation, TRP = Turkana Rehabilitation Project

4.3.2 Markets and food expenditure

The monetization of food aid, i.e. the exchange and trade of the food for other foods or goods, a common phenomenon at refugee camps as detailed by Pierre-Louis (2008), regularly occurs at Kakuma refugee camp, too. Dietary diversity is sought by selling a portion of the food aid to purchase, for example, vegetables, milk, meat and fish from markets and restaurants at the camp (WFP 2014). With *bamba chakula*, the refugees can access these foods with less need to barter away the food aid at poor terms of trade (WFP 2015b).

According to WFP (2015), refugees spend roughly 60 to 70 % of their income on food, although UNHCR (2014) data from 2013 puts the number at a lower 57 %. Non-food goods such as electricity, hygienic products, cooking and household items rarely amount to more than a few percent of their overall expenditure (UNHCR 2014). Two thirds of the money for food purchases is spent on sugar, meat, milk and vegetables (Fig. 1). A very small number of the refugees also have small personal gardens for growing green vegetables.

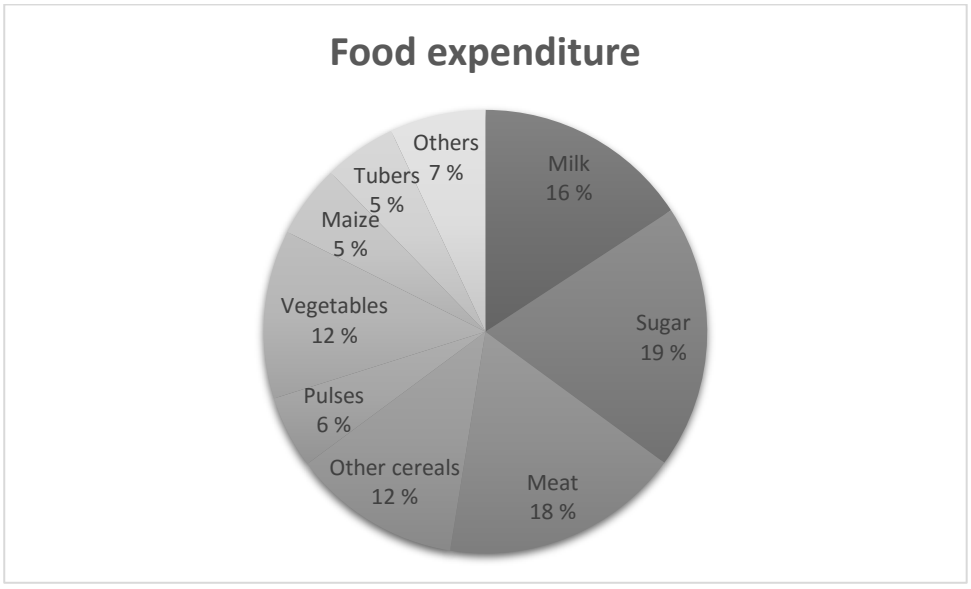


Fig. 1. Food expenditure based on UNHCR (2014)





First row: Houses of refugees; a Turkana dwelling near Kakuma town
Second row: A view of Tarach river in Kakuma; Turkana goats feeding at a rubbish heap
Third row: A satellite image of Kakuma refugee camp (Google Earth 2016); Food Distribution Centre at Kakuma 1

First row: Peas, sorghum and maize for refugees; the cricket biscuits used in the study
Second row: The cup used to assess food intake in the study; a Turkana child eating goat skin
Third row: The refugees' food allotment in April 2016. A single-person household received 10.5 kg/month, larger families 13.02 kg/month for every additional family member

5 METHODOLOGY

5.1 Data collection and sampling

The study consisted of four datasets, the dietary assessment using the 24-Hour Recall (24HR) and Food Frequency Questionnaire (FFQ), sensory evaluation questionnaire (SEQ) of a cricket-based food and a survey on dietary histories and insect consumption. The data were collected between 29/3/2016 and 2/5/2016 (Fig. 2). All questionnaires are presented in Appendix 1.

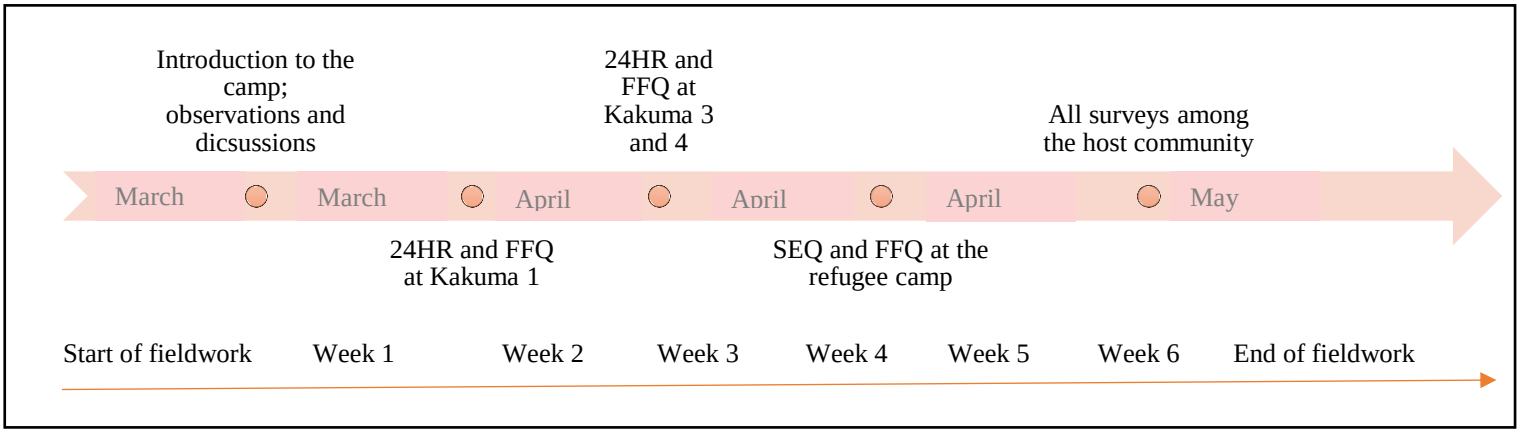


Fig. 2. Schematic of data collection timeline

5.1.2 Sampling

Kakuma refugee camp covers approximately 12 square kilometres of land (UNHCR 2014b) and is spread out across four distinct camps. Each camp is divided into zones and further into blocks. Clusters of adult refugees were chosen from camps 1, 3 and 4 to reflect the ethnic composition of the refugee population, since South Sudanese and Somali are by far the largest nationalities. Regarding gender, women were preferentially selected at household level due to their more vulnerable nutritional status in general and potentially better knowledge of household food consumption. Additionally, for the SEQ, clusters of Congolese, Sudanese and Somali Bantu respondents were chosen to investigate potential insect use among these minority groups. A cluster of refugees employed to an NGO at the camp was purposefully selected from refugees working at the Food Distribution Centre in Kakuma 1 to compare nutrient intake between these people and the other, non-employed or self-employed, refugees. The underage refugees, whose

mothers filled out the 24HR on their behalf, were randomly selected from the adult 24HR respondents.

Households within the zones and blocks were spread out in a haphazard manner and sometimes multiple households occupied the same compound, fenced off from the public areas. Sampling within the selected zones and blocks was done by visiting households in the area until the selected number of respondents (10 to 15 per day) had been reached. Kakuma town, where the Kenyan Turkana live, is located 1 km from the camp. Three locations located around the town were chosen for the questionnaires, approximately 500 metres to 1 kilometre away from each other and each with 8 to 10 respondents.

Details on sampling geography and cluster sizes at the refugee camps are presented in Appendices 2 and 3.

5.2 Measures

Participants in the selected locations were approached in their homes, given an introduction to the study and the responsible organizations and asked if they were willing to participate in the study. Further ethical consent was requested for the SEQ due to the insects and allergens in the food product. All the questionnaires are presented in Appendix 1. Questionnaires were in English (SEQ also in Swahili) and administered via interpreters. The languages of interview were Acholi, Arabic, Didinga, Dinka, English, Maay Maay, Somali, Swahili and Turkana.

5.2.1 Dietary measures

Dietary diversity was assessed using a 17-item Food Frequency Questionnaire in which consumption was recorded as 5-6 times a week, 3-4 times a week, 1-2 times a week, 2-3 times a month, once a month and never. Daily nutrient intake was evaluated with the 24-Hour Recall with quantities measured using locally available kitchenware. First, respondents were asked which meals (breakfast, lunch and dinner) they had eaten on the previous day and at what time; after that, they were asked to list the meal items one by one and thirdly, to evaluate the amounts of each food using a cup as visual aid. Lastly, the respondents were asked if any snacking had taken place between meals and if they had eaten anything outside the home. Since all refugees were provided with 1.2 kg of cooking oil monthly, it was extrapolated from that that the fat daily

fat intake would be at least 35 grams[3], as calculated by WFP (table 6). The programme NutriSurvey was used to calculate individual dietary intake. The standard food database available at the NutriSurvey site (*http://www.nutrisurvey.de*), elaborated with a Kenyan food database from the same website were used as sources for the nutrient data. Data on the highly fortified Corn-Soya Blend (CSB+) came from WFP (2016) and USDA (2008). The cooking oil was enriched with vitamins A and D, but there was no information on the level of fortification.

Dietary histories were collected with a short questionnaire on previous staple foods and possible history of insect consumption. This survey acted as a prelude to the sensory evaluation of the experimental food.

Additional information on the respondents' background and socio-economic characteristics, such as literacy, employment and household size, was collected from all respondents. The questionnaires were pilot-tested at the refugee camp and changes were made to the FFQ to better reflect the food aid and market goods at the camp.

5.2.2 Sensory evaluation measures

The experimental food was a wheat-flour biscuit with 10 w-% powdered crickets, prepared at JKUAT. Following the dietary history survey, participants rated their willingness to eat insects on a five-point scale, after which they were shown the biscuits, informed of the contents showing a photograph of *Acheta Domesticus*, briefed of the aims of the study and asked if they wished to participate in the research.

The sensory evaluation was carried out using a five-point, anchored, unipolar degree of liking scale ranging from 'do not like at all' to 'like a lot'. The biscuit was evaluated based on smell, taste and overall liking, after which the respondents were asked how willing they would be to include the biscuit in their diet. Evaluations were carried out in the respondents' homes.

[3] Some people complained that the oil did not last the whole month. However, since it was provided in single tin cans, it seems unlikely that people could easily have sold any of it, making it more justifiable to assume a consistent intake here.

5.3 Statistical analyses

Descriptive statistics, including minimum and maximum values, means and standard deviations, were calculated as the first step of statistical analysis. Normalcy of the data was assessed with the Shapiro-Wilk test and Q–Q plots. Differences in nutrient intake were tested between refugees living at different camps, employed and non-employed refugees and different ethnic groups using Analysis of Variance (ANOVA) and the non-parametric Mann-Whitney U-test. The same non-parametric was used to assess the SEQ results between respondents who had eaten insects in their home countries and those who had not. Statistical analyses were performed using IBM SPSS Statistics 20.

