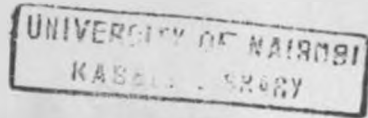


**FOOD CONSUMPTION PATTERNS AND DIETARY  
PRACTICES IN RELATION TO IRON AND SALT  
INTAKES IN KWALE DISTRICT:  
THE CASE OF LUNGA-LUNGA LOCATION, KENYA.**



By  
**Lynnette Awuor Opondo**  
**A56/P/7837/2002**

**A Dissertation Submitted to the Department of Food Technology and  
Nutrition in Partial Fulfilment of the Requirement for the Degree of Master of  
Science in Applied Human Nutrition, University of Nairobi**

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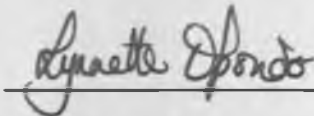


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## DECLARATION

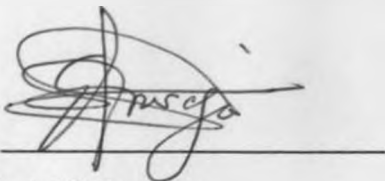
I, Lynnette Awuor Opondo hereby declare that this dissertation is my original work and has not been presented for a degree in any other university.



Lynnette Awuor Opondo

Date 18/01/05

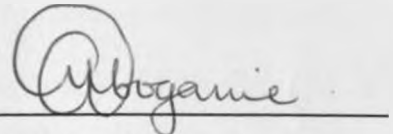
The dissertation has been submitted for examination with our approval as university supervisors



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## DEDICATION

To my husband, Major (Rtd) Francis D. Nyandong, for his relentless support and encouragement, to our children, for their patience and understanding during the period of my studies and to my parents for their guidance and inculcating in me the desire to succeed.

## ACKNOWLEDGEMENTS

I give thanks to God Almighty for his faithfulness for he has granted me favour to enable me pursue and achieve my dream.

I extend my sincere gratitude and appreciation to my supervisors Dr. A M. Omwega, Dr. A.M. Mwangi, and Dr J. K. Sehmi of the Department of Food Technology, University of Nairobi and Dr. D. L. Mwaniki of the Centre for Public Health Research, Kenya Medical Research Institute, for their advice and assistance throughout the study.

This work was carried out with the aid of a grant from Micronutrient Initiative, Ottawa, Canada, through the financial assistance of the Government of Canada through the Canadian International Development Agency (CIDA). I am very thankful for their assistance.

I also thank the entire staff of Applied Nutrition Programme for their invaluable support throughout the course and during data collection.

A special note of appreciation is also extended to Mr. Shabaan Mwatenga, the officer in charge of Public Health, Lunga-Lunga for his time and tireless effort in assisting with the logistic problems, and ensuring that there was transport for the field assistants and myself. I also acknowledge the assistance from Mr Mohamed Masood the Deputy Public Health Officer.

I thank my field assistants Mwanasha Mwamzuka, Robert Bogita and Daniel Makaya who worked willingly and tirelessly throughout the data collection period. Last but not least, I am extremely grateful to my husband who took care of the children while I was busy with the study.

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## LIST OF ACRONYMS

FAO	Food and Agricultural Organization
GOK	Government of Kenya
HAZ	Height-for-age Z-score
Ksh.	Kenya Shilling
UNICEF	United Nations Children's Fund
WAZ	Weight-for-age Z-score
WHO	World Health Organization
WHZ	Weight-for-Height Z-score
Fe	Iron
BMI	Body Mass Index
NCHS	National Centre for Health Statistics
KDHS	Kenya Demographic Health Survey
NGO'S	Non governmental Organizations
UNU	United Nations University
RDA	Recommended Daily Allowance
MUAC	Middle Upper Arm Circumference
MI	Micronutrient Initiative
IDA	Iron Deficiency Anaemia
IDD	Iodine Deficiency Disorder
VAD	Vitamin A Deficiency
Na	Sodium

## OPERATIONAL DEFINITIONS

**Adequacy of nutrient:** The daily intake of the nutrient expressed as percentage of the Recommended Dietary Allowance.

**Anti nutrients:** Substances, which can inhibit absorption or utilisation of the food or of specific nutrient. E.g. phytates and tannins.

**Bioavailability:** Proportion of a nutrient ingested which becomes available for utilization by the body.

**Dagaa:** Swahili word for small fish found in Lake Victoria and Tanganyika

**Hematocrit:** Percentages of red blood cells making up the entire volume of blood (the volume of red blood cells in a specified amount of blood).

**Hemoglobin:** It is the pigment that gives colour to red blood cells consisting of heme and protein. Hemoglobin carries oxygen from the lungs to the tissues and carbon dioxide from the tissues to lungs. It is measured in grams per decilitres (gm/dl.)

**Stunting:** It is a nutritional deficiency caused by chronically inadequate food intake, ill health, sustained incorrect feeding practices and low socio-economic

status, expressed as height-for-age. Children falling below the cut off point of minus two standard deviations ( $<-2SD$ ), from the median of the reference population is classified as stunted.

**Household:** All people who have lived together for at least three months sharing food and other essential facilities.

**Households head:** The person who is the major decision-maker on household income and expenditure.

**Household income:** Monthly cash earnings equivalent from all sources including sales, salaries and remittances.

## ABSTRACT

A cross-sectional and descriptive study was carried out in Lunga-Lunga location in Kwale District in March 2004 for a period of three weeks to determine the food consumption patterns and the dietary practices in relation to salt and iron intakes. The study comprised 30 households and involved the measuring of the food intakes of the study population for three days to establish their dietary patterns. Data on demography was collected by use of a structured questionnaire. Anthropometric measurements were taken for all household members who were present during meal times. Focus group discussions were conducted with mothers who did not participate in the study as well as women above childbearing age. In-depth interviews were also conducted as well as observations to obtain information on the dietary patterns and practices in the study area.

The dietary patterns indicate that the foods consumed by the households contained sufficient amounts of iron but most of it was non-haem iron and only 4.85% of the iron consumed was bioavailable for utilisation by the body. As a result, 83.9% of the respondents did not meet their iron nutrient adequacy levels. The foods consumed contained iron inhibitors such as phytates with a mean phytate content of  $15.44 \pm 12.45$  mg. Vitamin C that is an enhancer for the absorption of iron was also deficient in 60% of the households.

The diets were not varied and were insufficient in calories. Protein adequacy was met by 95.5% of the households but since the diets were deficient in supplying the energy requirements the proteins may be converted to calories to meet the energy needs of the individuals. Salt was consumed daily by all the households and the mean daily intake was  $4.36 \pm 2.54$  gms for children aged one to eleven years, to  $10.29 \pm 4.41$  gms for adults. The results also showed that

food avoidance taboos that affect food consumption mostly focus on expectant mothers. These taboos prohibit them from eating mostly fish and eggs that are good sources of iron during pregnancy.

The findings indicate that 17.4% of the under fives were wasted, when compared to the standard. The cases of underweight children were 21.7% while those who suffered from chronic malnutrition (stunting) were 30.4%. Among the 6-11 year olds, 17.4% were wasted, 21.7% underweight and 29.4% stunted. The BMI indicates that 46.5% of the adults were underweight.

The findings of the study indicate that the anaemia experienced in Kwale District may not be due to inadequate dietary iron, but other factors such as bioavailability of the iron consumed, the high level of phytates in the diet. Parasitic infestations e.g. malaria, hookworms and filiriasis which are common in the area could also be contributing factors.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 BACKGROUND INFORMATION

Large numbers of people in the world consume diets that do not satisfy their nutritional requirements and, as a result, are extremely vulnerable to poor health outcomes such as malnutrition. Malnutrition is a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate performance in such processes as growth and recovering from physical work. Inadequate food consumption is a consequence of insufficient food available at the household level or due to improper feeding practices. Apart from inadequate food consumption, malnutrition is also caused by poor environmental sanitation. Poor environmental sanitation conditions put the child at increased risk of illnesses such as diarrhoea that adversely affects their nutritional status (USAID, 1996).

Micronutrient deficiencies (referred to as 'hidden hunger') especially of Vitamin A, iodine and iron deficiencies have been taking their toll on populations worldwide. Iron deficiency anaemia (IDA) is the most prevalent nutritional disease worldwide (ACC/SCN, 1997) and it is a major problem in developing countries, especially in infants, pre-school children, and women of childbearing age. It has been recognised as a major cause of morbidity and mortality in children and women. It affects almost 3.5 billion people in the developing world, and needs attention. In Sub-Saharan Africa, bioavailability of dietary iron is the most important determinant of anaemia (ACC/SCN, 1997).

Kenya harbours large numbers of nutritionally deprived people. Chronic under consumption of energy and protein foods, referred to as protein energy malnutrition (PEM) is still among the most common and devastating forms of malnutrition among children under five years old. Direct causes of diet-related problems in Kenya may not essentially be the economic aspects of food supply and demand, but poor feeding practices, poor sanitation (to include water and hygiene), high annual population growth rates in the face of disproportionately low economic growth, and increased rural-urban migration. Periodic crop failure due to drought, inflation, refugee influxes and environmental degradation play an added role (WHO/FAO, 1992).

The 2003 Kenya Demographic Health Survey estimate of the prevalence of chronic malnutrition or stunting among the under fives is 31%, with about 11% of these children being severely stunted. These estimates show an improvement of 2 % in the status of children over the five-year period, from 1998 KDHS. About 6% of children under five in Kenya are wasted, 1%are severely wasted. Wasting is most common during ages 6-36 months indicating that food supplementation during the weaning period is inadequate (KDHS, 2003).

Vitamin A is a nutrient that is required by all body tissues for normal growth and tissue repair and its deficiency is a leading cause of blindness in children and can cause death. The prevalence of vitamin A deficiency in Kenya according to the 1999 Anaemia and Micronutrient Survey among pre-scholars was estimated at 14.7% and 61.2% for acute and moderate, 9.1%and 29.6% acute and moderate for mothers and corresponding 6.1-7.1% and 29.6-27.6% for adult males between the age of 25-34 respectively. (Mwaniki et al, 2001).



Iodine is also another micronutrient of importance to the body. It is required by the body to synthesize thyroid hormones. Zinc is an essential nutrient and its deficiency has been identified as the underlying cause of stunted growth in young children in many regions (Sandstead, 1991), and poor foetal growth during pregnancy, delivery complications and increased mortality in mothers and their babies (Tamara and Goldenberg, 1996). Both iodine and zinc deficiencies have been shown to be of public health significance in Kenya.

Salt is an essential component of human diets and salt is as essential as water. The main function of salt is to regulate the exchange of water between our cells and their surrounding fluids. One component of salt, sodium (Na) is involved in muscle contraction including heartbeat, nerve impulses, and the digestion of bodybuilding protein. The amount of salt is regulated in our bodies by our kidneys and by perspiration. Chronic salt deprivation leads to loss of weight and appetite, inertia, nausea and muscular cramps, whereas excessive intake can contribute to hypertension, heart, liver and kidney diseases (Mannar and Dunn, 1995) The National Academy of Sciences considers 1,500 mg/day of sodium an "adequate intake." The European Union Population Reference Intake for males aged 18 years (an "acceptable range of intakes") is 575-3500 mg.

Micronutrient deficiencies are a significant problem in Kenya. Iron deficiency is the most common deficiency worldwide and is the most common cause of anaemia. The 1999 National Anaemia and Micronutrient Survey indicated that about 43.2% of pre-school children, 42.9% mothers, and 15.9% adult male were iron deficient (Mwaniki et al, 2001). Lake Basin and the coastal and semi-arid lowlands lead in the anaemia burden with Kwale District in the Coast

province having the highest prevalence. This could be attributed to the dietary practices and food consumption patterns of the people in Kwale.

This study is part of a larger study by the Applied Nutrition Programme, University of Nairobi and the Centre for Public Health Research, Kenya Medical Research Institute in collaboration with the Human Nutrition Laboratory, Swiss Federal Institute of Technology Zürich (ETHZ) with funding from the Micronutrient Initiative and UNICEF. The aim of the efficacy study is to find the effectiveness of double fortified salt as a strategy to address Iron Deficiency Anaemia in Kenya.

## **1.2 STATEMENT OF THE PROBLEM.**

Available evidence from the 1999 National Anaemia and Micronutrient Survey and other independent studies indicate that anaemia of nutritional origin is a public health problem in Kenya (Mwaniki et al, 2001). Iron deficiency anaemia was high in the Coastal and Lake Basin populations. This report indicated that the estimated prevalence of anaemia among under five year olds was above 84% in the coast, 13.4% to 38.4% in the midlands, 2.1 % to 11.5 % in the highlands and 44% in the lake basin and adjacent highlands. Overall population prevalence was above 80% and 44% among coastal and lake basin indigents respectively and was positively correlated with hookworm and malaria.

The problem in Kwale district is that the prevalence of anaemia is very high, perhaps as a result of chronic food insecurity. Ninety two percent of Kwale district is of low agricultural potential and it experiences chronic food shortages. Another possible cause of anaemia could be parasitic

infestations (hookworm and malaria). However, it is not clear whether the problem is largely of dietary cause or not, hence the study.

### 1.3 JUSTIFICATION

The 1999/2000 National Micronutrient survey in Kenya indicated a high incidence of micronutrient deficiencies among the population especially among children and women of reproductive age. The incidence of anaemia varies greatly throughout Kenya, but the coastal area is the most severely affected using the criteria established by World Health Organisation; anaemia affects 90% of the population there (GOK, UNICEF, 1992).

The consequence of anaemia deficiency is that it hampers psychomotor and cognitive development in children and is associated with delays in speech development and behaviour. In mothers, there is risk of unfavourable pregnancy outcomes i.e., maternal mortality, low birth weight, and premature births (Mwaniki et al, 2001). Studies done in Kwale indicate the high prevalence of anaemia in the district. Strategies have been put in place by key players in the health sector to address Vitamin A deficiency through nationwide distribution of vitamin A capsules to infants, young children and mothers, and the iodisation of salt to combat IDD. However, no interventions have been put in place towards the elimination of iron deficiency in the general population in Kenya, except for iron supplementation in form of tablets to expectant mothers and as such other groups at risk of anaemia e.g. the preschoolers are not targeted. This method of iron supplementation is expensive and a food-based intervention would be more sustainable. The use of salt as vehicle for the fortification of iron is part of a wider project whose

intention is to find possibilities of fortifying commonly consumed easily available foods or condiments as a way of combating micronutrient deficiencies.

#### **1.4 THE STUDY OBJECTIVES**

The main objective is to assess food consumption patterns and practices in relation to salt and iron intakes in Lunga-Lunga Division, Kwale District.

##### **Specific Objectives**

1. To determine food availability and acquisition at household level.
2. To determine food patterns (frequency, variety, food preparation methods and meal patterns).
3. To determine the contribution of diet to iron intake.
4. To determine the amount of salt being consumed at household level.
5. To determine the nutritional status of the under fives, 6-11 year olds and the mothers' BMI.
6. To determine food avoidance or taboos that affect food consumption.

#### **1.5 HYPOTHESIS**

The iron intake through diets consumed by the population in Lunga-Lunga Division, Kwale District, is adequate.

#### **1.6 EXPECTED BENEFITS**

It is hoped that the information obtained from this study will be useful for the generation of baseline information for the study, to be conducted by the Micronutrient Initiative in

collaboration with UNICEF in Kwale District, on the use and effects of Double Fortified Salt, as a strategy to prevent and control nutritional anaemias.

