

**NUTRITIONAL STATUS ASSESSMENT OF  
CHILDREN (0-5 YEARS) OF FEMALE HEAD  
PORTERS (KAYAYEI) IN AGBOGBLOSHIE  
MARKET ACCRA, GHANA**

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## DECLARATION

I, Florence Elorm Eto, declare that with the exception of the references cited, all information in this document was obtained via research under the supervision of Dr Charles Brown and Mr Frank Hayford of the College of Health sciences, University of Ghana. This dissertation has never been presented in part or whole to any institution for the award of any degree or diploma.

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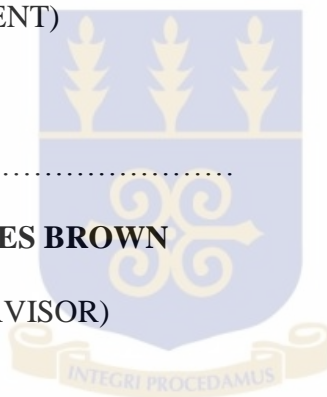
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## ABSTRACT

**Background:** Nutritional status is the balance between the intake of nutrients and the expenditure of these in the processes of growth, reproduction, and health maintenance. Under nutrition, especially in children, can lead to substantial problems in mental and physical development. Undernourished children can also suffer several diseases from nutrient deficiencies. Although the overall pattern of growth is genetically determined, it is significantly affected by nutrition. Socioeconomic status, nutritional knowledge and feeding practices among others are some of the reasons why children maybe undernourished. Female head porters (*kayayei*) who care for their children, due to the low wages they earn may not be able to afford healthy meals and provide the necessary care for these children.

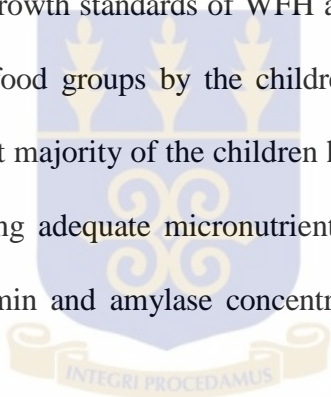
**Aim:** This study assessed the nutritional status of children of *kayayei* at Agboghloshie market in Accra.

**Methods:** Purposive sampling method was used to recruit subjects at Agboghloshie market. A validated questionnaire was used to collect data on demographic characteristics, feeding habits, dietary history and anthropometric measures. Dietary intake of the children was assessed using a food frequency questionnaire. Biochemical analyses were done to find total protein, albumin and amylase levels in saliva samples taken from the children.

**Results:** Seventy-three female head porters (*kayayei*), each with her child, participated in the study. All the *kayayei* were from northern Ghana. Majority of the children (32.9%) were between the ages of 25 and 36 months and 50.7% of them were girls. Most (58.9%) of the *kayayei* described a balanced diet correctly and 95.9% breastfed their children. However only 9.6% practiced exclusive breastfeeding. Most (63%) of the mothers fed their children three times daily though the majority (89%) of the children were not fed with home cooked

meals. More than half of the children (53.4%) had fish once a day and a grain or cereal daily in the form of tuo zafi (53.4%) though less than half (46.6%) had white bread or millet porridge (46.6%). Majority of the children, 78.1% and 67.1%, had their weight-for-height (WFH) and mid upper arm circumference (MUAC) measures, respectively, being normal. The average salivary pH for the children was  $7.46 \pm 0.867$ . The average albumin concentration for the children was  $2.920 \pm 1.353$  g/L. The average total protein concentration for the children was  $6.386 \pm 6.2676$  g/L. The average salivary amylase concentration for the children was  $99.114 \pm 177.816$  U/L.

**Conclusion:** There was a relationship between the nutritional knowledge of the *kayeyei*, their feeding practices and the nutritional status of their children. Majority of the children were within normal WHO growth standards of WFH and MUAC measures. Consumption frequencies of the various food groups by the children varied. Biochemical analysis of saliva samples indicated that majority of the children had their salivary pH within normal salivary pH ranges indicating adequate micronutrient levels. There was no relationship between total protein, albumin and amylase concentrations in saliva and the nutritional status of the children.



## DEDICATION

This work is dedicated to all the hard working kayayei mothers at the Agboghloshie market who were generous enough to volunteer relevant information for this study.



## **ACKNOWLEDGEMENTS**

Great is your faithfulness, God my father. I owe the successful completion of this work to the Almighty God.

I am thankful to Dr Charles Brown, my principal supervisor and Mr Frank Hayford my second supervisor for all the help.

Finally, thanks to all the Kayayei mothers who dedicated their time for this study.

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## ABBREVIATIONS

BMI	Body mass index
FFQ	Food Frequency Questionnaire
IASC	Inter-Agency Standing Committee
KW	kwashiorkor
MAM	Moderate Acute Malnutrition
MM	Moderate malnutrition
MUAC	Mid upper arm circumference
PEM	Protein energy malnutrition
SAM	Severe Acute Malnutrition
SCN	Standing Committee on Nutrition
Weight- for- height	WFH
WFP	World Food Programme
WHO	World Health Organization

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 BACKGROUND

Nutritional status is the balance between the intake of nutrients and the expenditure of these in the processes of growth, reproduction, and health maintenance. Because this process is highly complex and quite individualized, nutritional status assessment can be directed at a wide variety of aspects of nutrition (WHO, 2010).

The assessment of nutritional status is commonly summarized by the mnemonic "ABCD," which stands for anthropometric measurement, biochemical or laboratory tests, clinical indicators, and dietary assessment (WHO, 2010). Anthropometric measurement involves the use of weight, height, arm circumference and skin fold measurements as indicators for assessment of nutritional status (Abraham *et al.*, 1977).

Biochemical analysis involves quantitative chemical analysis of the blood, urine or other bodily fluids. The analyses are either made for a given nutrient or for some of the metabolites of that nutrient (Pearson, 1966). Clinical assessment of an individual's nutritional status indicates the level of health in relation to food consumption. Clinical examination is usually made by a doctor or nutritionist (Wilson *et al.*, 1979). The first stage of any nutritional deficiency is identified by dietary assessment methods. Several dietary methods are available including the 24-hour recalls, food records, dietary history and food frequency questionnaire.

Saliva is an aqueous bodily fluid found in the oral cavity and is composed of a complex mixture of secretory products (Dodds *et al.*, 2005). Malnutrition is one factor that might

compromise salivary gland function. Research on the effect of nutrition status on saliva covers general under nutrition, deficiency of specific nutrients, such as protein, minerals, and vitamins (Lingstrom and Moynihan, 2003). The ability to use saliva to monitor an individual's health and disease state is a highly desirable objective for healthcare research and promotion (Mahadeva and Velavan, 2013).

*Kayayei* (female head porters) is a Ga term that describes young women who carry goods and wares for a fee. A majority of them have migrated from the northern and rural parts of Ghana to earn income in the southern cities (Ahlvin, 2012).

## **1.2 PROBLEM STATEMENT**

The population of *kayayei* in Accra continues to increase and most of them are migrants without proper homes, illiterates who lack knowledge of personal hygiene, healthy feeding practices, live in poor sanitary conditions and poverty. These conditions under which they live together with their children render them at high risk of malnutrition and other health complication (Opare, 2010).

Many *kayayei* are encouraged by their families in northern Ghana to move to the cities due to financial hardships (Opare, 2010). Because of their lack of education these women tend to work in the informal sector when they reach the metropolis where they earn little money and have little or no time to care for themselves. The insanitary environment and unhygienic conditions under which they live and prepare their food is problematic. Many *kayayei* work for long hours and earn low wages. The wages that the *kayayei* earn typically go “from hand to mouth” (Ahlvin, 2012). Because of these, many *kayayei* who care for their children are not able to afford healthy meals and provide the necessary care when illness strikes in the slum (Yeboah and Appiah-Yeboah, 2009).

Under nutrition can lead to substantial problems in mental and physical development. In children, the impact of under nutrition on the cognitive abilities may lead to poor school achievement in later years (Olness, 2003). Under nourished children can also suffer several diseases from nutrient deficiencies. Although the overall pattern of growth is genetically determined, it is significantly affected by nutrition (Alan *et al*, 2002). Socioeconomic status, nutritional knowledge and feeding practices among others are some of the reasons why children may be under nourished.

### **1.3 SIGNIFICANCE OF THE STUDY**

The study will help to identify nutritional and other health needs of the *kayayei* and their children and serve as a basis for providing nutrition education for them. The study will also identify the relationship between mothers' feeding practices and child's nutritional status. This will help to determine their effect on the nutritional status of the children. The study will also serve as a reference material for future investigation into nutritional status assessment in other areas.

### **1.4 HYPOTHESIS**

Null hypothesis: There is no relationship between feeding practices of the *kayayei* and nutritional status of their children.

Alternate hypothesis: There is a relationship between feeding practices and nutritional status.

### **1.5. AIM**

The aim of the study was to assess the nutritional status of children of the *kayayei* and their child feeding practices.

### **1.5 SPECIFIC OBJECTIVES**

The specific objectives of the study were to:

1. Assess the child feeding practices of *kayayei* who are mothers.
2. Determine the nutritional status of the children using both anthropometric measures and biochemical analysis.
3. Determine the relationship between the level of nutritional knowledge of the mothers and the nutritional status of their children.
4. Determine the relationship between child feeding practices of the mothers and the nutritional status of their children.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 NUTRITION

Nutrition is defined as the "science of food, the nutrients and other substances therein, their action, interaction and balance in relation to health and disease, and the processes by which the organism ingests, absorbs, transports, utilizes and excretes food substances (Lagua and Claudio, 2004).

The macronutrients, needed in large amounts, are carbohydrates, fats, protein, and water. They provide structural material and energy. Some of the structural material can be used to generate energy internally. Carbohydrates and proteins provide approximately 4 kcal of energy per gram, while fats provide 9 kcal per gram (Dunford, 2006). The net energy from either depends on such factors as absorption and digestive effort, which vary substantially from instance to instance. Micronutrients (vitamins, minerals), fibre, and water do not provide energy, but are required for other reasons (Berg *et al.*, 2002).

Individuals are malnourished, or suffer from under nutrition if their diet does not provide them with adequate nutrients for maintenance and growth, or they cannot fully utilize the food they eat due to illness.

#### 2.2 MALNUTRITION

Malnutrition is the condition that results from eating a diet in which certain nutrients are lacking (under nutrition), in excess (over nutrition), or in the wrong proportions (Arthur, and Stevens, 2003).

There are two major types of under nutrition:

- i. Protein-energy malnutrition (PEM) - resulting from deficiencies in any or all nutrients
- ii. Micronutrient deficiency diseases - resulting from a deficiency of specific micronutrients

### **2.2.1 Protein-energy malnutrition (PEM)**

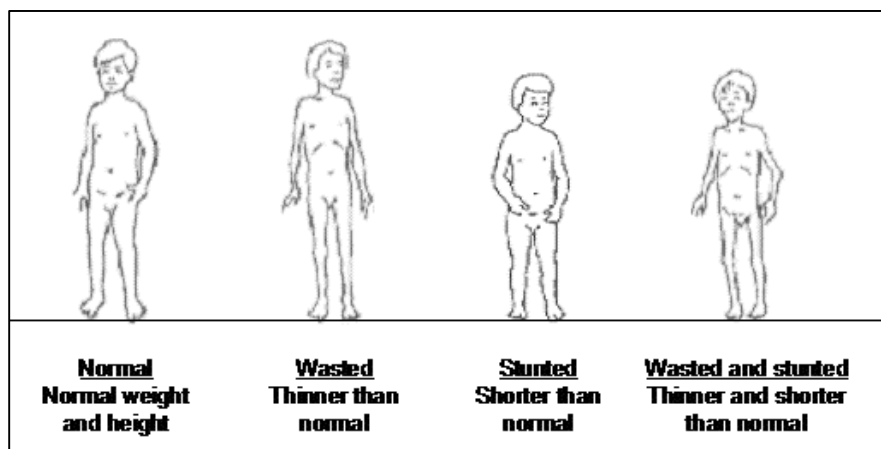
There are three types of protein-energy malnutrition in children (Table 1) [Franco *et al.*, 1999]. These forms of protein-energy malnutrition in children can be pictured in Fig.1. Losing 20% of body weight or more is generally classified as severe PEM.

Marasmus is one of the three forms of severe protein-energy malnutrition (PEM). The other two forms are kwashiorkor (KW) and marasmic KW. These forms of serious PEM represent a group of pathologic conditions associated with a nutritional and energy deficit occurring mainly in young children from developing countries at the time of weaning (Scrimshaw and Viteri, 2010). Marasmus is a condition primarily caused by a deficiency in calories and energy. It is characterized by stunted growth and wasting of muscle and tissue (Scrimshaw and Viteri, 2010). It usually develops between the ages of six months and one year in children who have been weaned from breast milk or who suffer from weakening conditions such as chronic diarrhoea (Kessler and Dawson, 1999).

Kwashiorkor indicates an associated protein deficiency, resulting in an oedematous appearance (Scrimshaw and Viteri, 2010). In 1999, WHO defined severe malnutrition in children as a weight-for-height<sup>1</sup> below -3 SD and/or the presence of oedema (WHO, 1999).

**Table 1:** Types of PEM and their causes (Source: London School of Hygiene and Tropical Medicine, 2009 ([http://conflict.lshtm.ac.uk/page\\_115.htm#Malnutrition\\_Types](http://conflict.lshtm.ac.uk/page_115.htm#Malnutrition_Types)),)

Type	Appearance	Cause
<b>Acute malnutrition</b>	Wasting or thinness	Acute inadequate nutrition leading to rapid weight loss or failure to gain weight normally
<b>Chronic/severe malnutrition</b>	Stunting or shortness	Inadequate nutrition over long period of time leading to failure of linear growth
<b>Acute and chronic malnutrition</b>	Underweight	A combination measure, therefore, it could occur as a result of wasting, stunting, or both



**Fig. 1:** Forms of PEM ([http://conflict.lshtm.ac.uk/page\\_115.htm#Malnutrition\\_Types](http://conflict.lshtm.ac.uk/page_115.htm#Malnutrition_Types), London School of Hygiene and Tropical Medicine, 2009)

This condition usually appears at about the age of 12 months when breast-feeding is discontinued, but it can develop at any time during a child's formative years (Kessler and Dawson, 1999). It causes fluid retention (oedema), dry, peeling skin; and hair discoloration (Kessler and Dawson, 1999). Marasmic KW indicates a condition that has features of both Kwashiorkor and marasmus (Scrimshaw and Viteri, 2010). This diagnosis is given for a child with severe malnutrition who is found to have both oedema and a weight for age below 60% of that expected for his or her age. Children with marasmic KW have all the features of nutritional marasmus including severe wasting, lack of subcutaneous fat and poor growth, and in addition to oedema, which is always present, they may also have any of the features of kwashiorkor described above. There may be skin changes including flaky-paint dermatosis, hair changes, mental changes and hepatomegaly. Many of these children have diarrhoea.

Moderate malnutrition (MM) is defined as a weight-for-age between -3 and -2 z-scores below the median of the WHO child growth standards. It can be due to a low weight-for-height (wasting) or a low height-for-age (stunting) or to a combination of both. Similarly, moderate wasting and stunting are defined as a weight-for-height and height-for-age, respectively, between -3 and -2 z-scores MM affects many children in poor countries. Children with moderate malnutrition have an increased risk of mortality and MM is associated with a high number of nutrition related deaths (Pelletier *et al*, 1995).

Severe acute malnutrition (SAM) is defined by a very low weight for height (below -3z scores of the median WHO growth standards), visible severe wasting, or by the presence of nutritional oedema. (WHO/UNICEF, 2007)

### 2.2.2 Micronutrient deficiency

In its 2002 report, the World Health Organization (WHO) estimates that approximately 168 million children under five years of age are underweight, meaning they do not get enough nutrients to meet their body's needs. Multiple micronutrient deficiencies (Table 2), such as from iron, zinc, and vitamin A, are affecting the lives and health of billions of people in the developing world (WHO, 2002).

Malnutrition at an early age leads to reduced physical and mental development and affects school performance (WFP, 2013). Malnutrition increases the risk of infection and infectious disease, weakens every part of the immune system, lowers energy and impairs function of the brain (Stillwaggon, 2008). The World Health Organization estimates that malnutrition accounts for 54% of child mortality worldwide (Walker and Watkins, 2008) about 1 million children (Manary *et al*, 2013). Even mild degrees of malnutrition double the risk of mortality for respiratory and diarrheal disease mortality and malaria (Walker and Watkins, 2008). There are three commonly used measures for detecting malnutrition in children: stunting (extremely low height for age), underweight (extremely low weight for age), and wasting (extremely low weight for height) (Adam and Naoke, 1999). These measures of malnutrition are interrelated, but studies for the World Bank found that only 9% of children exhibit stunting, underweight, and wasting (Adam and Naoke, 1999). According to a 2008 review an estimated 178 million children under age 5 are stunted, most of who live in sub-Saharan Africa (Bhutta *et al*, 2008). A 2008 review of malnutrition found that about 55 million children are wasted, including 19 million who have severe wasting or severe acute malnutrition (Bhutta *et al*, 2008). Measurements of a child's growth provide the key information for the presence of malnutrition (Walker and Watkins, 2008).