6 RESULTS

6.1. Characteristics of the participants

The characteristics of the refugees and members of the host community who took part in the study are presented in two sections. The first section is on socio-economic statistics, while the second section describes the respondents living conditions and diversity of income-generating activities. The survey with the largest sample size was the FFQ (n=181), followed by 24HR (n=109) and SEQ (n=71). In addition to this, 26 Turkana living in Kakuma town filled out all three questionnaires and 18 refugees employed for an NGO at the camp answered the 24HR and FFQ. The mothers of 30 underage refugees were requested to fill out the 24HR on behalf of their children, raising the total number of individuals who participated in the study to 255.

6.1.1 Descriptive statistics

Characteristics of the adult respondents are presented in Table 8. The respondents were primarily women (approximately 80 %) and chosen to reflect the dominant ethnic groups among the refugees. The small number of Sudanese respondents (n=12) have been grouped together with the South Sudanese. The oldest camp, Kakuma 1, housed many of the earliest arrivals who had arrived on average 6 years earlier than those at the more recent camps. Literacy rates were 43 % at camp 1, 30 % at camps 3 and 4 and 65 % in the host community. Male refugees were significantly more literate, 89 % compared to women's 29 %. Refugees with a history of school attendance had spent an average of 6 years in primary school (full duration 8 years) and 3 years

in secondary school (full duration 4 years). Overall, counting the non-attendees, the average refugee had gone to school for 3 years. Turkana literacy and education rates were significantly higher, 65 % literacy and 72 % school attendance. The average household size was 7 at the camp and 10 in the host community, with largest households having 17 and 20 members at the camp and in the host community, respectively. Male-headed households accounted for slightly more than one third of all families at the camp and three fourths in the host community. All single-person households consisted of men, mostly under the age of 30. The South Sudanese originated from different parts of their country, but most commonly from Eastern Equatoria (regional capital Torit) and Jonglei (Bor). The Somali refugees came from the south of the country, especially Kismayo in Jubaland and the capital, Mogadishu.

Table 8. Characteristics of adult respondents[a]

Characteristic	**All respondents (n=205)**	**Kakuma 1 (n=105)**	**Kakuma 3 and 4 (n=74)**	**Host community (n=26)**
Female, %	82 %	80 %	83 %	81 %
Nationality	SSD/SUD 50 % SOM 31.9 % KEN 13.2 % DRC/ETH/UGA 5.4 %	SSD/SUD 51 % SOM 36 % DRC/ETH/UGA 13 %	SSD/SUD 63 % SOM 37 %	KEN 100 %
Age, y[bc]	30.3 ± 9.5 (18-60)	29.6 ± 8.9 (18-60)	32.8 ± 9.7 (18-60)	27.2 ± 9.5 (19-49)
Duration of stay, y[b]		11 (24-1)	5 (16-1)	
Literacy, %	40 %	43 %	30 %	65 %
Education[d], %	45 %	45 %	35 %	72 %
Primary school[be]	6 ± 2 (1-8)	6 ± 2 (1-8)	6 ± 2 (1-8)	6 ± 2 (1-8)
Secondary school[be]	3 ± 1 (1-4)	3 ± 2 (1-4)	3 ± 2 (1-4)	4 ± 0.4 (3-4)
Household size[c]	7.8 ± 4.0 (1-20)	7.3 ± 3.9 (1-17)	7.6 ± 3.6 (1-17)	10.0 ± 4.7 (2-20)
Male head of household	45 %	39 %	36 %	75 %

[a] Excluding the purposeful sample of 18 refugees formally employed to an NGO
[b] Mean and standard deviation, range in parentheses
[c] For cultural reasons, age was not asked from Somali women
[d] Percentage of those who had attended school for any length of time
[e] Number of school years for those who had attended school

Underage refugees (n=30) ranged from 1 to 14 years of age, 28 % of whom had been born at the refugee camp (Table 9). School attendance for children aged 7 or more stood at 75 %.

Table 9. Underage refugees

Characteristic	**Respondents**	
	1-6 y (n=18)	7-15 y (n=12)
Female	24 %	33 %
Age, y[a]	5 (1-6)	11 (7-14)
Nationality	SSD/SUD 76 % SOM 12 % UGA/ETH 12 %	SOM 50 % SSD/SUD 42 % UGA 8 %
Duration of stay, y[a]	2 (6-1)	5 (9-2)
Born in the camp	30 %	25 %
School enrolment rate		75 %

[a] Mean and standard deviation, range in parentheses

The purposeful sample of 18 refugees employed to an NGO, who aided in food distribution at the camp, had a school attendance and literacy rate of 56 % (Table 10).

Table 10. Refugees employed to an NGO

Characteristic	**Respondents (n=18)**
Women	69 %
Age, y[a]	32 ± 7 (22-44)
Nationality	SOM 50 % SSD 38 % DRC/ETC 12 %
Duration of stay, y[a]	11 (23-2)
Literacy	56 %
Education[b]	56 %
Duration of school, y[ac]	9 ± 2 (6-11)
Household size[a]	6 ± 3 (1-12)
Male head of household	38 %

[a] Mean and standard deviation, range in parentheses
[b] Percentage of those who had attended school for any length of time
[c] Duration of education for school attendees

6.1.2 Surroundings and livelihoods

The refugee camp had characteristics of both urban and rural settings. Like an urban area, the camp was geographically sharply defined, with a population of approximately 190,000. Food, clothes, electronics and other goods could be bought from markets at the camp. The tin-roofed houses of the refugees, commonly separated by dried shrubs as privacy fences, were more characteristic of a rural setting. The very newest arrivals at Kakuma 4 lived in tents provided by UNHRC, but among the study participants even the newest arrivals lived in houses. In the host community, many of the Turkana, including those who participated in the study, slept in small,

huts made out of dry saplings, beaten out tin cans, cardboard and plastic wrapping. Communal taps provided the refugees with water and both refugee and host community households commonly had latrines donated by an international NGO.

Nearly all of the refugees from both sexes who did not work for one of the NGOs stated that they were unemployed. Four respondents worked as teachers, two as shopkeepers and one as a baker. Among the Turkana, 21 % of the respondents stated they were employed[4], while an additional 30 % did on-and-off work at the refugee camp in exchange for money or food. These tasks included collecting firewood and washing clothes for the refugee families.

6.2 Eating in the refugee camp

6.2.1 Food aid and everyday diets

The collection of GFD from the distribution centres took place on the first week of the month. Each camp had their own centre where a member of the household would queue to have their fingerprints checked and to collect the monthly food allotment. Food advisory committees consisting of refugees were tasked at linking up the refugees with the agencies.

Breakfast foods for the Somali were *injera* and/or porridge made from CSB+, while the South Sudanese and Sudanese ate porridges, either CSB+, maize or sorghum, for breakfast. There was no mention of any other breakfast foods in the 24HR. The selection of lunch and dinner foods (Tables 11 and 12) was more varied and also more culturally mandated. Core staple foods were maize grain and ugali, protein sources peas and beans. Meals usually consisted of only two different food items, the main dish and a staple that were only rarely accompanied by vegetables other than onions. In all instances when a meal included bread, it was used as a replacement for the staple food.

[4] Two teachers, two motorbike taxi drivers and one shopkeeper

Table 11. Typical lunch and dinner foods at the refugee camp

Category	**Components**
Main dish	Split yellow peas, beans, *githeri*
Staple	Maize grain, ugali, rice, pasta, *kisra*, *wal wal*
Vegetables	Onions, *sukuma-wiki*, *kudra*, tomato
Bread	*Injera, chapati*

Githeri is a mixture of cooked maize and beans, common in Kenyan cuisine. *Kisra* is a fermented wheat bread eaten in Sudan and South Sudan, while *wal wal* is a sorghum food from the same region. *Sukuma-wiki* is an East African dish of braised kale and *kudra* a green leafy vegetable. *Injera* and *chapati* are flatbreads, the former being a key ingredient in Ethiopian and Somali cuisines, where it is called *lahooh* or *saabayad*, but completely absent in the Sudanese and South Sudanese diet. Split peas are peas that have been halved so they cook faster and require no soaking.

The WFP food basket dominated the South Sudanese and Sudanese food use; ugali and peas accounted for 60 % of the food items mentioned in the 24HR (Table 12). The Somali had eaten more market-bought foods: rice, maize grain and beans were the most oft-cited lunch and dinner foods in the 24HR. Bread selection was strictly dependent on culture: *kisra*, a wheat bread, was eaten by the South Sudanese and Sudanese and *injera*, made from maize flour with a small amount of wheat, was eaten by the Somali. Vegetables were rarely mentioned and meat only twice. Fish and fruit were never mentioned in the 24HR by the unemployed refugees. For the Turkana, g*itheri* or plain cooked maize grain accounted for over 80 % of the foods that came up in the 24HRs. Children's foods did not differ from what the adults ate.

Table 12. Relative frequency (%) of all foods that were mentioned in the 24HR by nationalities[a]

	SSD/SUD (n=55)	SOM (n=28)	KEN (n=26)
Peas	36	6	4
Ugali	24	0	0
CSB+	21	13	0
Kisra	5	0	0
Githeri	5	10	48
Sorghum	4	0	0
Porridge	3	0	0
Vegetables	2	8	0
Rice	0	18	4
Beans	0	12	4
Maize grain	0	12	39
Injera	0	21	0
Meat	<1	<1	0

[a] Excluding the sample of refugees working for an NGO
SSD/SUD = South Sudanese and Sudanese, SOM = Somali, KEN = Kenya (Turkana)

Virtually every Somali expressed disgust at eating sorghum, a food they considered alien to their culture. The most common complaint was stomach pains following its digestion, along with unpleasant taste[5]. No such compunctions existed for the South Sudanese or Sudanese, whose traditional diet included sorghum.

Beverages were rarely brought up by the respondents. Tea was available in markets and coffee could be bought in restaurants. A fruit-flavoured drink powder fortified with vitamin C that was blended in water was sold in most shops and kiosks. An alcoholic drink, *changaa* (a distilled spirit made out of maize) was at least somewhat available. The mildly narcotic plant *khat* was sold in markets.

Practically all food was consumed in private as family meals, and little food was eaten outside the home. Public eating in restaurants appeared quite uncommon and was considered somewhat socially undesirable for women. None of the 24HR respondents mentioned having eaten anything outside the home, other than one cup of coffee. The selection of 'street food' was very limited. According to Turkana customs, food was not to be eaten on the move, although it is unclear how widely this was adhered to.

6.2.2 Market foods

Market prices for foodstuffs such as rice, beans, pasta and onions were generally between 70 to 120 KSH per kg at the refugee camp according to the market traders (Fig. 3).

According to the refugees, those who sold off a portion of the food aid to markets at the camp received between 10 to 30 KSH/kg for CSB+, maize and sorghum. Milling the food aid maize to make flour for ugali was an additional cost.

[5] Following the 24HR, 37 Somali were asked if they like sorghum. A whopping 53 % of them maintained that it causes stomach pains for them or their children, while most other respondents mentioned unpleasant taste as the main reason for their dislike. Only two of the Somali said they liked eating sorghum. The South Sudanese viewed the food in completely opposite terms: out of 20 respondents, 19 stated they liked eating sorghum.