This information will also be useful to health personnel, agricultural extension workers, the community and Non Governmental organisations (NGO's) involved in the formulation of corrective strategies and nutritional interventions especially with regard to iron deficiencies. It would also be used to promote the production and consumption of foods that are rich in iron.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 MALNUTRITION: A GLOBAL PROBLEM

Nutritional adequacy is one of the key determinants of the quality of human resources everywhere (Seshadri, 1997). An essential prerequisite to the prevention of malnutrition in a community is the ability to provide for the nutrient needs of all people. Nutritional inadequacies and disease particularly infections are the immediate causes of malnutrition (Latham, 1997). Malnutrition is major problem in developing countries. Malnutrition deficiencies that have the greatest impact in populations in developing countries are Protein Energy Malnutrition (PEM), iron, vitamin A, iodine and zinc.

Recent reports indicate that malnutrition is increasing in some parts of the world, particularly in Sub Saharan Africa, as a result of economic crisis and the adjustment most countries are undertaking in Africa. Because of its magnitude, its catastrophic impact on child and maternal survival and development, and the fact that it often results from international, political and economic crises, malnutrition is one of the most significant global problems today (UNICEF, 1993).

Seventeen percent of the populations in the world were undernourished during the period between 1997-1999. Sub-Saharan Africa had the highest proportion of undernourished from 1997-1999 at 34%. At the country level, were eight countries that had prevalence rates of undernourished at over 50% in 1997-1999 and three of which were in East Africa, two in

Southern Africa, one in Central Africa, one in the Near East, and one in the Caribbean (FAO, 1999).

Strategies to combat hunger and malnutrition in developing countries have been guided by food security principles (FAO, 1985). Food security whether at national or household level, means being able to secure adequate food either through own production or food purchases for meeting the needs of all their members (Young and Jasper, 1995).

### **2.1.1 Protein Energy Malnutrition:**

PEM is a major problem in the developing countries and it is a major killer of children. It is usually coupled with high episodes of infections which result in lots of disability and high mortality. It also causes higher vulnerability to infection and results in decreased work output (Kielmann, 1976). PEM among children has been reported to be the most widely spread disorder in tropical and sub-tropical areas (McLaren and Frigg, 1997)

PEM results in increased retardation in physical dimensions, mental development, and subscribes to the morbidity in children and finally laminating in deaths. Its severe forms lead to marasmus and kwashiorkor. Children in early life are the most afflicted by nutritional deficiency due to their growth resulting in high nutrient requirements. The best indicator of adequate food intake of a young child is growth (Scrimshaw, 1981)

A national survey carried out in Kenya to study the nutritional status of the population showed that the situation was unsatisfactory in terms of the status and trends in the health, nutrition, and

educability of children from birth to six years of age (World bank, 1996). About 34% of children in this age group were underweight, and the trend of decreasing malnutrition rates seen in the 1980s appeared to be reversing (World bank, 1996)). Morbidity levels were extremely high, with an 80% prevalence of infection with worms.

### **2.1.2 Micronutrients of Significant Health Problems in Kenya.**

#### **Vitamin A:**

Vitamin A is a nutrient that is required by all body tissues for normal growth and tissue repair. It is present in the form of retinal in a variety of foods including milk, eggs and fish, or in its precursor form as carotene in fruits and vegetables, green leafy vegetables and red palm oil. Vitamin A deficiency (VAD) is a leading cause of blindness in children and can cause death. The National micronutrient survey conducted in 1999 revealed that VAD was associated with anaemia and that malaria parasitaemia, hookworm and malnutrition increased the risk of maternal VAD (Mwaniki et al, 2001). VAD is linked much more to the nature of foods available and feeding practices than to geochemical or other conditions that affect the whole population of geographic areas. Many studies suggest that VAD has socio-economic associations like iron deficiency (Allen and Gillespie, 2001).

#### **Iodine:**

Iodine is also another micronutrient of importance to the body. It is required by the body to synthesize thyroid hormones. Iodine deficiency impairs physical and mental development, including intellectual capacity. It leads to goitre, which is the enlargement of the thyroid gland,



educability of children from birth to six years of age (World bank, 1996). About 34% of children in this age group were underweight, and the trend of decreasing malnutrition rates seen in the 1980s appeared to be reversing (World bank, 1996)). Morbidity levels were extremely high, with an 80% prevalence of infection with worms.

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Vitamin A deficiency (VAD) is a leading cause of blindness in children and can cause death. The National micronutrient survey conducted in 1999 revealed that VAD was associated with anaemia and that malaria parasitaemia, hookworm and malnutrition increased the risk of maternal VAD (Mwaniki et al, 2001). VAD is linked much more to the nature of foods available and feeding practices than to geochemical or other conditions that affect the whole population of geographic areas. Many studies suggest that VAD has socio-economic associations like iron deficiency (Allen and Gillespie, 2001).

#### **Iodine:**

Iodine is also another micronutrient of importance to the body. It is required by the body to synthesize thyroid hormones. Iodine deficiency impairs physical and mental development, including intellectual capacity. It leads to goitre, which is the enlargement of the thyroid gland,

increased perinatal morbidity and mortality (Allen and Gillespie, 2001), but the most devastating effect of iodine deficiency is reduced mental capacity (Kennedy et al, 2003).

#### **Zinc:**

Zinc is an essential nutrient and its deficiency has been identified as the underlying cause of stunted growth in young children in many regions (Sandstead, 1991), and poor foetal growth during pregnancy, delivery complications and increased mortality in mothers and their babies (Tamara and Goldenberg, 1996). Dietary sources of zinc are protein-rich foods including meat, fish and shellfish. Zinc in cereal staples is often poorly bioavailable. Zinc deficiency contributes to the morbidity and ill health, growth and retardation reduced levels of physical and developmental activities in children and lowered productivity in adults. They severely affect more than a third of the world's population and have serious health consequences, especially for women and young children (Diosday et al., 2002). In Egypt and the Islamic Republic of Iran a condition in males characterised by dwarfism and hypogonadism (poor development of sexual organs) is associated with zinc deficiency (Latham, 1997). High risk of zinc deficiency in Kenya occurred in about half of children, mothers and men and this could be due to insufficient consumption of animal flesh (Mwaniki et al, 2001).

#### **Iron:**

Iron deficiency is the most common deficiency worldwide and is the most common cause of anaemia. Iron Deficiency Anaemia (IDA) is considered as a micronutrient deficiency of public health significance and it bears serious consequences in both adults and children. IDA increases

the risk of poor pregnancy outcome including prematurity, low birth weight, and maternal mortality.

### **2.1.3 Strategies in Addressing the Micronutrient Problem in Kenya**

Great progress has been made in recent years towards the elimination of vitamin A and iodine deficiency, while studies are still underway on the best possible strategies to prevent and control iron deficiency. For example, different approaches have been employed to control Vitamin A deficiency, i.e. supplementation using vitamin A capsules [short term], fortification or food enrichment [medium term], and dietary diversity and quality improvement [long term](GOK, 1994). Supplementation of the vitamin has been given in form of high dose capsules (200,000 IU) or oral dispensers (GOK, 1994). Integrating vitamin A supplementation with immunisation services has been WHO and UNICEF policy since 1994 (Allen and Gillespie, 2001). In Kenya, the Expanded Programme in Immunisation (K.E.P.I) has been instrumental in giving vitamin A dose to children with the aim of reducing the incidences of night blindness. Regular supplementation, during pregnancy reduces the prevalence of night blindness, and also reduces child morbidity and mortality. Food fortification has been implemented in different countries. In Guatemala, Costa Rica, Honduras and Panama enacted laws and regulations for addition of Vitamin A to sugar in 1974-76 (Bowley, 2003). In Kenya Blue Band margarine and some cooking oil have been fortified with Vitamin A.

Salt iodization is by far the most important population based intervention ever undertaken (in the control of IDD) although other vehicles have been used, e.g., tea in Tibet and drinking water in Thailand. Efforts towards establishing and sustaining national salt iodization

programmers have accelerated over the recent years with many countries having legislation for salt iodization. Globally, 68% of households in countries with IDD now consume iodized salt through partnerships forged between UN agencies and national and international NGO's and the salt industry (Jonsson, 1997).

Kenya has the best-developed IDD control program in eastern and southern Africa. Iodization of salt started in the 1970's and at present all salt manufacturers and distributors are required to iodate salt using potassium iodate. The recommended level of iodisation at production level is 100-mg iodine/kg of salt (Mannar and Dunn, 1995). The constraints experienced in this area are the small salt producers and the control of imported salt that may not be iodized.

Dietary interventions or food based strategies should therefore be the ultimate goal of every country as a logical, preferred, long term strategy of solving micronutrient malnutrition. This entails stimulating the production and consumption of micronutrient rich foods through nutrition education, communication, social marketing and behaviour change programmes to improve dietary quality among vulnerable groups and increasing bio availability of vitamin A and iron in the diet either through home preservation or processing techniques. Food-based strategies are advantageous because they can be sustained and the potential for households to benefit economically from increased production (Allen and Gillespie, 2001). In Kenya, current programs include promotion of Vitamin A rich orange fleshed sweet potato by Vitamin A for Africa (VITAA), the production of high mineral bean and general nutrition education by ministries of Health and Agriculture.

Iron supplements have been used in an attempt to combat iron deficiencies. World Health Organisation recommends that all pregnant women be supplemented with iron daily. There have however been problems of compliance and that must receive adequate attention due to unpleasant side effects, have been cited as one of the reasons for lack of impact of the supplementation programmes. Food fortification has the greatest potential to improve the iron status of the largest number of people. Fortification of foods such as flour (maize and wheat) or refined cereals is been done by manufacturers. Condiments such as salt, sugar, curry powder have been fortified in some countries. Advances are being made in these areas –fortification of maize is proving to be successful in Zimbabwe and the first sugar fortification experience in sub-tropical Africa is moving towards Zambia (ACN/SCN and IEPRI, 2000). Salt has been used as a vehicle for fortification with iron in South Asia.

These interventions however have their limitations. Supplementary feeding takes about a half of the budget in food cost (Johnson, 2001) and this makes the intervention not sustainable. The money may otherwise be allocated to help people become self-sufficient in their food production. (Caliendo, 1979). In food supplementation the most vulnerable groups who are the pre-school children, pregnant and lactating mothers may not be helped since supplementation is usually done in established institutions. Supplementation may lead to dietary interactions that may be disadvantageous.

There is urgent need to expand efforts in fortification where foods reaching the target groups are processed and where local fortification is feasible (Mannar, 2001). Food fortification though it has been done poses a major challenge in quality control at the points of

consumption, storage and production. Suitable foods to fortify ('vehicles') and the technical matters of stability, acceptability and so forth are still a problem in most parts of the world (Johnson, 2001).

In Kenya, an efficacy study is currently underway on the use of double fortified salt as a strategy of combating iron deficiency. Salt, which is the vehicle for fortification has the following advantages:

- It is one of the few commodities that is close to being universally consumed by almost all sections of a community irrespective of economic level, and is consumed at approximately the same levels throughout the year in a given year by all normal adults (Mannar and Dunn, 1995).
- The production of salt is generally limited to a few centres unlike other commodities. Therefore, double fortifying salt with iron and iodine at centralised locations is both practical and feasible and a majority of the population all over the country will ingest the nutrient in physiological amounts continuously with no additional costs (Mannar and Dunn, 1995).
- Infrastructure for refining, iodisation and packing and distribution of iodised salt is in place.
- Addition of iron in a stable and bio-available form can be done at minimum marginal cost to address another major public health problem of iron deficiency anaemia

## **2.2 FOOD CONSUMPTION, PRODUCTION AND NUTRITIONAL PROBLEMS IN AFRICA**

Globally, food production has increased although the per capita food production in Africa has been declining due to the rapidly increasing population (IFPRI, 1985).

African countries have been making substantial efforts to increase agricultural production, with the view of reaching self-sufficiency in food, especially in the production of staple foods mainly for commercial purposes and cash crops for export. Consequently, several African countries that were grain exporters have within the last decade become major food importers due to failed government policies (Sebit, 1994).

Over the past decade, the food, nutrition and health situation in Africa has been characterised by food shortages, famine, high maternal and child malnutrition rates, morbidity and death. The major problems witnessed are protein energy malnutrition and specific micronutrient deficiencies as mentioned earlier in section 1.1. The immediate causes of these problems are low dietary intake and concurrent diseases. National food security policies that increase the access of vulnerable households to food either through increased income or decreased food prices will enhance household level of food security. An increase in household food intake is often assumed to improve the food intake of the individual members (ACC/SCN, 1997).

## 2.3 IRON

Iron is an important trace mineral that is found in every cell of the body, usually combined with protein. It is essential to the formation of haemoglobin and myoglobin, which carry oxygen in the blood and muscles. It is also needed for catalysing the conversion of beta-carotene to vitamin A, for detoxification of drugs in the liver and for production of anti bodies (Yip and Dallman, 1996). Most of the iron in the body is found in the blood, but some is present in every cell, bound to iron-containing enzymes (Guthrie, 1995).

### 2.3.1 Functions

- ***Iron is used in the transport and storage of oxygen.*** It can bind the oxygen molecule and transport them to the blood (haemoglobin) or store them within the muscles (myoglobin). Haemoglobin is found in the red blood cells and is responsible for making blood. Oxygen bound in the myoglobin allows the muscles to operate effectively.
- ***Cofactor of enzymes and other proteins.*** Iron is required in the conversion of beta-carotene (a precursor of vitamin A) to the active form of vitamin A. It is also required in the synthesis of carnitine, a vitamin-like substance needed for the transport of fatty acids, and synthesis of collagen, one of the major structural proteins in the body. Iron is also required for detoxification of drugs and other toxic compounds in the liver and the intestine, and the synthesis of neurotransmitters. (Guthrie, 1995).
- ***Formation of red blood cells.*** Iron is required for the formation of red blood cells.



### **2.3.2 Determinants of Anaemia and Iron Status**

Anaemia is a condition in which the body can no longer produce and maintain the levels of haemoglobin required for optimum transport of oxygen to the tissues. Physical signs and symptoms appear, and work capacity is severely curtailed (Basta et al, 1979). Iron deficiency, which is the most common nutritional precursor of anaemia, has adverse effects on performance in physical activity and in cognitive and immunological domains (Dallman, 1987). This causes cognitive impairment, decreased physical capacity, and reduced immunity. In severe cases, capacity to maintain body temperature may also be reduced. It is usually the result of inadequate bio-available dietary iron, increased iron requirement during a period of rapid growth (pregnancy and infancy), and/or increased blood loss such as gastrointestinal bleeding due to Schistosomiasis.

The factors that contribute to Iron Deficiency Anaemia include nutritional/ dietary factor i.e. low intake and/ or bioavailability of dietary iron, diseases and parasitic infestations, physiological factors and socio-economic factors.

#### **2.3.2.1 Nutritional /Dietary Factors That Cause IDA**

Nutritional iron deficiency or habitual iron intake that is insufficient to cover requirements is the most common cause of iron deficiency (FAO/WHO, 2002). Dietary sources are present in two forms, haem and non-haem iron. Haem iron found in animal sources such as meat, poultry and fish, has greater bioavailability than does non-haem iron found in cereals, pulses, fruits and vegetables (Kennedy et al., 2003).

