DIETARY PATTERNS OF CHILDREN AGED 6 – 59 MONTHS AND MATERNAL NUTRITIONAL KNOWLEDGE IN CHAMWINO DISTRICT,DODOMA.

CHRISTOPHER GEOFREY YUSUPII

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ABSTRACT

Under-nutrition in young children is widely distributed and fairly concentrated in the developing regions of the world. Over 150 million children suffer from under-nutrition globally. This study was carried out to determine factors affecting dietary patterns of children aged 6 months – 59 months and maternal nutritional knowledge in Chamwino Dodoma. The study was conducted at Chamwino district in Dodoma region. The study assumed a cross-sectional design in which data was collected once. Nutritional assessment was determined by using anthropometric measurements. WHO criterion was used to obtain indicators for nutritional status: weight-for-age, height-for-age, and weight –for-height. Structured questionnaire was used to assess nutritional knowledge of maternal towards health diets and a 24 hour dietary recall was used to quantify nutrient intake and food frequency questionnaire were used to asses' dietary patterns of children in the household. Data was computed and analyzed by WHO Anthro and Statistical Product for Social Services (SPSS) version 20.WHO Anthro was used to analyse nutritional status of Children. Both descriptive and inferential variables were analysed by using SPSS, where data on dietary patterns, quantification of nutrients and maternal knowledge were computed. The results also show that 86.7% of the mothers did not receive any education and/ or training about nutrition and about 94.7 % of mothers were feeding colostrum to their child. Majority of the children expressed moderate to severely underweight (20%) (2.7%); stunting (52%) (14.7%); and wasting (4%) (1.3%). Chi-square test, all indices (WAZ; HAZ and WHZ) were found to be significantly associated with socio – demographic at p values < 0.05 involving family size, marital status and education level and Maternal Nutritional Knowledge at p values < 0.05.Food

consumption patterns shows that 15.3% of the children aged 6-8 months feed three times a day and 19.3% of the children age 9 – 11 months feed three times a day and also 38.5% of the children age 12 – 23 months feed three times a day. Also the results show that 100% of the household use cereals, 98.7% use legumes and nuts, 90.7% use oil and fats and 78.7% consume vitamins A rich vegetables and other vegetables. Furthermore, the study show that 81, 68, and 65.3 % of the children did not meet recommended dietary allowances (RDAs) of carbohydrates, protein and fats per day. On the other hand 85.3, 69.3, 25.4, 77.3 and 78.8 % did not meet RDAs for Calcium, zinc, iron, vitamin C and vitamin A per day respectively.

DECLARATION

I, Christopher, Geofrey Yusuph, do hereby declare to the Senate of Sokoine University of Agriculture that the work presented here is my own creation and has not been submitted for any Master Degree award in any other University.

..... 01/06/2018

Christopher, Geofrey Date

(MSc. Candidate)

The above declaration is confirmed

..... 01/06/2018

Prof. C. N. Nyaruhucha Date

Supervisor

..... 12/06/2018

Miss N. Bundara Date

Assistance Supervisor

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DEDICATION

To my beloved late mother Ilida, Nyitambe and my father Christopher, Yusuph who has been a constant inspiration in my life. Also to my sister Tatuand my relatives whose love and support have pushed me through.

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LIST OF ACRONYMS

NBS	National bureau of statistics
UNICEF	United Nations Children's Funds
FAO	Food and Agriculture Organization
WHO	World Health Organization
RDA	Recommended Dietary Allowance (RDA)
AI	Adequate Intake
EAR	Estimated Average Requirements
UL	Tolerable Upper Intake Level
RNI	Recommended Nutrient Intakes
PAHO	Pan American Health Organization
TFNC	Tanzania Food and Nutrition Center
PEM	Protein Energy Malnutrition
WHES	World Hunger Education Service
FFQ	Food Frequency Questionnaire
HDDS	Household Dietary Diversity Score
WDDS	World Dietary Diversity Score
FANTA	Food and Nutrition Technical Assistance

WFP	World Food Program
IDD	Iodine Deficiency Anemia
IDA	Iron Deficiency Anemia
VAD	Vitamin A Deficiency
URT	United Republic of Tanzania
TDHS	Tanzania Demographic of Health Survey
SPSS	Statistical Product and Sciences Solution
WAZ	Weight for Age
HAZ	Height for Age
WHZ	Weight for Height
RNA	Ribo-nucleatic Acid
DNA	Diribonucleatic Acid

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

High prevalence rate of macro and micro-nutrient deficiencies observed in developing countries is mainly due to inadequate intake of dietary energy and protein, the low content of micronutrients in the diet and poor bioavailability (Rivera *et al.*, 2003).

Adequate nutrition during infancy and early childhood is fundamental to the development of each child's growth potential. It is well recognized that the period from birth to two years of age is a "critical window" for the promotion of optimal growth, health and behavioral development. After reaching two years of age, it is very difficult to reverse stunting that has occurred in earlier childhood (Dewey, 2003)

According to data from the Tanzania Demographic and Health Survey, about 42% of children younger than five years of age are stunted, i.e., they are short for their age, which is an indicator of chronic under nutrition and about 5% are wasted, and 16% have low weight-for-age, which is an indicator of acute under nutrition (NBS and ORC Macro, 2010).

Under-nutrition in young children is widely distributed and concentrated in the developing regions of the world. Over 150 million children suffer from under-nutrition globally. This malnutrition starts early in the life cycle of a child and thus interventions will not only improve a child's intellectual capacity and nutritional status, but it is also a long term investment in raising human capacity, national productivity and reducing

future health care expenditures (Grantham-McGregor, 1995;Gillespie and Allen, 2002).

There is abundant literature detailing the causes of child malnutrition, especially under-nutrition, and the means of reducing it (Caulfield *et al.*, 1999; Engle*et al.*, 2000). Poor availability of food both in terms of quality and quantity, poor dietary diversification and high rates of infection are the major determinants of under nutrition in the majority of developing countries like India (Mason *et al.*, 1999). But recent research suggests that apart from the poor composition of the diet, inappropriate caregiver-feeding behaviors may play an important role in child nutrition and development. These include mixed feeding and early cessation of breastfeeding, the untimely introduction of complementary foods, low psychosocial stimulation of children, poor food preparation and food hygiene practices, and inappropriate care for children during illness, among others (Pollitt *et al.*, 1993; Pollitt *et al.*, 1995; Engle *et al.*, 2000).

The quality and quantity of food available in a household are not the only factors explaining the determinants of malnutrition in infants and young children. Care and feeding practices of the caregiver are key factors that lead to undernourishment in young children (Bentley *et al.*, 1991; Gittelsohn*et al.*, 1998; Engle *et al.*, 2000).

The period from birth to two years of age is identified as a "critical window" for promotion of optimal growth, health and development. This is because the child is susceptible to growth faltering, certain micronutrient deficiencies and acute infections

during this period leading to significant morbidity, mortality and delayed mental and motor development. Thus importance of optimal feeding of infants and young children becomes a priority to avoid long-term consequences of malnutrition such as impaired intellectual performance, low work capacity and poor overall health during adolescence and adulthood (Dewey, 2003). The nutrient needs of full-term normal birth weight infants can be met by the human milk alone for the first six months. A systematic review suggests the optimum duration of breastfeeding and the benefits of exclusive breastfeeding is not only for the infant but the mother too (Kramer and Kakuma, 2002).

Right from birth, caring practices play an important role in the development of infant health. The first year of an infant's life is considered a critical period for child growth and development. The World Health Organization has recommended feeding behaviors and best practices during the first year of life for maximizing growth, development, and survival (Gillespie and Haddad, 2001; Dewey, 2003). These include initiation of breastfeeding within one hour of birth, feeding the first milk secretion (colostrum) to the infant, exclusive breast feeding for the first six months of life and introduction of complementary foods at the end of six months (180 days after birth) (Dewey, 2003).

1.2 Problem Statement

Chronic malnutrition has been and remains a persistent problem for young children in sub-Saharan Africa. A high percentage of young children fails to attain the normal international standard height for their age often associated with stunted growth. Moreover, the number of undernourished children in sub-Saharan Africa continues to increase and the region has shown little improvement over the past decades (FAO, 2008).

In Dodoma, malnutrition among children, especially in rural areas is a common phenomenon. The most common types are stunting, underweight, wasting, anemia due to low dietary intake and infections of diseases such as malaria and hookworms infestations. According to NBS and ORC Macro (2011), 42% of children under the age of 5 years are stunted, 5 % are wasted while 16 % have both chronic and acute under nutrition and millions of children and women in Tanzania continue to suffer from one or more forms of under nutrition, including low birth weight, stunting, underweight, wasting, vitamin A deficiency, iodine deficiency disorders and anemia.

The risk of not getting adequate amount of energy, protein, vitamins and micronutrient can negatively impact on growth, increase susceptibility to infection and also impair the mental development and learning ability of school children, poor health and low productivity among the general population (Mason *et al.*, 2001).

1.3 Study Justification

In Tanzania, the assessment of dietary patterns of children aged 6 -59 months has not been sufficiently studied, and knowledge about nutrition in this area is still limited.

Therefore, this study will help to provide information to nutritionists, health workers, and policy makers on the dietary intake and nutritional status of children aged 6-59 months in order to plan the appropriate intervention programs to improve dietary pattern and maternal nutritional status in order to address the problem of child malnutrition in Dodoma.

Although these nutritional problems continue to exist among children in Tanzania, little has been documented about their dietary adequacy and nutritional status. Dietary adequacy and malnutrition among children has direct impact on children health. Therefore, the results are intended to be used to implement measures to combat the problem of poor nutrition and its associated factors among children in Chamwino.

1.4 OBJECTIVES

1.4.1 General objective

To assess factors affecting dietary patterns of children aged 6 -- 59 months and maternal nutritional knowledge.

1.4.2 Specific objectives

i. To assess maternal nutritional knowledge towards ahealthy diet in the study area

ii. To determine nutritional status of children in the study area.

iii. To determine dietary patterns of children aged 6 – 59 months in Dodoma

iv. To determine children dietary diversity in the selected study sites

v. To determine energy and nutrients intake of children in Dodoma

Research questions

i. Do mothers in Chamwino have enough knowledge towards a healthy diet?

ii. What is the nutritional status of children aged 6-59 months in Chamwino?

iii. What is the pattern of eating for children aged 6-59 months in ChamwinoDodoma?

iv. How do parents/ or caregivers in Chamwino diversify diets for theirchildren?

v. Do children in Chamwino Dodoma take enough calories andnutrients?

CHAPTER TWO

2.0 LITERATURE REVIEW.

2.1 Overview of Dietary Intake.

Dietary intake is defined as "the amount of a nutrient that a person receives through their food intake or diet" (Smolin and Grosvenor, 2008). The food consumed provides different nutrients that are useful for the growth, development and well-being of a person. It is important to evaluate the food consumed by people in order to determine if it provides adequate nutrients. A nutrient based approach for the evaluation of dietary intake can be useful to identify specific nutrient deficiencies in the diet, but this does not easily translate into practical guidelines that can be understood by the general public (WHO/FAO, 2004).

2.2 Recommended Dietary Allowance (RDA).

The RDA is defined as the average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly 97 to 98% of the healthy population in a particular life stage and gender group. The RDA serves as a target for individuals, not as a standard of adequacy of diets of the population (Escott-Stump and Earl, 2008). Smolin and Grosvenor (2008) define Adequate Intakes (AI) as a level of intake based on experimentally derived intake levels or approximations of observed mean intakes by groups of healthy people. Despite the limitations of the RDA, it serves as the nutrient standard in many countries, both developed and developing (Lee and Nieman, 2007).

The recommended dietary allowance (RDA) was initially developed to address nutrient deficiencies and focused on the levels of nutrients required for healthy populations to prevent deficiency diseases. Despite the limitations of the RDA, it

serves as the nutrient standard in many countries, both developed and developing (Lee and Nieman, 2007).

The limitations of the RDA have led to the development of a more comprehensive set of nutritional and dietary standards that adequately address nutritional concerns. The DRI model includes four reference values or components, namely estimated average requirements (EAR), adequate intake (AI), tolerable upper intake level (UL) and RDA (Escott-Stump and Earl, 2008; Smolin and Grosvenor, 2008). Each reference value or component has specific characteristics and uses.