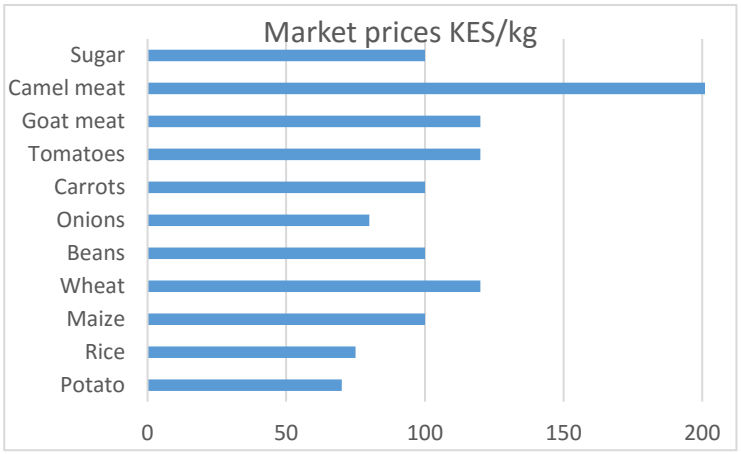


Fig. 3. Market prices at Kakuma 1 for some common foods in April. Camel meat sold for 480 KES. 100 KES = 0.88 EUR.

Bamba chakula was distributed at the end of the month and made it possible for even the poorest households to access a portion of food from the camp's markets. Nearly everyone was happy with the programme – a question included in the 24HR – although individual respondents reported technical issues, problems with the traders selling poor-quality food to those using *bamba chakula*, and worry that the quantity of food aid would be reduced due to the programme.

6.2.3 Coping with food shortage

Limiting portion sizes and skipping meals was the ubiquitous coping strategy at the camp and in the host community, evident from the 24HR data. Lunch was the most often skipped meal at the camp, whereas in the host community very few people could afford enough food for two meals per day – only 8 % of the 24HR respondents had eaten two meals and none of the 26 people had been able to eat breakfast on the day before the interview (Appendix 4). Food shortage was highest at the end of the month, with only 4 % of the South Sudanese who had been interviewed on the last week of the month (n=28) having eaten three meals on the day before asking. In the middle of the month, the number of South Sudanese respondents who had afforded three meals per day stood at 46 % in a different cluster. For the Somali, 45 % and 67 % of the respondents had eaten three meals the day before the interview in camp 1 on one hand and camps 3 and 4 on the other. The respondents could easily articulate that the disparity in meal frequency between the two groups was based on ethnic differences - the South Sudanese preferred to eat fewer, but larger, meals, whereas the Somali ate smaller meals more often. Sometimes the Somali saved some of their breakfast foods - porridge or *injera* - for dinner.

Going an entire day without eating was very rare. This was recorded twice in the refugee camp and twice in the host community based on the 24HRs. However, the Turkana sample was 5 times smaller (n=26) than the sample of the refugees (n=132). While very few of the 24HR respondents admitted to begging for food from neighbours on occasion, others maintained that it was not an option as everyone was already short of food.

6.3 Nutrient intake and dietary diversity

6.3.1 Daily nutrient intake

Overall, the intake of key nutrients either generally fell below the estimated average requirements or bordered on acceptable (Table 13). The host community's nutrient intake was consistently lower, in some cases a mere fraction, of the refugees' intake. Data on women's nutrient intake was mostly normally distributed and, based on the Q–Q-plots for the non-normally distributed variables, parametric methods were used and the results confirmed with a non-parametric method.

Table 13. Intake of central nutrients and energy among refugee and host community women

Nutrient	**Women**			
	Refugees (n=88)		**Host community (n=25)**	
	Mean (SD)	**Median (range)**	**Mean (SD)**	**Median (range)**
Energy, kcal	1,282 (665)	1,120 (0-3,345)	182 (93)	173 (0-385)
Protein, g	33.5 (18.9)	30.3 (0-106.2)	7.6 (6.4)	7.7 (0-32.6)
Fat, g	44.2 (6.5)	43.4 (35.0-63.4)	2.4 (2.7)	2 (0-14.2)
Fibre, g	25.1 (19.2)	20.0 (0-39)	6.4 (3.3)	6.4 (0-12.8)
Vitamin A, µg	396 (306)	349 (0-1,039)	49.8 (48.6)	49.8 (0-168)
Vitamin B1, mg	1.1 (0.8)	1.0 (0-3.8)	0.3 (0.2)	0.4 (0.7)
Vitamin C, mg	53.8 (35.2)	52.9 (0-148)	20.5 (15.2)	18.0 (0-68)
Iron, mg	11.7 (7.7)	10.5(0-36.3)	1.6 (0.9)	1.8 (0-3.6)
Zinc, mg	6.1 (3.6)	5.7 (0-15.90)	1.2 (1.1)	1.2 (0-5.8)

Consistently the highest nutrient intake was found among women from camps 3 and 4 (Appendix 5). The difference was significant ($p<0.005$) for all nutrients besides fat and vitamin A, based on one-way ANOVA. The results were confirmed with the non-parametric Mann-Whitney U-test to the same end. Likewise, when comparing South Sudanese/Sudanese respondents from Kakuma 1 (n=34) to those from Kakuma 3 and 4 (n=21), the differences were significant (p-value<0.005) for everything besides energy (p-value 0.005), fat and vitamin A (the Somali sample size would have been too small for comparison). Using one-way ANOVA, the

difference in nutrient intake between the Somali and South Sudanese/Sudanese respondents (Appendix 5) was not statistically significant for any macronutrient, but differed significantly ($p<0.005$) for fibre, iron and zinc, although zinc was not significantly different using the Mann-Whitney U-test.

Men's nutrient intake was slightly lower than women's (Table 14), although the difference was not statistically significant at a 95 % confidence level.

Table 14. Intake of central nutrients and energy among refugee men

Nutrient	**Men (n=16)**	
	Mean (SD)	**Median (range)**
Energy, kcal	1,139 (419)	1,111 (544-2,173)
Protein, g	29.4 (16.2)	25.7 (7.1-63.9)
Fat, g	44.0 (12.1)	40.2 (36.2-84.7)
Fibre, g	21.1 (17.2)	18.4 (3-69.6)
Vitamin A µg	290 (319)	176 (5.4-960)
Vitamin B1, mg	0.9 (0.7)	0.8 (0.1-2.5)
Vitamin C, mg	44.4 (40.9)	34.8 (0-156)
Iron, mg	8.7 (6.3)	7.11.3-24.8)
Zinc, mg	4.7 (2.9)	4.0 (0.9-11.2)

Children's dietary intake was similarly lacking as the adults'. Dietary recommendations on average were not met for most nutrients.

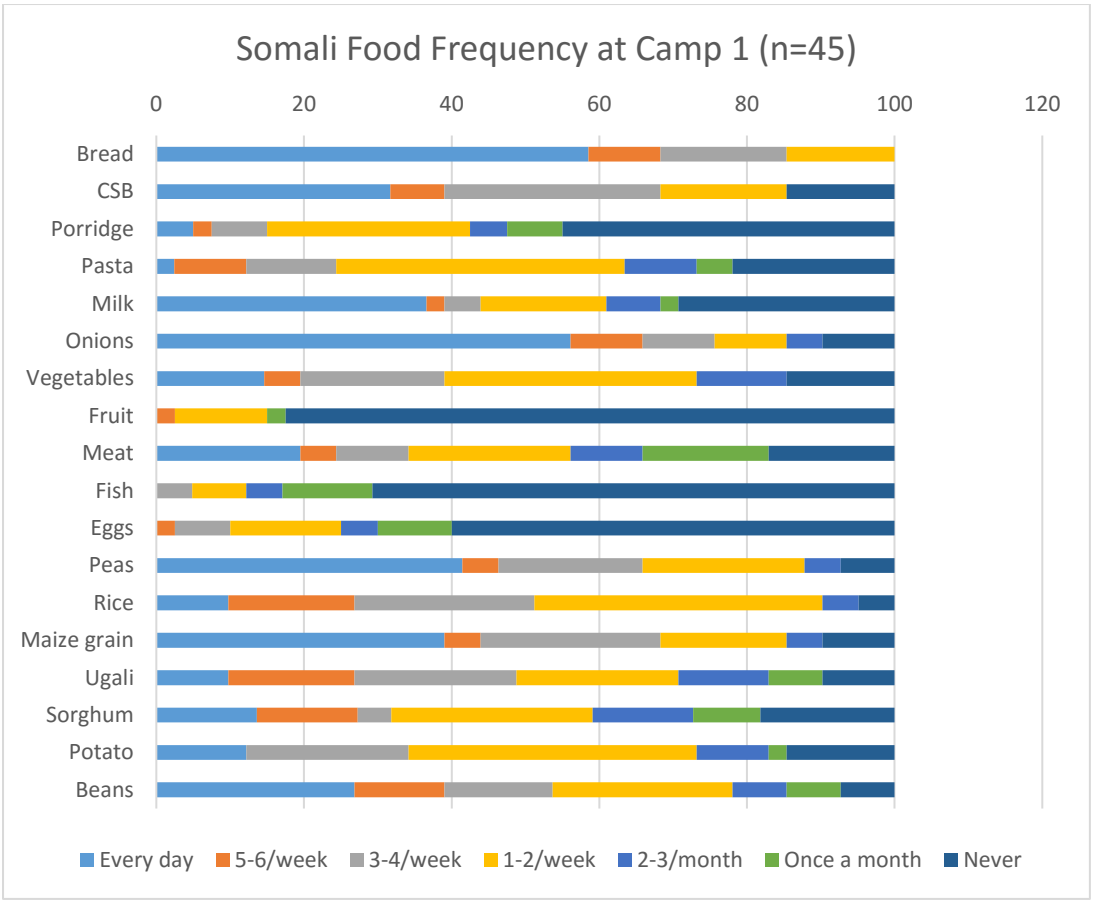
Table 15. Refugee children's nutrient intake

Nutrient	**Children 3-8 y (n=18)**		**Children 9-14 y (n=12)**	
	Mean (SD)	**Median (range)**	**Mean (SD)**	**Median (range)**
Energy, kcal	786 (339)	693 (340-1,630)	876 (312)	810 (498-1,457)
Protein, g	17.4 (8.8)	21.3 (4-31.4)	20.9 (10.3)	18.5 (6.7-37)
Fat, g	40.5 (3.3)	40.1 (35.2-47.0)	40.4 (3.0)	39.8 (35.4-46.1)
Fibre, g	12.7 (7.4)	12.1 (2.4-24.9)	11.3 (7.9)	10.6 (2.5-25.7)
Vitamin A µg	290 (305)	97.4 (1.4-836)	351 (236)	520 (55-592)
Vitamin B1, mg	0.6 (0.4)	0.5 (0.1-1.2)	0.5 (0.4)	0.4 (0.1-1.4)
Vitamin C, mg	36.1 (33.4)	19.6 (0-109.6)	42.8 (20.5)	45 (15.2-69.2)
Iron, mg	6.9 (4.1)	7.6 (1.1-14.7)	6.1 (3.0)	5.9 (1.8-11.9)
Zinc, mg	3.8 (2.2)	4.4 (0.5-7.8)	3.4 (1.7)	3.5 (0.9-6)

There was not a significant difference in energy or nutrient intake between refugees working for an NGO (n=16) and other refugees.

6.3.2 Frequency of food use

Results of the FFQs are presented in Figures 4, 5 and 6.