The main determinants of dietary iron are intake and bioavailability factors. Absorption inhibitors include calcium and phosphates, phytates found in foods cereals such as undegermed maize, whole wheat, brown rice, and legumes, phenolic compounds in legumes, nuts and high levels of tea and coffee consumption with meals and proteins from legumes and some animal protein sources. Oxalates found in spinach and other green leafy vegetables, low gastric acidity and dietary fibre also inhibit non-heme iron absorption (Guthrie, 1995; Ramakrishnan, 2000).

Absorption enhancers include ascorbic acid (vitamin C) that is found in fruits and raw or lightly cooked vegetables and animal products (meat, poultry and fish) (Gillespie, 1998).

#### **2.3.2.2. Diseases and parasitic infestation**

Malaria, diarrhoeal diseases, acute respiratory infections, HIV/AIDS, TB, Hepatitis B & C, severe protein-energy malnutrition, hookworm infestation, Schistosomiasis are known to cause and aggravate anaemia. Malaria is a leading causal factor. Non-inflammatory conditions such as rheumatic arthritis, malignant tumours and chronic renal failure are also associated with anaemia directly or indirectly. Genetic conditions e.g., sickle cell disease and trait affects haemoglobin levels (Mwaniki et al, 2001).

#### **2.3.2.3. Physiological Factors**

Increased physiological demands due to pregnancy, menstrual flow and growth of young children and male adolescents are also causes of anaemia.

##### **1) Pregnancy**

Pregnancy is a period of rapid growth and development. Maternal requirements for several hemopoietic nutrients (iron, folic acid and vitamin B<sub>12</sub>) are increased. Iron needs increase substantially during pregnancy and so does the prevalence of iron deficiency and iron deficiency anaemia. Iron deficiency during pregnancy is extremely common even among otherwise well nourished populations and the iron status at the beginning of a pregnancy is a strong determinant of haemoglobin concentration and iron status at the end of that pregnancy (UNICEF/UNU/WHO/MI, 1999). The total requirement of iron during a pregnancy is 1040mg of which 840mg are lost to the mother after delivery and 200mg retained as a reservoir of iron when blood volume decreases after delivery.

## 2) Lactation

Iron requirements during lactation are not increased as they are during pregnancy due to the low content of breast milk, absence of menstrual losses during lactation (part of it) and recuperation of iron reserves following delivery. Iron deficiency may continue during lactation among women who have small or no stores/or have incurred substantial blood losses during pregnancy. Other nutrient deficiencies and parasitic infections such as malaria and helminthic infections may contribute to anaemia. Anaemia during lactation can have adverse consequences for the health, productivity and ability to take care of the child (Ramakrishnan, 2000).

## 3) Early Childhood

Infants and pre-school age children are at an increased risk of iron deficiency and anaemia due to high physiological demands combined with low iron stores, inadequate dietary intake of bio-available iron and losses due to infection. Low birth weight infants and children 6 months to 2

years of age are at the highest risk of iron deficiency anaemia. Current recommendations include the provision of daily iron supplements in areas where anaemia is highly prevalent. (Ramakrishnan, 2000).

#### 4) Children, Adolescents and Adults

Numerous studies have shown the relationship between iron deficiency and/or iron deficiency anaemia and muscle function, physical activity, workplace and school productivity, and mental activity and concentration in older children and adults.

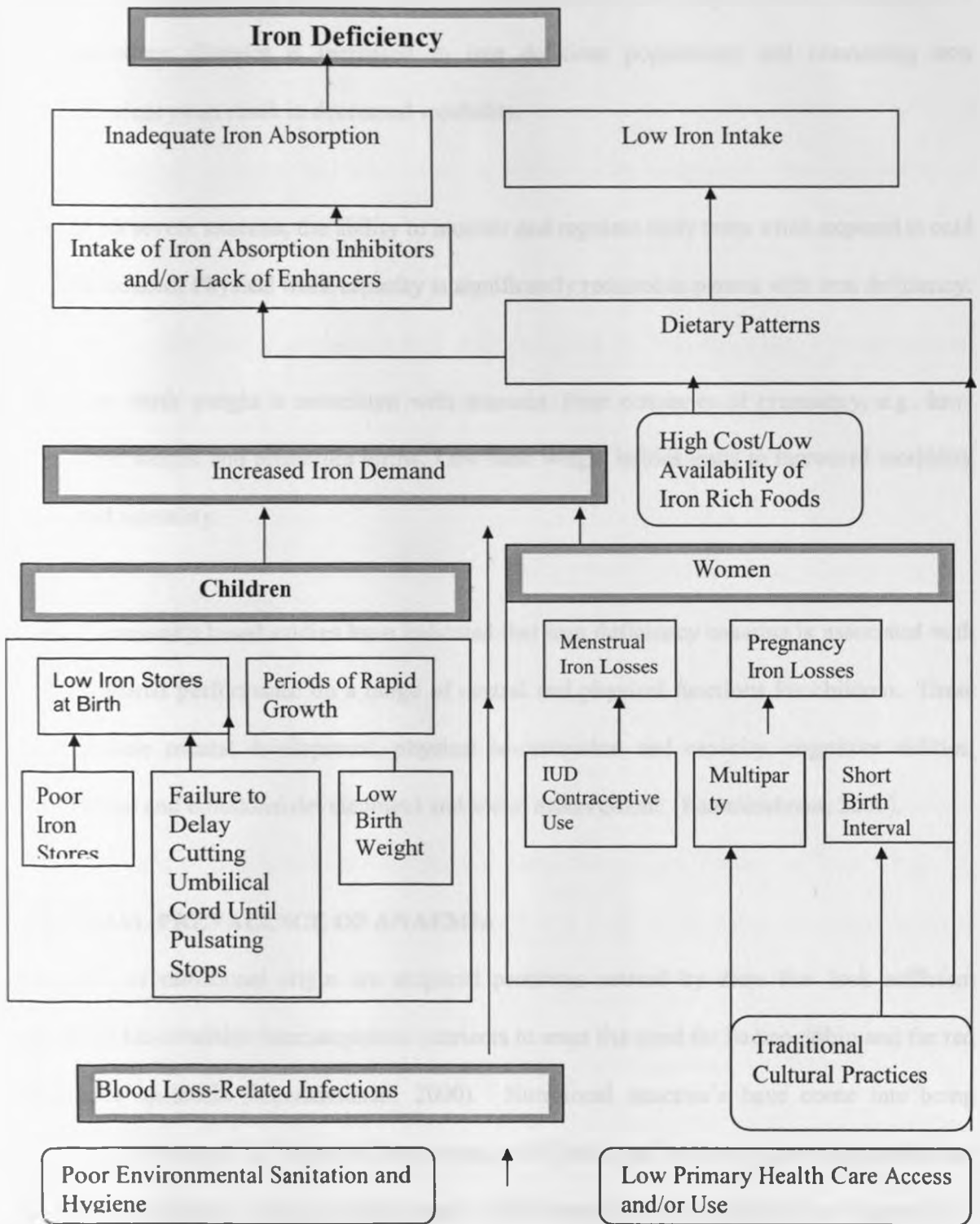
#### 5) Socio – economic and cultural factors

High prevalence of food poverty and inequitable availability, accessibility and affordability of health care services, and inadequate knowledge and skills to reduce risk of developing anaemia and in the general population are fundamental issues in the anaemia discourse.

At household level, while food security is the most closely associated factor in the nutrition matrix, food taboos, dietary and culinary practices have potential to alter the risk of developing anaemia (Mwaniki et al, 2001). **Figure 1** shows the factors contributing to anaemia in women and children. Failure to consume high amounts of iron required for growth and failure to replace losses during menstruation and pregnancy; a low intake of either total iron or absorbable iron; or excessive iron losses due to parasitic infections lead to iron deficiency.

## 2.4 CONSEQUENCES OF IRON DEFICIENCY

- Anaemia can contribute to maternal morbidity and mortality by increasing the chances of dying due to haemorrhage – there is evidence that severe anaemia (Hob<4g/dl) is associated with an increased risk of dying (Ramakrisnan, 2000).
- Child growth-iron deficiency may impair growth through its effect on immunity and appetite. Common causes of iron deficiency, especially parasitic infections such as malaria and hookworm, may also have direct effects on child growth. Poor intakes often co-exist with a variety of other nutrient deficiencies e.g. vitamin A, zinc and protein that may affect growth (Ramakrisnan, 2000).



**Figure 1: Factors Contributing to Iron Deficiency in Children and Women**

(Adapted from IPDAS, 1999).

- Iron deficiency can impair cognitive performance at all stages of life. Morbidity of infectious diseases is increased in iron deficient populations and correcting iron deficiency can result in decreased morbidity.
- With severe anaemia, the ability to monitor and regulate body temp when exposed to cold is reduced. Physical work capacity is significantly reduced in person with iron deficiency.
- Low birth weight is associated with anaemia. Poor outcomes of pregnancy, e.g., low-birth weight and premature births. Low birth weight babies leads to increased morbidity and mortality.
- Community based studies have indicated that iron deficiency anaemia is associated with impaired performance on a range of mental and physical functions for children. These include mental development, physical co-ordination and capacity, cognitive abilities, social and emotional development and social achievement. (Ramakrishnan, 2000).

## **2.5 GLOBAL PREVALENCE OF ANAEMIA**

Anaemia's of nutritional origin are acquired problems caused by diets that lack sufficient quantity of bio-available haematopoietic nutrients to meet the need for haemoglobin and the red blood cells synthesis (Ramakrishnan, 2000). Nutritional anaemia's have come into being because man changed his life-style from eating wild fruits and berries to growing cereals and cultivating vegetables. This caused the menu to shift towards foods containing less bio-available

haematopoietic nutrients (iron and vitamin B<sub>1</sub>) or those that enhance utilisation (Vitamin A and C).

Cultural evolution, however, has forced man to subsist on an increasingly narrower variety of food items, dominated usually by one or two crops, grains, tubers or both. This evolutionary transition of humans from hunters and gatherers to agriculturists reduced the micronutrient density of the diet, and as a consequence, micronutrients are consumed below recommended amounts by all but the most affluent societies. Combined with parasites, infections and chronic inflammatory stress, all of which reduce retention of dietary nutritional elements (Young and Jaspers, 2003).

The WHO estimates about 2 million individuals or 40% of the world's population suffer from anaemia. The prevalence of nutritional anaemia is very high among children and women of reproductive age in many developing countries and is associated with a range of functional consequences such as adverse pregnancy outcomes, limited school performance and reduced work productivity (Ramakrishnan, 2000). Inevitably the greater burden of iron deficiency anaemia is borne by developing sub Saharan African and South Asian countries. In these countries anaemia related morbidity and food inadequacies are a public health concern. **Table 1** below shows the World Health Organisation's estimates of the world's population that suffer from anaemia.



**Table 1: Global Prevalence of Anaemia and Iron Deficiency.**

WHO Region	Anemia ('000,000s)	%	Fe Deficiency Anemia ('000,000s)	%	Fe Deficiency ('000,000s)	%
Africa	237	39	175	29	438	73
America	142	18	106	14	266	34
S.E Asia	765	53	574	39	1435	99
Europe	80	9	60	7	150	17
E.Mediterranean	179	38	135	29	337	72
W.Pacific	578	38	434	29	1084	72
TOTAL	1981	34	14484	26	3710	64

(SOURCE: Adapted from Ramakrishnan, 2000).

Table 2 shows the World Health Organisation's cut off points and the proposed rank scoring criteria for anaemia.

**Table 2: WHO guidelines on cut-offs for public health importance of anaemia and proposed rank scoring criteria**

Grade of anaemia and its public health importance	Hbc, g/dl	Score	Prevalence of anaemia and grade, %			
			Mild and moderate	Score	Severe	Score
No problem	>11.0	0	<1	0	<0.1	0
Mild/mild problem	10.1 – 10.9	1	1 – 9	1	0.1 – 1	1
Moderate/moderate problem	7.0 – 10.0	2	9.1 – 9.9	2	1 – 9	2
Severe/severe problem	4.0 – 6.9	3	≥4.0	3	≥9	3
Very severe	<4.0	4	-	-	-	-

(Source: Ramakrishnan, 2000)

## **2.7 SITUATION IN KENYA AND KWALE**

The 1999 National Anaemia and Micronutrient Survey in Kenya indicated that nutritional anaemia was a major problem (Mwaniki et al, 2001). It indicated that about 40% of children and mothers were iron deficient and 30% were at risk of becoming iron deficient. In the Coast province, Kwale district has the highest prevalence. This could be attributed to the dietary practices and food consumption patterns. High prevalence of food poverty and inequitable availability, accessibility and affordability of health care services, and inadequate knowledge and skills to reduce risk of developing anaemia and in the general population are fundamental issues in the anaemia discourse. This study will furnish information on some of the factors that may be influencing Iron Deficiency Anaemia situation in Kwale District.

## **2.9 GAPS IN KNOWLEDGE**

Studies have been carried out that pointed towards micronutrient deficiencies in most parts of the country. However Studies done in Kwale indicate the high prevalence of anaemia in the district. Strategies have been put in place by key players in the health sector to address Vitamin A deficiency through nation-wide distribution of vitamin A capsules to infants, young children and mothers. No interventions have been put in place towards the elimination of iron deficiency, except for giving iron supplementation in form of tablets to expectant mothers. This strategy does not cater for the pre-schoolers or the other groups at risk and as such, food based intervention policies would be more appropriate because a larger population can be targeted and thus the aim of the study.

## CHAPTER THREE

### METHODOLOGY

#### 3.0 STUDY SETTING AND METHODOLOGY

##### 3.1 THE STUDY AREA AND POPULATION

The study was carried out in Kwale District, which is one of the six districts in the coast province. It is located in the south eastern corner of Kenya and borders Taita Taveta District in the west, Kilifi District in the north, Mombasa District and the Indian Ocean in the east and the Republic of Tanzania in the south.

Kwale district covers an area of 8,322 km, 62 km of which are under water, and an estimated population is 556,577 people, based on the projections of the 1989 National Population Census. The population in Lunga-Lunga location is 16,756 and the location covers an area of 441.6 square kilometres, with a density of 38 people per kilometre (CBS, 2001).

Kwale district is of low agricultural potential and experiences a monsoon type of climate. Its annual rainfall is 900- 1500mm along the coast to 500-600mm per annum in the hinterland. Average temperatures are between 26.3 C to 27.5 C. Administratively, Kwale District is divided into six divisions namely Matuga, Msambweni, Kubo, Kinango, Samburu and Lunga-Lunga. Lunga-Lunga division was carved out of Msambweni division in February 2004 and it has five locations namely Lunga-Lunga, Vanga, Mwereni, Kikoneni and Nzombo. Within these divisions, the district has 24 locations and 72 sub locations. **Appendix 3** shows the location of Lunga-Lunga.

The cash crops grown include coconuts, cashew nuts, bixa and cotton, whereas the subsistence crops grown in Kwale are maize and cassava. Sorghum and millet, both indigenous drought resistant cereals are not widely grown nor are vegetables. Pulses, e.g., beans, cowpeas, pigeon peas; groundnuts are commonly grown in small quantities. The livestock activities in the district include dairy, beef and poultry farming. Goats and sheep are also reared. **Table 3** shows the administrative divisions in Kwale District.

**Table 3: Administrative Units by Division**

DIVISION	NO OF LOCATION	NO OF SUB LOCATIONS
MATUGA	4	12
MSAMBWENI	7	22
KUBO	4	8
KINANGO	4	13
SAMBURU	5	17
<b>TOTAL</b>	<b>24</b>	<b>72</b>

Source: District Commissioners office Kwale (GOK, 1997).