**Table 2:** Micronutrient and deficiency disorders (Allen *et al.*, 2006).

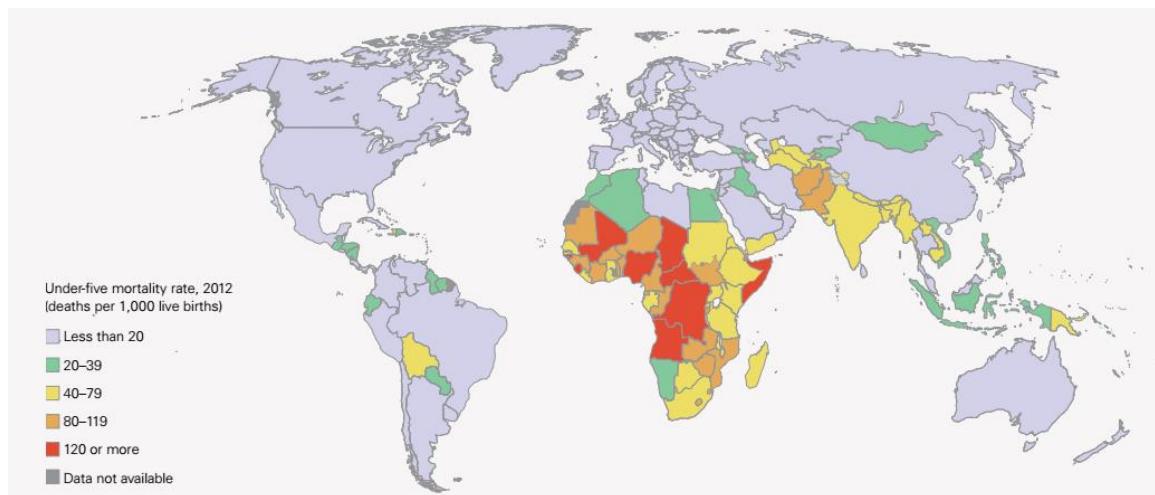
<b>Micronutrient</b>	<b>Major Deficiency Disorders</b>
Iodine	Goitre, hypothyroidism, iodine deficiency disorders, increased risk of stillbirth, birth defects infant mortality, cognitive impairment
Iron	Iron deficiency, anaemia, reduced learning and work capacity, increased maternal and infant mortality, low birth weight
<b>Micronutrient</b>	<b>Major Deficiency Disorders</b>
Zinc	Poor pregnancy outcome, impaired growth (stunting), genetic disorders, decreased resistance to infectious diseases
Vitamin A	Night blindness, xerophthalmia, increased risk of mortality in children and pregnant women
Folate (Vitamin B6)	Megaloblastic anaemia, neural tube and other birth defects, heart disease, stroke, impaired cognitive function, depression
Cobalamine (Vitamin B12)	Megaloblastic anaemia (associated with <i>Helicobacter pylori</i> induced gastric atrophy)
Thiamine (Vitamin B1)	Beriberi (cardiac and neurologic), Wernicke and Korsakov syndromes (alcoholic confusion and paralysis)
Riboflavin (Vitamin B2)	Non-specific – fatigue, eye changes, dermatitis, brain dysfunction, impaired iron absorption
Niacin (Vitamins B3)	Pellagra (dermatitis, diarrhoea, dementia, death)
Vitamin B6	Dermatitis, neurological disorders, convulsions, anaemia, elevated plasma homocysteine
Vitamin C	Scurvy (fatigue, haemorrhages, low resistance to infection, anaemia)
Vitamin D	Rickets, osteomalacia, osteoporosis, colorectal cancer
Calcium	Decreased bone mineralization, rickets, osteoporosis
Selenium	Cardiomyopathy, increased cancer and cardiovascular risk
Fluoride	Increased dental decay, affects bone health

The 2008 Copenhagen Consensus estimated that under nutrition causes 35% of the disease burden in children younger than 5 years old, and that the nutrition of children 5 years and younger depends strongly on the nutrition level of their mothers during pregnancy and breastfeeding (Sue-Horton *et al.*, 2008). Malnutrition can be detected by screening, interpretation of mid- upper-arm circumference measures, plotting of weight on growth charts etc. (Myatt, 2005).

Children in sub-Saharan Africa and South Asia face a higher risk of dying before their fifth birthday [Fig. 2] (UNICEF, 2013). Poor diet, frequent illness, and inadequate or inattentive care of young children can lead to malnutrition (WHO, 2002). Between five and six million under-fives die each year from diseases which are from malnutrition (Wadhvani, 2011). Globally, nearly half of all deaths among children under five are attributable to under nutrition (UNICEF, 2013).

Acutely malnourished children lack growth nutrients that are required to build new tissues. These nutrients aid weight gain after illness, repair damaged tissues and help replace the rapid turn-over of cells (intestine and immune cells). Correct replenishment of nutrients like essential amino acids (protein), potassium, magnesium and zinc (among other minerals) is essential for recovery from malnutrition (Wadhvani, 2011).

Effects of malnutrition could be seen as deficiency disease such as scurvy, beriberi, kwashiorkor, obesity, cardiovascular disease, diabetes and osteoporosis (Bowden, 2008). Improving nutrition is widely regarded as the most effective form of aid.



**Fig. 2:** Under five mortality rate, 2012 (UNICEF, 2013)

### 2.3 NUTRITIONAL STATUS

Nutritional status is the balance between the intake of nutrients by an organism and the expenditure of these in the processes of growth, reproduction, and health maintenance. Because this process is highly complex and quite individualized, nutritional status assessment can be directed at a wide variety of aspects of nutrition (WHO, 2010).

Nutritional status assessment is important because

- i. It helps in identifying people who are at nutritional risk
- ii. It helps to develop educational programs which encourage people to improve their eating habits.
- iii. Information gathered from nutritional status assessment helps government in setting priorities in food production and distribution and in the allocation of health facilities.
- iv. It helps to formulate policies to improve the overall nutrition of the population.

### **2.3.1 Methods of Assessment**

The assessment of nutritional status is commonly summarized by the mnemonic "ABCD," which stands for anthropometric measurement, biochemical or laboratory tests, clinical indicators, and dietary assessment (Johnston and Ouyang, 1991).

#### **2.3.1.1 Anthropometry**

Nutritional anthropometry has been defined as "measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition" (Jelliffe, 1966). Anthropometric measurement involves the use of weight, height, arm circumference and skin fold measurements as indicators for assessment of nutritional status (Abraham *et al.*, 1977). In children growth charts have been developed to allow researchers and clinicians to assess weight-for-age and height-for-age, as well as weight-for-height. For children, low height-for-age is considered stunting, while low weight-for-height indicates wasting. In addition to weight and height, measures of mid-arm circumference and skin fold measured over the triceps muscle at the mid-arm are used to estimate fat and muscle mass. To interpret anthropometric data, they must be compared with reference data. The choice of the appropriate reference has been discussed by Johnston and Ouyang (1991). Because well-nourished children in all populations follow similar patterns of growth, reference data need not come from the same population as the children of interest. It is of greater importance that reference data be based on well-defined, large samples, collected in populations that are healthy and adequately nourished. Reference growth charts (Kuczmarski *et al.*, 2002) have been compiled from cross-sectional data collected from population surveys of U.S. children. These have been adopted as international standards by the World Health Organization (WHO).

### **2.3.1.1.1 Anthropometric measures in young children**

#### **a) Weight**

Body weight represents the sum of protein, fat, water and bone mineral mass. Several indices can be conducted from body weight. For example, weight- for- age, an acute index for malnutrition is widely used to assess protein-energy- malnutrition and over nutrition especially in childhood (WHO and UNICEF, 2009).

The prevalence of malnutrition in children can be estimated if weight- for- age is used. To interpret a single measurement of weight in relation to reference data, the age of the child must be known (WHO and UNICEF, 2009). A paediatric scale with pan, a suspended spring balance and weighing sling or a beam balance is used for weight measurement in children (Waterlow *et al.*, 1978).

#### **b) Height or Length**

Recumbent length or height in children in relation to age, are used as indices of chronic nutritional status of children. They are particularly valuable in children as indices of stunting of a child's full growth potential.

Stunting is slowing down of the skeletal growth of a child and the end result of a reduced rate of linear growth (Waterlow *et al.*, 1978). The condition results from long periods of inadequate food intake and increased morbidity and is generally found in countries where economic conditions are poor. When weight is combined with height, it provides a sensitive index of current nutritional status which is relatively independent of age. For infants less than two years, recumbent length is measured, above two years height is measured (Waterlow *et al.*, 1978).

### *c) Mid-upper arm circumference (MUAC)*

The arm contains subcutaneous fat and muscle. A decrease in mid-upper arm circumference may therefore reflect a reduction in muscle mass, a reduction in subcutaneous tissue or both. In less industrialized countries, where the amount of subcutaneous fat is frequently small, changes in mid-upper arm circumference tend to parallel changes in muscle mass and hence are particularly useful in the diagnosis of protein-energy-malnutrition or starvation. MUAC is an indicator of wasting and in particular lean body mass (Young and Susanne, 2009). It is a proxy measure of nutrient reserves in muscle and fat (IASC Global Nutrition Cluster, and Standing Committee on Nutrition (SCN), 2009). Measurement is not time consuming, and has been documented as an effective predictor of risk of death in children aged 6 to 59 months (Young and Susanne, 2009).

Changes in mid-upper arm circumference measurements can also be used to monitor progress during nutritional therapy (Hofvander and Eksmyr, 1971), correlating positively with changes in weight. Arm circumference changes are easily detected and require a minimal amount of time and equipment (Gurney and Jelliffe, 1973). Some investigators claim that mid-upper arm circumference can differentiate normal children from those with protein-energy-malnutrition as reliably as weight for height. Mid-upper arm circumference measurements are made using a flexible, non-stretch tape.

#### **2.3.1.2 Biochemical analyses**

Biochemical analysis involves quantitative chemical analysis of the blood, urine or other bodily fluids. The analyses are either made for a given nutrient or for some of the metabolites of that nutrient (Wilson and Walker, 2005). Evaluations of nutritional condition are based, directly or indirectly, on measurements of body energy reserves

(Harder and Kirkpatrick, 1994; Brown, 1996). The concept of nutritional condition assumes a relationship between energy stores and fitness; indeed, a number of studies have reported correlations between the quantity of energy reserves and survival (Miranda and Hubbard, 1994; Sogard and Olla, 2000) or adaptive aspects of life-history variation (Crossin *et al.*, 2004). Body energy reserves may be determined by proximate composition analysis.

### **2.3.1.3 Clinical assessment**

Clinical assessment is an essential feature of all nutritional surveys. It is the simplest and most practical method of ascertaining the nutritional status of a group of individuals. It utilizes a number of physical signs, specific and non-specific, that are known to be associated with malnutrition and deficiency of vitamins and micronutrients (Jelliffe, 1966). Clinical examination (Table 3), with special attention to organs like hair, angles of the mouth, gums, nails, skin, eyes, tongue, muscles, bones, and thyroid gland detection of relevant signs helps in establishing the nutritional diagnosis (Darby *et al.*, 1953). Clinical assessment is fast and easy to perform, inexpensive and non-invasive.

### **2.3.1.4 Dietary assessment**

Dietary assessment encompasses food supply and production at the national level, food purchases at the household level, and food consumption at the individual level (Clay, 2002). Several dietary assessment methods exist.

#### ***2.3.1.4.1 Dietary records***

In the dietary record approach, the respondent records the foods and beverages and the amounts of each consumed over one or more days. Ideally, the recording is done at the time of the eating occasion in order to avoid reliance on memory.

**Table 3:** Physical signs indicative of malnutrition (Standard *et al*, 1966.)

<b>Body Area</b>	<b>Normal Appearance</b>	<b>Signs Associated with Malnutrition</b>
Hair	Shiny, firm, not easily plucked	Lack of natural shine, dull and dry, thin and sparse, easily plucked.
Face	Skin colour uniform, smooth, health appearance, not swollen	Lumpiness, flakiness of skin, swollen, scaling of skin around nostrils
Eyes	Bright, clear, shiny, no sores at corners, pale eye membrane, redness	pale conjunctivae, redness of eyelids, Bitot's spots, redness and moist, dryness of eye, dull appearance, soft cornea, scar on cornea.
Lips	Smooth, not chapped, not swollen or swelling, scarlet and raw tongue smooth tongue	Redness and swelling of mouth or lips (cheilosis) especially at corners of mouth (angular fissures and scars)
Teeth	No cavities, no pain,	May be missing or erupting abnormally, grey or black spots (fluorosis), cavities (caries)
Skin	No signs of rashes, swellings, dark or Dryness of skin (xerosis); sandpaper feel of skin (follicular light spots	Dryness of skin (xerosis), sandpaper feel of skin (follicular light spots hyperkeratosis), flakiness of skin; skin swollen and dark; red swollen pigmentation of exposed areas (pellagrous dermatosis), excessive lightness or darkness of skin (dyspigmentation), black and blue marks due to skin bleeding (petechiae), lack of fat
Nails	Firm, pink	Nails are spoon-shape (koilonychia), brittle, ridged nails

To complete a dietary record, the respondent must be trained in the level of detail required to adequately describe the foods and amounts consumed, including the name of the food (brand name, if possible), preparation methods, recipes for food mixtures, and portion sizes. The dietary record method has the potential for providing quantitatively accurate information on food consumed during the recording period (Gibson, 2005).

An important disadvantage of this method is that recording foods as they are being eaten can affect both the types of food chosen and the quantities consumed (Kristjansdottir *et al.*, 2006).

#### ***2.3.1.4.2 24-hour dietary recall***

In the 24-hour dietary recall, the respondent is asked to remember and report all the foods and beverages consumed in the preceding 24 hours or in the preceding day. The recall typically is conducted by interview, in person or by telephone (Buzzard *et al.*, 1996). The interview is often structured, usually with specific probes, to help the respondent remember all foods consumed throughout the day. An early study found that respondents with interviewer probing reported 25% higher dietary intakes than did respondents without interviewer probing (Campbell, 1967). The main weakness of the 24-hour recall approach is that individuals may not report their food consumption accurately for various reasons related to knowledge, memory, and the interview situation.

#### ***2.3.1.4.3 Food frequency***

The food frequency approach asks respondents to report their usual frequency of consumption of each food from a list of foods for a specific period. Information is collected on frequency, but little detail is collected on other characteristics of the foods as eaten, such as the methods of cooking, or the combinations of foods in meals (Willett,

1998). Strengths of the food frequency approach are that it is inexpensive to administer and process and it asks about the respondent's usual intake of foods over an extended period of time. The major limitation of the food frequency method is that it contains a substantial amount of measurement error (Subar *et al.*, 2003).

#### **2.3.1.4.4 Diet history**

Originally, as coined by Burke, the term dietary history referred to the collection of information not only about the frequency of intake of various foods but also about the typical make up of meals (Burke, 1947). The Burke diet history included three elements: a detailed interview about usual pattern of eating, a food list asking for amount and frequency usually eaten, and a 3-day dietary record. The major strength of the diet history method is its assessment of meal patterns and details of food intake rather than intakes for a short period of time (as in records or recalls) or only frequency of food consumption. A weakness of the approach is that respondents are asked to make many judgments about both the usual foods consumed and the amounts of those foods eaten. These subjective tasks may be difficult for many respondents.

## **2.4 THE WHO CHILD GROWTH STANDARDS**

Assessing a child's growth provides important information on the adequacy of the child's nutritional status and health. There are several measures to assess growth, including weight-for-age, weight-for-height, and height-for-age (WHO, 2005).

- i. **Weight-for-age:** Weight-for-age reflects body weight relative to the child's age on a given day. A series of weights can tell you whether or not a child's weight is increasing over time, so it is a useful indicator of growth. This indicator is used to assess whether a child is underweight or severely underweight, but it is not used to classify a child as overweight or

obese. Because weight is relatively easily measured, this indicator is commonly used, but it cannot be relied upon in situations where the child's age cannot be accurately determined. Also, it cannot distinguish between acute malnutrition and chronic low energy and nutrient intake.

- ii. **Weight-for-length/height:** Weight-for-length/height reflects body weight in proportion to attained growth in length or height. This indicator is especially useful in situations where children's ages are unknown (e.g. refugee settlements). Weight-for-length/height charts help identify children with low weight-for-height who may be wasted or severely wasted. These charts also help identify children with high weight-for-length/height who may be at risk of becoming overweight or obese.
- iii. **Length/height-for-age:** Length/height-for-age reflects attained growth in length or height at the child's age at a given visit. This indicator can help identify children who are stunted (or short) due to prolonged under nutrition or repeated illness. Children who are tall for their age can also be identified, but tallness is rarely a problem unless it is excessive and may reflect uncommon endocrine disorders. Acute malnutrition does not affect height.
- iv. **Mid-upper arm circumference (MUAC):** Another useful way to assess a child's present nutritional status is to measure the mid-upper arm circumference (MUAC) (WHO/UNICEF/WFP/UNSCN, 2007). MUAC below 115 mm is an accurate indicator of severe malnutrition in children 6–59 months of age (WHO/UNICEF). MUAC can be used for rapidly screening all children in a community for severe malnutrition.

In 2006, WHO published child growth standards for attained weight and height. These new standards are based on breastfed infants and appropriately fed children of different ethnic origins raised in optimal conditions and measured in a standardized way (WHO, 2006). The same cohort was used to produce standards of mid-upper arm circumference (MUAC) in relation to age. The new WHO growth standards confirm observations that the effect of ethnic differences on the growth of infants and young children in populations is small compared with the effects of the environment. Studies have shown that there may be some ethnic differences among groups, just as there are genetic differences among individuals, but for practical purposes they are not considered large enough to invalidate the general use of the WHO growth standards population as a standard in all populations (WHO, 2006). Using weight-for-height, WHO and UNICEF recommend the use of a cut-off for weight-for-height of below -3 standard deviations (SD) of the WHO standards to identify infants and children as having severe malnutrition. The commonly used cut-off is the new 2006WHO child growth standards (WHO standards). When using the WHO child growth standards to identify the severely malnourished among 6–60month old children, the below -3SD cut-off for weight-for-height classifies two to four times as many children compared with the National Centre for Health Statistics (NCHS) reference.

The reasons for the choice of this cut-off are as follows (WHO, 2006):

1. Children below this cut-off have a highly elevated risk of death compared to those above.
2. These children have a higher weight gain when receiving a therapeutic diet compared to other diets, which results in faster recovery.
3. In a well-nourished population there are virtually no children below -3 SD (<1%).

4. There are no known risks or negative effects associated with therapeutic feeding of these children applying recommended protocols and appropriate therapeutic foods.

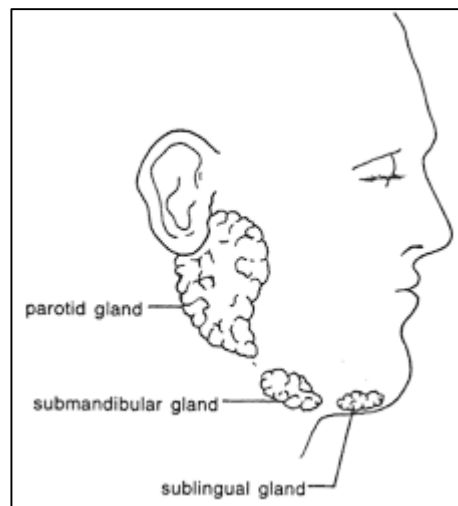
## 2.5 SALIVA

Saliva is a complex liquid consisting of secretions from the major and minor salivary glands (Fig. 3). It is a unique biological fluid, with an important role in the oral physiology (Table 4). It is also a major player in the process of oral and general health maintenance (Humphrey, 2001). According to recent data saliva mirrors general health condition, thus reflecting various systemic changes in the body (Nagler *et al.*, 2002; Nagler, 2008; Chiappelli *et al.*, 2006).

**Table 4:** Functions of saliva (Lingstrom and Moynihan, 2003)

<b>Lubrication</b>	Lubrication of oral structures and food bolus is important in eating (mastication, deglutition) and speaking
<b>Digestion</b>	Amylase activity of saliva commences the digestion of starch
<b>Prevention of dental caries</b>	Saliva is supersaturated with calcium ions, and salivary proteins prevent precipitation in saliva. It enhances oral clearance, is alkaline, and buffers acids. It modifies the composition of acquired pellicle. Saliva is also a vehicle to deliver fluoride ions to the tooth surface.
<b>Prevention of oral infections</b>	Immunoglobulin, lactoferrin, lysozyme, and sialoperoxidase have antibacterial properties that protect against oral infections
<b>Taste sensation</b>	Solids are solubilized in saliva and transported to the taste buds

Most of the saliva in the mouth is secreted by three pairs of major glands: the parotid, the submandibular, and the sublingual (Fig. 3). These are located symmetrically on either side of the mouth. The parotid glands empty through the parotid ducts, which open into the cheeks adjacent to the second upper molars (Human Anatomy, 2008).