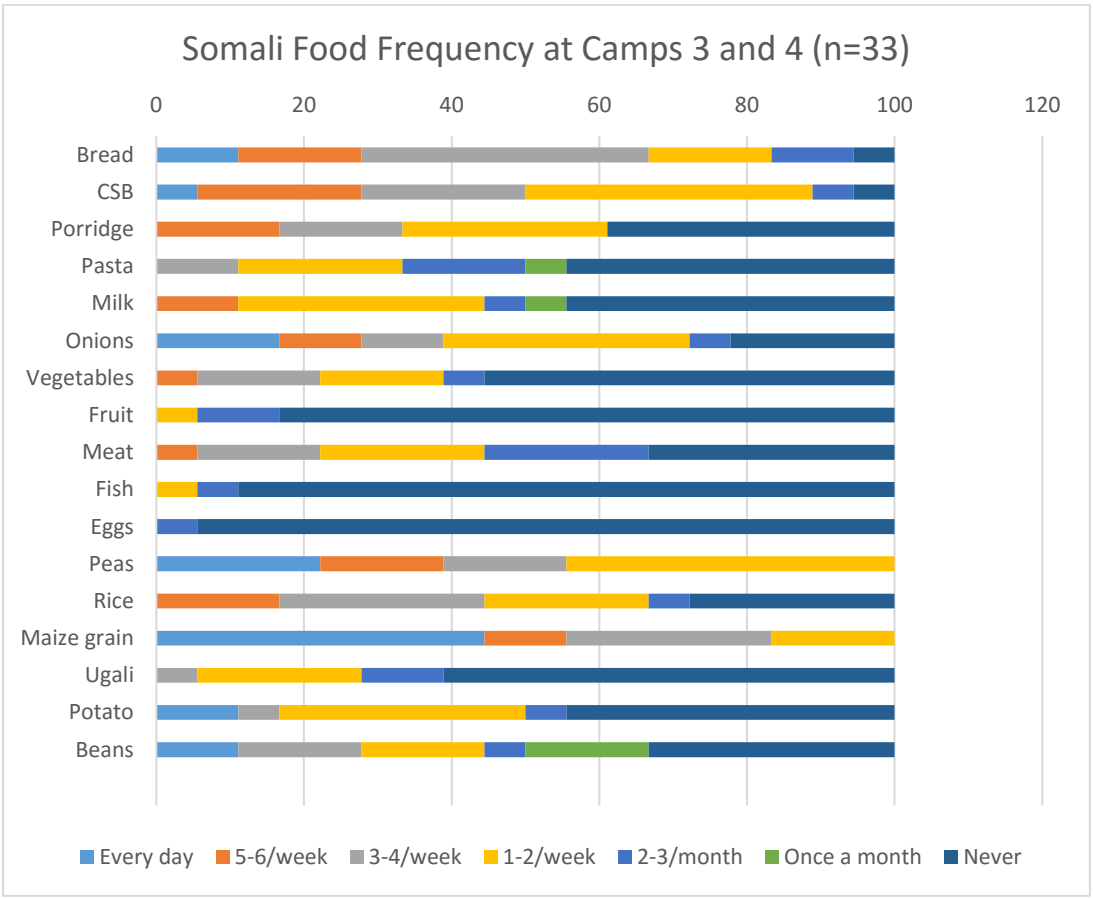


Fig. 4. Food consumption among the Somali (data on sorghum not available for camps 3,4)

Maize grain, ugali, peas, bread and porridges were the most commonly consumed foods among the Somali. Fruit, fish and eggs were the least consumed foods, with over 50 % of the respondents reporting zero intake of these foods. The dietary intake of the Somali respondents at Kakuma 3 and 4 was markedly poorer than that of refugees at Kakuma 1, with the consumption of market foods, such as milk, meat and vegetables much rarer. Only maize grain was consumed more often among those living at Kakuma 3 and 4. For the South Sudanese and Sudanese respondents, whose most common staples were ugali and sorghum, there is not such a drastic difference in consumption, although fewer respondents in Kakuma 1 reported meat and fruit intake as 'never'. Bread (*injera*) and milk were characteristic to the Somali, and rice and pasta also appear slightly more common. The least accessible foods were fish and eggs for all groups.

The Turkana diet (Fig. 5) was dominated by maize grain, sometimes combined with beans to make *githeri*, and ugali. Some foods got from the refugees, such as sorghum, also appear in the Turkana diet. Over 80 % were never able to have eggs or fish in their diet, while milk was inaccessible to over 70 %. Only 40 % could afford meat more often than once a month.

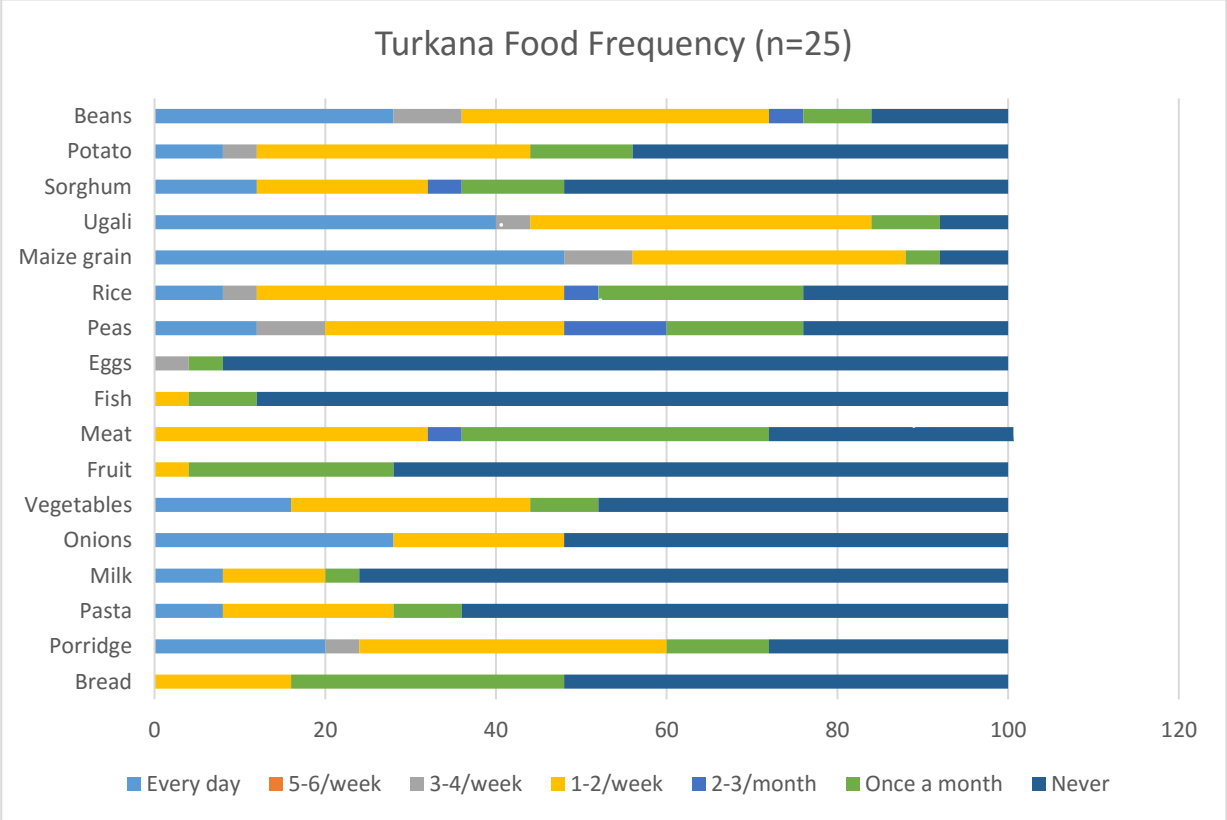
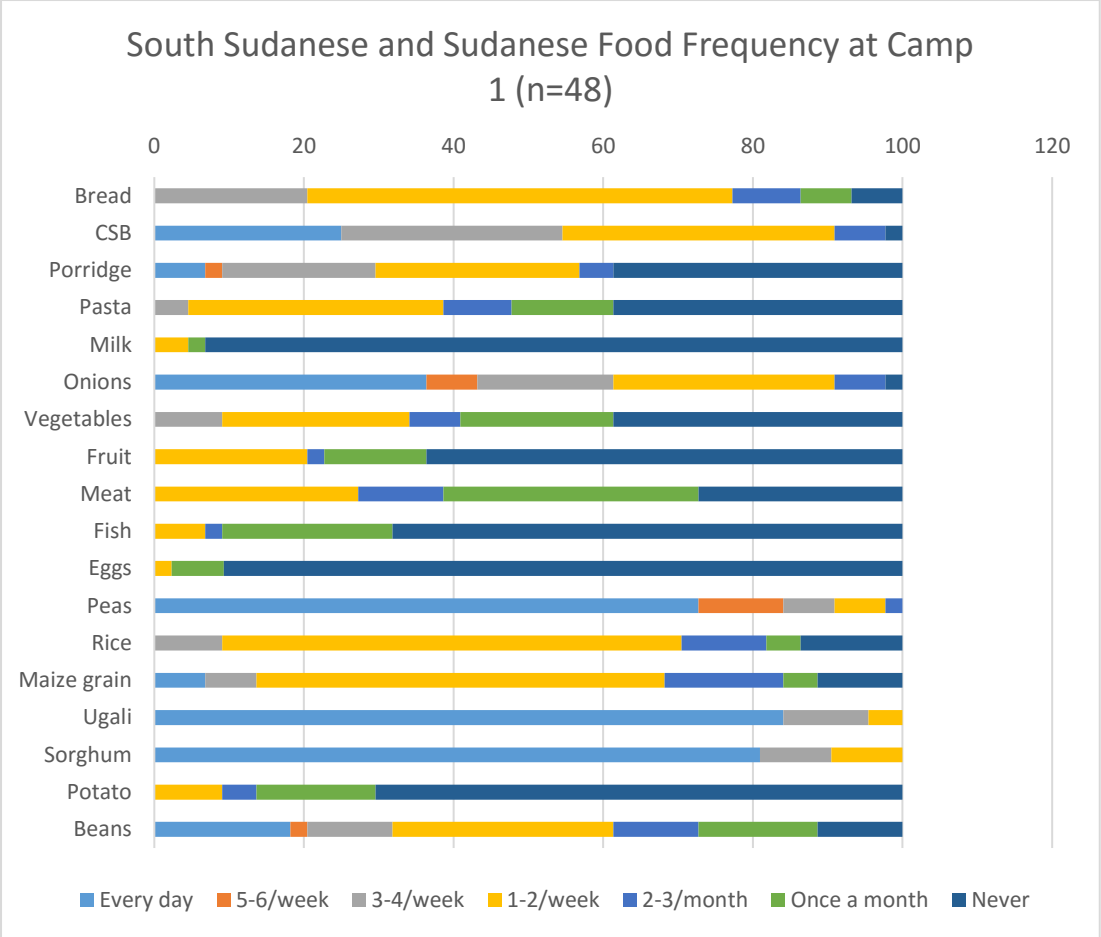