The infant mortality rates in the district are among the highest in the country, currently at 122/1000 live births against the country's 74/1000. The leading causes of death in the district are Malaria-28%, Pneumonia-21%, Anaemia-13%, Diarrhoeal diseases-10%, and Acute-respiratory infections-8%. Malaria and anaemia are interrelated, as Malaria is a confounding factor in cases of anaemia (GOK, 1997).

### 3.2 THE STUDY DESIGN

This was a cross-sectional and descriptive study that utilised both quantitative and qualitative data collection methods. A structured questionnaire was used to collect the data. Food

consumption data was collected using the 3-day weighed record and the food frequency method. It was carried out in Lunga-Lunga in Kwale District. The survey was a short-term study, conducted between March and April 2004.

### **3.3 SAMPLE SIZE AND SAMPLE SIZE DETERMINATION**

The sample size taken for the study was **30 households** in the study area. The main reasons for this sample size was:

The study was an in-depth consumption study. Weighed food method was to be carried out in each household for all the meals consumed, for three consecutive days. This study is similar to a study conducted in 1995 in Southeastern Mali, by Hatloy et al., who used a sample size of 77 children.

- The study methods were very intensive and demanding on the household members as the study involved weighing of ingredients before the meals were cooked, and weighing of the food after cooking. The food served to each and every household member was also weighed. Any leftover food was also weighed to determine the actual intake by the household member. Household members who were present for the meal also had their weight taken before and after each meal. This was done for three days in each household and for all the meals cooked each day.
- Given the study population, the variability in their consumption patterns was very minimal and thus small sample size.
- It would have been very expensive to have a larger sample size given the intensity of the study.
- A sample size of 30 or more yields results that are statistically significant.

### **3.4 METHOD OF SAMPLING**

The sample selection was carried out in four stages. Lunga-Lunga Division was selected because this study is part of a bigger study, which has identified Lunga-Lunga division and Lunga-Lunga location as their study site. One sub location was randomly selected from the location followed

by random selection of three villages from the selected sub-location. Systematic random sampling was then used to select 10 households from each village. Due to the intrusive nature of the study only those households that agreed to take part in the study (verbal consent) were selected, after the nature of the study had been explained to them. All the household members present during the meals were included in the study. Some households were excluded if they found the study too demanding on their time and privacy.

### **Inclusion criteria**

Household selection criteria included: -

- Households whose family head agreed to participate in the study.
- Households with a child who is between 6 and 11 years years old

The sampling procedure used in the survey is illustrated in **Figure 2**.

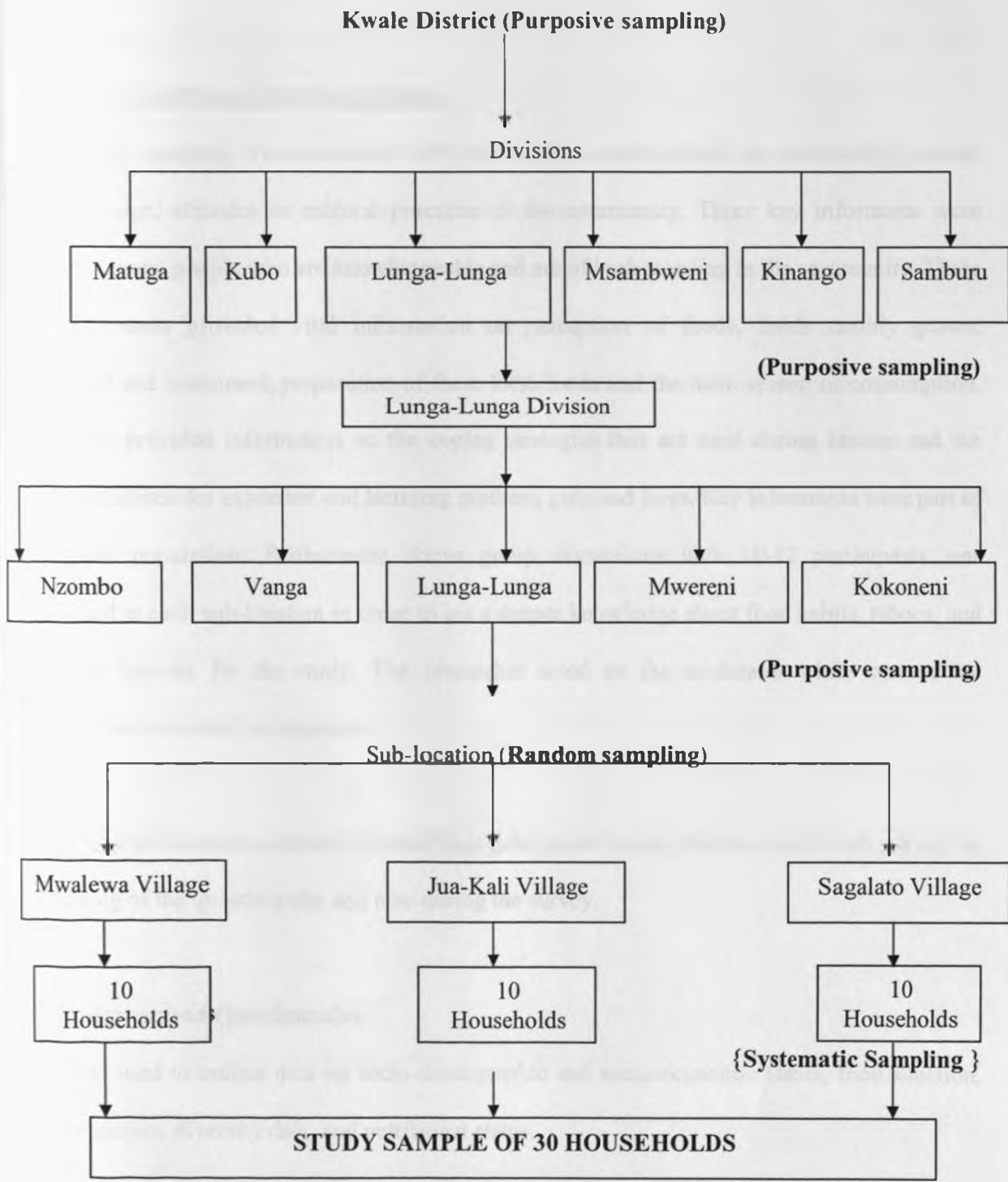


Figure 2: Sampling Chart

## **3.5 METHODS OF DATA COLLECTION**

### **3.5.1 Tools**

#### **3.5.1.1 Key Informant Interviews Guide:**

Face-to-face meetings were conducted with persons who could provide an overview/big picture of knowledge, attitudes or cultural practices of the community. Three key informants were selected among people who are knowledgeable and are of high standing in the community. These key informants provided vital information on perception of foods, foods mainly grown, purchased and consumed, preparation of these local foods and the main season of consumption. They also provided information on the coping strategies that are used during famine and the foods prohibited for expectant and lactating mothers, girls and boys. Key informants were part of the target population. Furthermore, focus group discussions with 10-12 participants was conducted in each sub-location in order to get a deeper knowledge about food habits, taboos, and to create interest for the study. The researcher acted as the moderator while one of the enumerators recorded the responses.

The local administration assisted in identifying field guides during the familiarity tour, during the pre-testing of the questionnaire and also during the survey.

#### **3.5.1.2 Structured Questionnaire**

This was used to collect data on socio-demographic and socio-economic status, food situation, dietary intakes, diversity data, and nutritional status.



### **3.5.1.3 Pre testing of the Questionnaire**

After training the field assistants, the questionnaire was pre tested to find out if the questions had been framed properly and to check the responses in order to correct any mistakes identified.

### **3.5.1.4 Socio-demographic and Socio-economic status**

On the first visit (day 1), the head of the household was interviewed and the socio-economic characteristics of all household members and the household were recorded using a household questionnaire. Demography entailed questions seeking information on the respondents division, location, sub-location and name of village, nature and age of respondent. It sought information on the household composition of the respondent, occupation, education level and marital status. All data were checked for errors each day. All dietary records were collected.

### **3.5.1.5 Food Situation**

The questionnaire sought to draw information on food availability. Questions were asked on the crops that the household grows, the amount of food they harvest, whether the food harvested is enough for subsistence or is it supplemented by foods from elsewhere, donations or purchases. This section looked at the food security of the household.

### **3.5.1.6 Dietary intakes and patterns**

The details of the study were explained to the household head in detail in order to avoid misunderstanding that could lead to errors. It was emphasised that they should do nothing extraordinary due to our presence. The Field Assistants were present during all three meals. The food scales were calibrated before use at everyday by weighing a two-kilogram packet of flour to reduce errors that could arise due to faulty scales. The food was measured to the nearest 1 gm.

All ingredients in each dish were measured before cooking. This was done using the food frequency questionnaire. The food frequency table contained a list of all the foods consumed locally in the area. Emphasis was laid on the consumption of iron rich, foods that inhibit or enhance the absorption of iron and substances that negatively interact with iron. A 3-day weighed food record was used, as it is the most precise method available for estimating usual food and / or nutrient intake of individuals. All food and beverages consumed by the household members were weighed during specified meal times. Details of methods of food preparation and types of food were also recorded (Gibson, 1990). The amount of water drunk was also measured. Firstly the weight of the empty pot was measured and then all the raw ingredients. When the dish was finished, the weight of the pot including all the cooked ingredients was measured and the time it took to cook the dish was recorded.

All ingredients were first measured in the container used to store the ingredients. After the use of each ingredient, the container was measured again and subsequently, the weight of the ingredient used was recorded as the difference between weight of the container before and after. This was chosen in order to reduce errors using the tare function and to interfere as little as possible when the food was prepared.

Emphasis was laid on the measurement of salt, as salt intake was a major component of the study. Salt was measured using a level metal teaspoon, whose standard measurement is 5 ml/gm. Measurements were taken with precision. If salt was added to the food and the broth discarded after cooking, the broth was weighed to determine the amount of salt discarded. Standard recipes were used if a dish was prepared outside the household or if the recipe was unknown. The weight

of each dish was recorded immediately after serving and any leftover food was measured at the end of the meal. Whenever foods, beverages or snacks were eaten in absence of the Field Assistant, the size or amount of each food item was estimated and recorded through recalls.

### **3.5.1.7 Nutritional Status**

Anthropometric measurements were used to assess nutritional status at household level of the children and the Body Mass Index (BMI) of the other members of the household. Height-for-age, weight-for-age and weight-for-height indices were derived from calculating and finding out the extent to which the three anthropometric indices deviated from the standard population measurement of healthy well-fed children. The height and weight were taken using the standard procedure as stipulated in the Food and Nutrition Technical Assistance manual (Cogli, 2003).

### **3.5.1.8 Calculations for bioavailability of iron**

Calculations were done on the bioavailability of iron present from the diets consumed by the households. This was done by multiplying the amount of iron present on the food by the bioavailability factor, for every meal consumed. The factors used were:

- 5% for cereals, roots, legumes with no ascorbic acid.
- 10% for low animal products with ascorbic acid.
- 15% for meat and ascorbic acid.

The calculations on the phytate: iron ratio was done as shown below

$$\frac{\text{Total phytates consumed by the individual per day}}{\text{Total iron consumed by the individual per day}}$$

### **3.5.2 Activities**

#### **3.5.2.1 Recruiting and training of field assistants**

The research/field assistants were recruited on the basis of their qualifications with assistance from the District Nutritionist. The minimum qualifications were Kenya Certificate of Secondary Education. Two of the research assistants recruited were trained public health officers while the other was experienced in field surveys. Those recruited were people of social standing within the community. The field assistants were trained for three days.

### **3.6 DATA TREATMENT AND ANALYSIS**

Data coding, entry and cleaning was done between April and May and analysis was carried out using SPSS and Epi –info statistical packages. Nutritional anthropometric indices, length or height-for-age, weight-for-age and weight-for-height of children were derived using height/length, weight and age determination. The Z scores were computed on the basis of NCHS-WHO reference growth curves. Maternal body mass index (BMI) was compared with the NCHS-WHO reference growth curves.

### **3.7 PROBLEMS AND CONSTRAINTS**

Some of the problems encountered during the study: -

- Some mother's refusing to complete the exercise, after collecting data for one meal
- School going children leaving for school too early before the field assistants arrive and their intakes had to be measured using the recall method.

### 3.8 DATA QUALITY CONTROL

Monitoring of the project was done to assess progress against set objectives and assess the effectiveness of implementation strategies. Evaluation assesses the efficiency and effectiveness of individual pre-determined stages of project implementation, beginning with the problem identification.

The Gantt Chart was used to evaluate the activities to ensure that activities were being carried out as initially scheduled. Verification of data on randomly selected questionnaires administered by the field assistants was carried out to minimise error due to data collection. Daily checking of all the questionnaires at the end of each day was done to check if there was information that needed to be verified the following day. Results were checked against the set objectives to determine whether they were being achieved or not.

## CHAPTER 4

### RESULTS

This chapter presents results of analysed data from the household questionnaire and measurements taken in the field. The results included characteristics of household members, socio-economic status of the households, food frequency and consumption. In addition, a result of the nutritional status of the households is given.

#### 4.1 STUDY POPULATION CHARACTERISTICS

A total of 30 households was randomly selected and interviewed during the study with a total population of 163. Of these, 84 (51.5 %) were men and 79 (48.5%) women. Seventy three per cent (73.3%) of the households were headed by males and 26.7% by females (**Table 4**). Majority of the household heads were married (86.7%), 6.7% widowed and 3.3% divorced and single respectively. There was no significant difference in marital status in the three villages ( $p > 0.05$ ).

**Table 4: Gender of household heads by village.**

Gender of HH Head	Total (%)N =30
Male	73.3
Female	26.7
Total	100

$$X^2 = 2.387 \quad p = 0.303 \quad (p > 0.05)$$

The population was distributed in the three villages as follows; Jua Kali had (61) Sagalato (58) and Mwalewa (44). There was no significant difference in gender in the villages ( $p > 0.05$ ). 44.3 % of the study population in Jua kali was male, 55.7 % female. In Sagalato the trend changed

with 60.3% males and 39.7% female. Mwalewa however had a 50/50 distribution of male and female. The mean number of children in the surveyed households was  $5 \pm 1.77$ . Table 5 shows the distribution of household members by age and sex.

**Table 5: Distribution of household members by sex and age.**

Years	Males	Females	Total
<5	10 (6.13%)	6 (3.68%)	16 (9.81%)
5-14	38 (23.3%)	32 (19.63%)	70 (42.94%)
15-64	31 (19.0%)	41 (25.15%)	77 (47.23%)
>65	5 (3.06%)	0 (0%)	5 (3.06%)
<b>Total</b>	<b>84 (51.49%)</b>	<b>79 (48.46%)</b>	<b>163 (100%)</b>

The predominant religion in the area was Islam (70.6%), Protestants (21.5%) and Catholics (7.4%). Sagalato village recorded 100% Muslim households while 70% of the households in Jua Kali were Protestants mainly due to the fact that most of the residents in this village are not indigenous people from the cost but are mainly the Kamba from Eastern Province. In Mwalewa 90% of the households were Muslims. There was a significant difference in religious affiliations in the villages ( $p < 0.05$ ).

#### 4.1.1 Level of Education

A majority of the population had basic primary education (61.9%). Those with secondary education were 8%, tertiary education 1.2%. Those who had not attained school enrolment age were 15.9% while those who never attended school accounted for 12.9% of the population. Less than half of the mothers attained primary education (44.8%) and 37.9% had no formal education. However, 13.8% attained secondary education with only 3.5% having tertiary education. The percentage of men (household heads) who had basic primary education among the households

surveyed was 66.7 % and those who had no formal education were 4.8 % and this is lower than the illiteracy level of women (Figure 3).