**Fig. 3:** The three major salivary glands.

Each submandibular gland empties into one long duct, the sub mandibular which opens at the sublingual caruncle underneath the tongue (Boron and Boulpaep, 2003). The sublingual glands are different in that they do not empty into a single duct rather, the front portion of each gland empties into the major sublingual duct. This duct sometimes opens adjacent to the submandibular duct, or in some individuals it merges with the submandibular duct just before reaching the mouth (Boron and Boulpaep, 2003).

In addition to the major salivary glands, there are hundreds of minor glands located in the lips, tongue, palate, and cheeks. Unlike the major glands, the minor glands do not form large structures with branched ducts, and each gland empties directly through its own small duct (Nanci, 2007).

### 2.4.1 Production

The secretory units of the saliva glands are made up largely of two types of secretory cells, serous and mucous (Boron and Boulpaep, 2003). These cells form globular or tubular clusters known as the acini. The acinar cells import water, salts, and various other components derived from plasma and combine them to produce saliva. The acinar cells also use some of the raw materials for the synthesis of large quantities of proteins that are added to the saliva (Boron and Boulpaep, 2003).

### 2.4.2 Components

Saliva contains various components (Table 5). The solid components, organic and inorganic molecules, are found dissolved in the aqueous component and vary widely from one individual to another, and even vary in the same individual several times during the day (Hofman, 2001). The most important components of the inorganic part (weak and strong ions) are  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ ,  $\text{Ca}^{2+}$ ,  $\text{HCO}_3^-$ ,  $\text{Mg}^{2+}$  and  $\text{NH}_3$ . The organic part has components such as body secretion products (urea, uric acid and creatinine), putrefaction products (putrescine, cadaverine; lipids e.g. cholesterol and fatty acids), and more than 400 protein types (Hofman, 2001). The most relevant proteins have a glandular origin (amylase, histatins, cystatins, lactoferrins, lysozymes, mucins, and proline-rich proteins (PRPs)) or are plasma-derived (albumin, secretory immunoglobulin A (sIgA), transferrin) (Hofman, 2001)

## 2.6 SALIVA AS A DIAGNOSTIC SPECIMEN

Saliva is a readily available specimen, which can be collected by non-invasive procedures and contains many hormones, drugs and antibodies of interest in screening and diagnosis (Major *et al.*, 1991).

**Table 5:** Components of saliva (Lingstrom and Moynihan, 2003)

<b>Component</b>	<b>Examples</b>
Electrolyte	Bicarbonate, calcium, fluoride, phosphate
Enzymes	$\alpha$ -Amylase, invertase
Mucins	MUC5B (MG1), MUC7 (MG2)
Immunoglobulins	A, G, M, secretory A
Lipids	Neutral lipids, glycolipids, phospholipids,
Non-immunoglobulin proteins	Histidine-rich proteins, lactoferrin, lysozyme, peroxidase, proline-rich proteins, salivary agglutinins

With a salivary specimen, one can collect multiple specimens from the same individual at the optimum times for diagnostic information. Saliva collection allows the measurement of analyte levels in multiple samples collected at home or in remote locations. When properly instructed, most individuals can collect adequate specimens without professional help. Children generally have lots of saliva and find spitting fun.

Saliva as a diagnostic medium has many advantages over serum for a large variety of types of testing. Because saliva can be collected without breaking the skin or entering the body in any other way, it has obvious advantages for multiple non-invasive collections and for obtaining samples from those whom, for cultural reasons or age or because of physical or mental handicaps, it would be unethical to collect blood samples (Hofman *et al.*, 2001). Saliva can be collected with devices so that it will be stable at room temperature for extended periods (Schramm and Smith, 1991).

The free, rather than the protein-bound, hormone is considered to be the active component in blood (Read, 1989). The steroid hormones in saliva are thought to reflect the free hormone concentration. Therefore, saliva levels are a more accurate reflection of

the active hormone in the body, especially for steroid hormones, which are strongly bound in blood by specific binding globulins (Read, 1989).

Many of the hazards associated with blood collection do not apply to saliva. There is no need for sharps, which have the potential for cross contamination among patients when used improperly and present a danger to health care personnel. Because of the low concentrations of antigens in saliva, HIV and hepatitis infections are much less of a danger from saliva than from blood (Major *et al.*, 1991).

Studies of correlations between saliva and serum and/or urine have shown that saliva is an easily obtainable reliable diagnostic specimen for steroid and some other hormones and many drugs and antibodies. Of even more significance are studies that correlate saliva with symptoms and expected patterns of hormone variation. Saliva as a diagnostic specimen can give not only the same information as serum testing, but also additional or new information that cannot be obtained from serum (Hofman, 2001).

## **2.7 NUTRITIONAL STATUS AND SALIVA**

Saliva is increasingly used and well validated in diagnosing, monitoring health and disease status, mainly due to its origin, composition, functions, and interactions with other organ systems (Mahadevan and Velavan, 2013). The effect of nutrition status on saliva covers a broad spectrum of factors. This includes the degree of malnutrition, the period when malnutrition takes place, the consistency of the diet, the effect on salivary gland growth and function, and the effects on the different salivary glands. Protein-energy malnutrition (PEM) is a serious nutritional problem in slum children (Agarwal *et al.*, 1984).

Nutritional intake influences the oral tissues to which bacteria bind (epithelium, collagen, bone, teeth), as well as saliva (Mangan, 2002). The contents of saliva are likely influenced by nutrients consumed daily, with consequences to oral health (Mangan, 2002). Synthesis of glycoproteins, such as mucin, requires vitamin A. In protein-energy malnutrition, retinol deficiency can reduce mucin production, leading to compromised salivary flow, weakened tooth integrity, and a marked increase in risk for caries (Mandel, 2002). The presence of immunologic and non-immunologic antibacterial systems within saliva, in addition to the neutralizing and buffering components, can counter the acids formed in bacterial plaques when cariogenic bacteria ferment sugars and soluble starches. Saliva is saturated with calcium and phosphate salts that can re-mineralize sub microscopic defects in tooth minerals when plaque acids initiate the caries process. In the presence of fluoride in the oral environment, saliva's function of remineralisation can potentially reverse the caries process (Mandel, 2002).

Salivary flow and composition of mixed whole saliva are controlled by parasympathetic and sympathetic stimuli and influenced by a number of physiologic factors. About 99% of saliva is water, and the remainder consists of mainly proteins and electrolytes. Saliva has three major functions: lubrication, digestion, and protection. Each of these functions has many aspects. Due to the diversity of the saliva functions, there is an overwhelming risk that factors compromising salivary gland function may also severely affect oral and general health (Ritchie *et al.*, 2002). A common compromising effect on saliva gland function is reduced saliva flow rate. Malnutrition is one factor that might compromise salivary gland function (Lagerlo and Tenovuo, 1994).

Research on the effect of nutrition status on saliva covers a broad spectrum of factors. This includes the degree of malnutrition, the period when malnutrition takes place, the

consistency of the diet, the effect on salivary gland growth and function, and the effects on the different salivary glands. Apart from general under nutrition, deficiency of specific nutrients, such as protein, minerals, and vitamins, has been related to impaired gland function (Enwonwu *et al.*, 2002).

Protein deficiency results in alterations to salivary gland structure and function (Ryberg and Johansson, 1991). Studies in children have shown that the severity of PEM is related to the extent of reduction of stimulated salivary secretion rate (Johansson *et al.*, 1994).

## **2.8 CONCEPT OF CHILD NUTRITION AND YOUNG CHILD FEEDING PRACTICES.**

Good nutrition during childhood is essential for growth and development, health and well-being, and the prevention of some chronic diseases in old age (CDC, 1999). Children require sufficient energy, protein, and other nutrients for growth as well as maintenance of body functions. Nutrient needs tend to parallel rates of growth. Growth continues at a steady rate during childhood, and then accelerates during adolescence, creating increases in nutrient needs to support the rapid growth rate and increase in lean body mass and body size (Story *et al.*, 2002).

Dietary practices represent the ways individuals or groups of people select, prepare, consume and generally use food available to them. Different societies use food differently and have chosen different flavours, textures and food combinations and have patterned their eating differently (Wardlaw, 1997). In addition to the impact on growth and development, children's diets are important to ensure overall health and well-being. Dietary practices of children affect their risk for a number of health problems, including obesity, iron deficiency, and dental caries. Inadequate nutrition also lowers resistance to

infectious disease, and may adversely affect the ability to function at peak mental and physical ability (IOM, 2005).

Inappropriate nutrition can also lead to childhood obesity which is an increasing public health problem in many countries. Early nutritional deficits are also linked to long-term impairment in growth and health. Malnutrition during the first 2 years of life causes stunting, leading to the adult being several centimetres shorter than his or her potential height (Martorell *et al*, 1994). The first two years of life provide a critical window of opportunity for ensuring children's appropriate growth and development through optimal feeding (World Bank, 2006). Based on evidence of the effectiveness of interventions, achievement of universal coverage of optimal breastfeeding could prevent 13% of deaths occurring in children less than 5 years of age globally, while appropriate complementary feeding practices would result in an additional 6% reduction in under-five mortality (Jones *et al.*, 2003).

### **2.8.1 Recommended infant and young child feeding practices**

In 2002, the World Health Organization and UNICEF adopted the Global Strategy for infant and young child feeding (WHO/UNICEF, 2003). The strategy was developed to revitalise world attention to the impact that feeding practices have on the nutritional status, growth and development, health, and survival of infants and young children.

WHO and UNICEF's global recommendations for optimal infant feeding as set out in the Global Strategy are (i) Exclusive breastfeeding for 6 months and (ii) nutritionally adequate and safe complementary feeding starting from the age of 6 months with continued breastfeeding up to 2 years of age or beyond.

- i. Exclusive breastfeeding: This means that an infant receives only breast milk from his or her mother or a wet nurse, or expressed breast milk, and no other liquids or solids, not even water, with the exception of oral rehydration solution, drops or syrups consisting of vitamins, minerals supplements or medicines (WHO, 2008). The advantages of exclusive breastfeeding compared to partial breastfeeding were recognised in 1984, when a review of available studies found that the risk of death from diarrhoea of partially breastfed infants 0–6 months of age was 8.6 times the risk for exclusively breastfed children. For those who received no breast milk the risk was 25 times that of those who were exclusively breastfed (Feachem and Koblinsky, 1984). A study in Brazil in 1987 found that compared with exclusive breastfeeding, partial breastfeeding was associated with 4.2 times the risk of death, while no breastfeeding had 14.2 times the risk (Victora *et al.*, 1987). More recently, a study in Dhaka, Bangladesh found that deaths from diarrhoea and pneumonia could be reduced by one third if infants were exclusively instead of partially breastfed for the first 4 months of life (Arifeen *et al.*, 2001). Exclusive breastfeeding for 6 months has been found to reduce the risk of diarrhoea (Kramer *et al.*, 2003) and respiratory illness (Chantry *et al.*, 2006) compared with exclusive breastfeeding for 3 and 4 months respectively.
- ii. Complementary feeding: This is defined as the process starting when breast milk is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk. The target range for complementary feeding is generally taken to be 6 to 23 months of age, even though breastfeeding may continue beyond two years (PAHO/WHO, 2003). From the age of 6 months, an infant's need for energy and nutrients starts to exceed what is provided by breast milk, and complementary feeding becomes necessary to fill the energy and nutrient gap (Dewey and Adu-Afarwuah, 2008).

If complementary foods are not introduced at this age or if they are given inappropriately, an infant's growth may falter. In many countries, the period of complementary feeding from 6–23 months is the time of peak incidence of growth faltering, micronutrient deficiencies and infectious illnesses (Dewey and Brown, 2003).

## **2.9 FEMALE HEAD PORTERS (KAYAYEI)**

*Kayayei* (Figs. 4a and 4b) are women who carry goods and wares on her head for shoppers and traders in and around commercial centres for a petty fee. “Kaya” in the Hausa language means luggage, load or goods. “Yoo” means woman in Ga, the language of the indigenes of Accra, the Ghanaian capital. A *kayayoo* (singular) is thus a young woman or a teenage girl who carries other people's loads on the head for a fee (Klein, 2000). According to one study, *kayayei* are typically younger and their work in southern Ghana is more temporary than their male porter counterparts (Yeboah and Appiah-Yeboah, 2009).

The *kayayei* are oftentimes unskilled migrants from northern Ghana who come from underdeveloped, rural areas in search of jobs in the cities to the south. The areas in northern Ghana from which the *kayayei* hail are commonly places of abject poverty. In the past ten years, the rainfall in the north has become unpredictable due to environmental degradation. Drought, unfertile soil due to excessive farming, and inadequate jobs in the northern rural areas are positively correlated with crop failures and, ultimately, low wages (Opare, 2010).



**Fig. 4a:** Kayayei at the market in the suburb of Agbogbloshie, in the capital Accra, Ghana (From [www.reportage-bygettyimages.com](http://www.reportage-bygettyimages.com))



**Fig. 4b:** A kayayo with her child at a back at work (Source: [todaygh.com](http://todaygh.com))

The result is that youth from these areas have been known to migrate to the south in search of greener pastures in the cities. In fact, many *kayayei* were encouraged by their families in northern Ghana to move to the cities due to financial hardships on the home front (Opare 2010).

Because of their lack of education and hard skills, women from the north tend to work in the informal sector when they reach the metropolis. To the porters, the *kaya* business is seen as simple self-employment with quick results that afford them minimum assets for marriage or for sending funds back home to their family in northern Ghana. According to one study, the majority of *kayayei* are saving their wages to “enter into large-scale trading or other sedentary work” (Opare 2010).

The second most common reason the women enter the *kaya* business is to purchase material items such as clothing, jewellery and kitchenware for marriage (Opare 2010). Some studies have shown that *kayayei* “live and work in closely-linked groups held together through strong social networks” (Yeboah and Appiah-Yeboah, 2009). Through social networking, the *kayayei* choose which city to go to for work. Most *kayayei* have family already working in the cities, and arrange to stay with them while they work in the markets. *Kayayei* are employed by travellers, shop owners, general shoppers, or traders and are used to offset the difficulty of vehicles accessing the centre of the markets to load or discharge goods (Yeboah and Appiah-Yeboah, 2009:1). It is common that *kayayei* are exploited by their patrons and hassled by police and city authorities (Yeboah and Appiah-Yeboah, 2009).

The wages that the *kayayei* earn typically go “from hand to mouth,” and more often than not are spent on living accommodations within Agbogbloshie. Many *kayayei* who care

for their children are not able to afford the school fees; consequently, children follow their mothers and begin work as *kayayei* at alarmingly young ages. The *kayayei* who live in Agboghloshie share rented kiosks and contribute to the payment of weekly (sometimes daily) rent; potable water, toilets, and showers also come with a user's fee in the slum. Yet, the residents consider the prices of their accommodations to be cheap, although many residents do not realize that the accumulated annual costs of living are often greater within the slum compared to other low income communities (Ahlvin, 2012).

## CHAPTER THREE

### 3.0 METHODS

#### 3.1 STUDY DESIGN

The study was cross-sectional.

#### 3.2 STUDY SITE

The study was conducted at the Agboghloshie market located in the heart of Accra, to the northwest of the Central Business District. Agboghloshie is considered to be one of the largest informal settlements in Accra (Afenah, 2010). The low-cost of rent and its close proximity to the city centre and large market which is directly supplied by farmers are factors that entice the migrants to settle in Agboghloshie. It is one of the largest markets in Accra and accommodates a high-density population of female head porters.

The town covers approximately four acres and is situated on the banks of the Korle Lagoon, northwest of Accra's Central Business District (Afenah, 2010). Forty thousand Ghanaians inhabit the area, most of whom are migrants from rural areas (PeaceFM online, 2011). The population of Agboghloshie consists of economic migrants from northern and rural parts of Ghana.

Dwellings are wooden shacks that lack water and sanitation (Afenah, 2010). There is only one health clinic located within the slum, but most residents do not have the funds to use its facilities. Because of this, self-medication and traditional medicinal methods are employed when illness strikes (Yeboah and Appiah-Yeboah, 2009).

Residents of Agbogbloshie frequently experience malaria, due to the poor environmental conditions such as open sewers and dense living spaces. Gastro-intestinal diseases are also common, due to the unsanitary environment and unhygienic conditions under which their food is prepared (Yeboah and Appiah-Yeboah, 2009).

### 3.3 PARTICIPANTS

The participants were children (0-5 years) of female head porters and their mothers.

### 3.4 SAMPLE SIZE

A sample size of 73 was determined based on an absolute precision of 5% and a confidence interval of 95% (Daniel, 1999):

$$\begin{aligned} N &= \frac{(Z)^2 P(1-P)}{d^2} \\ &= \frac{1.96^2(0.05)(1-0.05)}{(0.05)^2} \\ &= 72.9904 \\ &= 73 \end{aligned}$$

n is sample size

Z is level of significance

P is expected prevalence

d is precision

### 3.4 SAMPLING

Sampling was done between the first and third week of March 2014. Purposive sampling method was used to select the kayayei. The mothers were part of the participants because at age 0-5 years, the children depend mainly on their mothers for their meals. Data on the

*kayayei* relating to demographic characteristics, feeding practices as well as nutritional knowledge were obtained by the use a validated questionnaire (Appendix I). Saliva samples were received from all the *kayayei*, children, in labelled, clean plastic sampling tubes. The samples were kept on ice and brought to the laboratory as soon as the samples were taken.

### **3.5 ANTHROPOMETRIC MEASUREMENT**

Weight, height and mid-upper-arm-circumference (MUAC) of the children were taken and compared with WHO Child Growth Standards (WHO, 2006).

Weight measurements were taken with a normal weighing scale for children who could stand without difficulty. The children were made to remove any foot wear and heavy clothing. For children who could not stand without help their weights were taken by weighing both mother and child and then mother only, the weight of the child was then deducted. In both cases weights were measured in light clothing. The weights were measured correct to the nearest 0.1kg. Measurements were taken twice and an average value derived.

Height measurements were taken with a portable stadiometer which was placed on a firm flat ground to ensure accuracy. Measurements were made without shoes/footwear. Each child was asked to stand upright with hands by the sides and back towards the measuring pole. The marker on the stadiometer was dropped to the head to measure the height. Heights were recorded to the nearest 0.1 cm.

MUAC measures were taken with a non-stretch MUAC tape. The measurement was done by determining the midpoint between the shoulder and the elbow of the left arm while the

child stood erect with the arm bent. The mid upper circumference was then measured at this point while the arm was straightened.

Weight –for-height measures were calculated from the weight and height measures taken and the values were compared to WHO Child growth standards.

### **3.6 DIETARY ASSESSMENT**

A food frequency questionnaire (FFQ) (Appendix II) was used to gather information on the regular eating pattern of the children from their mothers. Information on the specific foods consumed and their frequency of consumption was obtained from the FFQ. The mothers provided detailed information of all foods and beverages consumed including cooking methods used. Food models were used to describe quantity and portions of food.

### **3.7 SALIVA SAMPLE COLLECTION**

Whole unstimulated saliva samples were collected from the children into sampling tubes between 9 am and 1 pm. The children were made to expectorate into the sampling tubes until 5 ml of saliva was realized. Children who could not easily produce the saliva were allowed to do a single mouth rinse with clean water. The collected samples were immediately kept on ice. The samples were then taken to the laboratory and centrifuged at 3000 rpm for 5 min and the supernatant was then used for analysis of total protein, albumin and amylase.