The EAR is defined as the amount of nutrients required to meet the 50% of nutrient needs of healthy people in a particular life stage and gender group. EAR values are used for planning and evaluating the adequacy of nutrient intakes of populations (not individuals) and serve as the basis of RDA (Smolin and Grosvenor, 2008).

2.3 Recommended Nutrient Intakes.

Recommended nutrient intakes (RNI) were developed by the WHO/FAO and are defined as a daily intake set at the EAR plus two standard deviation (2SD), which meet the nutrients requirements of almost all (97.5%) apparently healthy individuals in an age and sex-specific population group (WHO/FAO, 2004).

2.4 Dietary Patterns.

Dietary patterns are being increasingly examined as predictors of disease occurances in various settings. Dietary patterns facilitate the study of the whole diet, recognizing that people consume foods in combination. The study of foods and food groups accounts for interactions between different components of a food, and for effects of

physical characteristics and unknown components (Jacobs, 2000). In addition to different components of a food, synergy or antagonism may also exist for components of different foods and drinks that are included in the dietary pattern of an individual. As a result, health effects of dietary patterns may be greater than for individual foods or nutrients.

Different methods have been used to study dietary patterns in epidemiological studies.Main approaches can be distinguished, an exploratory approach can be used that identifies combinations of foods and drinks as they are consumed in reality in a particular population. Principal components analysis is frequently used exploratory approach to identify dietary patterns (Hu *et al.*, 2000).

2.5 Maternal Nutritional Knowledge.

There remain questions about the relative importance of nutrition knowledge versus formal education with regard to nutrition outcomes. The centrality of formal education (particularly for women) to successful socioeconomic development has been widely documented in terms of gender empowerment, social equity, delayed marriage and fertility effects and higher income earning potential (NBS and ORC Macro, 2005).

2.6 Complementary Feeding Practices.

In addition, the document published in 1991 included only one indicator of complementary feeding the timely complementary feeding rate. This indicator provided information about whether complementary foods were consumed, but not about the quantity or quality of those foods. In response to concerns about the lack of adequate indicators of complementary feeding, in 2002, WHO began a process to review and develop indicators of complementary feeding practices, a conceptual

framework for identifying potential indicators of complementary feeding practices was published (Ruel*et al.*, 2003). At the same time, the *Guiding Principles for Complementary Feeding of the BreastfedChild*were being developed, which addressed the multidimensionality of complementary feeding practices (PAHO/ WHO, 2001).

2.7 Overview of Malnutrition.

About 10 million children worldwide are estimated to suffer from severe under nutrition (defined by the presence of severe wasting, stunting and underweight, which greatly increases the risk of mortality). Faltering in length extends through the first 40 months of life and pronounced during the first 18months (Lutter and Dewey, 2003). Malnutrition refers to disorders resulting from an inadequate (under nutrition) or excessive diet (over nutrition) or from failure to absorb or assimilate dietary elements (UNICEF, 2008). A deterioration of nutritional status is also a function of infections, poor sanitary conditions, repeated infections, diarrhea and inadequate care. The nutritional status of a child, as with any individual, is assessed through dietary, anthropometric, biochemical and physical observation for signs of malnutrition (Labadarios, 2005). These methods of measurement are usually done in combination for more accurate results. In Tanzania, malnutrition is the major nutrition problem, as it is related mainly to undernourishment of macronutrients and micronutrients (TFNC, 2005). Vitamin and mineral deficiencies contribute to morbidity and mortality among children and women by impairing immunity, impeding cognitive development and growth, reducing physical capacity and work performance in adulthood, and increasing the risk of obstetric complications among pregnant women (WHO, 2010). According to NBS and IFC Macro (2011), vitamin A deficiency and anemia are problems of public health significance in Tanzania. Deficiency of zinc, selenium, calcium and

fluoride are public health concerns globally, but little is known about their prevalence in the country.

Malnutrition in children is the consequence of food insecurity, which stems from poor food quality and quantity, severe and repeated infections or combinations of all three. These conditions are linked to the standard of living and whether basic needs can be met (UNICEF, 2007:WHO, 2001). A lack of knowledge on the nutritional needs of children and the benefits of breastfeeding contributes to childhood malnutrition (UNICEF, 2007). The extent of hunger has also been associated with low energy intake, low micronutrient intake and poor income levels. This affects growth patterns negatively (Labadarios, 2005). Malnutrition can cause physical, cognitive and psychological impairment, which over time causes permanent learning disabilities (Pelletier *et al.*, 1995).When there is a deficiency in the amount and nutritional value of the food consumed, the growth pattern of a child becomes disrupted owing to nutrient deficiencies (Faber and Wenhold, 2007).

2.7.1 Causes of malnutrition.

The United Nations Children's Fund (UNICEF, 2004) developed a conceptual framework that categorizes the causes of malnutrition as basic, referring to poor economic and political structures; immediate, referring to poor dietary intake, psycho-social stress and trauma and diseases such as diarrhea and acute respiratory conditions, which further complicate malnutrition; and underlying causes, referring to household food insecurity, lack of knowledge and education, caring practices and health services, as well as an unhealthy environment.

2.7.2 Classification of malnutrition.

Malnutrition can be classified as over- and under-nutrition. When food required for growth and development is lacking, the consequence is under-nutrition, which refers to a condition resulting from either micronutrient or macronutrient deficiencies, or from both (De Haen and Thompson, 2003). Macronutrient deficiency is classified as Protein Energy Malnutrition (PEM). Under-nutrition is further categorized as micronutrient deficiencies, wasting, stunting and being underweight (Klugman, 2002).

2.7.3 Under-nutrition.

Under-nutrition is a condition caused by a lack of food of good nutritional value combined with interaction from infections. Micronutrient deficiency is caused by poverty, food insecurity, lack of knowledge, and lack of distribution of adequate resources (Nagati *et al.*, 2003). The WHO (2010) developed new standards to assess the growth of a child. Under-nutrition is associated with deficit in behavior and development of the brains anatomy, neurochemistry, and metabolism (Black *et al.*, 2005).

2.7.4 Protein energy malnutrition.

Protein energy malnutrition (PEM) is now regarded as a lethal form of malnutrition basically caused by a lack of energy and protein. Kwashiorkor is a form of malnutrition caused by inadequate protein intake, while marasmus is caused by a lack of energy and protein within the diet (WHES, 2008).PEM is associated with poor weight gain, slow linear growth and behavioral changes such as irritability, anxiety and attention deficit (Grigsby, 2003).

2.8 Nutritional Status of Children.

2.8.1 Underweight.

Children are classified as moderately underweight when the weight-for-age is below the median by -2SD. When the proportions are below the median by -3SD, this is regarded as severe underweight (UNICEF,2009: WHO, 2007).

2.8.2 Stunting.

Low height-for-age is referred to as stunting and occurs when the Z-score is below the median by more than -2SD (WHO, 2007). Stunting is seen as a failure to reach linear growth and is prevalent in children with long-term insufficient nutrient intake and frequent infections. If a child is stunted before the age of two, then irreversible effects of poor motor and cognitive development occur. The prevalence of stunting occurs amongst one-third of the world's children (UNICEF,2007; WHO, 2004).

2.8.3 Wasting.

Low weight-for-height, known as wasting, is reflected by a low body mass relative to age and is classified when the Z-score is below the median by -2SD. Low weight-for-height by a percentile lower than -3SD is regarded as severe wasting (WHO, 2007; WHO, 2004). This is as a result of acute starvation and disease, which results in severe malnutrition, with implications of acute malnutrition in a chronically stunted child. The child then becomes underweight because of poor food quality and quantity (WHO, 2010) as shown in Table 1.

Table 2: Classification for degree of malnutrition

Degree of malnutrition	Cut-off point (z-scores- W/A, H/A, W/H)
Normal	-2 to 2 SD
Moderate	-3 and < 3SD
Severe	< -3 to > 3 SD

Source: WHO (2010)

2.8.4 Factors affecting the nutritional status of children

The level of food insecurity within the household determines the nutritional status of children, and is the immediate cause of malnutrition. The caregivers and parents make most food choices for meals consumed at home. These choices are based on culture; beliefs, cost, time restraints and availability (Pelletier *et al.*, 1995).In the framework of malnutrition developed by UNICEF (2004), the immediate and underlying causes of malnutrition are also factors which affect the nutritional status of children.

2.8.5 The dietary diversity scores

The proposed numbers of food groups to be included in the household dietary diversity score (HDDS) and world dietary diversity score (WDDS) are based on synthesis of currently available research results. The household dietary diversity score (HDDS) is based on the food groups proposed by FANTA (Swindale and Bilinsky, 2006). There is no international consensus on which food groups to include in the scores and the results of new research could justify changing the groups proposed in these guidelines. The HDDS and WDDS are calculated based upon different numbers of food groups because the scores are used for different purposes. The HDDS is meant to provide an indication of household economic access to food, thus items that require household resources to obtain, such as condiments, sugar and sugary foods, and beverages, are

included in the score. Individual scores are meant to reflect the nutritional quality of the diet. The WDDS reflects the probability of micronutrient adequacy of the diet and therefore food groups included in the score are tailored towards this purposeas shown in Table 2.

Table 3: Guidelines for Measuring Household and Individual Dietary Diversity

Question number	Food group	Examples	YES=1 NO=0
1	CEREALS	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + *insert local foods e.g. ugali, nshima, porridge or paste*	
2	WHITE ROOTS AND TUBERS	white potatoes, white yam, white cassava, or other foods made from roots	
3	VITAMIN A RICH VEGETABLES AND TUBERS	pumpkin, carrot, squash, or sweet potato that are orange inside + *other locally available vitamin A rich vegetables (e.g. red sweet pepper)*	
4	DARK GREEN LEAFY VEGETABLES	dark green leafy vegetables, including wild forms + *locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach*	
5	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant) + *other locally available vegetables*	
6	VITAMIN A RICH FRUITS	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + *other locally available vitamin A rich fruits*	
7	OTHER FRUITS	other fruits, including wild fruits and 100% fruit juice made from these	
8	ORGAN MEAT	liver, kidney, heart or other organ meats or blood-based foods	
9	FLESH MEATS	beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects	
10	EGGS	eggs from chicken, duck, guinea fowl or any other egg	
11	FISH AND SEAFOOD	fresh or dried fish or shellfish	
12	LEGUMES, NUTS AND SEEDS	dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)	
13	MILK AND MILK PRODUCTS	milk, cheese, yogurt or other milk products	
14	OILS AND FATS	oil, fats or butter added to food or used for cooking	
15	SWEETS	sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
16	SPICES, CONDIMENTS, BEVERAGES	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	

Source: FAO (2010)

2.9 Nutrient Requirements During the First 2 Years of Life.

Access to nutrient dense foods during the complementary feeding period along with appropriate feeding practices and continued breast-feeding is needed to ensure optimal growth and development. Strategies to improve the availability of and accessibility to low cost complementary foods can play an important role in behavioral changes necessary to improve the nutritional status of infants and young children (Ruel, 2010). The availability of low cost, high quality and easy to prepare complementary foods in the commercial market could potentially address inadequacies in the macro and micronutrient content of typical complementary food diets.

2.9.1 Energy, protein and lipids.

Total daily average energy requirements for healthy breast feed children are 413 kcal/day at age 6-8 months, 379 kcal/day at 9-11 months and 346 kcal/day at 12-23 months of age (WHO/PAHO,2001). In developing countries the average expected energy intake from complementary food is approximately 200 kcal at 6-7 months, 300 kcal at 9-11 months and 550 kcal to 12-23 months (WHO/PAHO, 2001). These values represent 33, 45 and 61% of total energy needs respectively. Achieving these energy intakes requires that both feeding frequency and energy density of complementary foods be adequate. Assumed functional gastric capacity (30 g/kg reference body weight is 249/ feeding at 6-8 months, 285 g/ feeding at 9-11 month, and 345/feeding at 12-23 months (WHO/PAHO, 2001). The amount of protein needed from complementary foods increases from about 2 g per day at 6-8 months to 5-6 g per day at 12-23 months, with percentage from complementary foods increasing from 21% to 51%. However the fat content of complementary foods becomes more important as

breast milk intake declines. To achieve at least 30% of energy from fat in the total diet, the amount of fat needed from complementary foods (assuming average breast milk intake) is zero at 6-8 months. Approximately 3 g per day at 9-11 months and 9-13 g per day at 12-23 months, or 0, 5-8 and 15-20% of energy from complementary foods (WHO/PAHO, 2001).