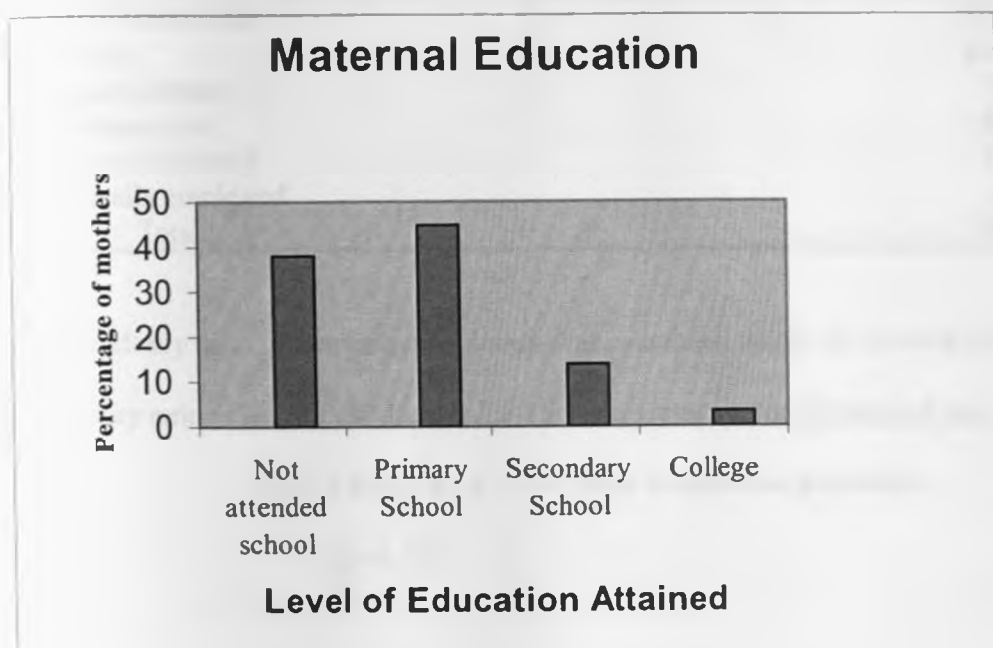


Figure 3: Maternal Level of Education

#### 4. 1. 2 Occupation

The dominant occupation in the three villages was small-scale trade. The next occupation was on farming. The population of students among the households was high as seen in the table below. Only 4.3 % were formally employed (Table 6). Most of the household's contribution to the running and maintenance of the homes was in monetary terms (93.3%) and that whose contribution was labour was only (6.7%).



**Table 6: Occupation of household heads by Village**

Occupation	Percentage (%)
Small scale trader	36.7
Farmer	23.3
Casual labourer	10
Business man	6.7
Others (children)	3.3
Formally employed	2
Total	100

The dependency ratio in the study population was calculated using the formula below: -

Dependency ratio =  $\frac{\text{Sum of children under 15 years} + \text{adults over 64 years of age}}{\text{Sum of adults aged 15-64 years in the same population}}$

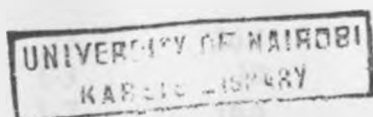
Sum of adults aged 15-64 years in the same population

$$= \frac{81}{72} = 1.125.$$

#### 4. 1. 3 Socio-economic Status

##### *Income and Expenditure on Food*

Results show that 58.6% of the households in the study had a total monthly income of between 2,000.00-5,000.00 Kenya Shillings. The mean household income was 2069.00 ± 0.650. 17.2% of the respondents had a monthly income of below 2,000.00 shillings (Table 7). There was no significant difference in the monthly incomes. Jua Kali village recorded the highest percentage of the maximum income bracket.



**Table 7: Percentage distribution of monthly income by Village**

Village	<2,000 KSh %	KSh. 2000-5000 %	KSh. 5000-10000 %
Mwalewa	11.1	44.4	44.4
Sagalato	20	80	0
Jua Kali	20	50	30
<b>Total</b>	<b>17.2</b>	<b>58.6</b>	<b>24.1</b>

The mean household expenditure on food was  $3051 \pm 1148$ . The results further showed that 58.6% of the households spent below Ksh. 3000 on food per month. Mwalewa recorded the highest expenditure of 5000.00 shillings per month.

*Amount of Land available to the Households*

The amount of land owned by the households ranged from 0.5acres – 4 acres with a mean of 1.84 acres and a SD of 0.85. Most of the respondents owned the land they lived in with only 3.3% renting land and pay between Ksh. 1000.00 –1500.00 per acre. Most of the households kept minimal livestock as shown in the **Table 8**.

**Table 8: Table Showing the Number of Livestock Owned by the Households**

Animal	Number	Percentages	Livestock units/animal
Cows	2	6.7	1
	4	3	
	5	3.3	
Goats	1-2	23.3	0.2
	>3	26.4	
Sheep	1-3	10	0.2
Rabbits	1-7	16.6	0.01
Chicken	1-3	16.7	0.01
	5	10	
	>7±	16.5	

Most of the households owned the houses they lived in with only 10 % (n=30) renting houses. This was mainly in Jua Kali village (30%) as the respondents in both Sagalato and Mwalewa recorded 100% ownership of the houses they lived in. There was a significant difference in the ownership of houses ( $p=0.036$ ). The mean rent paid was Ksh.416.66  $\pm$  .57.73 per month. The mean number of rooms in the houses was 3 and there was no significant difference noted in the three villages.

Most of the houses were semi-permanent. The most common material used for the construction of the roofs was 'makuti' (50%) and iron sheet (50%). Almost half the walls were made of mud (46.7%), 33.3% plastered with cement and 20% were block/ stone walls. The most common floors were mud floors (53.3 %) and 46.7% of the floors were cemented.

Majority of the households used tin lamps as their first energy source for lighting (90%; n=30), while 66.7% used hurricane lamps as their second source of energy. There was a significant difference in the second energy source for lighting among the villages ( $p=0.009$ ). Wood was the most common fuel used for cooking (83.3%) and there was no significant difference in the first source of cooking energy, but a significant difference was recorded in the second energy source for cooking ( $p=0.027$ ) in the three villages.

## 4. 2 FOOD CONSUMPTION

### 4. 2. 1 Food production

Minimum land under production was 0.5 acres with a maximum of 4 acres with a mean of 1.73  $\pm$  0.82. Only 23.3% of the households produced their own staple whereas the majority (76.7%) purchased the staple. Of those who produced their own food, 13.2% had their food last between

0-6 months; about 20%, 11-24 months, and 10% had their food last for 10 months. Most of the households, about 90% purchased their staple food during the year preceding the harvest.

#### **4. 2. 2 Consumption**

On average most households consumed two meals per day, breakfast and lunch, breakfast and supper or lunch and supper. Tea and 'mandazi' were the foods normally consumed during breakfast, by 38.2 % of the households while 20 % of the households take strong tea (i.e., tea without milk) for breakfast.

The households mostly consumed ugali and amaranths, and ugali and dagaa at lunchtime (46 % and 13.3 %). The third food group was ugali, fish and amaranths (6.7%). The majority of households ate ugali, fish and amaranths (20.0%), and ugali, dagaa or ugali amaranth (16.7%) for supper. Tea was usually during breakfast by 82 % of the households.

#### **4. 2. 3 Frequency of consumption**

Maize was consumed daily by 56.7% of the households mainly as ugali and the frequency was once per day. Other cereals were consumed daily by 44.6% of the households. The root and tuber group consumption was relatively poor with about a quarter of the households consuming them 2-3 times a week. Cassava was eaten 2-3 times a week and daily by 23.3% and 10.0% of the households, respectively. Irish potatoes 2-3 times a week by 33.3% of the households. Sweet potatoes were consumed once in a while by 66.7% of the households. Animal proteins were rarely consumed with only 23.3% of the households consuming them daily. Beef was rarely consumed with 33% of the households consuming this once in a while. Fish (shark) was

consumed by slightly over half of the households on a daily basis. Fish (Dagaa) was consumed daily by about a quarter of the households. Most of the households consumed sugar daily (93.3%). Fats and oils were consumed daily by 76.7% of the households. Salt was used daily in meal preparations by all the households (Table 9).

**Table 9: Frequency of consumption of some foods consumed by the households**

Food	Daily (%) n=30	4-6 times a week (%) n=30	2-3 times a week (%) n=30	Once a week (%) n=30	Once in a month (%) n=30	Once in a while (%) n=30
Maize	56.7	30	13.3	-	-	-
Rice	-	13.3	36.7	-	6.7	6.7
Wheat	73.3	10	-	6.7	-	-
Cassava	10	-	23.3	33.3	13.4	-
Irish potatoes	13.3	-	33.3	10	13.3	-
Sweet potatoes	-	-	-	13.3	6.7	66.7
Beans	20	13.3	56.7	-	-	-
Soya beans	-	13.3	43.3	10	6.7	-
Coconut	70	13.3	6.7	10	-	-
Beef	-	-	13.3	13.3	33	-
Milk	46.7	6.7	10	13.3	10	-
Fish	53.3	3.3	16.3	6.7	-	13.3
Dagaa	23.3	10.	20	23.3	-	10
Sugar	93.3	-	3.3	-	-	3.3
Salt	100	-	-	-	-	-
Fats & oils	76.7	3.3	6.7	3.3	6.6	-

#### 4. 2. 4 Frequency of vegetable and fruit consumption

45.7% of the households consumed vegetables daily, 19.9% 2-3 times a week, while 12.9% consumed them at least once a week. The green leafy vegetables consumed by the households were amaranths, cowpea leaves, nightshade, kales and spinach. Amaranths were consumed by 46.7% of the household's 2-3 times a week. Almost half of the households consumed kales 2-3

times a week. Cowpea leaves was consumed 2-3 times a week (26.7%). Cabbage consumed by a third of the households 2-3 times a week and nightshade once a week by a quarter of the households. Sweet potato leaves are rarely consumed in the area; majority of the households (83.3%) never used them while a quarter of the households used them once in a while. Spinach and carrots are also rarely consumed with only 23.3% and 30% respectively consuming them once in a while.

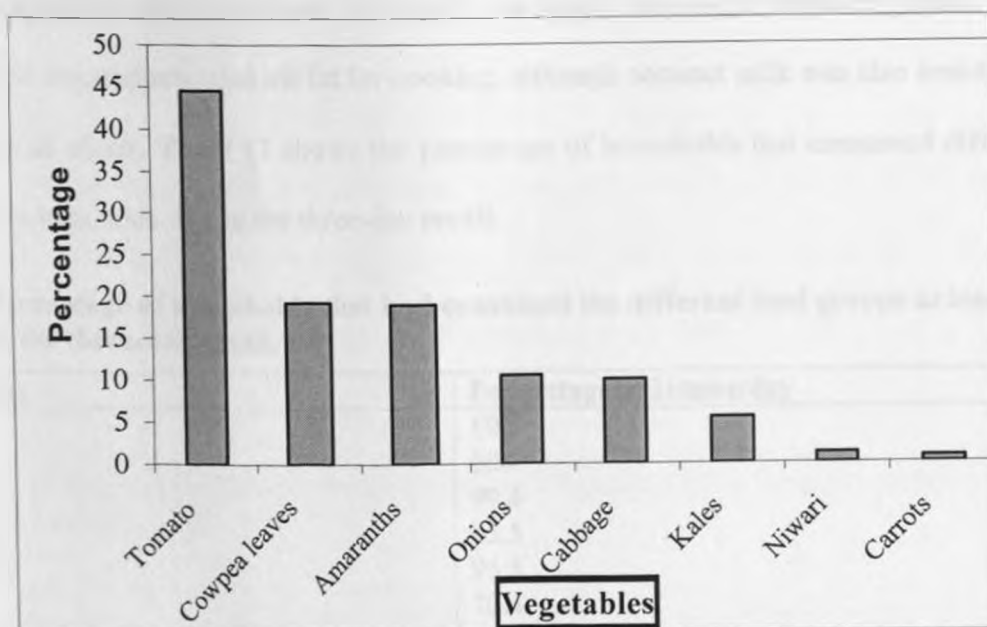
Fruits were not given much importance in the diets with the majority of the households consuming them once in a while. Only 8.5% of the households consumed fruits daily as illustrated below (Table 10).

**Table 10: Frequency of consumption of fruits and vegetables by the households.**

Fruit	Daily (%)	4-6 times a week (%)	2-3 times a week (%)	Once a week (%)	Once a month (%)	Once in a while (%)
Mango	16.7	-	-	-	-	50
Banana	-	-	13.3	20		40
Guavas	-	-	-	-	-	66.7
Lemon	23.3	-	10	33.3	-	33.3
Oranges	16.7	-	-	-	-	50
Pineapple	-	-	-	-	10.0	66.7
Paw Paw	-	-	-	6.7	-	50
Amaranths	6.7	20	46.7	13.3	-	-
Cowpea leaves	-	-	13.3	20	13.3	26.7
Kales	6.7	10	46.7	16.7	10	-
Cabbages	-	13.3	13.3	20	10	-
Onions	73.3	-	6.7	-	-	6.7
Tomatoes	53.5	-	16.7	-	-	13.3

#### 4.2.5 Methods of preparation of vegetables for consumption

The preparation and actual cooking of vegetables was observed. Amaranth, cowpea leaves, black nightshade and kale were sorted, chopped, washed and fried by 63% of the households, while 10% cut, washed and boiled the vegetables. Only 6.6% of the households washed their vegetables before chopping and either boiling or frying them. Cooking was mainly done in open fires i.e. on the three stone stoves. Amaranth was cooked in large amounts of water, which was discarded before frying the vegetables or addition of coconut milk. Cabbage was fried for about 10 minutes. Some households boiled the kales for about 10 minutes then fried them for another 10 minutes. Nightshade and cowpea leaves were boiled for between 20 to 30 minutes before frying them or adding coconut milk to them. **Figure 4** shows the percentage of vegetable consumption among the households surveyed.



**Figure 4:** Percentage of household's that consumed vegetables during the 3-day recall.

## 4.3 FOOD AND NUTRIENT INTAKE

### 4.3.1 Food intake

The 3-day weighed food record provided information that was used to evaluate the dietary intakes of the household surveyed. The households mainly drank strong tea and mandazi for breakfast. Most households' staple food was ugali. Non animal proteins such as beans were eaten more commonly than meat products. The most commonly consumed meat product was shark ("papa") that was consumed by 51.6% of the households. Dagaa was also consumed by 32.9% of the households. The percentage of households that consumed meat and milk was 28.4 and 43.9 respectively. The respondents did not consume a wide variety of vegetable everyday. The vegetables eaten almost daily were tomatoes. Other vegetables consumed included onions, carrots, amaranths, cowpea leaves, kales, cabbage, nightshade, carrots and 'niwari'. Figure 4 shows the vegetables that were most commonly consumed within the three-day period. The majority of the respondents used oil/fat for cooking, although coconut milk was also commonly used in place of oil/fat. Table 11 shows the percentage of households that consumed different food groups at least once during the three-day recall.