### **3.8 BIOCHEMICAL ESTIMATIONS**

Salivary pH was measured using a universal indicator (pH test strips, China). Salivary albumin was estimated using the Bromocresol green method (Doumas *et al*, 1971) [Appendix III]. Salivary protein estimation was done based on the Biuret method (Fenk,

*et al* 2007) [Appendix III]. Amylase was estimated by the method of Rohleder and Nater (2009) [Appendix III].

### **3.9 DATA ANALYSIS**

Statistical analyses was done using SPSS Version 19 for Windows (2007, SPSS Inc, Chicago, IL). Graphs, charts and tables were used to summarize data and display figures where appropriate. Correlation was used to test the association between mothers' knowledge and nutritional status of the children. Children's nutritional status was correlated to the biochemical parameters. A '*p*' value less than 0.05 was considered statistically significant.

### **3.10 ETHICS**

Ethical approval was obtained from the Ethics and Protocol Review Committee of the School of Allied Health Sciences (SAHS). In addition, an informed consent (Appendix IV) to participate after a detailed explanation of the study to the subjects was obtained and an accent on behalf of the children.

## CHAPTER FOUR

### 4.0 RESULTS

#### 4.1 SOCIO-DEMOGRAPHIC DATA OF THE MOTHERS

A total of 73 female head porters (*kayayei*), each with her child, at the Agboghloshie market in Accra participated in the study. Table 6 summarizes the socio-demographic characteristics of the *kayayei*. Out of the total of 73 *kayayei*, 53 (72.6%) were between the ages of 20 and 25 years and only one (1.4%) was above 30 years. All 73 *kayayei* were from northern Ghana with 22 of them (30.1%) being Sisala and Dagarti, and 20 (27.4%) being Dagomba. More than half (89%) of the *kayayei* had no formal education and only 8 (11%) had up to primary education. Forty-seven (64.4%) of the *kayayei* were married and the remaining 26 were single. Each *kayayo* had at least one child. More than half (54.4%) of the *kayayei* earned between GH¢ 20-30 daily and almost 3% earned less than GH¢ 10 daily. Majority of the *kayayei* (89%) lived in a common room (shared with other *kayayei*) and 28 (34.4%) of them had lived in Accra for less than a year or between one and two years.

Table 7 shows the age ranges and gender of the children. Majority of the children (32.9%) were between the ages of 25 and 36 months and 4.1% (3) were less than 12 months. None of the children was less six months. Thirty seven (50.7%) of the children were girls and the remaining 36 (49.3%) were boys.

**Table 6:** Socio-demographic data of the mothers

<b>Variable</b>	<b>Category</b>	<b>N = 73</b>	<b>%</b>
<b>Age</b>	Below 20 years	9	12.3
	20-25 years	53	72.6
	26-30 years	10	13.7
	30 and above	1	1.4
<b>Ethnicity</b>	Dagomba	20	27.4
	Kokomba	9	12.3
	Sisala	22	30.1
	Dagarti	22	30.1
<b>Level of education</b>	No Formal Education	65	89.0
	Kindergarten/ Primary	8	11.0
<b>Marital status</b>	Single	26	35.6
	Married	47	64.4
<b>Average daily income</b>	Less than GH¢ 10	2	2.7
	GH¢ 10-20	22	30.1
	GH¢ 20-30	40	54.8
	GH¢ 30-40	9	12.3
<b>Permanent residence</b>	Kiosk	7	9.6
	Common room/Veranda	65	89.0
	Street	1	1.4
<b>Length of stay at area of residence</b>	Less than 1 year	28	38.4
	1 – 2 years	28	38.4
	3 –4 years	17	23.3

**Table 7:** Demographic data of the children.

Variable	Category	N = 73	%
<b>Age</b>	Less than 12 months	3	4.1
	12 to 24 months	13	17.8
	25 to 36 months	24	32.9
	37 to 48 months	18	24.7
	49 to 60 months	15	20.5
<b>Gender</b>	Female	37	50.7
	Male	36	49.3

#### 4.2. REASONS FOR THE FEEDING PRACTICES OF THE KAYAYEI

Table 8 presents the nutritional knowledge of the mothers. Fifty-two (71.2%) *kayayei* fed their children for growth and development and 21 (28.8%) did so to satisfy hunger. Concerning what a balanced diet is, 58.9% (43) described a balanced diet as one that had appropriate amount of all nutrients and 1.4% described a balanced diet as one that had most nutrients. Most of the *kayayei* (91.8%) responded that different people required different amounts of food.

#### 4.3 BREASTFEEDING PRACTICES

Almost all the mothers (95.9%) breastfed their children (Table 9). However only seven (9.6%) did exclusive breastfeeding and 24 (32.9%) breastfed their children up to two years as recommended by WHO.

**Table 8:** Reasons for feeding practices

<b>Variable</b>	<b>Category</b>	<b>N</b>	<b>%</b>
<b>Why must we eat?</b>	Growth and development	52	71.2
	Satisfy hunger	21	28.8
<b>How would you describe a balanced diet?</b>	Appropriate amount of all nutrients	43	58.9
	Large amount of all nutrients	29	39.7
	Most nutrients	1	1.4
<b>Do all people require the same quantity of food daily?</b>	Yes	3	4.1
	No	67	91.8
	No Response	3	4.1

**Table 9:** Breastfeeding practice

<b>Variable</b>	<b>Category</b>	<b>N</b>	<b>%</b>
<b>Breastfeeding</b>	Yes	70	95.9
	No	3	4.1
<b>Duration of breastfeeding</b>	Less than 2years	49	67.1
	2years	24	32.9
<b>Practice of exclusive breastfeeding</b>	Yes	7	9.6
	No	66	90.4
<b>Start of complementary breastfeeding</b>	Before six months	64	87.7
	After six months	9	12.3

#### **4.4 GENERAL CHILD FEEDING PRACTICES OF THE *KAYAYEI***

Table 10 presents the general child feeding practices of the *kayayei*. Sixty-three percent (46) of the mothers fed their children three times daily and just 6.8% (5) fed their children twice daily. The *kayayei* fed their children these number of times mainly due to affordability (71.2%), with time factor (2.7%) being the least reason.

Sixty-five (89%) of the *kayayei* did not feed their children with home cooked meals and 72 (98.6%) provided food for their children by buying. Most of the *kayayei* (80.8%) bought food for their children because it was affordable and 19.2% (14) bought food for their children because it was available. In addition, almost all the *kayayei* (95.9%) ate the same food with their children always.

#### **4.5 FOOD FREQUENCY QUESTIONNAIRE**

##### **4.5.1 Fruits**

Figure 5 shows the consumption frequencies of fruits by the children. None of the mothers fed their children apples, grapes or guava fruits. Less than 10% fed their children sugarcane Coconut was given occasionally. Less than 10% fed their children pawpaw and banana once daily and almost 20% gave their children a citrus fruit once daily.

##### **4.5.2 Legumes, nuts and oil seeds**

Figure 6 shows the consumption frequencies of legumes, nuts and oil seeds by the children. None of the *kayayei* mothers fed their children soya beans, baked beans or bambara beans. Almost 50% fed their children bean cake (akara/koose) and agushie once daily. About 30% gave their children groundnut soup daily and almost 20% gave palm nut soup daily.

**Table 10:** General child feeding practice

<b>Variable</b>	<b>Category</b>	<b>N</b>	<b>%</b>
<b>Frequency of child feeding</b>	Twice	5	6.8
	Thrice	46	63.0
	More	22	30.1
<b>Reasons for frequency of child feeding</b>	Affordability	52	71.2
	Availability	15	20.5
	Nutritional Value	4	5.5
	Time	2	2.7
<b>Do you feed your child home cooked meals?</b>	Yes	1	1.4
	No	65	89.0
	No Response	7	9.6
<b>If no, how do you obtain food to feed your child?</b>	Buying	72	98.6
	Food from relatives/friends	1	1.4
<b>Why do you feed such foods to your child?</b>	Affordability	59	80.8
	Availability	14	19.2
<b>Do you eat the same food with your child?</b>	Always	70	95.9
	Usually	1	1.4
	Sometimes	2	2.7

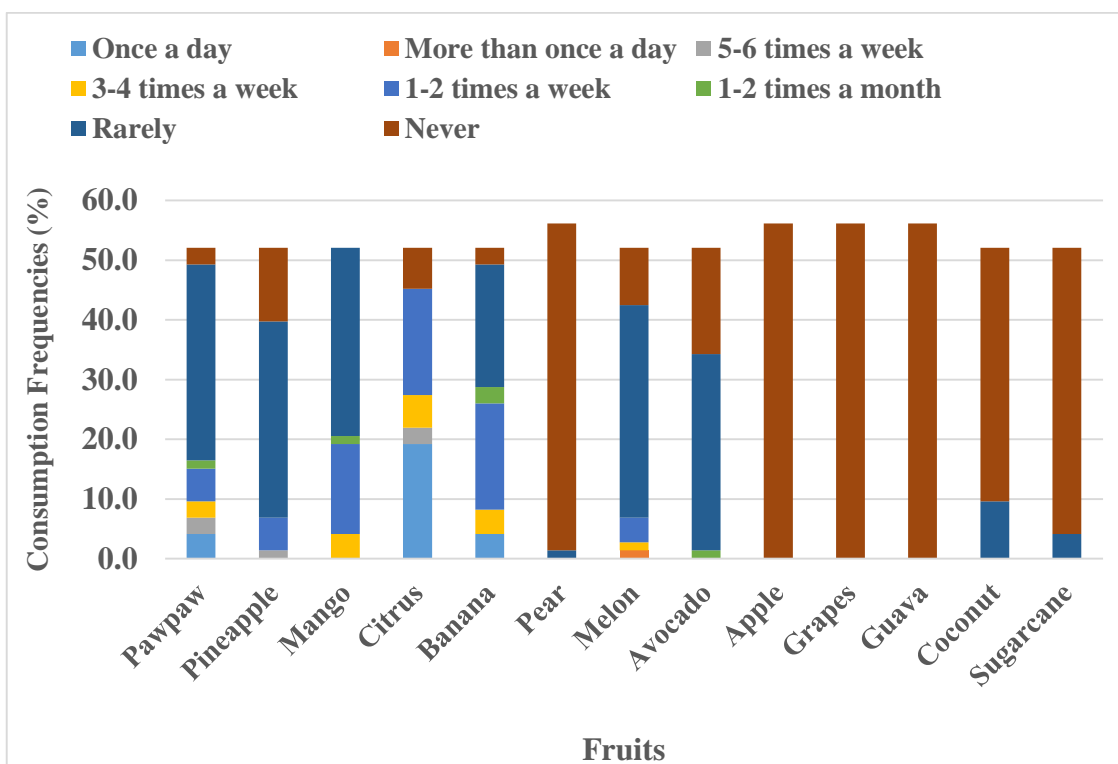


Fig. 5: Frequency of consumption of fruits by the children

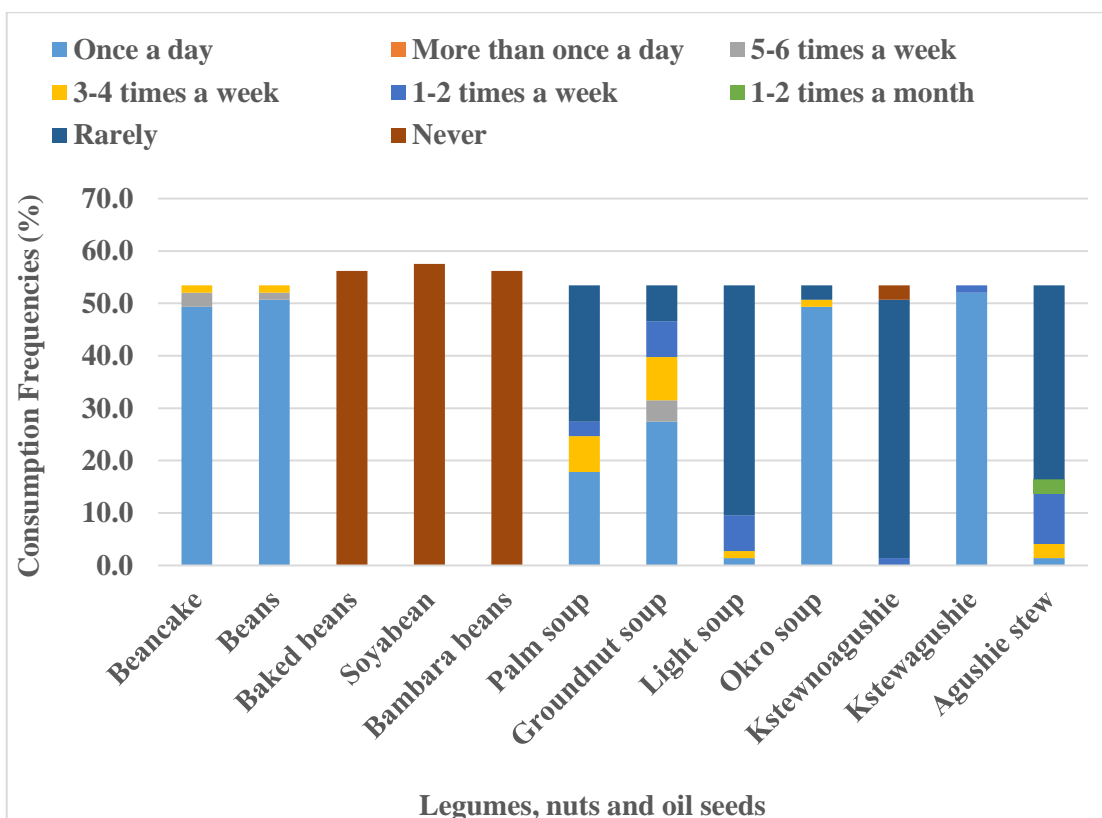


Fig. 6: Frequency of consumption of legumes, nuts and oil seeds by the children.

#### 4.5.3 Starchy roots and plantain

Figure 7 shows the frequency of consumption of starchy roots and plantain by the children. The most common starchy root that was consumed by the children was yam. About 20% consumed yam three or four times in a week and about 10% consumed yam once or twice a week. Majority (about 50%) fed on plantain occasionally, either as boiled, fried or plantain chips.

#### 4.5.4 Animal and animal products

Figure 8 shows the frequency of consumption of animal and animal products by the children. More than half of the children (53.4%) had fish once a day. None of the mothers fed their children game or seafood. More than 50% ate poultry, meat and sausage occasionally. About 40% had gave eggs and offal once or twice a week and only about 5% gave milk daily.

#### 4.5.5 Vegetables

Figure 9 presents the frequency of vegetable consumption by the children. The most common vegetable that was consumed by the *kayayei* children was kontomire. More than 50% of the mothers gave their children kontomire daily. Almost 50% gave their children okro daily and about 10% gave their children garden eggs three or four times a week.

#### 4.5.6 Grains and cereals

Figure 10 shows the frequency of consumption of grains and cereals by the children. Majority of the *kayayei* fed their children a grain or cereal daily in the form of tuo zafi (53.4%), white bread (46.6%) or millet porridge (46.6%), once a day. Kenkey and indomi/spaghetti were rarely taken.