2.9.2 Micronutrients.

Micronutrient needs are high during the first 2 years of life to support the rapid rate of growth and development during this period. The percentage of the recommended nutrients intake needed from complementary foods varies widely, depending on the concentration of each nutrient in breast milk. The nutrients that are most problematic for which at least 75% must come from complementary foods are iron (87-97%), zinc (80-87%) and vitamin B6 (80-90%) (WHO, 1998).Thus, complementary food diets need to contain foods rich in these nutrients or fortified in some way. Recommended nutrient requirements during first 2 years of life is shown in Table 3.

Table 4. Recommended nutrient requirements during first 2 years of life

Nutrients	Age category in months		
	6-8	9-11	12-23
Calcium (mg/day)	525.0	525.0	350.0
Iron (mg/day)	0.3	0.3	0.4
Zinc (mg/day)	5.0	5.0	6.5
Fat (g/day)	30.0	*nd	*nd
Protein (g/day)	9.1	9.6	10.9
Energy (kcal/day)	413.0	379.0	346.0

Source: WHO(1998)
*nd= Not determined

2.9.2.1 Micronutrient deficiencies.

The three most prevalent micronutrient deficiencies include Iodine Deficiency Disease (IDD), Iron (Fe) Deficiency Anaemia (IDA) and Vitamin A Deficiency (VAD) (Nagati*et al.*, 2003). According to the WHO/WFP/UNICEF (2007), an estimated two billion people across the globe are deficient in key minerals and vitamins.

2.9.2.2 Iron deficiency anemia.

IDA is more prevalent in women, young children and the elderly (Labadarios*et al.*, 2008). When a deficiency in oxygen-carrying red blood cells occurs, it is defined as IDA. It is the most common cause of anemia and related to vitamin B12 or folate deficiency. IDA also occurs during periods of higher Fe requirements, such as pregnancy and menstrual loss, and severe losses occur during illnesses such as malaria and parasite infections, also referred to as hookworms (Kennedy *et al.*, 2002).During infancy and in children of pre-school age, IDA causes impaired psychomotor and physical development, as well as poor immune structure. In adults, IDA diminishes stamina and work capacity by as much as 15-20 percent (Faber and Wenhold, 2007).

2.9.2.3 Vitamin A deficiency.

Vitamin A is needed for growth of all body tissues and repair. The immune and visual system is dependent on vitamin A for normal functioning. VAD is most recognized clinically through Bitots spots and complete blindness, and can be prevented in children (Mason *et al.*, 2001).

VAD can cause complete blindness and a decline in the functioning of the body's immune system and its resistance to disease (World Hunger Education Service (WHES), 2008).UNICEF suggests fortification and dietary diversification as a solution to address VAD (UNICEF, 2009).

2.10 Infant and Young Child Feeding.

Infant and young child feeding encompasses the set of feeding practices needed to protect against malnutrition. These practices are essential for the nutrition, growth, development and survival of infants and young children (UNICEF, 2007). Infants should be breastfed within one hour of delivery, exclusively breastfed for the first six months of life, and thereafter should receive nutritionally adequate and safe complementary foods while breastfeeding continues up to two years and beyond. Global analysis has indicated that if implemented at scale, appropriate breastfeeding and complementary feeding can avert almost one-fifth of all child deaths (Jones *et al.*, 2003). There is ample evidence of a positive influence of breastfeeding, especially exclusive breastfeeding on the survival of the infants. There is some evidence that motor development is enhanced by practicing exclusive breastfeeding for the first six months of life, but more research is needed to confirm this (Dewey, 2003).

2.10.1 Complementary food.

In many developing countries, complementary foods as well as foods for adults are based on local staple diets made from cereals, roots and tubers of cassava and potatoes. To be suitable for feeding young children, these cereals are prepared in liquid form by dilution with a large quantity of water, thereby resulting in more volume but with a

low energy and nutrient density (Sanni*et al.*, 1999). The traditional complementary foods in Tanzania are based on starchy staples, usually cereals such as maize, sorghum, rice and finger millet and non- cereals such as cassava, sweet potatoes, yams, bananas and plantains (Mosha*et al.*, 2000). Generally, complementary foods in Tanzania were found to be very poor in providing nutrients required by infants. These foods are often deficit in fats, iron and vitamins (especially vitamin A). Based on requirements in Table 2: adequate amounts can be attained by processing, fortification, and supplementation of staples or use of animal products.

Table 5. Recommended daily allowances for macro and micro-nutrients for children at various age groups

nutrients	6-9 months	9-12 months	1-2 years	2-3 years	3-4 years	4-5 years
Carbohydrate (kcal)	413.0	379.0	346	346	346	346
Protein (g)	11.9	11.9	13	13	19	19
Fats (g)	31.0	30.0	30	30	30	30
Iron (mg)	11.0	11.0	11	7	9	10
Calcium (mg)	270.0	270.0	270	500	500	800
Zinc (mg)	3.0	3.0	3	3	3	5
Vitamin A (RE)	400.0	400.0	500	300	400	400
Vitamin C (mg)	40.0	50.0	50	15	25	25

Source: WHO (1998)

2.10.2 Feeding behavior.

WHO/UNICEF (2000) recommend that, children should be exclusively breastfeed for the first 4-6 months and there after supplemented with safe and nutritionally adequate foods until they are at least 24 months old (Onyango *et al.*, 1999). This is because after six months of age, breast milk alone can no longer supply the required daily energy and other nutrients. The energy requirements outpace the energy supplied from

milk after six months. The amount of milk produced by the mother at this stage of lactation is far lower than the amount required producing the needed calories. Moreover, even if the milk would be adequate, the gastric capacity of the infant would not allow such intake. Table 5 indicates the energy intake from breast milk by children who are 6-24 months old from mothers in developing countries. Depending on the mother's breast milk output-low, average or high, the rest of the daily energy requirement should be supplied from complementary foods as shown in Table 5.

Table 6: Energy intakes from breast milk by children in developing countries, by age group

Age group (months)	Breast milk intake (kcal)		
	Low (-2SD)	Average	High (+ 2 SD)
6-8	908	1728	2548
9-11	656	1586	2515
12-23	377	1448	2519

Source: WHO(1998)

2.11 Supplementation.

According to the WHO (2008), groups at high risk of vitamin and mineral deficiencies need supplements to produce rapid improvements in their vitamin and mineral status. This is likely to remain the case until significant improvements are made in the diets of the entire population.

Supplementation with vitamin A, iron-folate and zinc is being implemented in Tanzania. Coverage of these supplements needs to be expanded to scale (>90%) and sustained consistently at these high levels among groups at high risk of deficiency. Multi-micronutrient supplementation of children and pregnant women should be considered for scale-up.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

The study was conducted in Chamwino district which is one of the six districts of Dodoma region. The district is located in the central plateau of Tanzania which extends between Latitude 40° and 80°South and between longitude 35° and 37°East. The district has five divisions, 28 wards, and 77 villages.

Chamwino district produces sorghum, maize, and cassava. Other crops grown include grapes, sunflower, sesame (simsim), groundnuts, bulrush millet and paddy. Livestock keeping is ranked very high. Dodoma is leading in terms of the percentages of stunted children (56%) under 5 years compared to other regions, this stunting level combines both moderate and severely stunting. The study was conducted in Ilolo village.

3.1.1 Socio- economic information

Majority are engaging in agriculture activities producing mainly cash crops such as wheat and food crop such as banana, sweet potatoes and maizefew of them are engagedin livestock keeping such as sheep, pigs, donkeys, goat and chicken. (URT/UNICEF, 2002).

3.1.2 Health

Health facilities in this village is not a problem, number of people have an access to health facilities example; in ILOLO village there is a dispensary that helps villagers to get health services. The main problems include "shortage of medicines", user charges and the poor state of health infrastructure (URT, 1999).

3.1.3 Education

About 68% of the rural villages are provided with primary schools in the study area. But the same problems facing primary schools in Tanzania arefacing these villages. The main problems such as shortage of class rooms, materials and teachers.

3.2 Study Design

The study employed a cross-sectional design in which data was collected only once. A cross sectional study is simple, inexpensive in terms of terms of time and resources, flexible, minimizes bias and maximizes reliability of data (Bailey, 1998).

3.3 Sampling Frame/ Population

3.3.1 Study population

3.3.1.1 Inclusion criteria:

All mother/ caregivers of children aged 6-59 months were included in the study.

3.3.1.2 Exclusion criteria:

All children aged 6-59 months who were, mentally retarded and Women who were not responsible for food preparation were excluded from the study.

3.3.2 Sampling technique/procedure.

In this study Purposive sampling was used to identify the regions, districts and wards that were involved in the study. Children age 6-59 months were randomly assigned numbers from one village in Dodoma namely Ilolo. The reason for using randomly sampling was to increase the accuracy and to get good result for the research without any bias.

3.3.3 Sample size.

The sample sizes were computed using Fischer *et al's.*(1991) formula as shown. Using the below formula, a sample size of 56% (0.56) children was calculated

Formula:

$$N = \frac{Z^2P(1-p)}{d^2}$$

Where

N=estimated sample size,

d= precision level (acceptable error; 0.05).

P= Group/respondent /references

Z= Confidence interval (1.96),

N= 1.96×1.96x 0.56 (1-0.56)/0.05×0.05. = 379

Therefore, the sample size was 379.

From calculation the sample size was 379 but only 75 children were included.Sample size was taken within calculated sample size to represent the whole population due to time limit, funds, the study concentrated in one village.

3.4 Data Collection.

3.4.1 Construction of questionnaires.

Questionnaires were prepared to obtain information about dietary pattern and dietary diversity of the selected household. Also information about age, weight, height of the children, social demographic variables and maternal nutritional knowledge towards health diets were included.

3.4.2 Pre-testing of the questionnaires.

The questionnaires were administered to 10 randomly selected families with children aged 6-59 months in Kilosa district, which has the similar characteristics with the sample in Chamwino. This was done to test for its validity and effectiveness of the questionnaire. Necessary changes were incorporated in the questionnaire before it was used in Chamwino district.

3.4.3 Administration of the questionnaire.

Three enumerators were deployed for the study. Three-day training was conducted to train the enumerators on how to ask questions on 24hours dietary record and to take anthropometric measurements.

3.4.4 24-hour dietary patterns measurement.

Household food assessment was measured three times a week in order to get the intake of the children and other members of the household, then digital kitchen scale was used to measure the amount of foods and tea cup scale was used to measure the amount of beverages consumed in grams and milligrams by individuals within the past 24 hours.

3.4.5 Determination of food intakes.

Food habits were determined by means of 24-hour food recall method, whereby all foods consumed at each meal and between meals were recorded during interviews. The quantities of respective foods eaten were also stated and whenever possible actual

measurements were conducted using standard measures such as glass tumblers, teacups and slices of bread, or other household utensils with known volumes.

3.4.6 Anthropometric measurements.

Standard techniques and equipment (weighing scale for weight and stadiometer for height) were used for collecting anthropomentric measurements.

3.4.6.1 Height.

Of all the parameters used at present to assess nutritional status, anthropomentric measures are ones most affected by the ageing process. Change in height or stature was noticeable. Height was important in nutrition assessment, as it is one of the measurements that are expected to be constant and therefore a reference point against which other measures are compared. Height was measured by using a stadiometer. The children age 6 -24 months were placed straight along recurmbent position measure was taken and the children above 24 months was stood straight along the length board and measurement was taken.

3.4.6.2 Weight.

Body weight is the most commonly measured anthropomentric parameter. Body weight is considered to include body fat plus fat free mass (water, protein glycogen and minerals). Chidren's weight measured using a weighing scale. The scale was adjusted to zero before starting the measurement. The weight was recorded to the nearest 0.2kg.

3.5 Household Dietary Diversity Score.

Dietary diversity score information is obtained by using a set of food scores written in the questionnaires. Questionnaires were used to ask caregivers or mothers if they use any kind of food group mentioned in the questionnaire in the past 24 hour. If yes a score was given 1 and if no a score was given 0.