**Table 11: Percentage of households that had consumed the different food groups at least once during the three-day recall.**

Food Groups	Percentage of Intake/day
Cereals	100
Maize	100
Beverages	99.4
Vegetables	95.5
Fats and oils	95.5
Pulses	79.4
Nuts (coconut)	74.2
Milk and milk products	43.9
Tubers and starchy roots	40.6
Meat, poultry and eggs	40.4
Fruits	27.7



#### 4.3.2 Intake of iron and other macronutrients

The daily iron, calorie, protein and vitamin C intakes for the household was calculated from the three day weighed food record data. This was then compared with the recommended dietary allowance to measure the adequacy in the diets.

The recommended dietary allowance (RDA) for iron was met by three-quarters of the households. However, the absorption rates from the foods consumed suggest that 83.9 % of the household members did not meet their recommended dietary allowance as the iron sources was mainly non haem-iron. The mean of the phytate: iron ratio in the foods consumed was  $0.873 \pm 0.858$ . This means that the bioavailability of iron is greatly interfered with by the phytates. Furthermore, the vitamin C requirement was met by only 40% of the households as shown in **Table 12**. It therefore appears that the calorie and vitamin C consumption in the area is quite inadequate.

The results showing that almost three-quarters of the households were deficient in calorie intake. The majority of the households met their daily protein requirement. **Table 12** shows the households consumption of the above nutrients during the 3-day weighed record.

**Table 12: Percentage of households meeting the recommended RDA for iron, calories, proteins and vitamin C.**

Nutrient	% below RDA
Proteins	4.5
Iron	20.6*
Vitamin C	60
Calories	72.9

\*Percentage does not take into account bioavailability of iron

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Nutrient	% below RDA
Proteins	4.5
Iron	20.6*
Vitamin C	60
Calories	72.9

\*Percentage does not take into account bioavailability of iron

The results indicate that the diets in the households surveyed were not adequate in meeting the nutritional requirements of the most vulnerable groups. Women and teenagers were quite disadvantaged when it came to iron RDA with only 53.1% and 66.7% meeting the RDAs when only intake is considered. However, when the foods were analyzed for bioavailability results indicated that 95.8% of children below five years did not meet their iron RDA because the sources of iron in the diet were mainly non-haem.

The percentages of the 6-11 year olds, teenagers and adults whose intake contained insufficient bioavailable iron and therefore did not meet the RDAs was 83.3%, 96.3% and 73.7% respectively as shown in **Table 13**. Vitamin C consumption was also wanting in the three groups with children below 5 years and teenagers being the most affected in this group. The households were also quite deficient in meeting their energy needs with over three-quarters of the under fives and teenagers below the recommended dietary allowance. (**Table 14**)

**Table 13: Iron status of the individuals after consideration of the influence of both diet and iron status on iron absorption.**

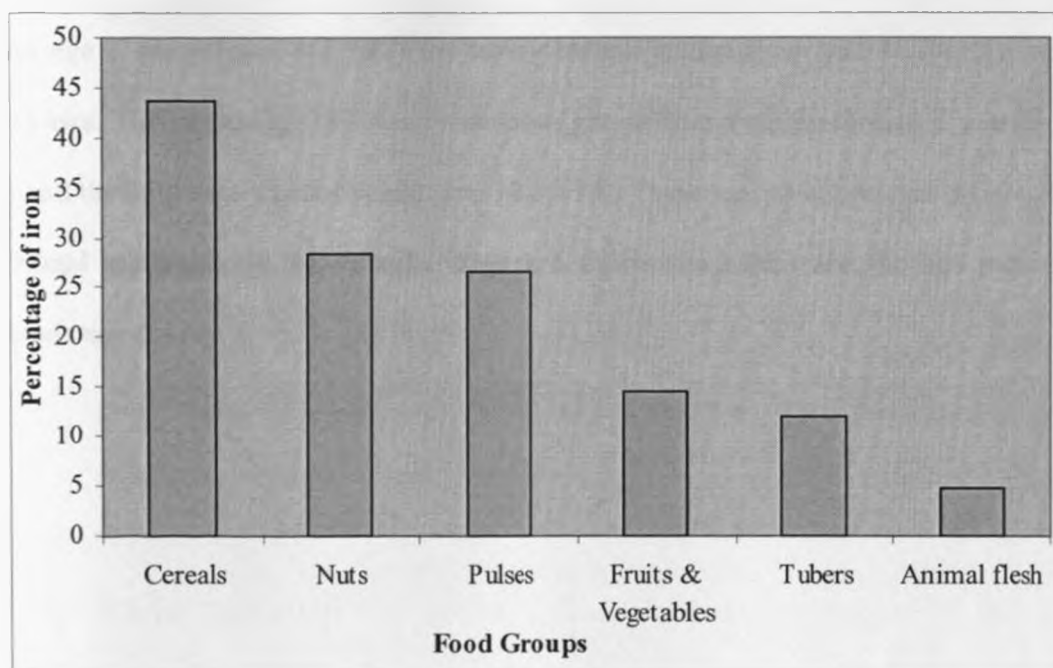
Group	% <RDA		Total % <RDA
	Male	Female	
< fives	60.4	34.8	95.5
6-11yr olds	37.5	45.8	83.3
Teenagers	55.6	40.9	96.3
Adults	21.1	52.6	73.7

**Table 14. Adequacy of iron, proteins, calories and vit .C among the vulnerable groups.**

Group	Kcal < RDA	Protein < RDA	Iron < RDA*	Vitamin C < RDA
Children<12	82.4 %	4.1 %	12.2 %	70.3 %
Teenagers	87.5%	16.7%	33.3%	70.3%
Women	31.3%	100%	46.9%	50%

\*Without considering the bioavailability of the iron from the foods consumed.

Results indicate that most households most of the iron in their diet was mainly plant based as shown in the figure below. Cereals contributed the highest percentage of iron among the food groups that was consumed. **Figure 5** shows the percentage of iron contributed by the different food groups.



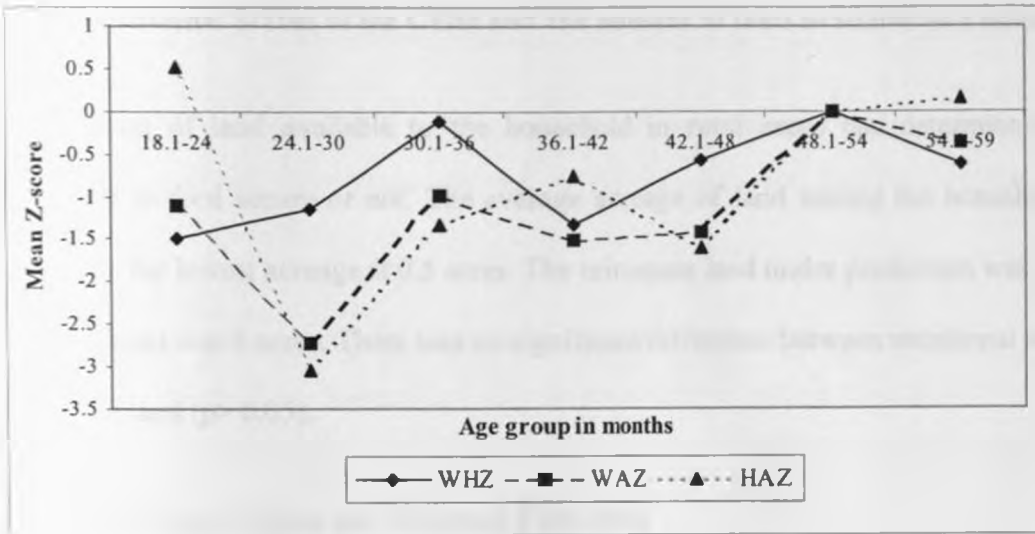
**Figure 5: Graph showing percentage of iron contribution by food groups consumed by households**

### 4.3.3 Salt Intakes

All the households used iodised salt. The amount of salt used by the various groups varied slightly according to the amount of food consumed. The under fives and the children aged 6-11 years consumed the least intakes with  $4.36 \pm 2.55$  and  $7.12 \pm 3.36$  grams daily respectively. The teenagers and adult consumption was  $8.87 \pm 4.38$  and  $10.29 \pm 4.42$  respectively. No significant difference was noted in the salt intakes between the men and women. (t test  $p = 0.734$ ).

### 4.4 AGE PATTERN OF MALNUTRITION

Three indicators were used to assess the nutritional status of the study of the children: height-for-age, weight-for-age and weight-for height. The percentage of the under fives who suffered from moderate malnutrition –(weight for height-Z scores) was 17.4% (4)). The percentage of stunting (height-for-age Z scores) was 8.7 %(2) for severe chronic malnutrition and 21.7% (5) for the moderate cases. The percentage of severely underweight children (weight-for-age Z scores) was 4.3% (1) and the moderately underweight was 17.4% (4). There was no significant difference in the nutritional status among the villages. **Figure 6** shows the means and the age pattern of malnutrition respectively.



**Figure 6: Malnutrition means of the under fives.**

The Weight-for-height, height-for-age and weight-for-age Z scores, trend lines show that the means increase with age.  $R^2 = 0.350, 0.085, \text{ and } 0.4$  respectively, indicating that there could be a problem with childcare practices in the area.

Of the children between 6-11 years of age, the results showed that 17.4% ( $n = 30$ ), were suffering from acute malnutrition (Weight-for-Height Z scores), while 30.4% and 21.7% were stunted (Height-for Age Z scores) and underweight (Weight-for-Age Z) scores respectively.

#### 4.4.1 Body Mass Index

The findings indicate that about half of the adults both male and female (50.9%) were underweight. Nearly half of the mothers were severely and moderately underweight (46.5%), while 32.1 percent of the mothers were found to have BMI values greater than 25.

#### 4. 4. 2 Nutritional Status of the Child and the amount of land available to a household

The amount of land available to the household in rural areas can determine whether the household is food secure or not. The average acreage of land among the households was 1.8 acres with the lowest acreage at 0.5 acres. The minimum land under production was 0.5 acres and the maximum was 4 acres. There was no significant difference between nutritional status and the amount of land ( $p > 0.05$ ).

#### 4. 4. 3 Nutritional Status and Maternal Education

Results in **Table 15** show levels of malnutrition (underweight, stunting and wasting) vis a vis. the maternal education. These findings indicate that malnutrition was highest among children from households where mothers had primary education and below. Malnutrition was also recorded in a family where the mother had college (tertiary) education. No cases of malnutrition were recorded in households where the mother had secondary education. There was no association between the nutritional status indices and education level for the under fives ( $p > 0.05$ ).

**Table 15: Distribution of Malnourished 6-11 Year Olds with Maternal Education**

Levels of Malnutrition N=30		Maternal Education			
		No formal education	Primary school	Secondary school	Tertiary education
<b>Underweight</b>	Moderate	3.3%	13.3%	-	3.3%
	Total	<b>3.3%</b>	<b>3.3%</b>	<b>0.0</b>	<b>3.3%</b>
<b>Wasting</b>	Moderate	-	3.6%	-	-
	Total		<b>3.6%</b>		
<b>Stunting</b>	Moderate	-	10.3%	-	-
	Severe	-	3.4%	-	-
	Total	-	<b>13.7%</b>		

#### **4.5 DIETARY AND CULTURAL PRACTICES THAT AFFECT FOOD CONSUMPTION**

Focus Group Discussions and Key Informant interviews were used to obtain information on the dietary practices of the people, and the culturally accepted feeding practices among the community.

The interviews indicated that the mothers with the assistance of the daughters who do not attend school do cooking. The mother does intra-household food distribution. Food is served to two different groups in the family, i.e. to the father who eats with his sons and the mother with her daughters and the young children. The cooking utensils used for food preparation are the aluminum pans "sufurias." Earthenware pots are used to make soups.

The food grown in the area included cereals, e.g., maize, rice and sorghum, vegetables, e.g., amaranths, nightshade, kale, cow pea leaves, cassava and beans, mangoes, watermelons, pineapples oranges and coconuts. Results also indicated that maize is grown in two seasons, but rice is only grown in one season.

##### **Preservation of food:**

The households usually do not harvest much but preserve maize by stashing the cobs above the fireplace, beans are dried then rubbed in ashes made from the bean pods and stalks, rice is sun dried, while cassava is smoke dried by putting it above the fireplace in the kitchen.

##### **Weaning foods and foods given to infants:**

Children are weaned from the fourth month. The infants are mainly fed on porridge made from maize meal. 'Wimbi' (millet) porridge is introduced between 4-6 months. Malnourished children are fed on porridge made from high protein flour (with beans and 'daga'). Other weaning foods include mashed English potatoes with milk and cassava flour. Solid foods are introduced earlier than usual infant cries too much and the mother suspects the breast-milk is not enough. By the time the child is one year old, he/she eats food eaten by all the household members', i.e., not on a special diet any more.



### Foods that are culturally forbidden:

Expectant mothers are not allowed to eat eggs because of the belief that they could give birth to children with little hair. They are also forbidden to eat certain fish, e.g., 'Fumi or ntongi' because it is believed that if eaten, the baby will not be able to cut its teeth quickly, and fish without scales would make a child slippery during birth. Expectant mothers are also not allowed to eat prawns for fear that the child would have patches on the skin. There were no taboos that restricted other groups within the family from eating any food.

### Coping strategies during famine

The community gathers /collects tubers from the forest during periods of food shortages e.g. from the 'Mtukuru' tree, which is grated and soaked in water to make flour. This flour is boiled to make porridge. Coconuts are also eaten, and so are mangoes, that are boiled and made into porridge like substance.

### 4.6 Pearson Correlation Results

The findings indicated that there was significant correlation between age and the total protein consumed, age and vitamin C consumption, food expenditure and total iron consumed and iron and weight- for-age Z scores. Table 15 shows the summary of correlation and significance of key variables with nutrient intake.

**Table 16: Correlation between different variables and nutrient intake**

Variables	T prot		T Iron		T Vit C		T Cal	
	r-value	P-value	r-value	p-value	r-value	p-value	r-value	p-value
land	-0.204	0.328	-0.234	0.261	-0.099	0.639	-1.147	0.515
Age	0.245	0.002**	0.149	0.063	0.284	0.000**	0.147	0.071
WAZ	-0.292	0.177	-0.477	0.021*	0.037	0.868	0.374	0.114
HAZ	-0.400	0.058	-0.03	0.160	0.059	0.791	0.379	0.108
WHZ	-0.027	0.903	-0.386	0.069	-0.030	0.891	0.189	0.438
Food Expenditure	-0.316	0.095	-0.287	0.132	-0.331	0.079	-0.425	0.034*

\* Correlation is significant at <0.05 level (2-tailed)

\*\* Correlation is significant at < 0.01 level (2-tailed)

## CHAPTER FIVE

### DISCUSSION

#### 5.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS

##### 5.1.1 Demography

A majority of the study population was below 15 years of age. A dependency ratio of above one indicates that those requiring support are more than those working and this is bound to put an economic strain on the households. The low percentage of males to females (4.3%, 6.1%) might indicate that females have a higher longevity than males in the study area, although the small sample size in this study was not adequate to give a clear representation of the true demography of the study population.

The mean household size in the study area was 5 persons. This was higher than the mean household size of 4.4 at the Coast and the country (KDHS, 2003), and almost similar to the 1998 household size of 5.3 (GOK, 1998). The average rural household size currently stands at 4.7 (KDHS, 2003). A household becomes food insecure when all potential resources are strained or threatened (GOK/UNICEF, 1998). The larger the household size, the less the available resources. Kenyan rural families are generally large, and with limited amount of land, most households are unable to produce adequate amounts of food (Kigutha, 1995). Given that the households were not food secure, the household size could impact negatively on the net per capita food consumption, especially of micronutrient rich foods. Studies have showed that when the number of people in a country or a community or a family increases, its food needs also increase (Kigutha, 1995). However, food availability is influenced by more than population size.