Fig. 5. Food consumption among the Turkana



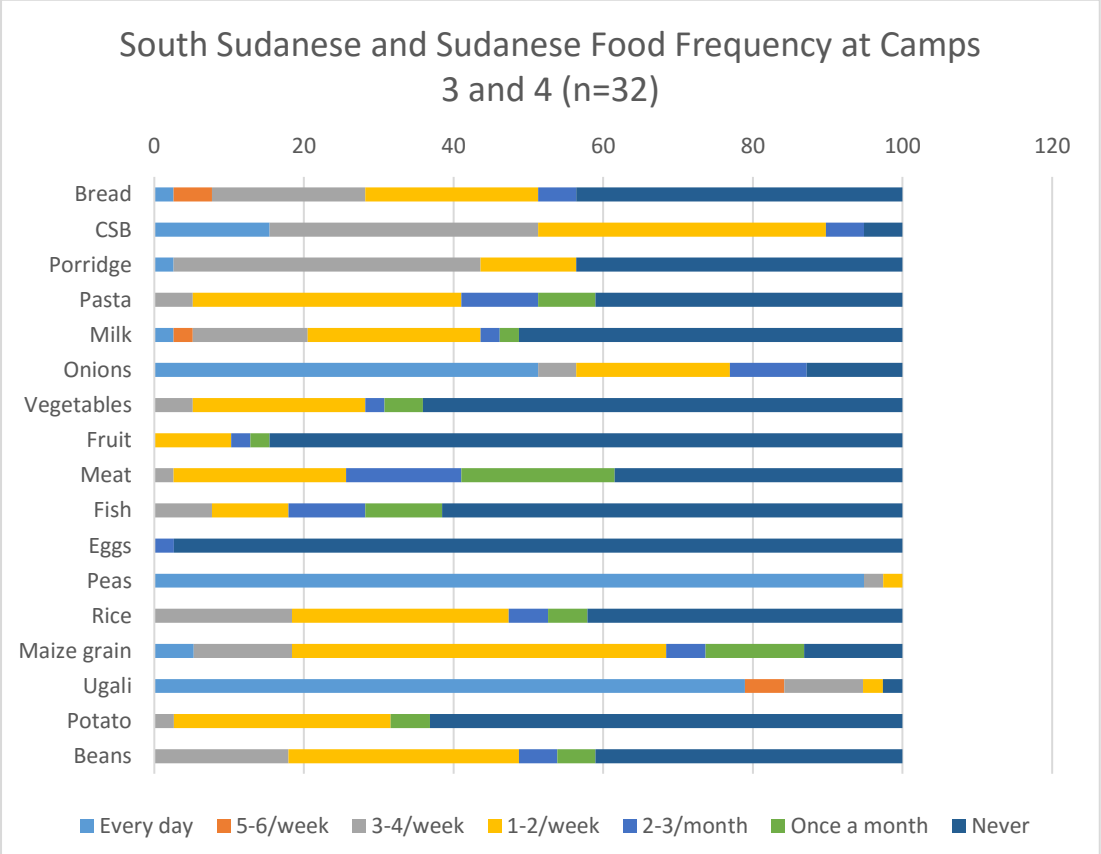


Fig. 6. Food consumption among South Sudanese and Sudanese (data on sorghum not available for camps 3,4)

6.4 Sensory evaluations

6.4.1 Insect eaters and non-practitioners

Past insect consumption was absent or nearly absent among the Somali and South Sudanese Dinka, practiced by a minority of the Congolese (DRC) and Turkana respondents, and very common among the Sudanese Nuba (Table 16).[6] Past use predicted willingness to eat insects and rates of refusal to participate in the sensory evaluations (Table 16, Fig. 7 and 8). Dinka and Somali assessors had the highest refusal rates at 53 % and 48 %, while none of the Nuba or Congolese (DRC) declined from eating the biscuit. None of the respondents reported consumption of any other invertebrates. While none of the Somali reported any use of non-livestock animal foods other than fish, a minority of the South Sudanese and Sudanese had eaten wild animals, such as gazelles, in their home country.

Table 16. Number of people with history of insect use in the sample and percentage of those refusing to participate in the sensory evaluation

Nation	Ethnicity	Insect use[a]	Refusal rate	Comments
South Sudan	Dinka	1:15	53 %	Insect consumption was virtually absent among the Dinka.
Sudan	Nuba	10:10	0 %	All the Nuba had eaten roasted grasshoppers as part of their diet in Sudan.
Somalia	All clans[b]	0:27	48 %	No history of insect consumption among any respondents. Islamic dietary laws were said to forbid the consumption of insects other than grasshopper, cricket and locust.
Congo (DRC)	Bembe	3:7	0 %	Insects had been part of the rural diet for some and not eaten by the urban folk. Grasshopper was the most commonly eaten species.
Kenya	Turkana	6:26	15 %	Crickets were eaten by the poorest households and during famine periods when food was scarce

[a] Ratio of past insect-eaters to the whole sample size
[b] Darod, Hawiye, Rahanweyn and Somali Bantus

Seasonal availability was an important factor for all insect-eating populations, with the practice restricted to the winter season when insects were most available. Among the Congolese

[6] Data from South Sudanese Nuer, Acholi and Jurchol and Sudanese Tira is not presented due to very small samples (sample size < 4 for each group). None of the traditionally pastoralist Nuer had eaten insects, the others had eaten grasshoppers.

respondents, people with no past insect use were aware of the practice in their communities, but did not eat insects due to unavailability in urban areas or for personal preferences. A minority of the Turkana (15 %) reported consumption of crickets, a practice two respondents in separate households attributed to their lack of other foods. Although nobody among the Somali ate insects in any case, an Islamic food taboo was further said to limit the selection of permissible, edible insects to certain *Orthoptera* species, such as crickets and grasshoppers. The grasshopper-eating Nuba are also a predominantly Muslim people.

6.4.2 Results of the sensory evaluations

'We do not want them. But you can give them to the children, that is OK'

– A Somali woman commenting on the biscuits

The experimental food was very highly rated on all sensory attributes as measured on the 5-point degree of liking scale (Table 17). Women's refusal rate, 33 %, was nearly twice as high as the men's. While past insect use affected the respondents' perception on consuming insects in their diet, this was not true for the hedonic ratings. The only statistically significant differences between past insect-eaters and non-practitioners, using the Mann-Whitney U-test, were for *liking* ($U=75.5$, $p<0.005$) and *willingness* ($U=166$, $p<0.005$). Ratings from past insect-eaters and those with no history of the practice are shown in Figures 7 and 8. The South Sudanese/Sudanese and Somali who were willing to eat the biscuits significantly differed from each other on past use of insects and liking ($U=44$, $p<0.005$), but not on any sensory variables or willingness to incorporate the biscuits in their diet ($U=93.5$, $p=0.065$). There were no significant age-related differences when dividing the sample into two age groups (under and over 30 years) for variables other than smell ($U=109.5$, $p<0.05$).

Table 17. Results of the sensory evaluation questionnaire [a]

Characteristic	Refusal rate	Liking	Smell	Taste	Overall	Willingness	
Female (n=75)	33 %	1.2 (0.7) 1	4.4 (0.7) 5	4.6 (0.7) 5	4.5 (0.7) 5	4.3 (0.7) 5	**Mean (SD)** **Median**
Male (n=17)	18 %	2.1 (1.6) 1	4.7 (0.5) 5	4.9 (0.4) 5	4.7 (0.5) 5	4.5 (0.8) 5	**Mean (SD)** **Median**

[a] The question on *liking* (liking to include insects in one's diet) was asked from all respondents. Only those willing to sample the biscuit (57 women, 14 men) answered the questions on sensory attributes (*smell, taste, overall liking*) and w*illingness* (willingness to include the biscuit in one's diet).

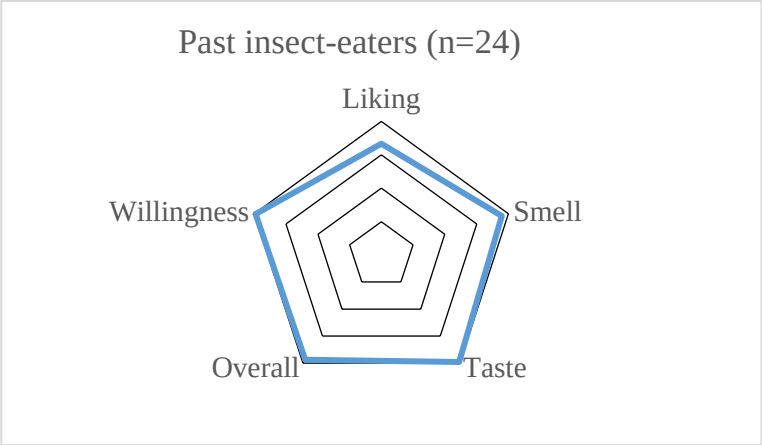


Fig. 7. Hedonic rating for refugees with history of insect use. Medians and standard deviations: liking = 4.3 (1.3), smell = 4.8 (0.4), taste = 5.0 (0.2), overall = 4.9 (0.4), willingness = 5.0 (0.2).

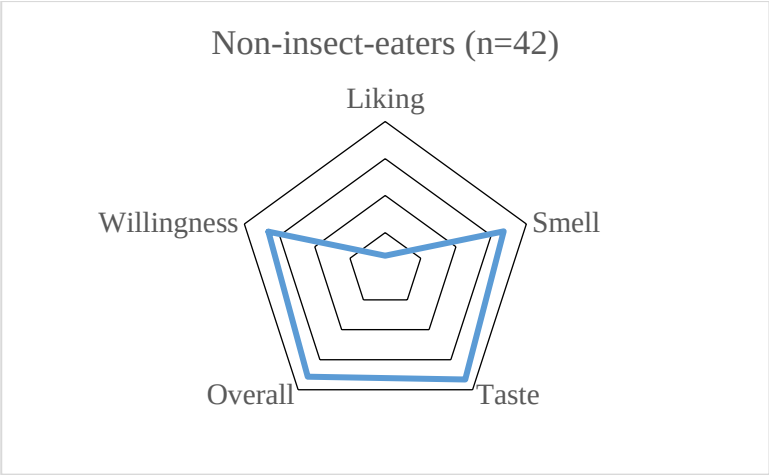


Fig. 8. Hedonic ratings for refugees with no history of insect use. Means and standard deviations: liking = 1.4 (0.9), smell = 4.4 (1.0), taste = 4.7 (0.7), overall = 4.6 (0.6), willingness = 4.3 (0.9).

Children were not included in the sensory evaluations for ethical reasons, although a number were present when their parents took part in the evaluations and were visibly curious about the biscuits. The quote in the beginning of this chapter describes the feelings of one Somali respondent who, while unwilling to taste the food herself, considered it perfectly suitable for her children.

7 DISCUSSION

This chapter is based on reflections of the study results and previous scientific knowledge on refugee nutrition, food preferences and acceptance of insects as human food. The chapter is structured around the broad themes presented in the literature review, namely food security, nutrition security and the use of edible insects, and presented in the order they appear in the results section.

Firstly, three aspects from the literature on food security in refugee situations can be pointed out to also be characteristic of Kakuma refugee camp: 1) Reliance on food aid alone means that refugees are commonly affected by low levels of malnutrition (Doocy e*t al*. 2007), 2) The host communities may be even more severely affected by food insecurity than the refugees (Salama *et al*. 2004) and 3) Monetization of food aid is a common practice at refugee camps (Pierre-Louis 2008). The last two points are discussed in relation to food security, the first in relation to nutrition.