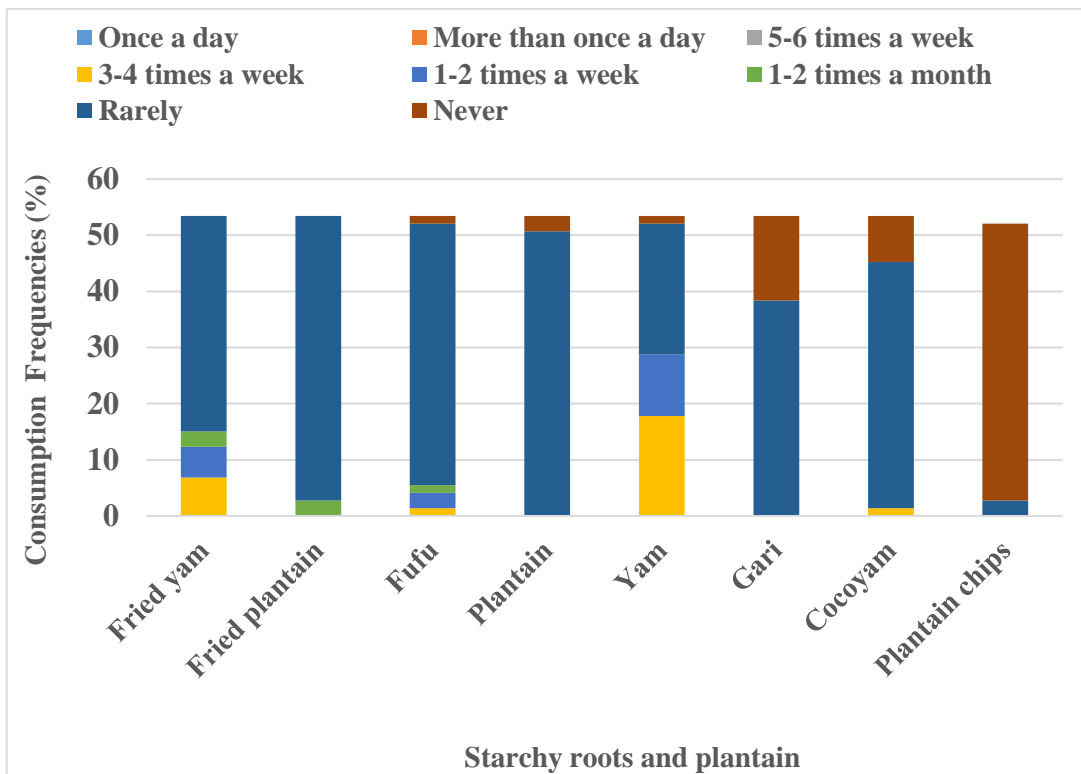


Fig. 7: Frequency of consumption of starchy roots and plantain by the children

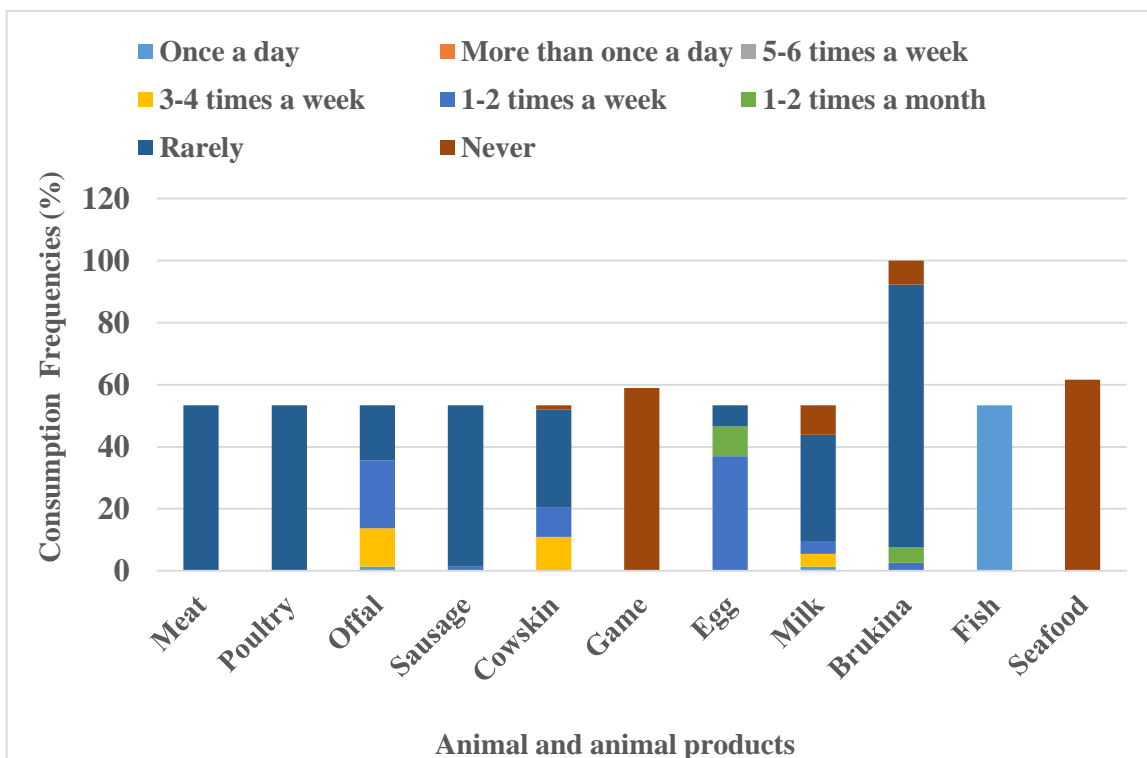
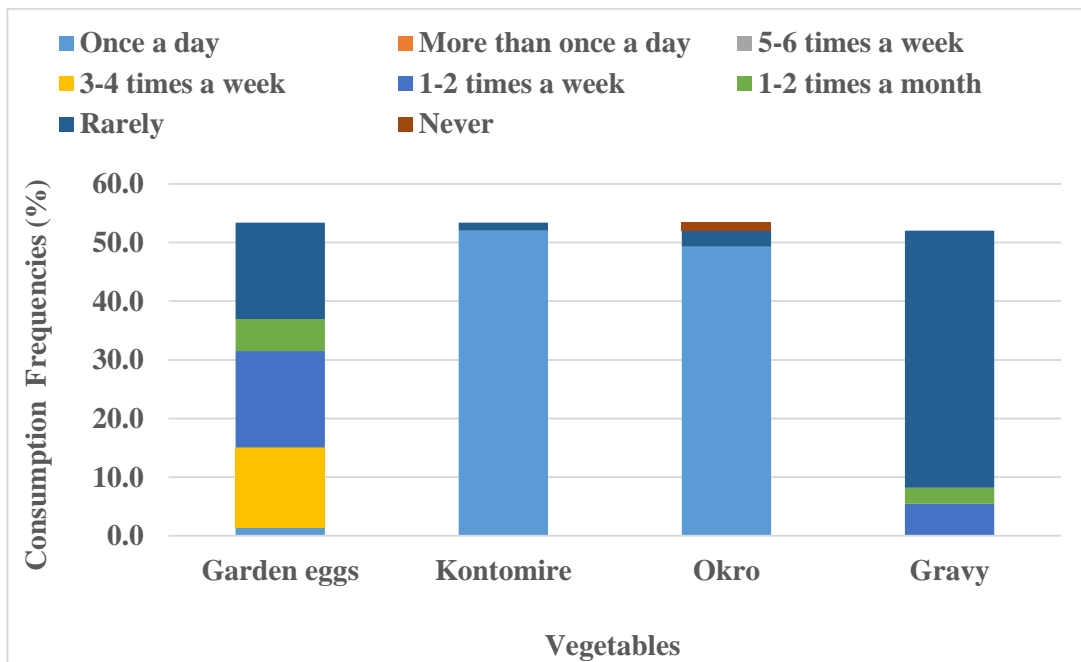
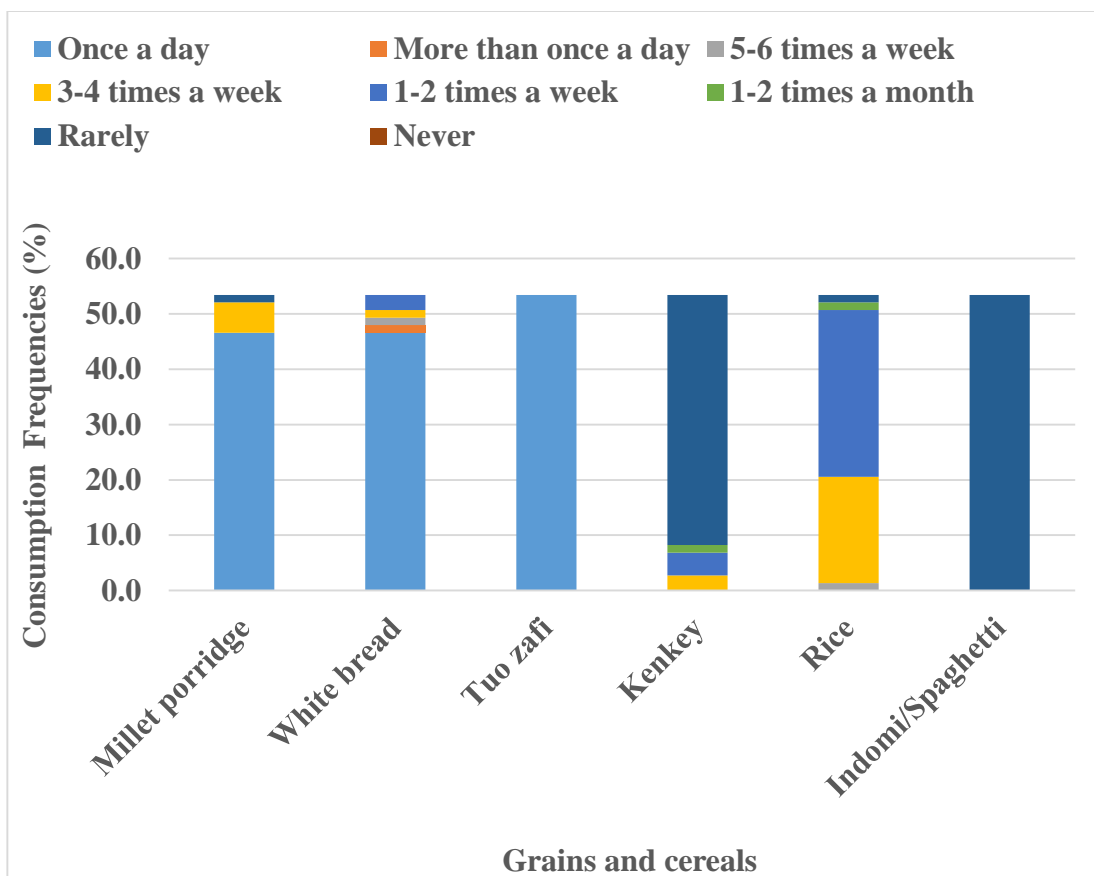


Fig. 8: Frequency of consumption of animal and animal products by the children.



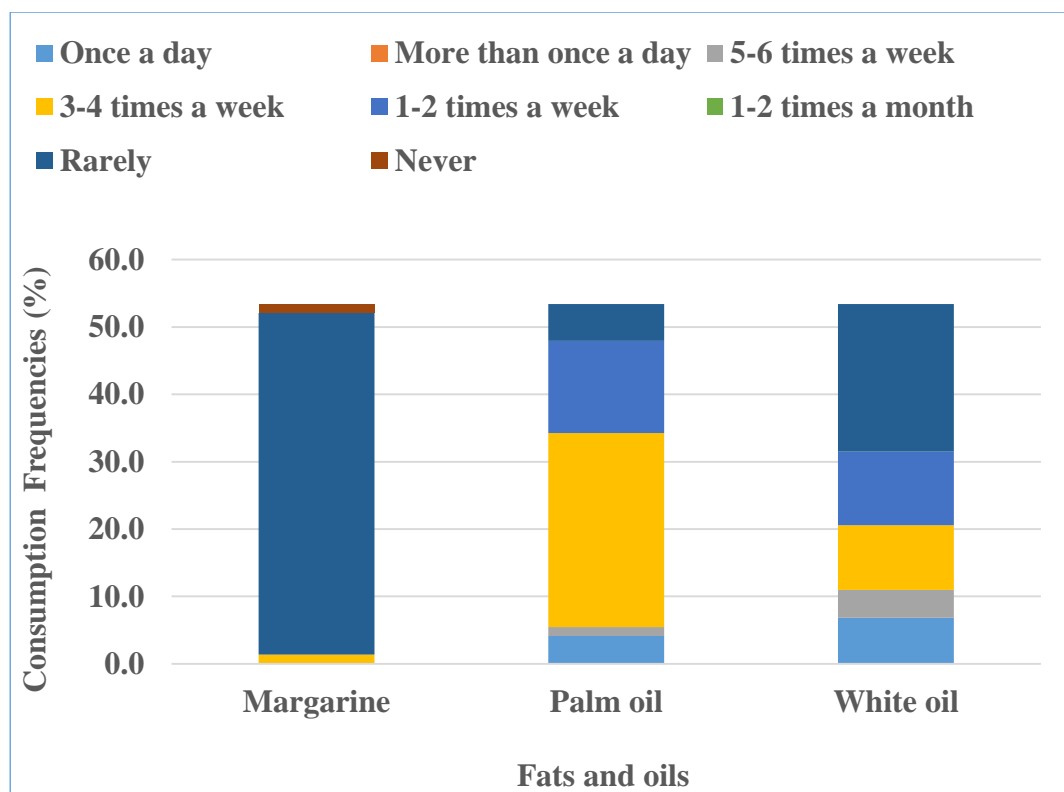
**Fig. 9** Frequency of consumption of vegetables by the children.



**Fig. 10:** Frequency of consumption of grains and cereals by the children.

#### 4.5.7 Fats and oils

Figure 11 shows the fats and oil consumption of the children. The commonest oil consumed was palm nut oil which was taken by most of the children, either 1-2 week a week (13.7%) or three to four times per week (28.8%). Margarine was rarely consumed by more than 50% and 11.1% consumed white oil daily.



**Fig. 11:** Frequency of consumption of fats and oils by the children

## **4.6 NUTRITIONAL STATUS OF THE CHILDREN USING ANTHROPOMETRIC MEASURES**

### **4.6.1 MUAC**

Table 11a shows the summary of the MUAC measures of the children. Majority of the children (67.1%) had measures in the normal range ( $>12.5$  cm). A few children (12.3%) were identified with SAM ( $<11.5$  cm). MUAC ranges in relation to age ranges of the children is shown under Table 11b. The children identified with SAM were in the 12 to 48 months age range. Table 11c shows the MUAC ranges in relation to the gender of the children. More females (6) were identified with SAM compared males (3)

### **4.6.2 Weight-for-height (WFH) measures**

Table 12a shows the summary of WFH measures of the children. Majority of the children (78.1%) had their WFH measures being normal ( $< -2$  SD of the WHO weight –for-height standards) whilst 11% (8) were identified with SAM. Table 12b shows the WFH ranges in relation to the age ranges of the children. The children identified with SAM were in the 12 to 48 months age range. Table 12c shows the WFH ranges in relation to the gender of the children. More females (6) were identified with SAM compared males (3)

**Table 11a:** MUAC measures of the children

<b>MUAC* Ranges (cm)</b>	<b>N</b>	<b>%</b>
<11.5	9	12.3
≥11.5 and <12.5	15	20.5
>12.5	49	67.1
<b>Total</b>	<b>73</b>	<b>100.0</b>

\* Normal > or equal to 12.5cm; MAM for >11.5 and <12.5cm; SAM for <11.5 cm)

**Table 11b:** Age ranges of the children and MUAC measures

<b>Age Ranges (months)</b>	<b>MUAC* Ranges (cm)</b>		
	<b>&lt;11.5</b>	<b>≥11.5 and &lt;12.5</b>	<b>&gt;12.5</b>
<b>less than 12</b>	0	1	2
<b>12 to 24</b>	3	3	7
<b>25 to 36</b>	4	6	14
<b>37 to 48</b>	2	3	13
<b>49 to 60</b>	0	2	13

\* Normal > or equal to 12.5cm; MAM for >11.5 and <12.5cm; SAM for <11.5 cm)

**Table 11c:** Child gender and MUAC measures

<b>Gender</b>	<b>MUAC* Ranges (cm)</b>		
	<b>&lt;11.5</b>	<b>≥11.5 and &lt;12.5</b>	<b>&gt;12.5</b>
<b>Female</b>	6	8	23
<b>Male</b>	3	7	26

\* Normal > or equal to 12.5cm; MAM for >11.5 and <12.5cm; SAM for <11.5 cm)

**Table 12a:** WFH measures of the children

Variable	Category	N	%
<b>Weight- for -height</b>	normal, < -2 SD	57	78.1
	moderate, -3 to -2 SD	8	11
	Severe, < -3SD	8	11

**Table 12b:** Age ranges and WFH measures

Child age ranges (months)	Weight for height		
	normal, < -2 SD	moderate, -3 to -2 SD	Severe, < -3SD
less than 12	3	0	0
12 to 24	8	3	2
25 to 36	17	3	4
37 to 48	14	2	2
49 to 60	15	0	0

**Table 12c:** Gender and WFH measures

Gender	Weight for height			Total
	normal, < -2 SD	moderate, -3 to -2 SD	Severe, < -3SD	
<b>Female</b>	29	2	6	37
<b>Male</b>	28	6	2	36
<b>Total</b>	<b>57</b>	<b>8</b>	<b>8</b>	<b>73</b>

## 4.7 NUTRITIONAL STATUS OF THE CHILDREN USING BIOCHEMICAL ESTIMATIONS

Nineteen of the children could not produce enough saliva and they were not included in the biochemical estimations.

### 4.7.1 Salivary pH

Figure 12 shows the salivary pH values of the children. The average salivary pH for the children was  $7.46 \pm 0.867$ . Majority of the children had their salivary pH value within the normal salivary pH range of 6.3 to 7.5.

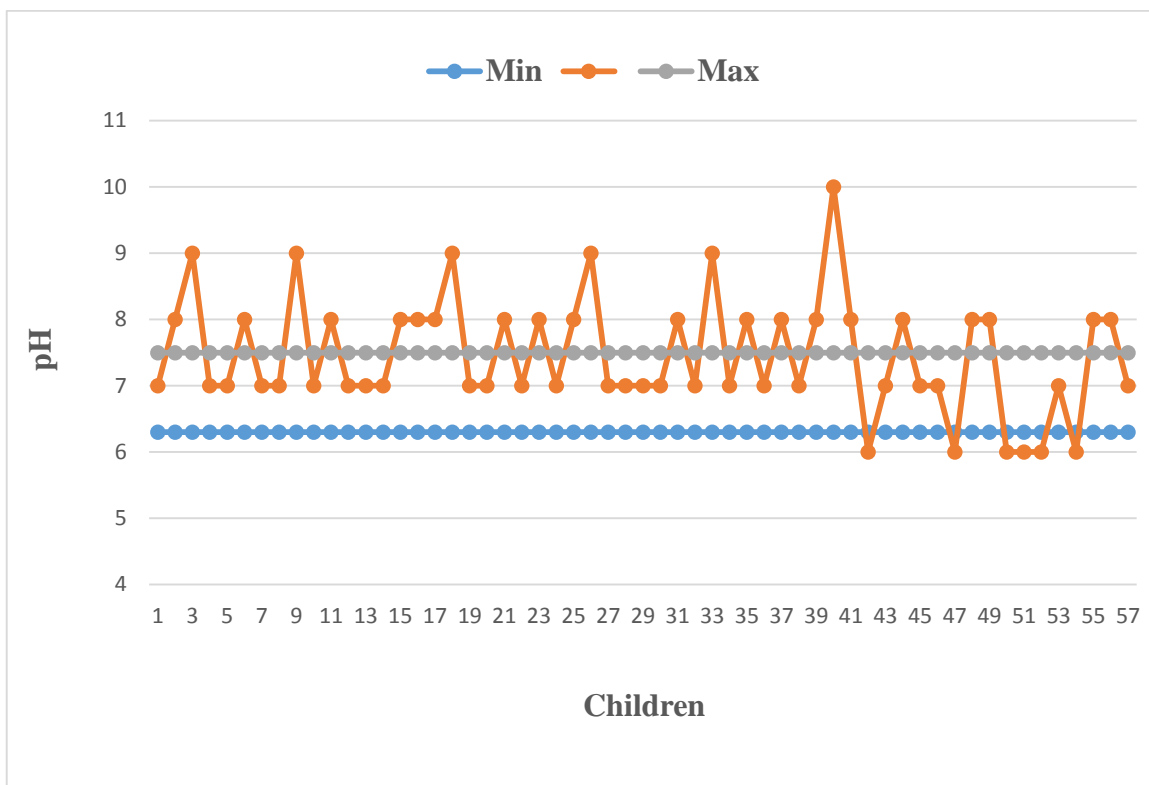
Table 13 shows the relationship of the pH ranges and gender of the children. Most of the children had a salivary pH value of 7. There was no significant difference ( $p = 0.3675$ ) between the pH values of between the genders.

### 4.7.2 Salivary albumin

Figure 13 shows the salivary albumin concentrations of the children. The average albumin concentration for the children was  $2.920 \pm 1.353$  g/L.

### 4.7.3 Salivary total protein

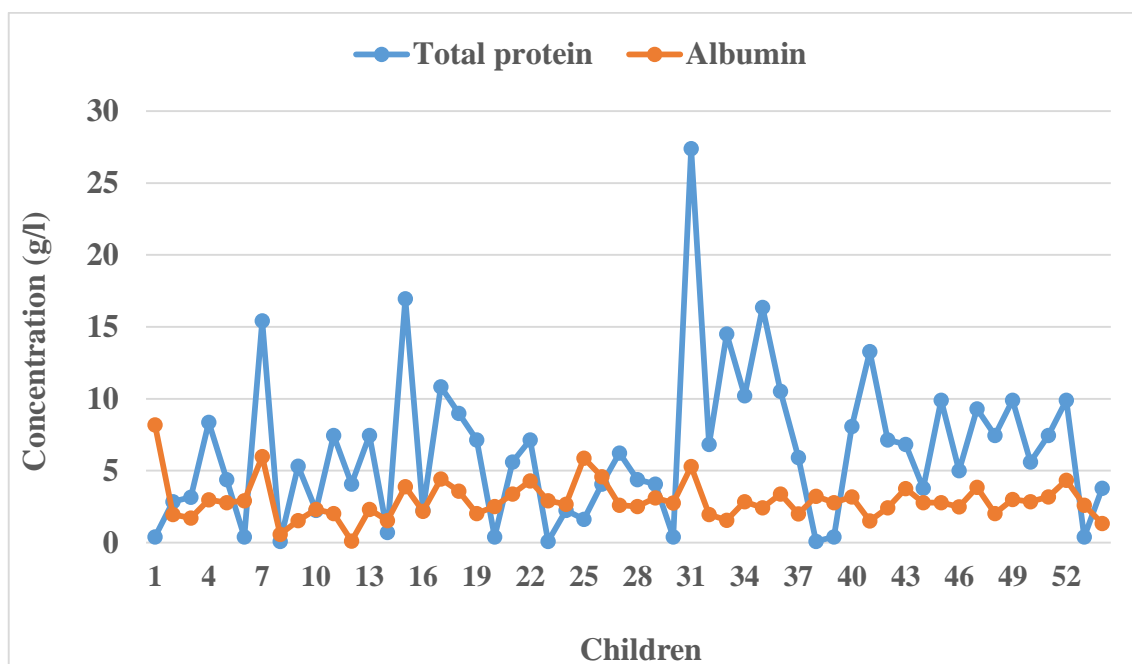
Figure 13 shows the total protein concentrations of the children. The average total protein concentration for the children was  $6.386 \pm 6.2676$  g/L.