Economics, politics and geography are factors; too. Kenya like many other developing countries, infant and young child mortality rates have declined markedly in the past 30 years, especially given that women have continued to have the same number of babies with fewer dying leading to increased average family size (Latham, 1997).

The amount of land owned by the households ranged from 0.5 acres – 4 acres with a mean of 1.84 acres ( $\pm 0.85$  SD). According to the World Bank, (1973) and FAO (1986), the adequate recommended land in acres that a household in a country like Kenya, should own for adequacy in food production is 12 acres. This however was not the case in Lunga-Lunga location. The mean acreage in the study area was 1.84 acres. The production of food, especially the staple, was inadequate with a large majority of the population not meeting their required caloric requirement and as such, had to depend on other sources for food, such as markets. The land has not been demarcated and the indigenous people do not have titles for their land. This affects crop production as people are unwilling to invest in agriculture as they are uncertain of their future (Sunday Standard, 2004). The area is of low agricultural potential. The area also receives relief food from the government indicating that the area is not food secure. Increasing scarcity of arable land and rapid population growth and strong land inheritance traditions, fragmentation, has reduced the land holdings in Kenya and other countries (Kigutha, 1994).

Males' (73.3%) and 26.7% females head most of the households. This is almost similar to the 2003 Kenya Demographic Health Survey figures for the Coast of 71.2% and 28.1% for male and females respectively. Nationally, women head 32% of Kenyan households (KDHS, 2003). Female-headed households are not a homogeneous entity. They tend to be poorer than the male headed households, earn lower and have high dependency ratio. Households headed by females

are disadvantaged because the children are at a greater risk of malnutrition. However, studies by Guerron-Montero and Moreno-Black (2001) proved that female-headed households are not always poorer or worse off than male-headed households. In Lunga-Lunga, the cases of malnutrition among the under fives were only found in the male-headed households although this may not be representative of the location due to the small sample size.

### **5. 1. 2 Income and Expenditure on Food**

Income is said to be perhaps, the single most determinant of diet and nutritional status (Caliendo, 1979). It has been noted that with increase in income, the proportion of total income spent for food decreases but the absolute expenditures for food. In many Third world nations, the poor spend 60 to 80 percent of their income on food. It cannot be guaranteed that food availability always leads to improving nutrition status of the community concerned. The purchasing power of individuals is important to ensuring that those households who cannot produce food materials at home have the opportunity to access the same food from other sources. Accessibility to food is a very critical aspect when dealing with malnutrition problems in developing countries, where most people are poor and rely heavily on subsistence production hence cannot obtain all their food requirements that might require external sourcing. This way, many communities experience chronic malnutrition problems resulting from lack of income and not necessarily lack of food availability.

The mean monthly income per household was lower than the national mean monthly income of K.sh 7,766 per household (CBS, 2002). The mean expenditure on food was  $3051 \pm 1148$ . This indicates that there was a disparity in incomes and expenditure with some households having an

income of K.sh. 1000. The highest expenditure on food was K.sh. 5000 and the lowest was K.sh. 1000. Though this figure is minimal, a rural household hardly purchases vegetables, and sometimes grains because they are normally grown in their parcels of land although this is usually not the case when there has been a dry spell. Twenty percent of the households spent more money on food than they earned. This extra income spent could have been from gifts or could have been borrowed.

There is a possibility that some respondents did not give accurate incomes, judging by their hesitation when responding to the question. The contribution of the mother's income to the family was also minimal because most of the mothers did not engaged in any gainful occupation and therefore had very little control of the household's expenditure. Income that is controlled by mothers has been reported to improve nutrition security of the households as more of it is availed for food purchase (Chaudhury, 1986). Studies conducted in Nepal in 1993 suggested that rural women's income cannot be assumed to translate automatically into increased household expenditure on food (Katz et al, 2001).

The food expenditure was significantly correlated to the caloric intake of the family. The higher the expenditure, the less the caloric intake. Higher expenditure allows for better choice and variety of food.

## **5. 2 DIETARY ADEQUACY**

*Intake of iron and other macronutrients.*

Variety of foods consumed is often considered an indicator of dietary adequacy. By increasing the variety of foods consumed, it is possible to reduce the risk of chronic diseases and increase the probability of meeting nutrient requirements. It is also postulated that it is advantageous to eat a variety of foods to dilute possible toxicants, include a number of non-nutrient components in the diet and take into account the physio-chemical properties of food (Hodgson et al. 1993). Foods such as maize, vegetables, leafy green vegetables, cassava, meat, beans and fish contributed to the iron intake.

Despite the fact that 79.4% of the households meet the recommended dietary allowance for iron, its availability to the body was questionable. Results indicated that the iron intake was mainly non-haem iron. The consumption of haem-iron from animal sources was also low. The absorption of non-haem is decreased by the presence of inhibitors such as phytates and calcium because they bind non-haem iron making it unavailable to the body. Enhancers of absorption such as vitamin C promotes the absorption of non-iron haem iron (Hurrell, 1997). The requirement for vitamin C was not met by 60% of the households. Different studies however show that vitamin C's effect on non-haem iron absorption from mixed diets is less than expected and its effect might be overestimated (Cook et al., 1984). The prevalence of anaemia in Kwale District for under five year olds is 84% and this could mean that the iron consumed in the diets is largely unavailable due to the inhibitors and it could also be attributed to the presence of parasites (malaria and hookworms). The households were deficient in meeting their energy requirement. This could have been because it was a dry season or because of the land as not very productive. Most of the households met their protein requirements but since the diets were

inadequate in calories, most households were using their proteins to meet the energy requirement.

The age of the household member was correlated to the protein consumption. This could have been due to the intra-household food distribution. The food was eaten from one pot, and the older people, especially the household head had more to eat than the children did. There was also a correlation between age and vitamin C consumption. Again this is because of the fact that the grown ups ate more than the children did.

### **5.2.1 Salt Intake**

Salt consumption patterns showed that salt was consumed daily by all the households. The amount of salt consumed by the households ranged between 4.36 grams per day for children to 10.29 for adults. This was lower than the per capita salt consumption of 5-15 grams per day per child for adults and children (Sullivan et al, 1995). Salt consumed in the area was mainly the iodised salt although the market survey showed that the non-iodised salt was being sold in the market. The consumption of salt daily by the households was advantageous because it showed that salt could be used as a vehicle for fortification for one or more micronutrients. Since the consumption of salt was not above the accepted daily per capita salt consumption, there would be no fear of an overload of the fortificants used. Fortification requires the identification of commonly eaten foods that can act as a vehicle for one or more micronutrients and lend themselves to centralised processing on an economical scale. Fortification can make an important nutritional difference for foods regularly purchased and consumed.

### 5.2.2 Household Fruit and Vegetable consumption

Ninety one percent of children do not consume the recommended minimum of five servings of fruits and vegetables. Vegetables were consumed by 95.5% of the households surveyed and only 27.7% consumed fruits. Fruits the main source of vitamin C was rarely consumed in the study households since their availability is limited. Vegetables, which contain some vitamin C, were cooked for over 20 minutes, which destroyed most of the vitamin because it is heat labile. Fruits the main source of vitamin C was rarely consumed in the study households since their availability is limited.

Availability and seasonality of the fruits affected the consumption of fruits especially since the survey was conducted during the dry season. Kipkurui (1998) reported that households with low incomes are unable to consume sufficient quantities of fruits unless they grew them supports this view. Those households that did not grow fruits especially those from Jua-Kali village might find the fruits too expensive to purchase especially when they are off-season, given the incomes they earned. Mathokoo and Imungi (1993) reported that rural people with low incomes are unable to consume fruits in sufficient quantities. The fruits available to some households were sold in the market place and at the border post to earn income for the household. Aritho (1995) reported that consumption of fruit and vegetables is normally affected by prices. This could explain the low intakes of Vitamin C in most of the households and marginal consumption of iron rich foods in a quarter of the households studied.



The dry spell affected the consumption of vegetables in that the serving in some families was quite inadequate to meet their nutritional needs. Most families were only able to have two meals in a day and the consumption of fruits and vegetables was highly affected by this, and this again could explain the low Vitamin C intake. Some families gathered vegetables and tubers from the wild. This mainly was due to the inability of the households to purchase or collect vegetables from their farms. This gathering of wild vegetables was a pointer towards that famine had already set in the area. The low socio-economic status of most households surveyed was likely to affect the consumption of fruits and vegetables. Fruits and vegetables contributed 0.4% and 28.4% of iron in the diets of the households. Fresh fruits however, traditionally have a negligible share of the total consumption and diet of the Kenyan population (Gomez, 1982). Most notable was the fact that most households did not have a vegetable garden that could be used to supply the needs of the family.

### **5.2.3 Method of preparation of vegetables for consumption**

The vegetables were sorted out before cutting and boiling. The water used for washing and boiling was poured out and this means that the water-soluble micronutrients were washed away. This method of preparation of green leafy vegetables is similar to those found in other communities in Kenya by Gomez (1982) and Mathooko and Imungi (1994). The cooking time for the vegetables was 20 minutes in intense heat and covered. This meant that the vitamin C in the vegetables was also destroyed. Iron in the vegetables was also reduced through leeching or discarding the iron-rich cooking broth. Cooking food in large pieces and simmering rather than boiling can minimise this.

### **5.3. CONTRIBUTION OF THE FOOD GROUPS TO THE IRON INTAKE**

Cereals made the greatest contribution to the iron intakes in the diets (43.9%), pulses 26.5% nuts 28.4%, tubers 12.1%, and animal products 4.8%. This clearly shows that most of the iron was non-haem iron which is not readily available. The iron available from cereals, roots and legumes with non-ascorbic or meat is only 5% of the total iron from the food group. Intermediate diets, i.e. low animal products with ascorbic acid have a 10% absorption rate while high bioavailable diets with high meat and ascorbic contents have 15% absorption rate (Ramakrishnan, 2000). Therefore the iron available from the cereals, legumes and tubers was 4.13 % and 0.72% from the animal sources. The socio-economic status of the household members could have contributed in the low consumption of haem-iron.

### **5.4 MATERNAL EDUCATION LEVEL AND NUTRITIONAL STATUS OF THE CHILD**

Some beneficial effects of maternal education on child nutritional status are mediated through better management of household resources, greater use of available health care services, lower fertility and more child centered care giving behavior (GOK, 1998). Most of the mothers in the study area had basic primary education (44.8%), with 37.9 % of the mothers having no formal education. Those who attained secondary education were 13.8%. The low level of secondary education may be due to high school drop out rate and also from socio-cultural, economic and pedagogical factors e.g. inability to pay fees, lack of interest or failure to achieve grades that would enable them to attain admission to secondary schools. Drop outs due to pregnancies and early marriages have been cited as other factors that contribute to low levels of maternal education.

The level of mother's education does play a role in the nutrition of the child. Mothers who are educated play a role in maintaining hygiene and good cleanliness, and this would impact positively on the child's nutrition by eliminating diseases like diarrhoea. High education level of mothers could be associated with the management of resources in favor of better nutrition. Chaudhury (1986) reported that mothers with higher levels of education had better nourished children than those with low levels, as most of them were aware of the nutritional needs of the household members. Results from the study showed that the level of maternal education affects the nutritional status of the children. Most of the malnourished children were from mothers who had minimal education i.e. primary education. These results clearly indicate that nutritional status improves with maternal education. This could be due to the fact that the mothers have nutritional education in terms of food choice; preparation and child care practices. There was however a mixed picture of an educated mother whose child was malnourished. This could be due to the time allocated by the mother on infant feeding (especially breastfeeding) and childcare. Mothers who have better education enter the job market and may be spending less time in childcare.

#### **5. 4. 1 Nutritional Status of the under fives.**

The major weakness in investigating the differences in dietary intake and nutritional status is the small sample size. Therefore the findings of the study may not be a representation of the nutritional status of the community. Malnutrition is considered to result from a set of factors, such as poverty, ignorance, feeding practices and lack of appropriate supplementary foods for infants.

**Stunting:** The mean Z score for the households surveyed for height for age was  $-0.985 \pm 1.51$ . When the villages were compared, there was no significant difference in the stunting levels. The percentage of stunting in the households was 30.5 %. This compares very closely with the 2003 KDHS preliminary findings that indicate the national stunting level at 31%, but are lower than the stunting levels for the Coast Province, which currently stands at 36% (KDHS, 2003). The high stunting levels indicate that the populations in Lunga-Lunga division have been suffering long periods of food insecurity. Currently, about 200,000 residents of Kwale District do not have any food to eat and 26,000 of these are in Lunga-Lunga and Mwereni location (The Standard, 2004).

**Underweight:** The mean Z score for weight for age was  $0.76 \pm 1.24$  and 21.7 % of the study population was underweight. When the villages were compared, there was no significant difference noted. The prevalence of underweight was slightly higher than the national figure, which stands at 20.2% (KDHS 2003). The percentage of severely underweight children nationally is 4.3% and one fifth of the Kenyan Children are underweight (KDHS 2003).

**Wasting:** Wasting levels indicates the failure to receive adequate nutrition in the period preceding the study or survey and may be due to inadequate food intake mainly due to drought and/or recent illness. The mean weight-for-height Z score was  $0.76 \pm 1.14$  and 17.4 % of the children surveyed were moderately wasted while 4.3% were severely wasted. The recorded wasting levels at the Coast Province is 25.9% and 6.1% for moderate and severe wasting levels respectively (KDHS, 2003). These figures are significantly higher than the national wasting

levels that currently stand at 6% with only 1% of the Children severely wasted (KDHS, 2003).

No significant difference was noted among the three villages.

#### **5.4.2 Nutritional Status of the Child and the amount of land available to a household**

The amount of land available to the household in rural areas can determine whether the household is food secure or not. Insufficient land or landlessness by a household may mean that the household will have limited access to food, shelter, health and education services (Kigutha, 1995). The average acreage of land among the households was 1.8 acres with the lowest acreage at 0.5 acres. The minimum land under production was 0.5 acres and the maximum was 4 acres. This meant that most of the households were food insecure and this would in turn impact negatively on the nutritional status of the children and the household in general. Studies have reported a higher incidence of underweight among landless than those with access to land (Aderman, 1996; Piechulek et al, 1999; HKI, 1998). The current famine in the region has been blamed on failure of the government to issue the coast residents with title deeds and people cannot make significant venture in farming (Sunday Standard, 2004). This uncertainty makes the indigenous people scared of investing in agriculture and therefore contributes to the low food production and investment in the land. Poor infrastructure also contributes in some cases to malnutrition in underdeveloped communities especially, in ability to distribute food materials with minimal costs from regions where there is surplus to regions with deficit. More often than not, transportation and processing costs are too high and pushes producer prices far beyond what majority of the people can afford.

## CHAPTER SIX

### CONCLUSION AND RECOMMENDATION

- Despite the fact that more than three-quarters of the households consumed sufficient in amounts of iron, most of this iron was from cereals and pulses. This put to doubt the availability of iron in some of the households that had met the required levels of iron as only 4.85% of the iron consumed was absorbed by the body.
- Vitamin C intake is below the recommended levels for 60% of the households. Vitamin C consumption is very important because it enhances iron absorption, but since its intake was not sufficient in most households, its influence was less in improving non-haem iron absorption. Therefore Iron Deficiency Anaemia is bound to be a problem of public health importance in Lunga-Lunga location because the diets provide insufficient bioavailable iron that the body can utilise for the formation of haemoglobin.
- All the households in the study population consume salt every day, and the per capita consumption is within the recommended intake and therefore salt would be a good vehicle for the fortification of iron. Salt is also quite cheap and therefore everybody stands to benefit from its use as a vehicle for fortification.
- There is a problem of food availability and access and this is evident in the inadequate caloric intake in the study population.