3.6 Dietary Patterns

Dietary patterns were assessed by using food frequency questionnaire (FFQ) whereby a person responsible for food preparation was interviewed to provide information on the modifications a household made on diet or food consumption patterns due to limited resource to acquire foods.

3.7 Maternal Nutritional Knowledge.

A mothers or persons responsible for food preparation were requested to provide information if they were aware about food groups and how they contribute to human health.

3.8 Data Analysis.

Information from the questionnaires was coded and analyzed by using Statistical Product and Services Solution (SPSS) software version 20.0. Descriptive statistics analysis was used to determine frequencies and percentages of various variables such as demographic information, maternal nutritional knowledge. Dietary diversity score and inferential analysis were used to determine relationship between nutritional status and social demographic variables and Excel were used to analyze Dietary pattern of children. WHO Anthro was used to analyse nutritional status of children.

CHAPTER FOUR

4.0 RESULTS

This chapter presents the research findings with respect to research objectives. It covers socio-demographic, nutritional status of children through anthropometric measurements, maternal nutritional knowledge, dietary patterns and feeding practices in Chamwino district Dodoma.

4.1 Socio-demographic Characteristics

Table 5 presents socio-demographic characteristics of the parents in Ilolo village in Chamwino. The study shows that more than half(80%) of household heads were males and about 39 % of family size ranged between four and five (4-5) children. Most of the children under five years of age (61.3%) were between two and three (2-3) in the households. The marriage pattern in the households was monogamous which accounted for 69 %. More than half (68%) of parents had primary education and about 95% of the household were engaged in farming activities.

Table 7: Parents Socio – demographic characteristics

		n	%
Household head sex			
Male		60	80.0
Female		15	20.0
Total		**75**	**100**
Family size			
2 – 3		11	14.7
4 – 5		29	38.7
6 – 7		12	16.0
8 – 9		21	28.0
More than 10		1	1.3
Total		**75**	**100**
Number children below 5 years of age			
0 – 1		26	37.3
2 – 3		48	61.3
4 – 5		1	1.3
Total		**75**	**100**
Marital status of household head			
Currently married- monogamous		52	69.3
Currently married- polygamous		7	9.3
Widowed		4	5.3
Divorced		4	5.3
Single		2	2.7
Other-specify		6	8.0
Total	**75**		**100**
Education level			
No education		18	24.0
Primary school		51	68.0
Secondary school		6	8.0
Total		**75**	**100**
Your occupation			
Farmer		71	94.7
Employed		3	4.0
Other (specify)		1	1.3
Total	**75**		**100**

4.2 Maternal Nutritional Knowledge towards Healthy Diet

From the results 86.7% of the parents had not received any education and/ or training about nutrition and more than half of the parents (60%)did not know the good way of eating healthy diets. About 61 % of the parents and caregivers did not know about

balanced diets and 69% of the parents did not know foods that contain dietary fiber. Thirty two percent of the parents said that someone not having enough food must have low weight/ thinness. Sixty eight percent of the parents went to health centers to seek advice and opinion about whether their babies were growing well or not and about 43% of the parents and caregivers said that green leafy vegetables and orange fruits are healthy foods because there are rich in protein(Table 6).

Table 8: Maternal Nutrition Knowledge towards healthy diet

Variables	n	%
Ever received any education and/ or training about nutrition before		
Yes	10	13.3
No	65	86.7
Total	**75**	**100**
Good way of eating healthy		
Eat many different kinds of foods	16	21.3
Eat some foods more than other foods	6	8.0
Eat certain kinds of foods in moderate or small amounts	8	10.7
Do not know	45	60.0
Total	**75**	**100**
Balance diet		
Diet rich in protein	5	6.7
Diet without carbohydrates	3	4.0
Diet containing all nutrients in proper quantities	21	28.0
Do not know	46	61.3
Total	**75**	**100**
Ever know foods or meals that enhance dietary intake of fibre		
Yes	12	16.0
No	11	14.7
Do not know	52	69.3
Total	**75**	**100**
Ability to recognize that someone is not having enough food		
Lack of energy	12	16.0
Becomes ill easily or become seriously ill	5	6.7
Loss of weight/ thinness	24	32.0
Growth faltering	7	9.3
Other	9	12.0
Do not know	18	24.0
Total	**75**	**100**
Seek advice and opinion about whether your baby is growing well or not		
Go to the health center/ ask a doctor or nurse	51	68.0
Go to relative (mother/grandmother to seek their opinion)	11	14.7
Other	7	9.3
Do not know	6	8.0
Total	**75**	**100**
Reasons why green leafy vegetables and orange fruits are health foods		
They are rich in protein	32	42.7
They are rich in vitamin A	13	17.3
They are rich in iron	13	17.3
They are rich in many nutrients	7	9.3
Do not know	10	13.4
Total	**75**	**100**

4.3.1 Breast and complementary feeding practices for children

Table 8 presents breastfeeding and complementary feeding practices for children in Ilolo village in Chamwino. Most of mothers (98.6%) were breastfeeding their child and 95% mothers feed first milk to their child. On the other hand more than half of the mothers (60%) sought advice from health professional about breastfeeding, whereas57.3% of children started complementary feeding before six months and about 40% of the children were last given breast milk at age from 19 to 24 months.

Table 9: Breast and complementary feeding practices for children of age 6-59 months

	N	%
Ever breast feed this child		
Yes	74	98.6
No	1	1.4
Total	**75**	**100**
Feed first milk to this Child		
Yes	71	94.7
No	4	5.3
Total	**75**	**100**
Advice to help start breastfeeding this child		
Health professional	45	60.0
Relative, family member or Neighbor	12	16.0
Other (specify)	18	24.0
Total	**75**	**100**
Ever done exclusively breast fed to the child		
Below 1 months	20	26.7
1 to 3 months	43	57.3
4 to 6 months	5	6.7
Do not know	7	9.3
Total	**75**	**100**
Age of the baby last given breast milk		
1 to 3	2	3.4
4 to 6	2	3.4
7 to 12	1	1.7
13 to 18	16	27.6
19 to 24	23	39.7
Above 24	14	24.1
Total	**75**	**100**

4.40 Nutritional Status

4.4.1 Nutritional status (WAZ)

The weight-for-age z-score (WAZ) reflects the effects of the most current changes in the nutritional status (both acute (wasting) and chronic (stunting) under nutrition). Low weight-for-age indicates a child whose weight for age is below minus two standard deviation (-2 SD) from the median of reference population.The results indicated that prevalence of underweight was 22.7% (Table 9).

Table 10: Nutrition (WAZ) for children age 6 to 59 months

Nutritional status Categorization	n	%
Severe underweight (<-3 z-score)	2	2.7
Moderate underweight (≥-3 and <-2 z- score	15	20.0
Total underweight	17	22.7
Normal (≥ -2 z-score)	58	77.3
Total	**75**	**100**

4.4.2 Nutrition status (HAZ)

The height-for-age z-score (HAZ) reflects achieved linear growth for age. Low height for- age indicates a child whose height for age is below minus two standard deviation (-2 SD) from the median of reference population. It also reflects chronic under-nutrition referred to as stunting. The results in Table 10indicate that stuntingwas66.7%.

Table 11: Nutrition status (HAZ) of children age 6 to 59 months

Nutritional status Categorization	n	%
Severe stunting (<-3 z-score)	11	14.7
Moderate stunting (≥-3 and <-2 z- score)	39	52.0
Total stunting	50	66.7
Normal (≥ -2 z-score)	25	33.3
Total	**75**	**100**

4.4.3 Nutrition status (WHZ)

Weight for height reflects the effects of both acute (wasting) nutritional statuses. Wasting in children therefore symbolizes deficit in tissue and fat mass compared with their peers of the same height.It also reflects chronic under-nutrition referred to as stunting. The results in Table 11 indicates that severe and moderate wasting were 1.3 and 4% respectively.

Table 12:Nutrition status (WHZ) of children age 6 to 59 months

Nutritional status Categorization	n	%
Severe wasting (<-3 z-score)	1	1.3
Moderate wasting (≥-3 and <-2 z- score)	3	4.0
Total wasting	4	5.3
Normal (≥ -2 z-score)	71	94.6
Total	**75**	**100**

4.7.1 Dietary patterns of children

Table 12 shows the frequency of feeding complementary foods to the children aged sixto 59 months. The findings show that majority 38.5 %of the children between 12 – 23 months were fed three times per day unlike five times per day as recommended by WHO. On the other hand the results indicated that few children for each group were fed more than three times per day.

Table 13: Dietary patterns of children aged 6 to 59 months

Child age category in months	Frequency of feeding Per day	N	%
6-8	Once	0	0.0
	Twice	0	0.0
	Three times	4	15.3
	More than three times	2	7.7
	Total	**6**	**23.0**
9-11	Once	0	0.0
	Twice	0	0.0
	Three times	5	19.3
	More than three times	2	7.7
	Total	**7**	**27.0**
12-23	Once	0	0.0
	Twice	3	11.5
	Three times	10	38.5
	More than three times	0	0.0
	Total	**13**	**50.0**
24-59	Once	5	6.7
	Twice	12	16.0
	Three times	28	37.3
	More than three times	4	5.3
	Total	**49**	**65.0**

4.7.2 Household dietary diversity

Table 13 shows that foods in the household were locked variety. The finding shows that 100% of the children were taking maize, rice, wheat, sorghum, bulrush millet, finger millet or any other grains or foods made from this group. About 75% were

taking dark green/leafy vegetables, including wild ones, locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach, mlenda. Very small proportion (2%) was taking liver, kidney, heart or other organ meats or blood based foods.

Table 14:Household dietary diversity

	n yes	(%)	n no	(%)
Maize,rice,wheat,sorghum,bulrush,millet,finger millet or any other grains or foods made from these	75	100.0	0	0.0
Pumpkin,carrots,squash or sweet potatoes that are orange inside,other locally available vitamin A rich	12	22.2	63	77.8
Vegetable (e.g. Red sweet pepper) White potatoes, white yams, white cassava, or other Foods	9	18.0	66	82.0
Dark green/leafy vegetables, including wild ones, locally available vitamin A rich leaves such as amaranth, cassava leaves, kale,spinach,mlenda	61	75.0	14	25.0
Ripe mangoes,ripepapaya,peaches + other locally available vitamin A rich fruits	20	32.0	65	68.0
Other vegetables (e.g.Tomatoes,Onion,Eggplant,Bitter tomatoes etc.)	51	63.0	24	37.0
Other fruits including wild fruits	3	6.0	72	94.0
Liver, kidney,heart or other organ meats or blood based foods	1	2.0	74	98.0
Beef,pork,lamb,goat,rabbit,wild game, chicken,duck + any other flesh meats	12	22.2	63	77.8
Chicken,duck,guinea hen or any other eggs	6	12.0	69	88.0
Fresh or dried fish or shellfish	7	13.0	68	87.0
Beans, peas,lentils, nuts, seeds or foods made from these	26	39.0	49	61.0
Milk, cheese, yogurt, or other milk	12	22.2	63	77.8
Oils,fats or butter added to foods or used for cooking	44	55.0	31	45.0
Red palm products	15	26.0	60	74.0
Sugar, honey, sweetened soda or sugary foods such as chocolates, candies, cookies and cakes	36	46.0	39	54.0
Spices(black pepper,salt),condiments(soy sauce,hot sauce),coffee, tea, alcoholic beverages or local alcoholic beverages	7	14.0	68	86.0

4.8 Dietary Intake for Children Aged 6 – 59 months

4.8.1 Macro-nutrients intake for children aged 6 months to 59 months

The results indicate that 18.6, 32 and 34.7 % of children aged between six and 59 months of age met recommended dietary intake of carbohydrates, protein and fats respectively per day. Therefore 81.4 , 68 and 65.7 % of children did not meet recommended dietary intake of carbohydrates, proteins and fatsrespectively per day (Table 14).