**Fig.12:** Salivary pH values of the children

**Table 13:** Salivary pH and gender

Gender	pH value				
	6.00	7.00	8.00	9.00	10.00
Female	4	17	8	3	1
Male	2	9	11	2	0
<b>Total</b>	<b>6</b>	<b>26</b>	<b>19</b>	<b>5</b>	<b>1</b>



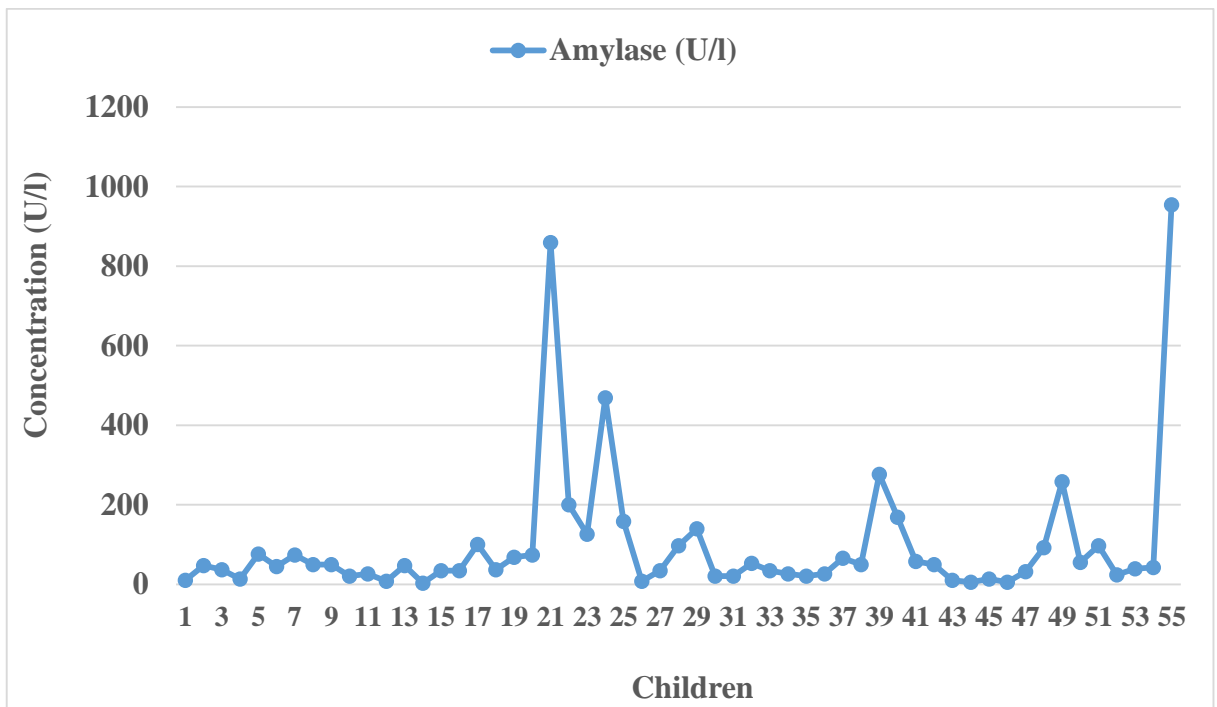
**Fig. 13:** Salivary total protein and albumin concentrations of the children

#### 4.7.4 Salivary amylase

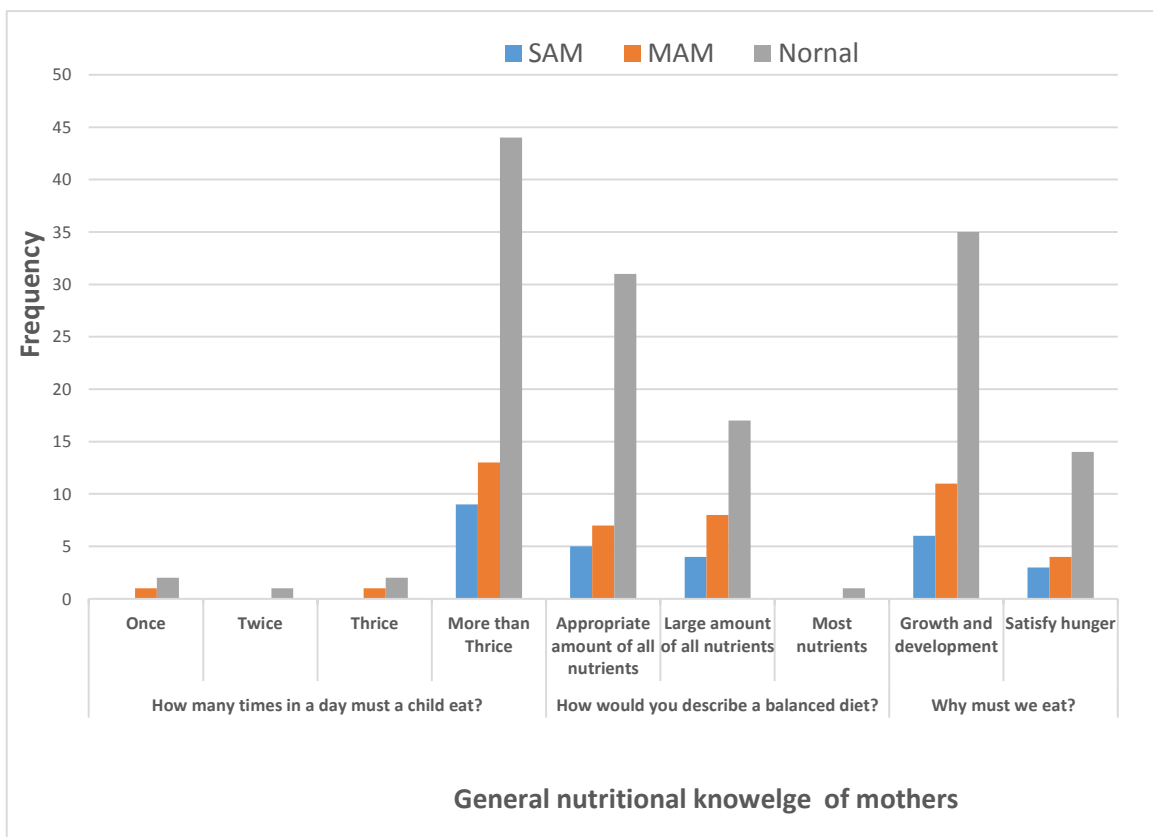
Figure 14 shows the salivary amylase concentrations of the children. The average salivary amylase concentration for the children was  $99.114 \pm 177.816$  U/L

### 4.8 RELATIONSHIP BETWEEN THE LEVEL NUTRITIONAL KNOWLEDGE OF THE MOTHERS AND THE NUTRITIONAL STATUS OF THEIR CHILDREN

Figure 15 shows the nutritional knowledge of the mothers in relation to the MUAC values of the children. Majority of the children who were fed more than thrice daily had their MUAC measures greater than 12.5cm. More than half of the mothers who knew what a balanced diet was had children with MUAC values  $> 12.5$ cm. Women who fed their children for growth and development had most of the children with MUAC values  $> 12.5$ cm. A similar trend was observed with the WFH values



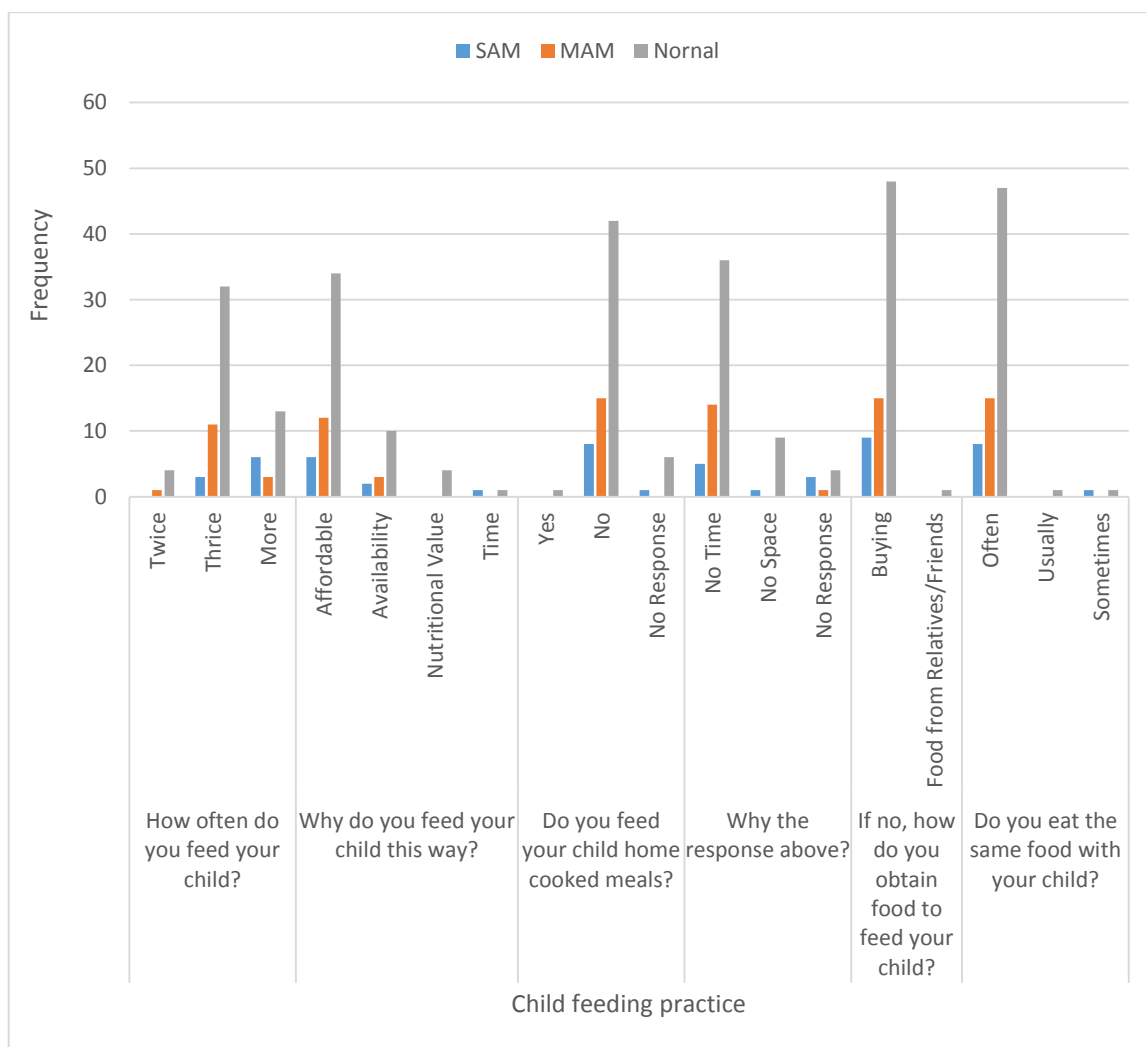
**Fig.14** Salivary amylase concentrations of the children



**Fig. 15:** Reasons for the feeding practices of the *kayayei*

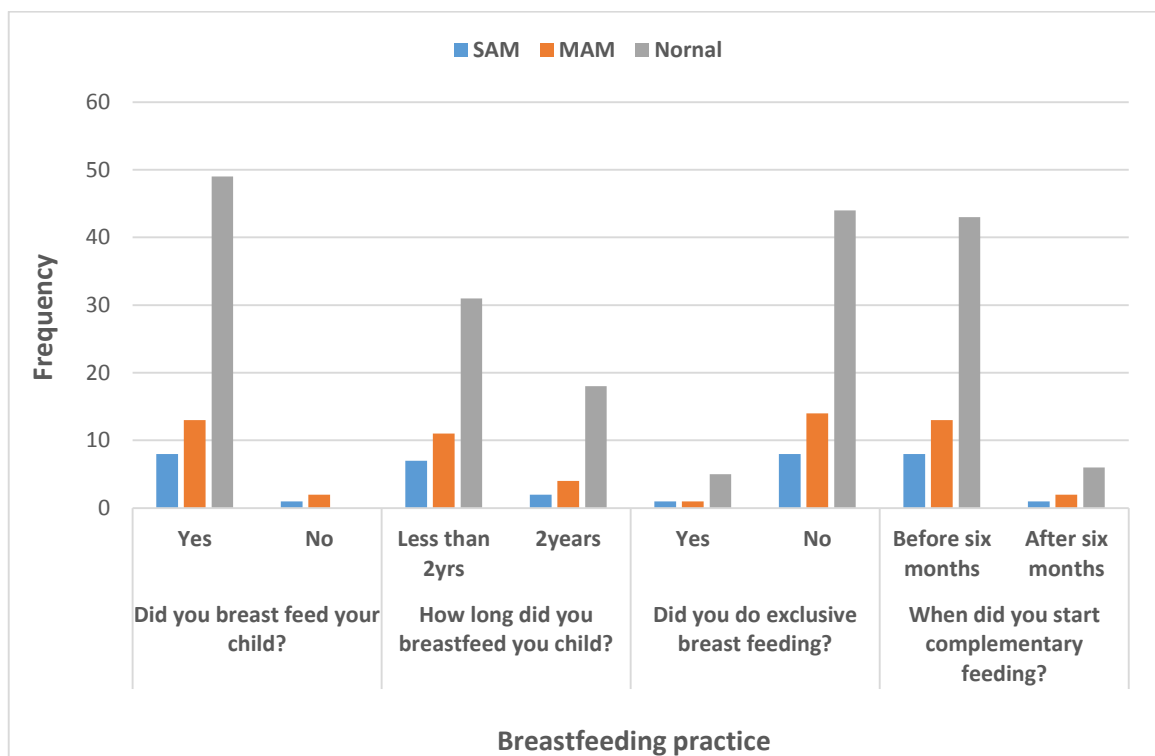
### 4.9 RELATIONSHIP BETWEEN CHILD FEEDING PRACTICES OF THE MOTHERS AND THE NUTRITIONAL STATUS OF THEIR CHILDREN

Figure 16 shows the summary of the child feeding practices of the mothers and the MUAC measures of the children. Majority of the children who were fed more than thrice daily had their MUAC measures > 12.5cm.



**Fig. 16:** Child feeding practices and MUAC measures.

Figure 17 shows the breast feeding practices and the MUAC measures of the children. More than half of the mothers breastfed their children however they did not practice exclusive breast feeding. Majority breastfed for two years and complementary feeding started before children attained the age of six months.



**Fig. 17:** Breastfeeding practice and MUAC measures

## CHAPTER FIVE

### 5.0 DISCUSSION AND CONCLUSION

#### 5.1 DISCUSSION

The aim of the study was to assess the nutritional status of children of *kayayei* as well as the level of nutritional knowledge of the women and their child feeding practices.

In this study, 72.6% of the *kayayei* were between the ages of 20 and 25 years and all 73 of them were from the northern region. This agrees with the study by Yeboah and Appiah-Yeboah (2009) who reported that *kayayei* are mostly younger women, are oftentimes unskilled migrants from northern Ghana who come from underdeveloped, rural areas in search of jobs in the cities to the south.

In Ghana, it is a very popular cultural belief that women are seen as homemakers. Thus, the socialization of females is very different from that of males. While boys are socialized to fit into the production system, girls are socialized into a homemaker role. Because school leads to one's role within the production system, the idea of sending girls to school is not taken seriously (Amu *et al.*, 2005). One study of 80 *kayayei* found that a majority lacked basic education - the first nine years of schooling, from kindergarten through junior high school (Yeboah and Appiah-Yeboah, 2009). To the porters, the *kaya* business is seen as simple self-employment with quick results that afford them minimum assets for marriage or for sending funds back home to their family in northern Ghana. In this study as well, most of the *kayayei* (89%) had no formal education and 11% had up to primary education. Many *kayayei* are encouraged by their families in northern Ghana to move to the cities due to financial hardships at home (Opare, 2010). Because of their lack of education and hard skills, women from the north tend to work in the informal sector when they reach the

metropolis (Opare, 2010).

The *kayayei* who live in Agbogbloshie share rented kiosks and contribute to the payment of weekly (sometimes daily) rent; potable water, toilets, and showers also come with a user's fee in the slum. *Kayayei* accommodation is clearly of a poor quality. However, 'economising' on accommodation costs is part of their savings strategy. The less spent on survival needs in the urban context, the quicker can be the return to the rural context. Even where *kayayei* are sleeping outside, their accommodation practices are organised. They sleep together as a group to provide both for safety and identification purposes (Agarwal *et al.*, 1994).

From this study, more than half (71.2%) *kayayei* fed their children for growth and development and that 58.9% described a balanced diet as one that had appropriate amount of all nutrients although almost all the mothers had no formal education. This is contrary to other studies. Formal education of mothers directly transfers health knowledge to future mothers (Desai and Alva, 1998). Children born to educated women suffer less from under nutrition which manifests as underweight, wasting and stunting in children. Maternal education has been associated with nutrition outcomes among children in studies in various settings (Abuya *et al.*, 2011). The literacy and numeracy skills that women acquire in school enhance their ability to recognise illness and seek treatment for their children. Additionally, they are better able to read medical instructions for treatment of childhood illness and apply the treatment. A strong link between maternal education, social economic status and child nutritional status has been found (Desai and Alva, 1998). Another study by Lorant *et al.*, 2003 also found an association between maternal education and maternal depression which has been associated with poor child health outcomes, including poor nutritional outcomes. Thus despite results of

these studies, this current study shows that maternal education had no association with nutritional status of the children of the kayayei.

Adequate nutrition during infancy and early childhood is essential to ensure the growth, health, and development of children to their full potential. Parental education had been identified as a predictor of child's nutritional status (Musa *et al.*, 2014). A study conducted by Musa *et al.* (2014), found that most parents of malnourished children either completed their basic education or were illiterate, and their average income was low. However this study found that even though majority of the kayayei (89%) had no formal education, majority of their children had normal weight-for-height and MUAC measures indicating that they were not malnourished. Poor nutrition increases the risk of illness, and is responsible, directly or indirectly, for one third of the estimated 9.5 million deaths that occurred in 2006 in children less than 5 years of age (WHO, 2009).

Studies in Lesotho by Ruel *et al.* (1992) show that nutrition education for mothers could contribute to improving children's growth, but only in households that have access to a minimum level of resources. However this study showed that even though majority of the female head porters had no formal education and earned between GH¢ 20-30 daily their children were not malnourished.