7.1 Food security and cultural food preferences

7.1.1 State of food security

It can be reasonably asserted that nearly all of the study participants, overwhelmingly unemployed women with large families, were chronically food insecure and reliant on external food aid. Food availability was generally not the issue, since both local and domestically imported foods could be bought from the refugee camp and Kakuma town; access to food, on the other hand, was severely curtailed by the people's very limited buying power. The socio-economic background information collected from all respondents showed that the Turkana participants had on average attained longer education than the refugees but were similarly lacking in income-generating opportunities. Among the refugees, some had been at the camp since its inception in 1992; those staying at Kakuma 1 had, on average, arrived 6 years earlier than those at Kakuma 3 and 4. In Kakuma, the refugees provided on-and-off employment to the Turkana in the form of different services, such as firewood collection, thereby somewhat increasing the locals' access to food. Since the data was collected during mornings and afternoons in people's homes, the very low employment rates in this study may not be a wholly accurate reflection on the true employment rate, although in any case it must be clear that the

employment opportunities at the camp were very limited. Additionally, some casually employed people such as bakers and shopkeepers may have felt that their small-scale entrepreneurship did not count as true employment.

The refugees had very limited means to cope with the continuous scarcity of food. Eating less by skipping meals was virtually an everyday practice, evidenced by the 24HR data that showed how majority of the respondents could not afford to eat three meals per day. Reliance on such negative coping strategies appeared higher at the end of the month, understandable given that the GFD was held at the first week of the month. Lunch was the most commonly skipped meal. The Turkana relied more drastically on coping strategies, with nearly all the respondents eating only one meal per day in the evening. Indeed, one of the more striking findings of this study must be the state of food security among the Kenyan host community, whose diet seemed to consist of little else besides maize and beans. This is in line with the existent literature on food security among host communities in remote, harsh environments unsuited for agriculture.

7.1.2 'Tradition is tasteful' - food habits, food aid and markets

Many aspects of traditional diets were maintained despite the refugees' reliance on food aid. There were strong cultural differences in food preferences between South Sudanese and Sudanese on one hand, and Somali on the other hand at the camp. *Injera* was absent in the former's diet, while very common among the latter's. The Somali expressed a dislike for sorghum almost as a rule, while the South Sudanese and Sudanese, who traditionally eat sorghum, described the food in positive terms and used it to prepare a traditional dish, *wal wal*. Rice and maize grain appeared to be the staples of choice for the Somali, and milk also appeared more common based on the FFQ. In light of this, the WFP food basket was more culturally appropriate to the South Sudanese and Sudanese respondents than the Somali, since the former were better able to use the food aid goods to prepare their traditional dishes. Differences in food habits also extended to the structure of mealtimes. Despite receiving the same foods in same amounts, skipping meals was less common among the Somali than the South Sudanese and Sudanese, who ate fewer, but larger, meals. This came up clearly in the 24HRs, but was also expressly articulated by some of the respondents.

Following the classification of Kjærnes *et al.* (2001), it can be concluded that virtually all food was eaten in private eating events, as family meals. Public eating in restaurants was a gendered

practice, more common among men than women. Snacking was almost non-existent among the respondents, which was also in line with the very limited selection of snack foods available at the camp's markets.

For many common foods, such as onions, rice, meat and potatoes, prices at the markets in the refugee camp ranged from 70 to 120 KSH. *Bamba chakula* provided 500 KSH to a single-person household for food purchases and 300 KSH per person to larger families. For the unemployed refugees this may have been the only source of income. Since *bamba chakula* could only be used for food purchases, it is easy to see that it would allow a person to purchase a few kilograms of desirable foods such as rice, meat and fresh vegetables. Assessing how commonly the refugees sold off a portion of the food aid to acquire other foods was not done in this study, but some participants mentioned the practice independently, and judging by the 24HR and FFQ results (such as the rare use of sorghum and more common use of market foods among the Somali), it may have been quite common. It may also have been somewhat sensitive a subject, in case it was perceived as something the NGOs would view negatively. A minor finding of the study was that *bamba chakula* was highly popular among the refugees[7].

7.2 Nutrition security - dietary intake and diversity

7.2.1 Insufficient nutrient intake

Iron, zinc, thiamine, vitamin A and ascorbic acid are the most commonly deficient micronutrients in emergency situations (UNHCR 2007). This appears to hold true for the refugees at Kakuma refugee camp as well. While the dietary data understates the intake of vitamin A (also provided by the vitaminized vegetable oil), it is clear that diets on average do not meet recommendations for many important nutrients, such as protein, iron, zinc, thiamine and vitamin C. A nutritional assessment by WFP (2014) demonstrated the physiological lack of iron in diets, noting that 2/3 of refugee children were anaemic. Since the cereal ration that is part of the GFD was reduced by 50 % in 2015, it is perhaps no surprise that the 2,100 kcal recommendation for energy per day, set by UNHCR, was not met at the camp in spite of *bamba chakula*. Another ramification of the decreases rations is that, logically, cutting the cereal portion of the WFP food aid by 50 % would have decreased the proportion of energy and nutrients

[7] Anecdotal evidence would suggest that the Somali were the happiest with *bamba chakula*. This seems probable, as they would benefit the most from access to foods that were not part of the food basket.

available from maize and sorghum, and increased the role of dietary fats as providers of energy. Fat intake from any sources other than cooking oil were minimal among the refugees, as demonstrated, for example, by the very low variance and range in mean fat intake. Protein intake mid-month came close to the average intake in developing countries (45 g/d) mentioned by Tabassum-Abbasi *et al.* (2015) but was otherwise very low

There was a statistically significant difference in mean nutrient intake between refugees from camp 1 and refugees from camps 3 and 4. However, this is almost certainly a reflection on the data collection dates for the 24HR. Kakuma 1 was visited at the end and during the first few days of the month when food rations were either at their smallest or had not been collected yet. Kakuma 3 and 4 were visited on the second and third week of the month when household food stockpiles were most likely at their highest. Alternatively, it would have to be that the more recent arrivals at camps 3 and 4, who had on average spent 6 years less at the camp and had lower literacy and education rates than those from camp 1, were somehow less food insecure than the more settled refugees at camp 1, although the socio-economic data gathered from all camps does not suggest a difference in the general lack of employment opportunities. Further, the difference was not dependent on ethnicity, as the same conclusions applied when comparing women of the larger ethnic group, South Sudanese, from the two locations. Additionally, the FFQ data indicated a more varied dietary diversity among the people staying at Kakuma 1 than those living at camps 3 and 4. Hence, the study results support the conclusion that caloric intake, along with the demonstrated decrease in the number of meals per day, descended heavily towards the end of the month from over 1,500 kcal on the second and third week of the month at Kakuma 3 and 4 to only about 1,000 kcal at the end of the month in Kakuma 1.

There was no statistically significant difference in macronutrient intake between South Sudanese/Sudanese and Somali women. The intake of fibre, iron and zinc was significantly lower in the former group. Considering that the Somali diet contained a larger share of market-bought foods (rice, beans), this could indicate that the monetization of food aid is a slight detriment to dietary intake, although in any case the difference does not appear great.

The difference in men and women's nutrient intake was not statistically significant, although men's intake based on the descriptive statistics appeared slightly lower. Since the male sample was markedly smaller than women's and the data was collected from all camps, it is not possible to say whether this was an overall trend. However, it could be surmised that the equality in food

availability posed by reliance on external food aid would negate some of the gendered differences in food security.

The refugees working for an NGO appeared to have a slightly more diverse diet – only mentions of meat consumption in the 24HR – but there was no statistical significance in mean nutrient intake. This may again be due to collection dates: the small sample of employed refugees had been surveyed during the last days of the month.

The Turkana diet, consisting almost solely of maize grain and beans eaten once a day was sorely lacking in essential nutrients. The host community participants had the lowest dietary intake regarding all key nutrients. Additionally, the majority of respondents were unemployed or depended on the refugees for on-and-off work. A higher dietary intake could perhaps be expected from rural families who practice herding.

7.2.2 Core foods and dietary diversity

Food use at the camp and host community strongly reflected the limited nature of the food basket and scant access to other foods. The relatively worse-off state of the host community was clearly reflected in their food consumption. Regarding animal products, approximately 60 % of the South Sudanese and Sudanese reported eating meat less than once per week and over 20 % stated they never ate meat. Milk intake was accordingly very low in all groups. Comparison of the FFQ between different camps showed quite a clear difference between the Somali at Kakuma 1 and those at camps 3 and 4, while the difference in dietary diversity among the South Sudanese appeared slightly smaller[8]. Better employment opportunities could be one explanation for this, although as already noted, very few respondents, irrespective of gender, reported being employed.

Besides data on dietary diversity, the cultural preferences also evident from the 24HR were well collaborated by the FFQ. For the Turkana, the monotonous nature of their diet was drastic compared to the refugees and well confirms the 24HR in that sense.

[8] One Somali cluster at Kakuma 4 consisted of arrivals from Dadaab refugee camp who had come to Kakuma in 2014. These people were visibly poorer than the other refugees. Additionally, all the children who did not attend school came from this area.

7.3 Insect consumption and sensory evaluations

7.3.1 Past use and acceptance of insects as food

In line with Kelemu *et al.* (2015), there was evidence of insect consumption among the Sudanese and Congolese respondents and even cricket use by the Kenyan Turkana. South Sudanese also reported some insect use, although in this study the practice appeared extremely limited. Nobody in the Somali community reported any insect use, and neither did the Somali Bantus. The most commonly consumed species was grasshopper, prepared by de-winging the insects and roasting or boiling them. A small number of Turkana reported consumption of crickets. The practice appeared restricted to some of the poorer households – indeed, expressly attributed to the households' poverty by some respondents –, whereas in other households the participants were disgusted by the idea. This pattern strongly implies that insects were a 'famine food' for the Turkana, something eaten by the most resource-poor people and in times of need.

7.3.2 Degree of liking

Ethnicity was a clear predictor of willingness to try out the experimental cricket biscuit. Close to half of the Somali, Somali Bantu and Dinka were unwilling to sample the biscuits, whereas none of the insect-eating Sudanese Nuba or Congolese refused from taking part in the sensory evaluations, even though a number of the Congolese themselves had not eaten insects in their own communities and nobody had specifically eaten crickets. However, the hedonic ratings were not associated with ethnicity - both insect-eaters and non-insect-eaters rated the biscuit very highly on all sensory aspects and were highly willing to include it in their diets. The high ratings for intrinsic characteristics, such as smell and taste, are a strong statement that the sensory properties of the biscuit are not an issue, but rather the ideational disgust at consuming insects. The high refusal rates among non-insect-eating tribes were similarly clearly a reflection on cultural food traditions, in that insects were considered an unacceptable food by these people. It may be that the respondents who refused from sampling the biscuit may have been more neophobic overall, i.e. more unwilling to ingest novel foods in general. Additionally, men were almost twice as willing to try out the biscuit than women, most likely a reflection on gender roles, in the sense that declining form the proffered biscuit might have been considered unmanly.

7.3.3 What role could insects have?

On nutritional grounds, insects would provide calories, protein, iron and zinc to deficient diets and contribute to improving food security. Especially the widely prevalent anaemia (UNHCR 2014) lends credence to the idea of including insects in diets. The iron and zinc content of crickets – 6.3 mg/100 g, 21.3 mg/100g according to Finke (2002) – are quite high and could go a long way towards increasing especially children's intake to acceptable levels, even in poor-quality vegetarian diets (see table 1 for nutrient recommendations).