- A protein intake in the study population is adequate.
- The diet consumed by the households surveyed was not varied. The foods mostly consumed are on maize, fish (papa)/dagaa and green leafy vegetables.
- Taboos that affected food consumption in the study population on touch only on expectant mothers.
- The level of malnutrition in the location is high. Wasting levels were higher than the national wasting levels, and so were the stunting and underweight levels. The BMI also indicated that there was a food crisis as almost half of the adults were wasted.

#### **Recommendations:**

Kwale district has a high prevalence of anaemia. The results however indicate that the anaemia is not from dietary inadequacy, as the diets seem to be adequate in iron. However, most of the iron is from non-haem source that is not readily absorbed by the body. The consumption of Vitamin C rich foods is also wanting, the especially consumption of fruits and vegetables. This could have been as a result of the dry season and as such these results could be limiting. This study therefore recommends:

- (a) That a food fortification strategy be initiated to improve the iron bioavailability through the double fortification of salt with iron. When such a strategy is superimposed on existing food patterns, it does not necessitate changes in the customary diet of the

population and therefore can yield results quickly and can be the most cost-effective means of overcoming micronutrient malnutrition.

- (b) Promotion of keeping animals e.g. poultry and rabbits for consumption to improve their intake of haem-iron.
- (c) Nutrition education of mothers on the nutritional importance of eating fruits and vegetables rich in vitamin C that would help increase the availability of iron in their bodies and on the importance of food diversity.
- (d) Households are encouraged to have small kitchen gardens that would provide them with vegetables to supply their need for vitamin C and iron.
- (e) Nutrition education on the importance of adequate nutrition during pregnancy and the avoidance of taboos that prohibit the consumption of certain foods during pregnancy.
- (f) Promotion of modern methods of agriculture and the use of drought resistant crops to combat the perennial food shortage in the area.



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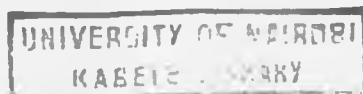
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## APPENDICES

### APPENDIX 1

#### RESEARCH QUESTIONNAIRE

#### Food Consumption Patterns and Dietary Practices in Relation to Iron and Salt Intakes in Kwale District; the Case of Lunga-Lunga Location,

Please fill in the spaces with the requested information or tick or circle where applicable.

#### DEMOGRAPHY

Location ----- Sub-location ----- Village-----

Household Number

Name of Interviewer -----     ate ----- dd/---mm/----yr.

Name of Respondent ----- Age -----

#### Household composition table

1. Please list the household members in the table below and their characteristics.

Serial no.	Name	Sex	Age	RHHH	Marital Status	Religion	Level of edu	Occup	Contri to HH

Sex	Relationship to Household Head (RHHH)	Level of Education	Occupation	Religion	Contribution to HH
2. Male	1. Household Head	1. Not of school going age	1. Farmer	1. Catholic	0. Nothing
3. Female	2. Wife	2. Did not attend school	2. Housewife	2. SDA	1. Money
	3. Son	3. Lower primary 1-4	3. Unemployed	3. Lutheran	2. Labour
<b>Marital Status</b>	4. Daughter	4. Upper primary 5-8	4. Student	4. Protestant	99. Less than 15 yrs n/a
1. Married	5. Grandchild	5. Secondary School	5. Small scale trader	5. Muslim	
2. Separated	6. Parent to HH	6. College	6. Businessman	6. ATR	
3. Divorced	7. Niece/Nephew	7. University	7. Casual laborer	7. No religion	
4. Single	8. Others (specify)	8. Others (specify)	8. Formally employed	8. Others (specify)	
5. Widowed			99. Not applicable		

**SECTION 2. SOCIO-ECONOMIC STATUS**

2. Is the house you live in? .....
  1. *Your own*                      2. *Rented*
3. **[If rented]** how much to you pay per month? Kshs. ....
4. What is your total household income per month?.....
  1. *Less than 2,000*            2. *2,000 – 5,000*            3. *5,000 – 10,000*
  4. *10,000 – 20,000*            5. *20,000 and above*
5. How much do you spend on food per month? Kshs. ....
6. **[Observe]** What material has been used to construct the main house?
  - (a) Roof
    1. *Makuti*            2. *Iron sheets*            3. *Tiles*            4. *Grass/thatch*
    5. *Others (specify) .....*
  - (b) Wall
    1. *Mud*            2. *Plaster*            3. *Wood*            4. *Brick/block/stones*
    5. *Iron sheets*            6. *Others (specify) .....*
  - (c) Floor
    1. *Mud*            2. *Cemented*            3. *Wood*            4. *Brick/tiles/stone*
    5. *Others (specify)*
7. What are the two main sources of energy for lighting?
  1. *Wood*            2. *Tin lamps (koroboi)*            3. *Hurricane lamps*
  4. *Pressure lamps*            5. *Gas*            6. *Electricity*
8. What are the two main sources of energy you use for cooking?
  1. *Wood*            2. *Charcoal*            3. *Parrafin*            4. *Gas*
  5. *Electricity*            6. *Others (specify)*

**SECTION 3. FOOD PRODUCTION AND UTILIZATION**

9. Do you own land?            1. Yes            2. No  
**[If yes]**, how many acres do you own?.....  
**[If yes]**, many acres do you use for food production?  
**[If no]**, do you rent land?    1. Yes            2. No  
**[If yes]**, how much do you pay per acre of land? .....
10. Please fill the table below according to the livestock owned

ANIMAL	NUMBER OWNED

Animals

1. Cows            3. Rabbit            5. Chickens            7. Sheep
2. Goats            4. Donkeys            6. Pigs            8. Others (specify) .....
11. What is the staple food for your household?.....

12. What is your main source of staple food?

1. farm/garden                      2. shop/kiosk                      3. market                      4. others  
(specify).....

13. [If own production], how long does the food last after harvest?

Staple.....

14. [If purchased is an option], did you ever purchase your staple food in the last 1 year?

1. Yes                      2. No

15. Which is the main source of vegetables for your household?

1. Farm/garden ..... 2. shop /kiosk ..... 3. market ..... 4. others  
(specify).....

19. For the vegetables that are mainly consumed in your household. Kindly explain how they are prepared.

Name of Vegetable	Method of preparation

17. Which is the main source of fruits?

1. Farm/garden.....                      2. Market .....                      3. Shop/kiosk .....  
4. gathered from roadside/bush ..... 5. others(specify).....

18. When are fruits usually taken?

1. Breakfast time    2. With or after a snack    3. With or immediately after main meal    4. Others (specify).....

19. Which type of pots do you use for cooking?

1. Aluminium    2. Iron    3. Copper                      4. Earthenware                      5. others

#### SECTION 4 FOOD CONSUMPTION PATTERN

20. What food do you most commonly eat for ?

1. Breakfast? .....  
2. Lunch .....  
3. Supper.....

21. When is tea /coffee/cocoa usually taken?

1. Breakfast time  
2. with snacks  
3. with or immediately after meals    4. others (specify).....

22. Please tell me how often you as a household consume the following foods?

FOOD EATEN		FOOD EATEN			
English Name	Kiswahili Name	FREQ- UENCY	English Name	Kiswahili Name	FREQ- UENCY
Maize	Mahindi				
Finger millet	Wimbi		Cassava leaves	Kisamuu	
Rice	Mchele mweupe		Cow pea leaves	Makunde	
Sorghum	Mtama		Kales	Sukuma wiki	
Sorghum +Cassava	Mutio wa mukira na manga		Night shade	Manuvu/man agu	
Wheat	Ngano		Pumpkin leaves	Majani ya mboga	
Arrow roots	Nduma/majimbi		Spinnach	Mboga mbichi	
Cassava	Mhogo		Sweet pot.leaves	Matembele mabichi	
Cassava (ugali)	Bada		Carrots	Carrotl	
Potatoes(Eng)	Viyazi ulaya		Coconut	Dafu	
Sweet potatoes	Viyazi vitamu		Onions	Vitungu	
Beans	Maharagwe		Pumpkin	Mboga	
Chicken pea	Ndengu		Tomatoes	Nyanya	
Cow peas	Kunde		Avocado	Avacado	
Green grams	Choroko/pojo		Lemon	Ndimu	
Pigeon peas	Mbaazi		Mango	Embe	
Soya bean	Soya		Orange fruit	Machungwa	
Cashew nuts	Koroshu		Pawpaw	Papai	
Coconuts	Nazi		Pineapple	Nanasi	
Ground nuts	Njugu karanga		Guavas	Mapera	
Amaranths	Mchicha		<i>Bananas</i>	Ndizi	
Cabbage	Mboga				

1=Once a year	5=Once in two weeks	9=Daily
2=Four times a year	6=Once a week	10. Once in a while
3=Once a month	7=2-3 times a week	N=Never
4=Twice a month	8=4-6 times a week	

24. Please tell me how often you as a household consume the following foods

FOOD EATEN		FREQUENCY CONSUMPTION
English Name	Kiswahili Name	
Beef	Nyama ya ng'ombe	
Eggs	Mayai	
Goat meat	Nyama ya mbuzi	
Sheep meat	Nyama ya kondoo	
Fish	Samaki	
Fish(omena)	Dagaa	
Milk (cow)	Maziwa ya ng'ombe	
Sugar	Sukari	
Bread	Mkate	
Tea	Chai	
Coffee	Kahawa	
Cocoa	Coco	
Fats/oils	Mafuta /Samuli	
Margarine		
Salt	Chumvi	

1=Once a year	5=Once in two weeks	9=Daily
2=Four times a year	6=Once a week	N=Never
3=Once a month	7=2-3 times a week	
4=Twice a month	8=4-6 times a week	

### 3-DAY WEIGHED FOOD RECORDS

#### INSTRUCTIONS:

- 1) Randomly selected households will be visited a day before the three-day period during which time the aim of the study will be explained to the household head and, if he/she agrees to participate, then the detailed study procedure will be explained to the women responsible for food preparation and to other family members. The names, ages and sex of all family members will be recorded in Question 1 – household composition table.
- 2) During the three-day study period, each ingredient will be identified and weighed before cooking. When the meal is ready, the total amounts of cooked main dish and sauce will be weighed. The weight of each feeding bowl will then be determined empty and after distributing the food within the family. If the main dish and the sauce were served in the same bowl, the weight of each component will be determined separately.
- 3) The quantitative distribution of meat and fish will be estimated.
- 4) All household utensil used for eating will be identified by size and colours so as to facilitate the identification after the meal. The leftover food will be weighed.
- 5) Each person will receive a weighed cup of drinking water that will be reweighed after the meal. The intake of water during each meal will be subtracted from the difference in body weight before and after the meal. It will be explained to the participants that this water should not be shared with anyone else.
- 6) The body weight of each person will be measured before and after the meal using a balance (accurate to  $150\text{kg} \pm 50\text{g}$ ) for adults and a Salter scale for children.
- 7) For individuals eating from the same bowl, the percentage eaten will be calculated considering the increase in body weight. The amount of sauce or main dish eaten by the group will be divided among the subjects based on their body weight increase. The assumption was made that each subject consumed the same proportion of sauce and main dish.
- 8) If any subjects were absent during the day, they will be interviewed on their return about the amounts of food and drinks eaten outside the house.



### 3-Day Weighed Food Record

HH.No..... Meal .....Date.....

Hh member Serial No.	Dish Name	Ingredients (name)	Weight of Ingredients	Method of cooking	Weight of dish	Wt of bowl	Amt served member	
							Staple	Other

**Section 8. Weight Table**

- a) What was the weight of each household member before the meal?
- b) What was the weight of the cup of water served to the household member?
- c) What was the weight of the cup after the meal?
- d) What was the total amount of water drunk during the meal?
- e) What was the weight of each household member after the meal?
- f) What is the difference between weight added and the water intake?

HH Member	Weight of water cup			Member's weight			Height or length of member (cm)
	Before meal (with water)	After meal (left over)	Total wt of water drank	Before meal	After meal	Weight gained (lost)	

## APPENDIX 2

### KEY INFORMANTS INTERVIEW GUIDE

Please record the **RESPONDENT'S** background information and answers to the following questions in the notebook

1. Date of interview	5. Name of Interviewee
2. Sub-location	6. Age
3. Village	7. Level of education
4. Interview No.	10. Occupation

1. Who usually does the cooking and with whose assistance?
2. How are the different foods and drinks prepared?
3. How do household members eat (from own plates or in-groups)? Who distributes food within the household and in-groups?
4. What kind of cooking utensils are used in cooking in this community and what are they made of?
5. What type of food crops is grown or gathered in his area and, which seasons?
6. How are foods preserved in your community?
7. What kinds of beverages are consumed?
8. What kind of special foods are prepared or bought for infants and at what age are they introduced in to the child's diet?
9. What foods are culturally considered special or forbidden during pregnancy? (Name them and give reasons).
10. Which foods are culturally encouraged or prohibited during lactation? Give reason.
11. Which foods are culturally considered special or forbidden for girls? Give reason.
12. Which foods are culturally encouraged or prohibited to boys? Give reason.
13. What foods are consumed during periods of famine or food shortage?

### APPENDIX 3a

#### QUANTITATIVE ANALYSIS OF NUTRIENT INTAKE (WEIGHED FOOD INTAKE).

Data collected on the quantities of food are expressed in terms of their caloric and protein content using the factors that convert quantities of edible portions into calories and proteins.

These are provided for a range of foods. These intake data are compared against a definition of food needs. The ratio of the family as well as each individual's foods consumed was used to derive the amount of ingredients taken by the individual household member. For example, if 500 grams of beans was used to prepare 1750 grams of bean stew, of which a 26-year-old mother took 300 grams, beans intake for the mother is 85.71 grams. Using the National Food Composition Tables and The Planning of Satisfactory Diets in Kenya conversion figures, the iron and protein content was calculated as follows:

$$100\text{g beans} = 11.27 \text{ mg (Iron)}$$

$$85.71\text{g beans} = ? \text{ Mg of iron}$$

$$= 85.71\text{g} \times 11.27\text{mg (iron)} / 100\text{g}$$

$$= 9.66 \text{ mg of iron}$$

Each ingredient in the food prepared and consumed was analysed for iron, phytates, proteins, calories and vitamin C. A total of all iron, phytates, calories and proteins and vitamin C consumed were computed to determine if the individual had reached the desired nutrient intake for the day.

APPENDIX 3b

RECOMMENDED DAILY CALORIC, PROTEIN, IRON AND VITAMIN C INTAKES

AGE in Years	kcal /day	protein (grams)/ day	Iron (mg)/day	Vitamin C (mg)/day	
1-2	1150	13.5	5-10	20	
2-3	1350	15.5	5-10	20	
3-5	1550	17.5	5-10	20	
Boys	5-7	1850	21	5-10	20
	7-10	2100	27	5-10	20
Girls	5-7	1750	21	5-10	20
	7-10	1800	27	5-10	20
Men*	18-30	2600	49	5-9	30
	30-60	2500	49	5-9	30
Women	18-30	2000	41	14-28	30
*	30-60	2050	41	14-28	30

\* Energy requirements are given for light work.

(Adapted from Sehmi, 1993).