Table 15: Macro-nutrients intake for children aged 6 to 59 months

Age group				Met RDAs	% of who met RDAs	Did not meet RDAs	% that did not meet RDAs
carbohydrates	Average intake	RDAs (Mg)	Intake in % RDAs				
6-<9 months	386	413	93.0	4	5.3	27	36.0
9-<12 months	362	379	96.0	3	4.0	14	18.7
12-23 months	328	346	95.0	2	2.7	1	1.3
24-35 months	284	346	82.0	4	5.3	16	21.3
36- 59 months	323	346	93.0	1	1.3	3	4.0
Total				**14**	**18.6**	**61**	**81.4**
Protein		RDAs (g)					
6-<9 months	9.0	11.9	75.6	11	14.7	20	26.7
9-<12 months	9.3	11.9	78.3	8	10.6	9	12.0
12-23 months	9.1	13.0	70.0	0	0.0	3	4.0
24-35 months	7.0	13.0	53.8	5	6.7	15	20.0
36-59 months	11.0	19.0	57.9	0	0.0	4	5.3
Total				**24**	**32.0**	**51**	**68.0**
Fats		RDAs (kcal)					
6- <9 months	28.0	31	90.3	12	16.0	19	25.3
9-< 12 months	28.0	30	93.3	2	2.7	15	20.0
12-23 months	28.1	30	93.7	3	4.0	0	0.0
24-35 months	28.0	30	93.3	7	9.3	13	17.3
36- 59 months	28.0	30	93.3	2	2.7	2	2.7
Total				**26**	**34.7**	**49**	**65.3**

4.8.2 Micro-nutrients intake for children aged 6 months to 59 months

The results indicate that 74.6, 14.7, 30.7, 21.2 and 22.7 % of children aged between six and 59 months of age met recommended dietary intake of iron, calcium, zinc, vitamin A and vitamin C. There fore 25.4, 85.3, 69.3, 78.8 and 77.3% of children did not meet recommended dietary intake of iron, calcium, zinc, vitamin A and vitamin C respectively per day(Table 15).

Table 16: Micro-nutrients intake for children aged 6 to 59 months

Age group				n			%
				Met RDAs	% of who met RDAs	Did not meet RDAs	% that did not meet RDAs
Iron	Average intake	RDAs (Mg)	Intake in % RDAs				
6-8 months	8.0	11	72.7	27	36.0	4	5.3
9-11 months	9.0	11	81.8	7	9.3	10	13.5
12- 23 months	8.0	11	72.7	3	4.0	0	0.0
24- 35 months	8.0	7	11.4	16	21.3	4	5.3
36-59 months	7.8	10	78.0	3	4.0	1	1.3
Total				**56**	**74.6**	**19**	**25.4**
Calcium		RDAs (mg)					
6-<9 months	180	270	66.7	3	4.0	28	37.3
9-<12 months	180	270	66.7	4	5.3	13	17.3
12-23 months	332	500	66.4	2	2.7	1	1.3
24- 35 months	310	500	62.0	2	2.7	18	24.0
36- 59 months	458	800	57.3	0	0.0	4	5.3
Total				**11**	**14.7**	**64**	**85.3**
Zinc		RDAs (mg)					
6-<9 months	1.5	3	50.0	12	16.0	19	25.3
9-<12 months	1.2	3	40.0	8	10.7	9	12.0
12-23 months	1.3	3	43.3	0	0.0	3	4.0
24-35 months	1.9	3	63.3	1	1.3	19	25.3
36-59 months	1.3	5	26.0	2	2.7	2	2.7
Total				**23**	**30.7**	**52**	**69.3**
Vitamin A		RDAs (µg)					
6-<9 months	350	400	87.5	7	9.3	24	32.2
9-<12 months	350	400	87.5	4	5.3	13	17.3
12-23 months	230	500	46.0	1	1.3	2	2.7
24-35 months	188	300	62.7	1	1.3	19	25.3
36-59 months	300	400	75.0	3	4.0	1	1.3
Total				**16**	**21.2**	**59**	**78.8**
Vitamin C		RDAs (mg)					
6-<9 months	30	40	75.0	13	17.3	18	24.0
9-<12 months	35	50	70.0	2	2.7	15	20.0
12-23 months	35	50	70.0	0	0.0	3	4.0
24-35 months	13	15	86.7	0	0.0	20	26.6
36-59 months	17	25	68.0	2	2.7	2	2.7
Total				**17**	**22.7**	**58**	**77.3**

4.11 Relationship between Nutrition Status and Socio-Demographic Characteristics of the Respondents

4.11.1 Relationship between socio-demographic and nutritional status (underweight) of children

To capture the relationship between nutritional status and socio-demographic characteristics of the respondents a cross-tabulation descriptive analysis test was used. It was revealed that there was a significant association between nutritional status (weight-for-age) and family size (P=0.01) and nutrition status (weight-for-age) and marital status of the household (P=0.02) (Table 16).

Table 17: Relationship between socio-demographic and nutritional status (WAZ) of children

WAZ	Severe (<-3 z-score) n (%)	Moderate (≥-3 and <-2 z- score) n (%)	Normal (≥ -2 z-score) n (%)	Total n(%)	χ2	df	p-value
Household head sex							
Male	1(1.3)	5(6.8)	54(72.0)	60(80.0)	2.084	2	0.95
Female	1(1.3)	2(2.6)	12(16.0)	15(20.0)			
Total number of members in this HH							
2 – 3	0(0.0)	0(0.0)	11(14.7)	11(14.7)	39.403	80.01*	
4 – 5	1(1.3)	4(5.3)	25(33.3)	30(40.0)			
6 7	0(0.0)	2(2.6)	9(12.0)	11(14.7)			
8 – 9	0(0.0)	2(2.6)	19(25.3)	21(28.0)			
More than 10	1(1.3)	0(0.0)	0(00.0)	1(01.3)			
Number children below 5 years of age							
0 – 1	2(2.7)	4(5.0)	40(53.0)	46(60.7)	1.707	40.95	
	0(0.0)	3(4.0)	25(33.0)	28(38.0)			
2 – 3	0(0.0)	0(0.0)	1(01.3)	1(01.3)			
4 – 5							
Marital status of Household Head							
Married- monogamous	0(0.0)	4(5.0)	48(64.0)	52(69.0)			
Married- polygamous	0(0.0)	2(2.6)	6(08.0)	8(10.6)	28.055	100.02*	
Widowed	0(0.0)	0(0.0)	4(05.0)	4(05.0)			
Divorced	1(1.3)	1(1.3)	1(01.3)	3(03.9)			
Single	0(0.0)	0(0.0)	2(02.6)	2(02.6)			
Other-specify	1(1.3)	1(1.3)	5(06.4)	6(09.0)			
Education level							
no education	3(5.3)	1(1.3)	17(22.7)	21(29.3)			
primary school	2(2.7)	6(8.0)	42(56.0)	50(66.7)	1.359	40.99	
secondary school	0(0.0)	1(1.3)	3(04.0)	4(05.3)			
Your occupation							
Farmer	2(2.6)	7(9.3)	61(81.3)	70(93.3)	2.528	4 0.85	
self employed	0(0.0)	0(0.0)	3(04.0)	3(04.0)			
other (specify)	0(0.0)	0(0.0)	1(02.7)	2(02.7)			

* shows significant association at P<0.005

4.11.2 Nutrition status (HAZ) and socio-demographic variables

To capture the relationship between nutritional status and socio-demographic characteristics of the respondents a cross-tabulation descriptive analysis test was used. It was revealed that there was significant association between nutritional status (height-for-age) and marital status(P=0.03)(Table 17).

Table 18: Relationship between social demographic and nutritional status (HAZ) of children

HAZ	Severe (<-3 z-score) n (%)	Moderate (≥-3 and <-2 z- score) n (%)	Normal (≥ -2 z-score) n (%)	Total	χ2	d.f	p-value
Household head sex							
Male	7(09.3)	11(14.7)	42(56.0)	60(80.0)	1.570	2	0.670
Female	3(04.0)	3(04.0)	9(12.0)	15(20.0)			
Total number of members in this HH							
2 – 3	2(02.7)	3(04.0)	6(08.0)	11(14.7)			
4 – 5	3(04.0)	5(06.7)	21(28.0)	29(38.7)	5.939	80.919	
6 – 7	3(04.0)	2(02.7)	7(09.3)	12(16.0)			
8 – 9	15(20.0)	4(05.3)	2(02.7)	21(28.0)			
More than 10	0(00.0)	0(00.0)	2(02.7)	2(02.6)			
Number children below 5 years of age							
0 – 1	7(09.3)	9(12.0)	30(40.0)	46(61.4)			
2 – 3	3(04.0)	5(06.7)	20(26.7)	28(37.3)	4.203	40.649	
4 – 5	0(00.0)	0(00.0)	1(01.3)	1(01.3)			
Marital status of Household Head							
Married- monogamous	5(06.7)	10(13.3)	37(49.3)	52(69.3)			
Married- polygamous	4(05.3)	1(01.3)	2(02.6)	7(09.3)	26.760	100.031*	
Widowed	0(00.0)	0(00.0)	4(05.3)	4(05.3)			
Divorced	0(00.0)	0(00.0)	4(05.3)	4(05.3)			
Single	0(00.0)	1(01.3)	1(01.3)	2(02.6)			
Other-specify	1(01.3)	2(02.6)	3(04.0)	6(08.0)			
Education level							
no education	2(02.6)	4(05.3)	14(18.7)	20(26.7)			
primary school	8(10.7)	11(14.7)	32(42.7)	51(68.0)	3.528	4	0.740
secondary school	0(00.0)	1(01.3)	3(04.0)	4(05.3)			
Your occupation							
farmer	9(12.0)	11(14.7)	51(68.0)	71(94.7)			
self employed	1(01.3)	2(02.6)	0(00.0)	3(04.0)	11.559	40.073	
other (specify)	0(00.0)	1(01.3)	0(00.0)	1(01.3)			

* shows significant association at P<0.005

4.11.3 Nutrition status (WHZ) and social demographic variables

To capture the relationship between nutritional status and socio-demographic characteristics of the respondents a cross-tabulation descriptive analysis used.It was revealed that there was significant association between nutritional status (weight-for-height) association between and marital status (P=0.01) and association between nutritional status (weight-for-height) and education level (P=0.022) (Table 18).

Table 19: Relationship between social demographic variable and nutritional status (WHZ) of children

WHZ	Severe (<-3 z-score) n (%)	Moderate (≥-3 and <-2 z-score) n (%)	Normal (≥ -2 z-score) n (%)	Total n(%)	χ2	d.f	p-value
Household head sex							
Male	0(00.0)	1(01.3)	59(78.7)	60(80.0)	4.724	2	0.940
Female	1(01.3)	2(02.7)	12(16.0)	15(20.0)			
Total number of members in this HH							
2 – 3	0(00.0)	1(01.3)	10(13.3)	11(14.7)	7.601	8	0.470
4 – 5	3(04.0)	6(08.0)	20(26.7)	29(38.7)			
6 – 7	0(00.0)	1(01.3)	11(14.7)	12(16.0)			
8 – 9	0(00.0)	2(02.6)	19(25.3)	21(28.0)			
More than 10	1(01.3)	0(00.0)	1(01.3)	2(02.6)			
Number children below 5 years of age							
0 – 1	1(01.3)	4(05.3)	41(54.7)	46(61.4)	4.063	4	0.398
2 – 3	2(02.7)	6(08.0)	20(26.7)	28(37.3)			
4 – 5	0(00.0)	0(00.0)	1(01.3)	1(01.3)			
Marital status of Household Head							
Married- monogamous	1(01.3)	8(10.7)	43(57.3)	52(69.3)	24.776	10	0.011*
Married- polygamous	0(00.0)	1(01.3)	6(08.0)	7(09.3)			
Widowed	2(02.7)	0(00.0)	2(02.7)	4(05.3)			
Divorced	0(00.0)	0(00.0)	4(05.3)	4(05.3)			
Single	0(00.0)	0(00.0)	2(02.7)	2(02.7)			
Other-specify	0(00.0)	1(01.3)	5(06.7)	6(08.0)			
Education level							
no education	2(02.7)	3(04.0)	13(17.3)	18(28.0)	11.494	4	0.022*
primary school	0(00.0)	6(08.0)	45(60.0)	51(68.0)			
secondary school	1(01.3)	0(00.0)	2(02.7)	3(04.0)			
Your occupation							
farmer	3(04.0)	10(13.3)	58(77.3)	71(94.7)	0.886	4	0.927
self employed	0(00.0)	0(00.0)	3(04.0)	3(40.0)			
other (specify)	0(00.0)	0(00.0)	1(01.3)	1(01.3)			

* shows significant association at P<0.005

4.3 Relationship between Maternal Nutritional Knowledge and Nutritional Status (HAZ)

To capture the relationship between nutritional status and maternal nutritional knowledge of the respondents a cross-tabulation descriptive analysis used. It was revealed that there was significant association between nutritional status (HAZ) and balance diet (P = 0.002)nutritional status (weight-for-age) and foods that must be eaten to increase dietary intake of fibre(P= 0.045)(Table 19).