Poor breastfeeding and complementary feeding practices are widespread. Worldwide, it is estimated that only 34.8% of infants are exclusively breastfed for the first 6 months of life, the majority receiving some other food or fluid in the early months (WHO, 2009). Complementary foods are often introduced too early or too late and are often nutritionally inadequate and unsafe (WHO, 2009). The results from this study indicate that majority of the female head porters (90.4%) did not practice exclusive breast

feeding. However almost all the mothers (95.9%) breastfed their children and 87.7% started complementary feeding before their children were six months old. As a global public health recommendation, infants should be exclusively breastfed for the first 6 months of life to achieve optimal growth, development and health. To meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for up to two years of age or beyond.

This study showed that majority of the kayayei (63%) fed their children three or more times daily and dark-green leafy vegetables (e.g. kontomire) were consumed daily and citrus fruits were also consumed often. This result is in accordance with WHO (2005), statement that non-breastfed children need to eat meals 4-5 times per day with additional nutritional snacks 1-2 times per day as desired. The child should be given pulses daily to help provide iron and vitamins, with vitamin C-rich foods to help iron absorption. The child should also be given orange and yellow fruits and dark-green leafy vegetables to provide vitamin A and other vitamins.

Anthropometry has become a practical tool for evaluating the nutritional status of children in developing countries (Hakeem *et al* 2004). Severe malnutrition in children 6-59 months of age is defined as weight-for-height less than -3 z-scores, or the presence of oedema of both feet or a mid-upper arm circumference (MUAC) of less than 11.5 cm. This current study found that using MUAC, 67.1% of the children had their MUAC value >12.5 indicating that they were not malnourished though 12.3% had their MUAC value <11.5 indicating SAM. Using MUAC a study by Musa *et al.* (2014) found that 79.0% of children were well nourished, 18.1% had mild malnutrition and 2.9% had moderate malnutrition. Children with a MUAC <11.5 cm should be treated for severe malnutrition

regardless of their weight-for-height ratio (Prudhon *et al.*, 2006).

This study showed that majority of the children (78.1%) of the female head porters had a WFH value greater than -2SD indicating absence of malnutrition and no need for immediate nutritional support and 11% had weight-for-height values less than -2 SD indicating moderate malnutrition. A low WFH reflects wasting, a result of acute nutritional stress and severe food shortages or serious illness (WHO, 1995), which would need immediate nutritional support (Solarsh *et al.*, 1994).

The normal pH of saliva is 6 to 7, meaning that it is slightly acidic. The pH in salivary flow can range from 5.3 (low flow) to 7.8 (peak flow). The average salivary pH for the children in this study was  $7.46 \pm 0.867$ . This means that the children had normal salivary pH. pH readings within this normal range indicate that the body has a good mineral reserve and no dietary modifications are necessary. pH readings below 6.75 indicate that the body is slightly acidic while readings below 6.25 indicate severe acidity and low mineral reserves (Edgar, 1990). Majority of the children had their salivary pH value within the normal salivary pH range of 6.3 to 7.5. This means that the children might not have had micronutrient deficiencies. This is very important, as deficiencies of essential vitamins and minerals have important adverse effects on child survival and development (Maternal and Child Nutrition Study Group, 2013).

The minimum total protein level recorded was 0.9g/l and the maximum recorded was 27.39g/l. In general, the major factors affecting the protein concentration and composition of whole saliva are the salivary flow rate, protein contributions of the glandular saliva and crevicular fluid proteins. Thus, the elevated protein levels are most likely due to enhanced synthesis and secretion by the individual glandular saliva.

The average albumin concentration for the children in this study was  $2.920 \pm 1.353$  g/L. Albumins help carry other substances throughout blood and keep fluid from leaking out of blood vessels. Increased amount of protein in blood usually signals an underlying medical condition.

Salivary amylase is the first step in starch digestion, but the amount between different people can vary by quite a bit due to things like stressors or genotype (Mandel and Breslin, 2012). In this study, average salivary amylase concentration for the children was  $99.114 \pm 177.816$  U/L. The large differences in the salivary amylase levels could probably be due to these reasons as mentioned by Mandel and Breslin (2012).

This study showed that majority of the mothers (95.6%) breastfed their children though they started complementary feeding before their children were six months old. However, these children were found to have normal MUAC and WFH measures. This indicates that they were not malnourished. The results from this study are in agreement with studies by Adokiya (2010) which showed that there was no association between early introduction of complementary foods before six months and child under nutrition based on univariate analysis (unadjusted). The study also found that there was no statistically significance when the children were compared using complementary foods introduction time and child under nutrition. More than half of the children were fed at least three times daily.

## 5.2 CONCLUSION

There was a relationship between feeding practices of the *kayayei* and the nutritional status of their children. Majority of the mothers (58.9%) knew what a balanced meal was, they (71.2%) fed their children for growth and development and this showed in the anthropometric measures of their children: majority of the children 78.1% and 67.1%,

were within normal WHO growth standards of weight-for-height measures, respectively. Most of the *kayayei* (91.8%) also responded that different people required different amounts of food. Majority of the children (95.5%) were breastfed and they (63.0%) were fed more than three times daily and these children had anthropometric measures that were within normal ranges indicating the absence of malnutrition. Consumption frequencies of the various food groups by the children varied. Biochemical analysis of saliva samples indicated that majority of the children had their salivary pH being within normal salivary pH ranges indicating adequate micronutrient levels. There was no relationship between total protein, albumin and amylase concentrations in saliva and the nutritional status of the children.

It is recommended that:

1. The *kayayei* should be encouraged to include more fruits in their daily meals.
2. Although most of the children were not malnourished, due emphasis should be given in improving the knowledge and practice of the *kayayei* parents on appropriate infant and young child feeding practices and appropriate child health care measures.
3. Further research should be conducted to include a larger number of the *kayayei* and their children in different locations.

## REFERENCES

- Abraham S, Johnson CL & Naijjar MF (1977). Weight by Height and Age. United States. Advanced Data. Washington DC. National Center for Health Statistics, US dept. Health, Education and Welfare.
- Abuya BA, Onsomu EO, Kimani JK & Moore D (2011). Influence of maternal education on child immunization and stunting in Kenya. *Matern Child Health J* **15**:1389-1399.
- Adam W & Naoke W (1999). Socioeconomic Inequalities in Child Malnutrition in the Developing. World Bank Policy Research Working Paper No. 2434. Retrieved March 2012
- Afenah A (2010). (Re)claiming Citizenship Rights in Accra: Community Mobilization against the Illegal Forced Eviction of Residents in the Old Fadama Settlement. Article from the HIC publication "Cities for All: Experiences and Proposals for the Right to the City", Sugranyes A. y Mathivet C., HIC, Santiago, 2010, page 159
- Agarwal PK, Agarwal KN & Agarwal DK (1984). Biochemical changes in saliva of malnourished children. *Am J Clin Nutr* **39**:181-184.
- Agarwal S, Attah M, Apt N, Grieco M, Kwakye EA & Turner J (1994). Bearing the weight: The Kayayoo, Ghana's working girl child. Paper presented at the UNICEF Conference on the Girl Child, Delhi, February 1994.
- Ahlvin K (2012). The burden of the female head porter: Cultural and socio-economic difficulties facing female porters in Agbogbloshie. *PURE Insights*: **1**: Issue. 1, Article 4.
- Allen L, de Benoist B, Dary O & Hurrell R (2006). Guidelines on food fortification with micronutrients. World Health Organization and Food and Agricultural Organization of the United Nations. Geneva: World Health Organization.
- Amu NJ (2005). The Role of Women in Ghana's Economy. Friedrich Ebert Stiftung.
- Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L & Becker S. (2001). Exclusive breastfeeding reduces acute respiratory infection and diarrhoea deaths among infants in Dhaka slums. *Pediatrics* **108** (4):E67.

- Arthur S & Steven MS (2003). *Economics: Principles in action*. Upper Saddle River, New Jersey 07458: Pearson Prentice Hall. p. 481.
- Berg J, Tymoczko JL & Stryer L (2002). *Biochemistry* (5th ed.). San Francisco: WH. Freeman. p. 603.
- Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, Haider BA, Kirkwood B, Morris SS, Sachdev HP & Shekar M; Maternal and Child Undernutrition Study Group. (2008). What works? Interventions for maternal and child undernutrition and survival. *Lancet* **371** (9610): 417–440.
- Boron WF & Boulpaep EL (2003). *Medical physiology: A cellular and molecular approach*. Philadelphia: Saunders (Elsevier Science),
- Brown ME (1996). Assessing body condition in birds. In: *Current Ornithology*, **13**. (Nolan V Jr & Ketterson ED, eds), pp. 67–135. New York: Plenum Press.
- Burke BS (1947). The dietary history as a tool in research. *J Am Diet Assoc* **23**:1041–1046
- Buzzard IM, Faucett CL, Jeffery RW, McBane L, McGovern P, Baxter JS, Shapiro AC, Blackburn GL, Chlebowski RT, Elashoff RM & Wynder EL (1996). Monitoring dietary change in a low-fat diet intervention study: advantages of using 24-hour dietary recalls vs food records. *J Am Diet Assoc* **96** (6) 574 -579.
- CDC (1999). Centre for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA. [www.cdc.com](http://www.cdc.com)
- Campbell VA & Dodds ML (1967). Collecting dietary information from groups of older people. *J Am Diet Assoc* **5**: 129 -33
- Daniel WW (1999). *Biostatistic: A Foundation for Analysis in the Health Sciences*. 7<sup>th</sup> edition. New York: John Wiley & Sons.
- Chantry C, Howard C & Auinger P (2006). Full breastfeeding duration and associated decrease in respiratory tract infection in US children. *Pediatrics* **117**:425–432.
- Chiappelli F, Iribarren F & Prolo P (2006). Salivary biomarkers in psychobiological medicine. *Bioinformation* **8** (1): 331–334.

- Clay E (2002). Food security: concepts and measurement. Paper for the FAO Expert Consultation on Trade and Food Security: Conceptualizing the Linkages, Rome, 11-12 July, 2002.
- Crossin GT, Hinch SG, Farrell AP, Higgs DA, Lotto AG, Oakes JD & Healey MC (2004). Energetics and morphology of sockeye salmon: effects of upriver migratory distance and elevation. *J Fish Biol* **65**: 788–810.
- Daniel WW (1999). Biostatistic: A Foundation for Analysis in the Health Sciences. 7<sup>th</sup> edition. New York: John Wiley & Sons
- Darby WJ, Densen PM, Cannon Ro, Bridgfort E, Martin MP, Kaser MM, Peterson C, Christie A, Frye WW, Justus K, McClellan GS, Williams C, Ogle PJ, Hahn PF, Sheppard CW, Carothers EI, Newbill JA (1953). The Vanderbilt cooperative study of maternal and infant nutrition. I. Background. II. Methods. III. Description of the sample and data. *J Nutr.* 51(4):539-563.
- Desai S & Alva S (1998). Maternal education and child health: is there a strong causal relationship? *Demography* 1998, 35(1):71-81
- Dewey KG & Adu-Afarwuah S. (2008). Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Matern Child Nutr* **4** Suppl 1: 24-85.
- Dewey K & Brown K. (2003). Update on technical issues concerning complementary feeding of young children in developing countries and implications for intervention programs. *Food Nutri Bull* **24**:5–28.
- Dodds MW, Jonson DA & Yeh CK (2005). Health benefits of saliva: a review. *J Dent* **33**:223–233.
- Doumas BT, Wataon W & Biggs HG (1971). Albumin standards and the measurement of serum albumin with bromocresol green. *Clin. Chem. Acta* **31**:87
- Dunford M (ed). (2006). Sports Nutrition: A Practice Manual for Professionals, 4th Edition. American Dietetic Association.
- Edgar WM (1990). Saliva and dental health. Clinical implications of saliva: report of a consensus meeting. *Br Dent J* **169**: 96–98.

- Enwonwu CO, Phillips RS & Falkler WA, Jr. (2002). Nutrition and oral infectious diseases: State of the science. *Compend Cont Educ Dent* **23**(5):431-434, 436, 438.
- Feachem R & Koblinsky M (1984). Interventions for the control of diarrhoeal disease among young children: promotion of breastfeeding. *Bull WHO* **62**:271–291.
- Fenk CJ, Kaufman N & Gerbig DG. (2007). A new colorimetric assay of tabletop sweeteners using a modified biuret reagent: An analytical chemistry experiment for the undergraduate curriculum. *Chem. Educ.* **84**: 1676-1678.
- Franco VH, Hotta JK, Jorge SM & dos Santos JE (1999). Plasma fatty acids in children with grade III protein–energy malnutrition in its different clinical forms: marasmus, marasmic kwashiorkor, and kwashiorkor. *J Trop Pediatr* **45** (2): 71–75
- Gibson RS (2005). *Principles of Nutritional Assessment*. New York: Oxford University Press.
- Hakeem R, Shaikh AH & Asar F (2004). Assessment of linear growth of affluent urban Pakistani adolescents according to CDC 2000 references. *Ann. Hum. Biol.* **31**: 282-291
- Harder, JD. & Kirkpatrick, RL (1994). Physiological methods in wildlife research. In: *Research and Management Techniques for Wildlife and Habitats*, 5th edn (Bookhout TA, ed.). Bethesda, MD: The Wildlife Society, pp. 275–306
- Hofman LF (2001). Human saliva as a diagnostic specimen. *J Nutr* **131**:1621–1625.
- Humphrey S & Williamson, R (2001). A review of saliva: normal composition, flow and function. *J Prosthet Dent* **85** (2). 162–168.
- Hofvander Y & Eksmyr R (1971). An applied nutrition program in Ethiopian rural community. *Am. J. Clin. Nutr* **24** (5): 578-591
- IASC Global Nutrition Cluster, and Standing Committee on Nutrition (SCN) Task Force on Assessment, Monitoring, and Evaluation. (2009). Fact sheet on MUAC. Geneva: UNSCN.
- Jelliffe DB (1966). The assessment of nutritional status of the community. *Wld Hlth Org Monogr Ser* **53**. World Health Organization, Geneva.

- Johnston FE & Ouyang E (1991). Choosing appropriate reference data for the anthropometric assessment of nutritional status. In: *Anthropometric Assessment of Nutritional Status* (Himes JH. ed.). New York: Wiley-Liss.
- Johansson I, Lenander-Lumikari M & Saellström AK (1994). Saliva composition in Indian children with chronic protein-energy malnutrition. *J Dent Res* **73**:11-19.
- Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS; Bellagio Child Survival Study Group (2003). How many child deaths can we prevent this year? *Lancet* **362**:65–71.
- Kessler DB & Dawson P (1999). Failure to thrive and pediatric undernutrition: a transdisciplinary approach. Baltimore: P.H. Brookes.
- Kramer MS<sup>1</sup>, Guo T, Platt RW, Sevkovskaya Z, Dzikovich I, Collet JP, Shapiro S, Chalmers B, Hodnett E, Vanilovich I, Mezen I, Ducruet T, Shishko G, Bogdanovich N (2003). Infant growth and health outcomes associated with 3 compared with 6 mo of exclusive breastfeeding. *Am J Clin Nutr.* **78**(2):291–295.
- Kristjansdottir AG, Andersen LF, Haraldsdottir J, deAlmeida MD, Thorsdottir I (2006). Validity of a questionnaire to assess fruit and vegetable intake in adults. *Eur J Clin Nutr* **60** 408 -415.
- Kuczmarski RJ, Ogden CL & Guo SS (2002). CDC Growth Charts for the United States: Methods and Development. National Center for Health Statistics. *Vital Health Statistics* **11** (246).
- Lagerlöf F & Tenovuo J (1994). Saliva. In: Thylstrup A, Fejerskov O, eds. *Textbook of Clinical Cariology*, 2nd ed. Copenhagen: Munksgaard
- Lagua RT and Claudio VS (2004). *Nutrition and Diet Therapy Reference Dictionary*. 4<sup>th</sup> ed. New York: Chapman & Hall.
- Lingstrom P & Moynihan P (2003). *Nutrition, Saliva and Oral Health*. Nutrition and Oral Health 2003
- Lorant V, Deliege D, Eaton W, Robert A, Philippot P, Ansseau M (2003). Socioeconomic inequalities in depression: a meta-analysis. *Am J Epidemiol* 2003, **157**(2):98-112.

- Mahadevan K & Velavan S (2013). Analysis of salivary proteins as the biochemical indicators of nutritional status and salivary gland function. *Int J Pharm Bio Sci* **4**(2): 689-694
- Major, CV, Read, SE, Coates, RA., Francis, A, McLaughlin, BJ, Millson, Myatt, Mark, Tanya Khara, Steve Collins (2005). A review of methods to detect cases of severely malnourished children in the community for their admission into community-based therapeutic care programs. *Food and Nutrition Bulletin*. **27**(3)
- Mandel ID (2002). Oral infections: Impact on human health, well-being, and health-care costs. *Compend Cont Educ Dent* 2002;**23**(5):403-413.
- Mandel, AL, & Breslin, PAS (2012). High Endogenous Salivary Amylase Activity Is Associated with Improved Glycemic Homeostasis following Starch Ingestion in Adults. *J Nutri*. doi:10.3945/jn.111.156984.
- Mangan DF (2002). Nutrition and oral infectious diseases: Connections and future research. *CompendContEduc Dent* 2002; **23**(5):416-422.
- Manary, Mark J, Indi Trehan, Hayley S, Goldbach, Lacey N. LaGrone, Guthrie J. Meuli, Richard J. Wang, and Kenneth M. Maleta (January 31, 2013). "Antibiotics as Part of the Management of Severe Acute Malnutrition". *Eng J Med***368** (5): 425–435.
- Martorell R, Kettel Khan L, Schroeder DG (1994). Reversibility of stunting: epidemiological findings in children from developing countries. *Eur J Clin Nutr*, 1994, **58**(Suppl.1):S45–S57.
- Maternal and Child Nutrition Study Group (2013). Maternal and child nutrition: building momentum for impact. Published Online June 6, 2013 <http://dx.doi.org/10.1016/S0140-6736> (13)60988
- Miranda, LE. & Hubbard, WD (1994). Length-dependent winter survival and lipid composition of age-0 largemouth bass in Bay Springs Reservoir, Mississippi. *Trans Am Fisheries Soc* **123**, 80–87.
- Nanci A. (2007). Ten Cate's Oral Histology: Development, Structure, and Function. 7th Revised edition. UK: Mosby

- Nagler, R, Hershkovich, O, Lischinski, S, et al. (2002). Saliva analysis in clinical setting: revisiting an underused diagnostic tool. *Journal of investigative medicine: the official publication of the American Federation for Clinical Research*. **50** (2), May 2002, pp. 214–225
- Nagler R. (2008). Saliva analysis for monitoring dialysis and renal function. *Clin Chem* **54**:. 1415-1417
- Olness K (April 2003). Effects on brain development leading to cognitive impairment: a worldwide epidemic. *J DevBehavPediatr* **24** (2): 120–30.
- Opare, JA (2010). Female head porter: The Women Head Porters of Southern Ghana. Google, accessed October 13 2013. Online
- PAHO/WHO (2002). Guiding principles for complementary feeding of the breastfed child. Washington DC, Pan American Health Organization/World Health Organization, 2002.
- Peace FM Online (2009) "Time up for Sodom and Gomorrah". Ghanaian News. 4 Sept. 2009. Web. 15 Mar. 2011
- Pelletier DL, Frongillo EA Jr, Schroeder DG, Habicht JP (1995). The effects of malnutrition on child mortality in developing countries. *Bull World Health Organ* 1995; **73**: 443-448.
- Prudhon C (2006). WHO, UNICEF and SCN informal consultation on community-based management of severe malnutrition. *Food Nutri Bull* **27**(3):
- Read, GF (1989). Hormones in saliva. In: *Human Saliva: Clinical Chemistry and Microbiology*. Vol. II. (Tenovuo JO. ed). pp. 147–176.
- Ritchie CS, Joshipura K, Hung HC, Douglass CW (2002). Nutrition as a mediator in the relation between oral and systemic disease: Associations between specific measures of adult oral health and nutrition outcomes. *Crit Rev Oral Biol Med* 2002; **13**(3):291-300.
- Rohleder N & Nater UM (2009). Salivary alpha amylase in humans Determinants and methodological considerations. *Psychoneuroendocrinology*. **34**(4): 486-496
- Ruel TM, Jean-Pierre H, Per PA and Yrjö G (1992). The mediating effect of maternal nutrition knowledge on the association between maternal schooling and child nutritional status in Lesotho (1992). *Am. J. Epidemiol.* **135** (8): 904-914.