On ideational grounds, it is important to note that past insect-eaters are a minority at the camp, since the most avid insect-eating tribes (Congolese Bembe and Sudanese Nuba) contribute only a small fraction to the population of refugees in Kakuma, and there was very little evidence of insect consumption among the larger ethnic groups, such as South Sudanese Dinka or the Somali clans of Darod, Hawiye and Rahanweyn or the Somali Bantu. However, it may be unlikely that the refusal rates would remain persistently high among those with no history of insect use if the insects were widely available. Mere exposure to the biscuits and learning of the nutritional advantages would arguably have a positive impact. Additionally, it needs to be stressed that even people who themselves would not wish to eat the biscuits may not have compunctions against serving them to their children, as expressly stated in the sensory evaluations. It can reasonably be assumed that children would rate the biscuit at least as highly on a hedonic scale as their parents.

Much like in the study by Kodish *et al.* (2011)[9] on fortified foods at refugee camps, respondents in this study were also very curious of the experimental food, its contents and the putative health benefits. Working together with the community (the food advisory committee at Kakuma refugee camp) and clear communication regarding the food must be seen as preconditions for any successful intervention on fortified foods. Regarding the food itself, a biscuit was clearly a pleasing choice for the assessors. Considering alternatives, insect powder could also be added to foods that the refugees already commonly eat, such as porridge.

[9] In fact, this study on the use of fortified blended foods was carried out at Kakuma refugee camp. The product, a micronutrient powder, was met with suspicions regarding both its contents, possible health effects and external characteristics, such as culturally inappropriate packaging and lack of product information – factors that had little to do with the food itself, but the way it was presented to people.

7.4 Strengths and weaknesses

7.4.1 Nutrition measures

The restricted diet and strict meal patterns provided an ideal setting for a dietary assessment, since recollection mistakes, for example, were very unlikely. The quality of the 24HR data depends on how adequately the respondents reported their intake of different foods and were able to estimate the portion size using visual aids. Calculating the amount of vegetable oil based on the food aid basket adds a systematic error to the results, meaning that the caloric and fat content may be smaller than presented here. Additionally, vitamin A content will be higher, since it was not possible to establish how much vitamin A was added in the fortified vegetable oil. Conscious underreporting also cannot be ruled out, although it seems unlikely that this would have been common enough to affect data quality.

Besides information on habitual dietary intake, the FFQ seemingly captured well the refugees' different dietary preferences, showing the differences in the diets of South Sudanese and Sudanese on one hand and the Somali on the other. This also aligns quite closely with the 24HR, since both surveys demonstrated how the Somali diet differs from the South Sudanese in terms of different foods. Meat was one of the foods that came up very rarely in the 24HR and appeared more common based on the FFQ.

A statistical comparison of nutrient intake between the beginning and the end of the month was not conducted. This was not done because, due to GFD schedule in April (belated by one week due to network issues), the sample of refugees who would definitely have collected the GFD would have been quite small. Additionally, the samples would have been from different camps and *bamba chakula*, which would increase food security at the end of the month, could not have been accounted for. Additionally, a comparison of nutrient intake depending on household size was not conducted. Since the quantity of the GFD is calculated by household size and does not account for age differences (each family member adding 13.02 kg to the household's food ration), there is no reason to assume that larger households would be more food insecure.

7.4.2 Sensory evaluation measures

Because of the low literacy rates among women at the camp the SEQ was administered orally, even though a Swahili translation of the questionnaire was also made. This, and the use of numerous different languages that may differ in the use of emotive terms, is a weakness to the SEQ. Additionally, evaluating foods that are generally well-liked by people can be difficult on a degree of liking scale: differences in hedonic responses are eclipsed when nearly everyone rates the food in positive terms (Tuorila 2008). Effectively, the 5-point scale becomes stunted as people operate only on the positive end of the scale, making it difficult to pin down differences based on, e.g. gender and ethnicity. Lack of privacy in carrying out the assessments is likewise a weakness.

As a data collection tool, the 5-point scale was a good choice for its simplicity, and it successfully fulfilled the study objective: to establish if the experimental food's sensory properties are acceptable to the study population. Further research on the biscuit's sensory properties would require more sophisticated methods, such as paired comparisons or relative-to-ideal ratings, or qualitative methods suited for describing what attributes in the biscuits are relevant with regard to sensory acceptance. However, such methods offer little insight into the social and cultural aspects of insect consumption and ideational disgust; in effect, even the most delicious food will go uneaten if people reject it on ideational grounds.

8 CONCLUSION

The dietary assessment by UN agencies published in 2014 put the rates of malnutrition at the camp high, at 20.5 %, while crude mortality and under-five mortality in 2016 were within acceptable limits. Cuts to the food aid in 2015 reduced the amount of cereals by 50 % and changed the bimonthly food distribution to a once-per-month cycle, while *bamba chakula* increased the refugees' ability to access desirable foods from the camp's markets.

Currently, the adult and child refugees' intake for many core nutrients did not meet the recommendations or bordered on acceptable. Dietary quality, along with the number of meals had per day, deteriorated towards the end of the month when food stockpiles were at their lowest. Accordingly, the frequency of use of highly nutritious foods such as meat, but especially

fish and eggs, and vegetables and fruit, were low. The local Turkana in Kakuma town were considerably more food insecure than the refugees. Even accounting for issues in data collection or misreporting of food intake it is clearly evident that many of the urban Turkana had staggeringly little food at the time the data was collected.

Comparing the food habits and choices of the two largest ethnic groups at the camp was a commonly used analytical tool in the study. This cross-sectional approach showed how the refugees strove to maintain the traditional aspects of the cuisines of their countries of origin with the limited means available to them. Culture affected not only eating habits but also the structure of meals, with the Somali meal pattern differing markedly from that of the South Sudanese and Sudanese when it came to meal size and frequency.

People with a history of past insect use were a minority at the camp. The largest ethnic groups, such as the Dinka from South Sudan and the Somali clans were very unwilling to eat whole, visible insects. Only the smaller minorities, such as Sudanese Nuba and Congolese Bembe, had a history of insect use. This, however, had no effect on how the experimental cricket biscuit was assessed: everyone, regardless of ethnicity, found it highly palatable. Another main finding in the sensory evaluations was the high refusal rate among those with no history of insect use. However, continued availability of the biscuits in the refugee communities might well increase willingness to eat them. On the other hand, the biscuit is also a tradeable good and as such could have value to even those not willing to eat them. As both the literature and this study suggest, barter and trade of food aid is a natural part of life at refugee camps.

Lastly, it can be concluded that processed foods with powdered insects may have potential in boosting food security among vulnerable populations, including communities who have not traditionally used insects as food. For future research, assessing food neophobia could be a useful tool for understanding refugees' perceptions of unfamiliar food items, generally and in relation to insects. For practical purposes, the contents and health benefits of the foods need to be clearly communicated to the people to make sure the product is acceptable both on sensory and on cultural grounds. Addressable factors could be, for example, choosing a familiar food product fit for both adults and children, making sure there are no religious taboos or stigmatization to using the food and respectfully communicating that the food in question is a valued commodity, not a last resort to meet inadequate nutritional needs of the vulnerable communities.

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APPENDIX 1: Questionnaires

Before the interview, potential participants are informed of the aims of the study, i.e. to conduct a dietary assessment, and asked if they wish to participate. Participation in the study is fully voluntary.

1. General information

Gender male ☐ female ☐

Age _____ years

Ethnicity _____

Place of origin (living before coming to Kakuma; name of county or town**)** _____

Year of entering Kakuma refugee camp _____

Education literate (read/write) ☐ illiterate ☐

_____ years of primary school _____ years of secondary school

Occupation (if unemployed, write 'no') _____

Number of members in the household _____

Head of household male ☐ female ☐

2a. The 24-Hour Recall for adults

Time	Details of food	Quantity

Was the intake unusual in some way?

_____

What meals did you have yesterday? Breakfast ☐ Lunch ☐ Dinner ☐

If some of the foods were eaten outside the home (e.g. lunch), please indicate which foods:

_____

Do you take vitamin and/or mineral supplements? Which ones and how often?

_____

2b. The 24-Hour Recall for children

Gender: male □ female □

Age _____ years (if unsure, request to see a birth certificate)

Ethnicity _____

Place of origin (living before coming to Kakuma; name of county or town**)** _____

Year of entering Kakuma refugee camp _____

Education Enrolled in school □ Not enrolled □

Number of members in the household _____

Head of household male □ female □

Was the child breastfed yesterday? Yes □ No □

Time	Details of food	Quantity

3. Frequency of food use

Frequency	Every day	5-6 times a week	3-4 times a week	1-2 times a week	2-3 times a month	Once a month	Never
Bread							
Porridge CSB							
Porridge							
Spaghetti							
Milk							
Onions							
Vegetables							
Fruits							
Meat							
Fish							
Eggs							
Split peas							
Rice							
Maize grain							
Maize, ugali							
Sorghum							
Potato,sweet potato							
Beans							

4. Dietary history

What are the dietary staples you most commonly eat?

_____

_____

Have you eaten insects as part of your diet? Yes ☐ No ☐

If yes, what species and in what situations? (i.e. specific seasons or other contexts)

_____

_____

Has your diet included other invertebrates, such as snails or snakes?

_____

Do you like the idea of including insects in your diet?

1	2	3	4	5
☐	☐	☐	☐	☐

1 = Do not like at all, 2 = Do not like, 3 = Neither like nor dislike, 4 = Like, 5 = Like a lot
1 = Haipendezi kabisa, 2 = Haipendezi, 3 = Maoni yangu iko kati, 4 = Naipenda, 5 = Naipenda sana

INFORMED CONSENT TO PARTICIPATE IN SENSORY RESEARCH

Principles of consent

With this consent, assessor agrees to comply with the given instructions for the test, as precisely as possible. The assessor has the right to refuse the participation in the test. The assessor may cancel his/her participation whenever s/he wants without a reason for cancellation and without pressure to continue against his/her will.

Information of the research that assessor agrees to participate in by consenting

Name of the research: Edible insects for improved food and nutrition security at Kakuma refugee camp
Period, in which tests are conducted: 13-30/4/2016
Samples, quality and amount: One medium-size wheat biscuit with 10 % dried, powdered crickets
Swallowing of samples: Yes
Number of sessions: One sample per participant in one session
Contact persons (name and tel.): Markus Naukkarinen 0791 486 199
Email: jdp690@alumni.ku.dk

Signature of participant _____

5. Sensory evaluation

How much do you like the biscuit's smell?
Unapenda jinsi zinavyonukia?

1	2	3	4	5
☐	☐	☐	☐	☐

1 = Do not like at all, 2 = Do not like, 3 = Neither like nor dislike, 4 = Like, 5 = Like a lot
1 = Haipendezi kabisa, 2 = Haipendezi, 3 = Maoni yangu iko kati, 4 = Naipenda, 5 = Naipenda sana

How much do you like the biscuit's taste?
Je, unapenda ladha?

1	2	3	4	5
☐	☐	☐	☐	☐

1 = Do not like at all, 2 = Do not like, 3 = Neither like nor dislike, 4 = Like, 5 = Like a lot
1 = Haipendezi kabisa, 2 = Haipendezi, 3 = Maoni yangu iko kati, 4 = Naipenda, 5 = Naipenda sana

How much do you like the biscuit as a whole?
Kwa ujumla, unapenda hizi biskuti?