Table 20: Relationship between maternal nutritional knowledge and nutritional status (HAZ) of children

WHZ	Severe (<-3 z-score) n (%)	Moderate (≥-3 and <-2 z-score) n (%)	Normal (≥ -2 z-score) n (%)	Total n(%)	χ^2	d.f	p-value
Ever received any education and/ or training about nutrition before							
Yes	0(00.0)	2(02.7)	7(09.3)	9(12.0)	5.452	4	0.491
No	10(13.3)	12(16.0)	43(57.3)	65(86.7)			
Do not know	0(00.0)	1(01.3)	0(00.0)	1(01.3)			
How often should children 2 - to 5 years be fed a day							
Once	0(00.0)	0(00.0)	3(04.0)	3(04.0)	13.219	8	0.352
Twice	4(05.3)	2(02.7)	12(16.0)	18(24.0)			
Three times	4(05.3)	11(14.7)	28(37.3)	43(57.3)			
More than three	1(01.3)	1(01.3)	6(08.0)	8(10.7)			
Do not know	1(01.3)	0(00.0)	2(02.7)	3(04.0)			
Frequency of servings of fruit and vegetables a day							
One	5(06.7)	5(06.7)	17(22.7)	27(36.0)	17.812	10	0.273
Two	3(04.0)	3(04.0)	15(20.0)	21(28.0)			
Three	1(01.3)	5(06.7)	7(09.3)	13(17.3)			
Four	0(00.0)	0(00.0)	3(04.0)	3(04.0)			
Five	0(00.0)	1(01.3)	1(01.3)	2(02.7)			
Do not know	1(01.3)	0(00.0)	8(10.7)	9(12.0)			
Good way of eating healthy							
Eat many different kind of foods							
Eat some foods more than other foods	1(01.3)	0(00.0)	6(08.0)	7(09.3)	17.457	6	0.292
Eat a certain kinds of foods in moderate	0(00.0)	5(06.7)	8(10.7)	13(17.3)			
Do not know	3(04.0)	1(01.3)	2(02.7)	6(08.0)			
	6(08.0)	8(10.7)	35(46.7)	49(65.3)			
Balance diets							
Diet rich in protein							
Diet without carbohydrates	1(01.3)	0(00.0)	6(08.0)	7(09.3)	30.587	4	0.002*
Diet contain all nutrients	6(08.0)	3(04.0)	15(20.0)	24(32.0)			
Foods must be eaten to increase dietary intake of fibre	3(04.0)	11(14.7)	30(40.0)	44(58.7)			
Yes							
No							
Do not know	0(00.0)	2(02.7)	8(10.7)	10(13.3)	23.587	8	0.045*
	2(02.7)	3(04.0)	8(10.7)	13(17.3)			
	8(10.7)	6(08.0)	38(50.7)	52(69.3)			

* shows significant association at P<0.005

4.4 Relationship between Maternal Nutritional Knowledge and Nutritional Status (WAZ)

To capture the relationship between nutritional status and maternal nutritional knowledge of the respondents a cross-tabulation descriptive analysis was used. It was revealed that there was significant association between nutritional status (weight-for-age) and frequency of feed children aged 2-5 years a day (P=0.009), frequency of serving fruits and vegetables to the children a day (P= 0.012), knowledge about balance diet(P=0.002)and knowledge about food groups(P=0.007) (Table 20).

Table 21: Relationship between maternal nutritional knowledge and nutritional status (WAZ) of children

WHZ	Severe (<-3 z-score) n (%)	Moderate (≥-3 and <-2 z- score) n (%)	Normal (≥ -2 z-score) n (%)	Total n (%)	$\chi 2$	d.f	p-value
Ever received any education and/ or training about nutrition before							
Yes	0(00.0)	2(02.7)	0(00.0)	2(02.7)	0.657	4	0.995
No	1(01.3)	6(08.0)	1(01.3)	8(10.7)			
Do not know	8(10.7)	56(74.7)	1(01.3)	65(86.7)			
How often should children 2 - to 5 years be fed a day							
Once	0(00.0)	3(04.0)	3(04.0)	6(08.0)	26.661	8	0.009*
Twice	0(00.0)	1(01.3)	16(21.3)	17(22.7)			
Three times	2(02.7)	3(04.0)	37(49.3)	42(56.0)			
More than three	0(00.0)	0(00.0)	7(09.3)	7(09.3)			
Do not know	0(00.0)	1(01.3)	2(02.7)	3(04.0)			
Frequency of servings of fruit and vegetables a day							
One	0(00.0)	3(04.0)	23(30.7)	26(34.7)	30.113	10	0.012*
Two	0(00.0)	1(01.3)	20(26.7)	21(28.0)			
Three	0(00.0)	3(04.0)	10(13.3)	13(17.3)			
Four	0(00.0)	2(02.7)	3(04.0)	5(06.7)			
Five	1(01.3)	0(00.0)	1(01.3)	2(02.7)			
Do not know	1(01.3)	0(00.0)	7(09.3)	8(10.7)			
Good way of eating healthy							
Eat many different kind of foods							
Eat some foods more than other foods	0(00.0)	1(01.3)	12(16.0)	13(17.3)	9.4266	6	0.854
Eat a certain kinds of foods in moderate	1(01.3)	2(02.7)	4(05.3)	7(09.3)			
Do not know	2(02.7)	2(02.7)	6(08.0)	10(13.3)			
	2(02.7)	4(05.3)	39(52.0)	45(60.0)			
Balance diets							
Diet rich in protein							
Diet without carbohydrates	1(01.3)	0(00.0)	6(08.0)	7(09.3)	30.587	4	0.002*
Diet contain all nutrients	6(08.0)	3(04.0)	15(20.0)	24(32.0)			
Foods must be eaten to increase dietary intake of fibre	3(04.0)	11(14.7)	30(40.0)	44(58.7)			
Yes							
No	0(00.0)	2(02.7)	16(21.3)	18(24.0)	27.998	4	0.007*
Do not know	1(01.3)	4(05.3)	10(13.3)	15(20.0)			
	1(01.3)	3(04.0)	38(50.7)	42(56.0)			

* shows significant association at P<0.005

4.5 Relationship between Maternal Nutritional Knowledge and Nutritional Status (WHZ)

To capture the relationship between nutritional status and maternal nutritional knowledge of the respondents a cross-tabulation descriptive analysis was used. It was revealed that there was significant association between nutritional status (WHZ) and frequency of feed children aged 2-5 years a day (P=0.011)(Table 21).

Table 22: Relationship between maternal nutritional knowledge and nutritional status (WHZ) of children

WHZ	Severe (<-3 z-score) n (%)	Moderate (≥-3 and <-2 z- score) n (%)	Normal (≥ -2 z-score) n (%)	total n (%)	χ2	d.f	p-value
Ever received any education and/ or training about nutrition before							
Yes	0(00.0)	0(00.0)	7(09.3)	7(09.3)	1.243	4	0.871
No	3(04.0)	8(10.7)	54(72.0)	65(86.7)			
Do not know	0(00.0)	2(02.7)	1(01.3)	3(04.0)			
How often should children 2 - to 5 years be fed a day							
Once	0(00.0)	0(00.0)	3(04.0)	3(04.0)	13.219	8	0.626
Twice	2(02.7)	3(04.0)	13(17.3)	18(24.0)			
Three times	1(01.3)	7(09.3)	35(46.7)	43(57.3)			
More than three	0(00.0)	0(00.0)	8(10.7)	8(10.7)			
Do not know	0(00.0)	0(00.0)	3(04.0)	3(04.0)			
Frequency of servings of fruit and vegetables a day							
One	3(04.0)	1(01.3)	23(30.7)	27(36.0)	23.028	10	0.011*
Two	0(00.0)	5(06.7)	16(21.3)	21(28.0)			
Three	0(00.0)	1(01.3)	12(16.0)	13(17.3)			
Four	0(00.0)	0(00.0)	3(04.0)	3(04.0)			
Five	0(00.0)	2(02.7)	0(00.0)	2(02.7)			
Do not know	0(00.0)	1(01.3)	8(10.7)	9(12.0)			
Good way of eating healthy							
Eat many different kind of foods	1(01.3)	0(00.0)	6(08.0)	7(09.3)	17.457	6	0.292
Eat some foods more than other foods	0(00.0)	5(06.7)	8(10.7)	13(17.3)			
Eat a certain kinds of foods in moderate	3(04.0)	1(01.3)	2(02.7)	6(08.0)			
Do not know	6(08.0)	8(10.7)	35(46.7)	49(65.3)			
Balance diets							
Diet rich in protein	0(00.0)	0(00.0)	18(24.0)	18(24.0)	12.302	4	0.144
Diet without carbohydrates	0(00.0)	9(12.0)	5(06.7)	14(18.7)			
Diet contain all nutrients	1(01.3)	12(16.0)	30(40.0)	43(57.3)			
Foods must be eaten to increase dietary intake of fibre							
Yes	0(00.0)	10(13.3)	8(10.7)	18(24.0)	12.302	4	0.656
No	1(01.3)	2(02.7)	12(16.0)	15(20.0)			
Do not know	1(01.3)	2(02.7)	40(53.3)	42(56.0)			

* shows significant association at P<0.005

CHAPTER FIVE

5.0 DISCUSSION

5.1 Socio-demographic Characteristics

From this study, the household male to female ratio was 4:1; these had implication on decision making in food choice in the households in Chamwino. This was also reported by TDHS (2010) that one quarter of Tanzanian households were headed by females. Female headed households are typically poorer than male-headed households (Table 6).

Family size in the study area ranged from 4 to 5 members. This had implication on children dietary intake during meal eating in the household in Chamwino. The large number of members may compromise food availability among family members. This was also reported by TDHS (2010) that, average household size was 5.0 persons, with the average household size being lower in the Mainland (4.9) than in Zanzibar (5.6). Over 55 percent of households in Tanzania have a household size of 3 to 6 members

It was also noted that, there were more than half (61.3%) of children ranged from 2 to 3 below 5 years of age in the household. This had an implication on food intake and caring practices because there were more children compared to available food in the household. This may lead to acute and chronic malnutrition. High proportion of children below 5 years of age increases the dependency ratio; since expenditure of the income on care of household members perpetuates poverty (low per capital income) (Table 6).

On the other hand, most of the members of the households were currently in monogamous marriage; this implies that the head of the household was the one who was responsible for food production in the family. Observation from the study area showed that, there were food shortages which contributed by the habit of household heads to migrate to other places like Morogoro in search for wage labor during the rainy season.

Most of the respondents in the study area had primary education. Low education can contribute to poor general caring practices to the children. This was in line with the study done in Simanjiro by Nyaruhucha *et al.* (2006) which indicated that mothers with primary or no education are less likely to give their children complementary foods that meet the recommended dietary diversity, minimum meal frequency and minimum acceptable diet (Table 6).

The main occupation of community members in the study area is farming and petty business. Livestock keeping such as cows, goats and pigs can contribute to household's income but the number of animals kept is low in number. This was in line with the study done by Kimani *et al.* (2011) which indicated that because of poverty and poor living conditions of the of households members, the children were unlikely have adequate complementary foods (Table 6).

5.2 Maternal Nutritional Knowledge towards Healthy Diet

Studies done by Uddin *et al.* (2008) revealed that knowledge plays an important role in public health. This study shows that the level of nutrition knowledge of parents and

caregivers was low. The difference in their level of understanding is most likely related to exposure in different training curricula. In this study, it was noted that, most of the respondents had primary education; which may explain their poor knowledge on nutrition. This may also imply that the respondents prepare food without knowing if the food is good for their health or not, simply because they do not have ideas and knowledge about nutrition; hence we need to direct more attention to that community by introducing nutrition programs that would be of help.