- Ryberg M & Johansson I (1991). The effects of moderate protein deficiency on-adrenoceptor Density in rat parotid and submandibular salivary glands. *Arch Oral Biol*; **36**:591
- Schramm, W. & Smith, R. H. (1991). Anultrafiltrate of saliva collected in situ as a biological sample for diagnostic evaluation. *Clin. Chem.* **37**: 114–115.
- Scrimshaw NS & Viteri FE (2010). INCAP studies of kwashiorkor and marasmus. *Food Nutr Bull.* **31**(1):34-41.
- Sogard, SM. & Olla, BL (2000). Endurance of simulated winter conditions by age-0 walleyepollock: effects of body size, water temperature, and energy stores. *J Fish Biol* **56**, 1–21.
- Solarsh GC, Sanders DM, Gibson CA & Gouws E. (1994). Community-based survey versus sentinel site sampling in determining the nutritional status of rural children. *SAMJ*, **84**:747-52
- Standard KL, Lovell HG & Garrow JS. (1966). The validity of certain physical signs as indices of generalised malnutrition in young children. *J Trop Pediatr Afr Child Health.* **11**(4):100-106.
- Stillwaggon E (2008). Race, Sex, and the Neglected Risks for Women and Girls in Sub-Saharan Africa. *Feminist Economics***14** (4): 67–86.
- Story M, Lytle LA, Birnbaum AS & Perry CL (2002). Peer-led, school-based nutrition education for young adolescents: feasibility and process evaluation of the TEENS study. *J Sch Health.* **72**(3):121-127.
- Subar AF, Kipnis V, Troiano RP, Midthune D, Schoeller DA, Bingham S (2003). Using intake biomarkers to evaluate the extent of dietary misreporting in a large sample of adults: the OPEN study, *Am. J. Epidemiol* **158**: 1-13
- UNICEF (2013). 2013 Statistical snapshot: Child Mortality. UNICEF Data & Analytics, Division of Policy and Strategy, September 2013
- Victora CG, Smith PG, Vaughan JP, Nobre LC, Lombardi C, Teixeira AM, Fuchs SM, Moreira LB, Gigante LP & Barros FC (1987). Evidence for protection by breastfeeding against infant deaths from infectious diseases in Brazil. *Lancet*, **330**: 319–322.

- Wadhvani N (2011). Mother and Child nutrition; Mother, infant and young child nutrition and malnutrition. [www.motherchildnutrition.org](http://www.motherchildnutrition.org).
- Wardlaw GM. (1997). Contemporary Nutrition: Issues and Insight 4<sup>th</sup> edition. New York: McGraw-Hill Company Inc.
- Waterlow, JC, Garlick, PJ, & Millward, DJ (1978). Protein turnover in mammalian tissues and in the whole body, North-Holland, Amsterdam and Oxford.
- Walker JB & Watkins WA (2008) Nutrition in pediatrics: basic science, clinical application. (Christopher D, ed.). Hamilton: BC Decker. pp. 127–141.
- WHO/UNICEF (2003). Global strategy for infant and young child feeding. Geneva, World Health Organization, 2003.
- WHO (2005). Guiding principles for feeding non-breastfed children 6–24 months of age. Geneva, World Health Organization, 2005.
- WHO. Child growth standards. Arm circumference for age. Available at: [http://www.who.int/childgrowth/standards/ac\\_for\\_age/en/index.html](http://www.who.int/childgrowth/standards/ac_for_age/en/index.html)
- WHO/UNICEF/WFP/UNSCN (2007). Community-based management of severe acute malnutrition. WHO, Geneva, 2007.
- WHO/UNICEF Joint Statement. The use of the WHO child growth standards for the identification of severe acute malnutrition in 6–60 month old infants and children. Geneva, World Health Organization (in press).
- WHO. Child growth standards: child catalogue. Geneva, World Health Organization, 2005 ([http://www.who.int/childgrowth/standards/chart\\_catalogue/en/index.html](http://www.who.int/childgrowth/standards/chart_catalogue/en/index.html), accessed 27 August 2008).
- WHO (2007). Evidence on the long-term effects of breastfeeding: systematic reviews and meta-analyses. Geneva, World Health Organization, 2007.
- WHO (2009) Global Data Bank on Infant and Young Child Feeding, 2009.
- WHO and UNICEF.(2009).WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children’s Fund. Geneva: WHO and UNICEF

- WHO/UNICEF/IMTF Technical Review Committee Meeting on Management of Severe Acute Malnutrition World Health Organization, Geneva 28-29 June 2007
- WHO Multicentre Growth Reference Study Group (2006). WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. Geneva, World Health Organization, 2006. Available at [http://www.who.int/childgrowth/standards technical \\_report/en/index.html](http://www.who.int/childgrowth/standards technical _report/en/index.html)
- WHO in collaboration with Public Health Nutrition (London School of Hygiene and Tropical Medicine) (2002). Management of Severe Malnutrition (Training Modules 2002).
- WHO Press, World Health Organization, nutrition interpretation guide, 20 Avenue Appia, 1211 Geneva 27, Switzerland.[www.who.int/nutrition/nlis-interpretation-guide](http://www.who.int/nutrition/nlis-interpretation-guide).
- WHO/UNICEF/USAID (2008). Indicators for assessing infant and young child feeding practices. Geneva, World Health Organization, 2008.
- Wilson, ED, Fisher KM and Carcia PA (1979). Principles of Nutrition, 4<sup>th</sup> edition USA, John Willey and Sons, Inc. NewYork.
- Wilson K and Walker J. (eds) (2005).Principles and Techniques of Biochemistry and Molecular Biology. 6<sup>th</sup> ed. New York: Cambridge University Press
- Willett WC (1998). Nutritional Epidemiology, Oxford University Press, New York, 1998
- World Health Organization (2001)."Water-related diseases: Malnutrition 2013."The addition of antibiotics to therapeutic regimens for uncomplicated severe acute malnutrition was associated with a significant improvement in recovery and mortality rates.
- World Health Organization (1999). Management of severe malnutrition: a manual for physicians and other senior health workers. Geneva, 1999. Available at: [http://www.who.int/nutrition/publications/en/manage\\_severe\\_malnutrition\\_eng.pdf](http://www.who.int/nutrition/publications/en/manage_severe_malnutrition_eng.pdf)
- World Bank (2006). Repositioning nutrition as central to development: a strategy for large scale action. Washington DC, The World Bank, 2006.

Yeboah, MA and Appiah-Yeboah K (2009). Examination of the Cultural and Socio-Economic Profiles of Porters in Accra, Ghana. *Nordic Journal of African Studies* **18**(1): 1-21.

Young H & Susanne J (2009). Review of Nutrition and Mortality Indicators for the IPC: Reference Levels and Decision-making. Geneva: UNSCN

## APPENDIXES

### APPENDIX I

#### ASSESSMENT OF NUTRITIONAL STATUS OF CHILDREN OF HEAD PORTERS AT AGBOGBLOSHIE IN ACCRA.

##### **SECTION 1: DEMOGRAPHIC CHARACTERISTICS OF MOTHER**

- 1.2 Age distribution :(1) Below 20 years (2) 20-25 years (3) 26-30 years (4) 30 and above
- 1.3 Ethnicity.....
- 1.4 Level of education (1) None (2) Kindergarten/ Primary (3) JHS (4)SHS (5) Tertiary
- 1.5 Marital status (1) Single (2) married (3) separated / divorced (4) widowed
- 1.6 What is your average daily income? (1) <GHC 10 (2) GHC 10-20 (3) GHC 20-30- (4) GHC 30-40 (5) More
- 1.7 Where is your permanent residence? (1)Kiosk (2) Common room/Verandah (3) Street (4) others (Please specify.....)
- 1.8 Length of stay at area of resident. (1) < 1 yr (2) 1 – 2 yrs (3) 3 –4 yrs (4) 5 yrs or more
- 11.8 How do you perceive your overall health status? (1) Very good (2) Good (3) Fair (4) poor

##### **SECTION 2: FEEDING PRACTICES**

- 2.1 Did you breast feed your child? (1) Yes (2) No
- 2.2 How long did you breastfeed you child? (1) < 2yrs (2) 2years (3) more than 2 years
- 2.3 Did you do exclusive breast feeding? (1) Yes (2) No
- 2.4 When did you start complementary feeding? (1) Before six months (2) after six months

##### **SECTION 3: FACTORS THAT INFLUENCE CHILD FEEDING PRACTICES**

- 3.1 How often do you feed your child? .....

(1) Once (2) Twice (3) Thrice (4) More

Which of these do you normally give your child?

Breakfast....., Lunch....., Supper.....

3.2 Why do you feed your child this way?

(1)Affordable (2) Available(3) Nutritional value (4) time (5) other (specify).....

3.2 Do you eat the same food with your child? (1) often (2) usually (3) sometimes (4) rarely/never

Why? .....

3.3What do you know about child feeding?

.....

3.4 Do you feed your child home cooked meals? (1)Yes (2) No

Why.....

3.4b.If no, how do you obtain food to feed your child?

.....

3.5 Why do you feed such foods to your child? (1) Affordable (2) Available (3) Nutritional value (4) other (specify).....

### **NUTRITIONAL STATUS-ANTHROPOMETRIC DATA**

AGE OF CHILD (months):

Gender:

MEASUREMENT	FIRST READING	SECOND READING	MEAN
Height(CM)			
Weight(KG)			
MUAC(CM)			

50. Weight-for-age .....

51. Weight-for-height .....

52. Height-for-age .....

**Appendix II**  
**Food Frequency Questionnaire (Adapted from WHO, 2010)**

Thank you for agreeing to take part in this study. Can you please answer the following questions?

**How often does your child usually eat the following foods? (Please tick one)**

Food/dish	Once a day	More than once a day	5-6x a week	3-4x a week	1-2x a week	1-2x a month	Rarely	Never
<b>Beverages</b>								
Tea								
Cocoa eg milo								
<b>Porridges</b>								
Corn porridge								
Millet porridge/ fula								
Rice porridge								
Tombrown								
<b>Milk and milk products</b>								
Evaporated								
Brukina								
Cheese/wagashie								
<b>Spreads</b>								
Margarine								
Peanut butter								
<b>Bread</b>								
Wholemeal								
White bread								
<b>Deep fried foods</b>								
Fried yams								
Fried plantain								
Beans cake(akara)								
<b>Oils</b>								
Palm oil								
White oil e.g. frytol								
<b>Fish and seafood</b>								
Fish								
Sea foods								
<b>Vegetables</b>								
Garden egg								
Kontomire/ademe/al efu/ayoyo								
Okro								

Food/dish	Once a day	More than once a day	5-6x a week	3-4x a week	1-2x a week	1-2x a month	Rarely	Never
<b>Meat and meat products</b>								
Meat (Beef, goat meat etc.)								
Poultry								
Offals								
Sausages								
Cow's skin (wale)								
Game (Bush meat)								
Eggs								
<b>Starches</b>								
Banku/TZ								
Kenkey								
Fufu								
Plantain								
Yam								
Gari								
Cocoyam								
Rice								
indomie, spaghetti,								
<b>Legumes</b>								
Black/red-eyed beans								
Baked beans								
Soy flour								
Bambara beans								
<b>Soups</b>								
Palm soup								
Ground-nut soup								
Light soup								
Okro soup								
<b>Stews</b>								
Kontomire stew (no agushie)								
Kontomire stew (plus agushie)								
garden egg stew								
Agushie stew								
Ghanaian gravy								

<b>Food/dish</b>	<b>Once a day</b>	<b>More than once a day</b>	<b>5-6x a week</b>	<b>3-4x a week</b>	<b>1-2x a week</b>	<b>1-2x a month</b>	<b>Rarely</b>	<b>Never</b>
<b>Fruits</b>								
Pawpaw								
Pineapple								
Mango								
Citrus fruits								
Banana								
Pear								
Melon								
Apples								
Avocado pear								
Grapes								
Guava								
Coconut								
Sugarcane								
<b>Soft drinks</b>								
Fanta, coke etc.								
Sobolo								
<b>Snacks</b>								
Pastries								
Plantain chips								
Biscuits								
Roasted groundnuts								
<b>Sweets</b>								
Toffees								

**Thank you for completing the questionnaire**

### **APPENDIX III - Biochemical Analysis**

#### **A. Salivary protein determination**

Salivary protein estimation was done based on the Biuret method. Protein forms a coloured complex with cupric ions in alkaline medium. Based on this principle, salivary protein estimation was done by mixing undiluted saliva with the reagent (45 g of Rochelle salt and 15 g of copper sulfate in 400 mL of 0.2 N sodium hydroxide. Five grams of potassium iodide was added to make up to 1 L with 0.2 N sodium hydroxide) and measuring the colored product using a photoelectric colorimeter at a wavelength of 546 nm. Standard solution of 6 g of bovine albumin dissolved in 100 mL of normal saline containing 0.1 g/dL sodium azide was used.

#### **B. Salivary albumin determination**

Salivary albumin was estimated using the Bromocresol green method (albumin colorimetric test). The reaction between albumin in saliva and the dye Bromocresol green (prepared by mixing 8.85 g succinic acid, 108 mg Bromocresol green, 100 mg sodium azide and 4.0 mL Brij-35 in 900 mL of distilled water) produces change in color, which is proportional to the albumin concentration in the saliva. It was estimated using a photoelectric colorimeter at wavelength of 630 nm. Standard solution of 6 gm of bovine albumin dissolved in 100 mL of normal saline containing 0.1 g/dL sodium azide was used.

#### **C. Salivary pH determination**

Salivary pH was estimated by the use of universal indicator paper. The paper was dipped into the sampling tube containing the saliva and the colour change in the paper was compared to the pH chart to determine the pH of the sample.

**APPENDIX IV**  
**INFORMED CONSENT FORM**

**Name of Researcher:** **FLORENCE ELORM ETO**  
**Name of Institution:** School of Allied Health Sciences  
College of Health Sciences  
University of Ghana.

**Name of Supervisors:** **DR. CHARLES A. BROWN**  
(School of Allied Health Sciences, University of Ghana)

**MR. FRANK HAYFORD**  
(School of Allied Health Sciences, University of Ghana)

**Project Title:** **NUTRITIONAL STATUS ASSESSMENT OF FEMALE  
HEAD PORTER CHILDREN (0 TO 5 YEARS OLD) IN  
ACCRA**

## CONSENT FORM

Title: **NUTRITIONAL STATUS ASSESSMENT OF CHILDREN (0-5YEARS) OF FEMALE HEAD PORTERS (KAYAYEI) IN AGBOGBLOSHIE MARKET ACCRA**

Principal Investigator: Florence Eto

Address: Department of Dietetics, School of Allied Health Sciences, University of Ghana, P. O. Box KB 143, Korle Bu, Accra.

### **General Information about Research**

Malnutrition is the condition that results from eating a diet in which certain nutrients are lacking, in excess or in the wrong proportions. A number of different nutrition disorders may arise, depending on which nutrients are under- or over-abundant in the diet. Nutritional status is the balance between the intake of nutrients and the expenditure of these in the processes of growth, reproduction, and health maintenance. Although the overall pattern of growth is genetically determined, it is significantly affected by nutrition. Malnutrition can lead to substantial problems in mental and physical development. In children, the impact of malnutrition on the cognitive abilities may lead to poor school achievement in later years. Malnourished children can also suffer several diseases from nutrient deficiencies

You are being invited to participate in a research project that is being conducted at Agbogbloshie market. The aim of the study is to assess the nutritional status of children of female head porters (Kayayei) as well as the level of nutritional knowledge of the women and their child feeding practices. Your participation in this study will last for a few minutes.

You will be included in the study if you agree to be part of the study and its procedures. You will answer questions about your dietary history and feeding practices. Weight, height and mid-upper-arm-circumference of your child will be taken in addition to 5mls of saliva.

### **Possible Risks and Discomforts**

There is no risk to you or your child if you are part of the study.

### **Possible Benefits**

You will know your child's nutritional status. The study will provide information on the level of your nutritional knowledge. This will help to identify nutritional and other health needs you may have and serve as a basis for providing nutrition education for you and thus improve on your child feeding practices.

### **Confidentiality**

If you decide to participate in this study, the investigator will collect personal information about you as part of the study. Supervisors of the work and others like the independent

ethics committee or the institutional review board (IRB) for the study will have access to this information at the site. They will check to see if the study is going on well and to ensure your rights. All staff that review your information at the site will keep it confidential. All records about you will be kept in locked cabinets.

### **Voluntary Participation and Right to Leave the Research**

Participation is entirely voluntary and refusal will not result in penalty or loss of benefit. You may be withdrawn from the study at any point in time during the duration of the study. You will not be required to give any reason for this action. However, information collected from you will be used as part of the study's analysis. You will not be denied access to health if you withdraw from the study

### **Contacts for Additional Information**

If you have any questions about this study, if there are things that you do not understand, or if your child has a study-related injury or hospitalized, please contact: Dr. Charles Brown at the School of Allied Health Sciences, University of Ghana, Korle Bu or by telephone, 026 820 3808

### **Your rights as a Participant**

This research has been reviewed and approved by the Ethics and Protocol Review Committee of the School of Allied Health Sciences. If you have any questions about your rights as a research participant you can contact the Ethics and Protocol Review Committee Chairman between the hours of 8am-5pm or through the mobile 026 120 6524.

### VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research title “**Nutritional Status Assessment of Children (0-5years) Of Female Head Porters (Kayayei) In Agbogbloshie Market Accra**” has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

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Date  
volunteer

---

Name and signature or mark of

**If volunteers cannot read the form themselves, a witness must sign here:**

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

---

Date

---

Name and signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

---

Date  
obtained Consent

---

Name and signature of Person who