1	2	3	4	5
☐	☐	☐	☐	☐

1 = Do not like at all, 2 = Do not like, 3 = Neither like nor dislike, 4 = Like, 5 = Like a lot
1 = Haipendezi kabisa, 2 = Haipendezi, 3 = Maoni yangu iko kati, 4 = Naipenda, 5 = Naipenda sana

How willing would you be to include these biscuits in your diet?
Unaeza zingatia kuweka biskuti hizi kwa mlo wako wa kila siku?

1	2	3	4	5
☐	☐	☐	☐	☐

1 = Very unwilling, 2 = Unwilling, 3 = Neither unwilling or willing, 4 = Willing, 5 = Very willing
1 = Siezi zingati kamwe, 2 = Siezi zingatia, 3 = Maoni yangu iko kati, 4 = Naeza zingatia, 5 = Naeza zingatia kabisa

INTERVIEWER ANSWERS:

Date _____ Language of interview _____

Place Kakuma 1 □ Kakuma 2 □ Kakuma 3 □ Kakuma 4 □

Zone and block _____ , _____

APPENDIX 2: Kakuma refugee camp

Fig. 9. Kakuma refugee camp. Kakuma 1 is located in the east, close to the river, and consists of 6 zones, each with their own numbered blocks. Kakuma 2,3 and 4 are adjacent and similarly divided. Colours and red borders represent different zones and blocks. Reliefweb 2014.

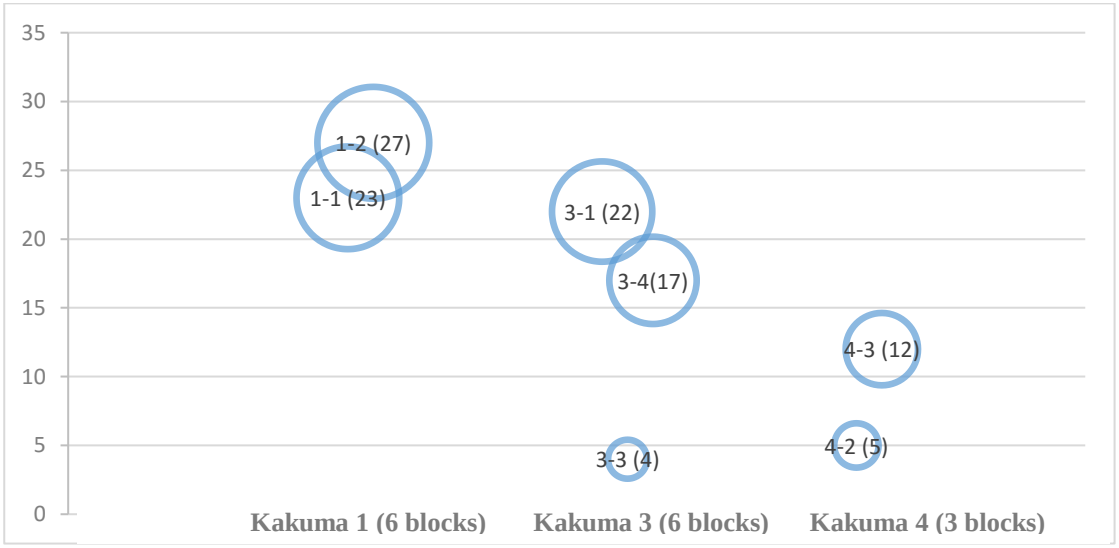


Fig. 10. Sampling for the survey with 24HR and FFQ. The numbers in circles represent different camps and zones therein (e.g. 1-1 is camp 1, zone 1), the numbers in parentheses mark sample sizes. On the ordinate are represented the different camps and the number of blocks within the camps that were visited. Sample size on the abscissa. Closeness of the circles does not represent geographical distance.

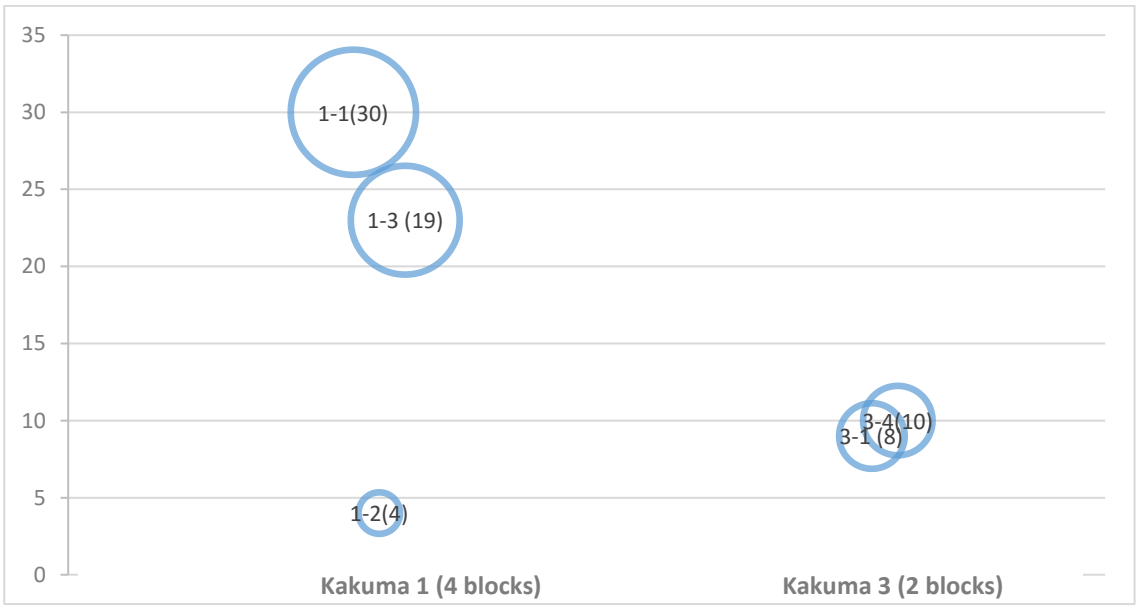
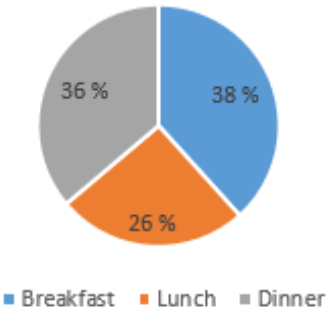


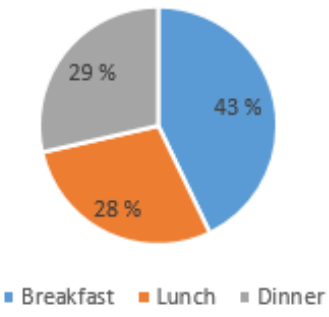
Fig. 11. Sampling for the survey with SEQ and FFQ (latter not filled by all respondents). The numbers in circles represent different camps and zones therein (e.g. 1-1 is camp 1, zone 1), the numbers in parentheses mark sample sizes. On the ordinate are represented the different camps and the number of blocks within the camps that were visited. Sample size on the abscissa. Closeness of the circles does not represent geographical distance.

Appendix 4: Meals (percentage of respondents who had eaten the indicated meal)

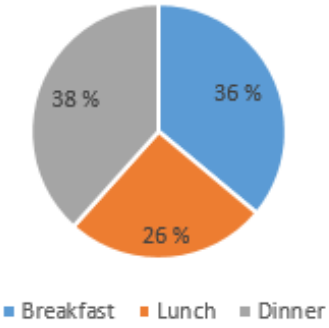
Somali meals at camp 1 on the first week of the month (N = 20)



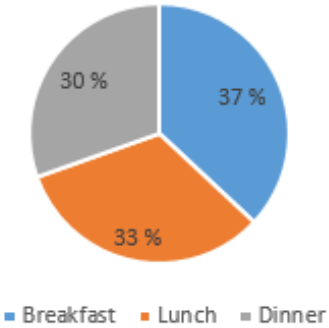
Somali meals at camps 3 and 4 on the second week of the month (N = 18)



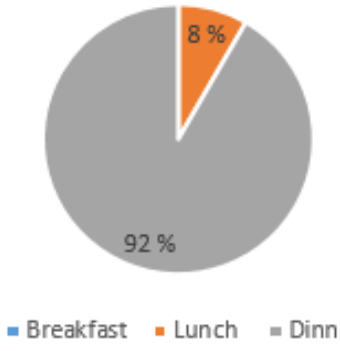
South Sudanese and Sudanese meals in the middle of the month at camps 3 and 4 (N = 37)



South Sudanese and Sudanese meals at camp 1 on the last week of the month (N =28)



Turkana meals (N = 26)



Appendix 5: Nutrient intake

Table 18. Nutrient intake among South Sudanese/Sudanese and Somali women

Nutrient	**Women**			
	SSD/SUD (n=55)		**SOM (n=28)**	
	Mean (SD)	**Median (range)**	**Mean (SD)**	**Median (range)**
Energy, kcal	1,383 (694)	1,160 (209-2,839)	1,126 (556)	1013 (387-3,345)
Protein, g	30.5 (22.6)	37.2 (7-79.7)	22.6 (4.3)	21.7 (12.7-106)
Fat, g	54.7 (72.6)	43.9 (33.7-58.1)	43.2 (5.6)	41.2 (37.7-63.4)
Fibre, g	22.9 (17.6)	26.7 (2.5-70.5)	18.4 (21.1)	13.1 (1.3-118)
Vitamin A, µg	588 (1.156)	521 (9.4-858)	356 (330)	265 (1.4-1,039)
Vitamin B1, mg	1.3 (0.8)	1,2 (0,1-3,2)	0.8 (0.7)	0.6 (0-3.8)
Vitamin C, mg	60 (33)	63 (0-138)	49 (36)	39 (0-148)
Iron, mg	13.7 (7.6)	11.9 (2.2-30.5)	8.5 (6.6)	6.6 (2.5-36.3)
Zinc, mg	6.9 (3.8)	6.2 (1-15.4)	4.8 (3.0)	3.0 (1.5-15.9)

Table 19. Nutrient intake at Kakuma 1 and at Kakuma 3 and 4

Nutrient	**Women**			
	Kakuma 1 (n=38)		**Kakuma 3 and 4 (n=45)**	
	Mean (SD)	**Median (range)**	**Mean (SD)**	**Median (range)**
Energy, kcal	1,008 (498)	961 (209-2,802)	1,540 (684)	1,550 (499-3,345)
Protein, g	23.1 (12.3)	20.1 (7.0-60.3)	43.1 (20.7)	40.3 (7-106)
Fat, g	42.2 (5.5)	40.5 (35.5-60.5)	46.1 (6.7)	45.3 (33.7-63.4)
Fibre, g	14.7 (9.1)	12.7 (1.3-39)	34.4 (21.2)	31.6 (2.5-118)
Vitamin A, µg	344 (286)	251 (1.4-1,039)	466 (309)	557 (7.4-921)
Vitamin B1, mg	0.7 (0.5)	0.5 (0-2.8)	1.5 (0.8)	1.5 (0.1-3.8)
Vitamin C, mg	39 (25)	38 (0-99)	71.2 (8.1)	75 (0-148)
Iron, mg	8.2 (5.5)	7.2 (2.2-25.7)	14.9 (8.1)	13.9 (2.4-36.3)
Zinc, mg	4.5 (2.8)	3.8 (1-13.1)	7.6 (3.7)	7.1 (1.5-15.9)