Furthermore, it was observed that the common foods given to children were bulrush millet porridge. Few were given maize porridge and none of them were given rice and cassava daily because the accessibility of rice and cassava was difficult. Most of the children began complementary feeding earlier than the recommended time of introducing complementary foods, most of infants had been weaned with bulrush millet porridge by the time they were aged three to four months. This study agrees with the study done by Poggensee *et al.* (2004) which reported that, in Tanzania, the main solid foods given to the children before weaning were maize porridge, *ugali*, potatoes, rice and bananas.

It was also noted that, most of the children were not given fruits and vegetables. Most were given *Mlenda* and *Amaranths* which is associated with seasonal factors such as drought in Dodoma. This deprives children of important nutrients especially micronutrients that are obtained from fruits and vegetables.

The findings of this study show that more than half of the total study sample had no knowledge on balanced diet. A study done by Ali *et al.*(2009) revealed that dietary diversity is highly associated with individual knowledge and awareness. Rural people in Northern Chad had poor knowledge that obesity was associated with poor dietary diversity; on the other hand underweight in children was associated with low dietary diversity. A diet that contains proper proportions of carbohydrates, fats, proteins, vitamins, minerals, and water is necessary to maintain good health through a balanced diet (Ali *et al.*, 2009).

5.3 Nutritional Status

Tables 9, 10, and 11 present detailed results of nutritional status assessment for children under the age of five as assessed with anthropometric indices. Mean z-score also showed that unlike acute under-nutrition which is not a significant problem in this population. Stunting in children under the age of five was a significant problem.

5.3.1 Nutritional status (WAZ)

The weight-for-age z-score (WAZ) reflects the effects of the most current changes in the nutritional status (both acute (wasting) and chronic (stunting) under nutrition). Low weight-for-age indicates a child whose weight for age is below minus two standard deviation (-2 SD) from the median of reference population.

Moreover, results from this study shows that the poor nutritional status of the children might be due to low caloric intake. As age of the children increases breast milk alone can no longer satisfy the energy needs of the growing child (WHO, 2000). Therefore,

complementary foods that meet the recommended dietary allowances have to be provided to infants and young children.

The prevalence of underweight in this study could have been due to poor intra-household food distribution, which is a common practice in many households. It was also noted that, complementary foods provided to these children were of poor quality thus could not meet nutritional requirements. Adequate breastfeeding, combined with timely and proper complementary feeding are important in ensuring children have good health and normal growth (Kirsten *et al.*, 2001).

Furthermore, many households do not consume a balanced diet mainly due to the low economic status of the household heads. The most common complementary food in this area was porridge made from bulrush millet. The age group (6-59months)was more susceptible to diseases such as diarrhea and worms due to poor environmental sanitation and lack of and poor access to clean water. Another cause of malnutrition is lack of knowledge on nutrition and nutrition related issues among women or caregivers who are responsible for food preparation.

Moreover, the results showed that, a larger number of children had a normal nutrition status compared to the underweight children; this implied that protein and other nutrients was not the problem for the children but other factors such as diseases, poor knowledge on nutrition and poor caring practices of parents or caregivers could be the problem. It was noted that the proportion of severely underweight children observed was higher than that reported in the Tanzania Demographic and Health Survey

(2004).According to TDHS (2004), prevalence of severe underweight at national level was 0.4% for the age group 24 - 60 months and 3.0% for the age group 61 - 119 months (NBS and ORC Macro, 2005).This shows that the trend of wasting was inconsistent simply because the supplemental feeding did not have much influence and maybe other factors were masking the effect of the diet.

5.3.2 Nutrition status (HAZ)

The height-for-age z-score (HAZ) reflects achieved linear growth for age. Low height-for-age refers to a child whose height for age is below minus two standard deviation (-2 SD) from the median of reference population. It also reflects chronic under-nutrition referred to as stunting.

According to TDHS (2004) prevalence of moderate stunting in female children was 36%at national level. This level is higher than that observed in this study. Similarly TDHS (2004) reported higher prevalence of moderate stunting among male children, which is 38.6% at national level (NBS and ORC Macro, 2005). According to NBS and ICF Micro (2011), prevalence of stunted children at national level was 17.9% while for moderately stunted children was 46.5%. The proportion of stunted children observed in this study was lower compared to the level in Dodoma region in which 56% of the under five children were reported as stunted (NBS and ICF Macro, 2011).

The study revealed that stunting among children of 6 months to 59 months was a main problem; these can be related to the fact that poor knowledge on nutrition and feeding practices is still problem for mothers and caregivers in the study area, for example

most of the women did not know about the 1000 days-window of opportunity. It means that there is poor nutrients intake during pre-conception and in pregnancy women. It was also noted that there were incidences of diseases for the children such as hookworm infestation that can cause malabsorption of food hence resulting to stunting.

A factor contributing to high prevalence of stunting is poor dietary intake. The dietary pattern is characterized by high carbohydrate and low protein content. Also intra-household food distribution was poor, in some households children were served food last, were served a small portion than they required or they were eating from one plate with adults. This kind of feeding pattern will obviously affect growth pattern of children as well as their nutritional status.

Furthermore, continued low intake of zinc in children might increase prevalence of stunting hence low weight for age. Umeta *et al.* (2000) showed that diets rich in zinc improved growth (increase in weight and height) of stunted children in Ethiopia and this was attributed to the ability of zinc to reduce morbidity due to infection and increase appetite which all have positive effect on growth in terms of weight and height. In addition, there was low level of education among women in Chamwino that decreased possible access to nutrition information. It was also noted that, most of the households earned less than one dollar per day hence accessibility to adequate foods was difficult/limited.

5.3.3 Nutrition status (WHZ)

Weight for height reflects the effects of both acute (wasting) and chronic malnutrition. Wasting in children therefore symbolized deficit in tissue and fat mass compared with their peers of the same height. Supplementation with the bean-maize composite food, children showed noticeable improvement as evidenced by the decrease in the proportion/number of wasted children to levels below those reported by NBS and ICF Macro (2011).

The prevalence of wasting could be attributed to poor intra-household food distribution. In many households both adults and children eat from the same plate and in such a situation the young ones cannot compete with the older family members, hence reduction in the amount of meal intake due to food shortage and the intake of unbalanced diets. Some of children have poor appetites due to illness and this increases their vulnerability. It was also noted that, traditional beliefs contribute to poor nutritional status of the children. Mothers believed that their children were suffering due to witchcraft therefore they were not taking them to hospitals for treatment instead they preferred to consult the traditional healers.

Factors like increased infection due to malaria, reduced appetite, reduced intake of zinc and vitamin C, inadequate care, and inadequate family income exacerbated the severity of malnutrition among children. Infections like malaria increase body activities (metabolism) and therefore demand for energy. Failure to cope with the demand by intake of more nutrients during illnesses, increase the use of body fat reserves and muscles as alternate sources of energy (Schaible, 2006). Poor nutrient intake in

children and poor knowledge on nutrition and diseases are the major factors that cause underweight in children resulting to poor immunity that lead them to be very weak thus vulnerable to diseases such as malaria and diarrhea. According to NBS and ICF Macro (2011), the proportion of moderately wasted children at national level was 4.0% for females and 5.6% for males. TDHS (2010) measured three anthropometric indicators of nutritional status in children: height-for-age, weight-for-height, and weight-for-age. At the national level, 42 percent of children under the age 5 have low height-for-age or are stunted, 5 percent have low weight-for-height or are wasted, and 16 percent have low weight-for-age(underweight), which reflects both chronic and acute under nutrition. These results reflect a mix in progress in nutritional status from the 2004-05 TDHS when these indicators were measured at 38, 3, and 22 percent respectively.

5.4 Dietary Patterns of Children Aged 6 months to 59 months

The results on dietary patterns were in line with Subba *et al.* (2007) who reported a mean feeding frequency of 3 times a day. In both studies, none was reported to be feeding more than five times a day. Preparing and feeding five meals per day requires a considerable amount of time, capital/money and effort by caregivers. This may prompt the care-givers to hold prepared food over from one meal to the next, there by potentially increasing the risk of microbial contamination (PAHO and WHO, 2001) (Table 12).

The only food prepared especially for young children, though not exclusively for the young children were home prepared bulrush millet and maize porridges which were

the most commonly used complementary food. The findings of this study are similar to the findings by Faber (2004) and that of Gardner (2002) who reported infants to be most fed with maize porridge. Faber (2004) reported more than half of the infants in South Africa were fed with maize porridge whereas Gardner (2002) and Kamudoni *et al.* (2007) reported 80% and 79% of children were fed maize porridge in Jamaica and Malawi, respectively. In Kenya, of the actual foods selected, cereal-based gruel was consumed daily by over 90% of children throughout the study (Onyango *et al.*, 2002) (Table 12).

Cereal consumption was common in the study area, consumed at least once per day in all households in Chamwino, Dodoma. The most consumed cereals were bulrush millet (as ugali), wheat (as chapatti and buns) and rice. This implied that, the diet is commonly based on cereals. Observations from this study were similar to those reported at national level where more than 60% of the predominant diet in Tanzania is cereal-based with low energy and nutrient density (NBS, 2011).

The results shows that 92% of households consume vitamin A rich vegetables and tubers that consisted of dark green leafy vegetables and other vegetables had more individual food items compared to other food groups in the household. These consisted of sweet potatoes that are orange inside, pumpkins, red sweet peppers, amaranths, cassava leaves, sweet potato leaves, cow pea's leaves, onions and tomatoes. Others were *chiwandaguru*, *mnafu* and *figiri* the locally available vegetables in Chamwino (Table 12). Observation in this study is similar to that documented in Morogoro region

by Ngasongwa (2007) who reported that the rate of vegetables and fruits consumption in Morogoro region is 17.9% while for national level is 36.5%.

The results show that more than half of the households consumed white roots and tubers. Observation from this study revealed that, white roots and tubers group including white potatoes, white yam, and cassava were consumed in terms of cooked or raw. Others were sweet potatoes, pumpkin and Irish (round) potatoes. It was observed that, in Chamwino there is less consumption of white roots and tubers because of the seasonality. These findings are similar to those reported in Morogoro, where more than 65% of the cultivated food crops are transported out of the region and farmers in rural areas remain food insecure (NBS, 2011 ; MAFS 2012).

About 98% of the households consume legumes and nuts such as beans, cowpea, soybeans and pigeon pee. Beans were the major food consumed by many people in all sub-sections in Chamwino. Consumption of legumes as the source of protein was higher as compared to consumption of animal protein in all households.

In this study, findings indicate that, 90.7% of the households use sunflower and oils. Because these help to enhance vitamin A absorption during digestion process (Table 12).

Few households (24%) consumed milk and milk products in Chamwino. To many smallholders, milk is a dependable product sold to rural people. Observations from this study were similar to those reported by Shapiro *et al.* (2009) who reported that

consumption of milk and milk products in Tanzania in rural areas has been estimated to have grown at the rate of 1.43% as compared to growth in production of 2.72% between 2005- 2014.

5.6 Household Dietary Diversity

Most of the respondents use cereal products. This study showed that most of the households lacked diversified diets; they eat more carbohydrate rich foods such as bulrush millet than other food groups. As a result, most of the respondents did not meet the daily recommended dietary allowance, which results into poor growth of the children and prevalence of diseases to the children as well as other community members. Also, due to poor diversification of foods there were increased possibilities for mothers to give birth to pre-term babies or to give birth to children with spinal bifidia because of lack of vitamin B_9 that comes from foods like beans, avocados and some vegetables. Similar observations were made by (Lee and Niemann, 2003;Mann and Truswell, 2007) the top food consumption list in this study indicated that the majority of food items consumed were carbohydrate-based with a low frequency of small portions of vegetables and fruit, not meeting the recommended intake of 400 g per day.

Furthermore, it was observed that vitamin and mineral deficiencies affect people of all genders and ages, as well as certain risk groups. They not only cause specific diseases, but they act as exacerbating factors in infectious and chronic diseases, greatly impacting morbidity, mortality, and quality of life. Micronutrient deficiency conditions

relate to many chronic diseases, such as osteoporosis, ostcomalacia, thyroid deficiency, colorectal cancer and cardiovascular disease.

5.7 Dietary Intake for Children Aged 6 – 59 months

A high proportion of children aged 6 months to 59 months in Chamwino district do not consume enough nutrients, due to these they do not meet the RDA of nutrients though their dietary patterns as shown in table 11 The low intakes could also be related to the limitations of FFQs to assess the food and nutrition consumption of individuals which have been summarized by Gibson (2005).

The dietary patterns and eating habits of people of Chamwino district, as well as the lack of knowledge about the composition of several commonly consumed foods has led to the inadequate intake of nutrients. The deficiencies in micronutrients observed in this study could be associated with increased risks of morbidity and mortality as noted elsewhere (Barclay *et al.*, 2003). Zinc deficiency, whether mild or moderate, increases the risk of poor growth and development, reduced immune function, increased infectious diseases and mortality (Black, 2002).

5.7.1 Carbohydrates

From the results (Table 14)most of the children did not meet recommend amount of carbohydrates per day. The reason for the low RDA of food (carbohydrates) intake in Chamwino may be explained by the fact that most families belonged to the low socio - economic group, i.e. they sell most of their crops and do small petty business that end up having low purchasing power and hence poor diet.Besides income other socio economic indicators (i.e., education and occupation) appear to have similar, but

independent, effects on nutrition and diet, although several studies have shown that education is the strongest determinant of socio economic differences in diet (Bowman and Russel, 2001).

5.7.2 Protein

Protein is important for building, repairing and maintaining the body cells and tissues. When a person does not eat enough protein, the body begins to break down its muscles resulting in weight loss and muscle wasting. The foods consumed by these children were more of plant based protein which is of poor quality than of animal based protein which is high quality protein.

The study noted that more than half (68%) of the children had low protein intake, Also the study observed that there was food shortage at household level and this made children change their dietary habits in order to cope with the problem of economic constraints, hence it was not possible for the children to eat sufficient amounts of foods containing important nutrients, this had an implication in poor metabolism such as synthesis of RNA and DNA in the cell, impairing growth and muscular development of the children in Chamwino.

5.7.3 Fat

Data indicated that, children consumed less amount of fat than recommended. Fat makes meals less bulky and help the absorption of some vitamins such as Vitamin A, D, E and K but too much fat can lead to overweight and obesity.

Moreover, more than half(65.3%)of the children had low fat intake. Low intake of fat diets lead into impaired absorption of vitamins A, D, E and K in the body and lead to diseases such as eye defect. These results are similar to those reported by Burgess and Savage (1998) which reported that everyone needs to eat some fat especially children who needs essential fatty acids.

5.7.4 Vitamin A

From the results in Table 15 children had low vitamin A intake, this leads to impaired iron metabolism. Subsequent improvement in iron status may be limited when vitamin A status is low. This study is similar to the study done by Kenedy *et al.* (2002) which stated that for the short term, providing vitamin A supplements, multiple micronutrient supplements or vitamin A fortified foods to children may be effective strategies to prevent Vitamin A deficiency (VAD) in a population.

In addition to that, a recent study on assessment of the vitamin A status of schools in Tanzania, Ghana, Indonesia and Vietnam found that that VAD was a severe public health problem in Tanzania, a moderate problem in Ghana and a mild problem in Indonesia and Vietnam according to WHO criteria (Kenedy *et al.*, 2002).

The study also observed that, rural population had low dietary intake of vitamin A. Although they had a lot of vitamin A rich sources such as dark green leafy vegetables and other vegetables, they consume low amount of this kind of food.

5.7.5 Vitamin C

The study in Table 15 has revealed that, many children failed to meet the recommended daily allowance for Vitamin C due to low consumption of foods or drinks that are rich in Vitamin C such as guava, oranges, baobab fruit, passion fruits, pineapples or their juices and other fresh fruits and vegetables found in the area.

It was observed that, the low intake of vitamin C by children of Chamwino was caused by environmental factors such as drought and poor knowledge about nutrition, the villagers did not provide fruits to their children even if they had accessibility to fruits simply because of poor nutritional knowledge. This had an impact on the health status of the children such as subcutaneous and intramuscular hemorrhages, leg edema, neuropathy, and cerebral hemorrhage characterizing scurvy. The result from this study is similar to the study done by Faber and Wenhold (2007) which reported that, vitamin C together with other micronutrients such as vitamin E, selenium, and zinc act as antioxidants thus help to prevent cell damage caused by highly reactive free radicals. Also vitamin C has a role in enhancing iron absorption. Thus, those children who have failed to meet their recommended daily intake are likely to get oxidative stress and are likely to have scurvy.

5.7.6 Iron

Result in Table 15 shows that most (74.6%) of the children had high Iron intake and few had low intake levels. Moreover, the high frequency of hookworm infestations and the endemic malaria might also contribute to anemia, the intake and effects were due to the bioavailability of dietary iron.

5.7.7 Zinc

Results from Table 16 indicate that, about 69.3% of the children had low intake of zinc compared with the Recommended Dietary Allowances (RDAs). In evaluating the adequacy of Zinc intake, it was necessary to relate it to the intake of animal protein of the study subjects. The intake of zinc is lowest when protein intake is also low and highest when protein intake is high. Since protein intake in this group was low, this could also explain the observed low mean zinc intake in children which was inadequate with respect to RDA. Similar observations made by Zimmerman and Kraemer (2007) suggested that, dietary Zinc deficiency is common because of reduced zinc bioavailability in foods of vegetable origin that form a large proportion of the diets of the poorest populations. Animal products such as meat, fish and offal are the richest sources of easily assimilated zinc.

5.7.8 Calcium

The results in Table 16, show that there was a high percent (85.3%) of children failing to meet the recommended calcium intake per day which is 800 mg per day. Calcium is required in higher amount per day. The results of this study as shown above tell us that a proportion of children in Chamwino (Ilolo) fail to meet the recommended calcium intake per day and their diet lacked dairy products, which are one of the major sources of calcium. For this reason, they need nutrition education and maternal health programs to reach children about appropriate nutrient consumption.

5.8 Relationship between Nutrition Status and Socio-demographic Characteristics of the Respondents

5.8.1 Relationship between socio-demographic variables and nutritional status (underweight) of children

The results in Table 17 show the association at (P<0.005) between socio-demographic and nutritional status (underweight). This had an impact on food share because children and other members of the household eat on the same plate. in such a situation the young ones are more likely to be deprived of their fair share of the meal, hence reduction of the amount of meal due to food shortage and the intake of unbalanced diets because most of the family eat food in order to full fill their need so they do not plan for balance diets. Poor availability of food both in terms of quality and quantity, poor dietary diversification and high rates of infection are the major determinants of under nutrition in the majority of developing countries (Caulfield *et al.*, 1999).

It was also noted that children who live with divorced mothers were found to be more underweight compared to others, families with only one parent eat once per day due to low economic status or low income of the family. The low status of women is thought to compromise their own health, the subsequent birth weight of their children, and the quality of care that children receive during their infancy.

5.8.2 Nutrition status (HAZ) and socio-demographic variables

The results in Table 18 show the association at (P=0.003) between socio-demographic and nutritional status (Stunting). It was noted from the results, family with currently married monogamous has highly severely and moderately stunting level compared to

the other families with single or more than one wife, this due to fact that a family with single wife has larger number of other family member (relatives) they take care, these lead to low portion of food intake by children due to larger number of people in the family.A similar study made by URT and UNICEF (1990) reportedthat, a relationship between family size and nutritional status were not evident, although other studies showed larger family affects child's nutrition status as large family tend to increase food budget.

5.8.3 Nutrition status (WHZ) and social demographic variables

The results in Table 18showed an association between socio-demographic and nutritional status (wasting). this had an implication in food portion consumed by an individuals in the household since the young's eat on the same plate with adults cause unbalance of diet due to low intake of food lead them to have wasted.

This implies that a household headedhave enough food compared to the female headed household simply because male headed house hold could have well in economic status than female headed house. The findings conducted in Tanzania (URT, 2002) observed the same.

5.8.4 Relationship between Maternal Nutritional Knowledge and Nutritional Status (HAZ)

Results in Table 19above showed the significant association between socio-demographic and nutritional status (stunting). This had an impact on children's health because mothers do not have knowledge on how to plan and what kinds of food are

needed by the children to help them grow healthily. These findings show that children suffer from longer-term chronic under-nutrition, manifested in high rates of stunting. Possible reasons for this include low-birth weights, inadequate breastfeeding, poor weaning practices as well as insufficient consumption of nutritious food. Stunting has a lot of consequences in a child's life. In order to reduce stunting rates, mothers must be well informed about the 1000 days-window of opportunities. There is evidence that improving growth through adequate complementary feeding can have a significant effect on adult nutritional knowledge. Moreover, nutritional status of under-five children is an important outcome measure of children's health (NBS and ICF Macro 2011). Research shows that the level of resistance to infection is lower for malnourished children than other children, causing high levels of morbidity and mortality (UNICEF 2001). Further, poor nutrition also affects the cognitive development of children.

5.8.5 Relationship between Maternal Nutritional Knowledge and Nutritional Status (WAZ)

The results in Table 20above show an association at ($P<0.005$) between social demographic and nutritional status (underweight). This implies that poor maternal nutritional knowledge may lead to underweight in children; it is because if the mothers had good nutritional knowledge they can make good meals, rich in nutrients required for growth and development of the children as well as consumption of diversified to prevent underweight in children. Also due to poor maternal nutritional knowledge in Chamwino the results shows 22.7% of the children are underweight.

Moreover, inadequate food intake is a basic cause of underweight; several other factors such as living standards, water and sanitation, birth weight, birth interval and parity, weaning practices and mother's nutritional knowledge have been identified as contributing to malnutrition among the pre-school children. Maternal nutritional knowledge includes breastfeeding, so the observed results may have been due to a combination of these factors (Fawzi *et al.*, 1998).

The protective effects of children's nutritional status, observation in this study suggest that breastfeeding is an important part of child care. However, there is need to educate mothers on safe breastfeeding and timely introduction of complementary foods because poor breastfeeding practices such as prolonged breastfeeding or failure to introduce adequate complementary foods as recommended, places children at risk of becoming underweight (Madzingira, 1995). Underweight children were more likely to be breastfed for a longer period (over 12 months) compared to well-nourished children (Tharakan *et al.*, 1999).

5.8.6 Relationship between Maternal Nutritional Knowledge and Nutritional Status (WHZ)

The results in Table 22above show an association at ($P<0.005$) between social demographic and nutritional status (wasting). These imply that mothers in Chamwino did not feed their children at least three times a day simply because of economic factors and others because of poor nutritional knowledge on feeding practices.

The results also show that there is no association between nutritional status (WHZ) and maternal nutritional knowledge. These results are comparable to other findings in the literature, for example, in their study using the Cambodia 2005 DHS, Miller and Rodgers (2009) did not find any significant inverse association between maternal nutritional educations and wasting, but found a significant inverse relationship between mother's nutrition educations and stunting.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

There are many causes of stunting and other forms of under nutrition in Chamwino (Ilolo), not just a lack of food. This study shows that children become malnourished due to low intake of nutritious food and poor nutrition knowledge of maternal, caregivers and other family members

From the results, inadequate dietary intake caused by multiple underlying factors including inadequate physical or economic access to food, poor health services, an unhealthy environment and inadequate caring practices for children and women. More basic causes include poverty, illiteracy, and low status of women, social norms and behaviors.

6.2 Recommendation

Data from this study showed that most of the children aged 6 to 58 months do not met some of their nutrients requirements as recommended while others failed to meet the daily recommended allowance for their age. Based on the findings of the study, the following are recommendations to address the nutrient deficiencies among children.

- Feeding program should be established and implemented to ensure that children meet their daily nutrition requirements of both micronutrients and Macronutrients. By doing that it can help to reduce the great number of

absentees, improve nutrition state and health status of the children as well as it will improve child cognitive development.

- Multi-micronutrient supplementation of children aged 6 to 58 months are to be taken plus other nutritional strategies including dietary interventions, food fortification and bio-fortification, together with other public health measures should continue to be encouraged.

- More researches on dietary assessment in the children are required so as to monitor the nutrition status based on nutrients obtained from their daily consumption of foods and beverages in relation to their ages and the environment where they live.

- Community nutrition educations were required in order to deduce and eradicate the cultural belief about feeding practices to fewer than 6 months example breastfeed practices.

- Further research at the village level should be undertaken in order to assess the need for fortification of food with micronutrients like calcium, zinc, iron, and vitamins. Also nutritional campaigns should be arranged which will emphasize the need for women to attend to different nutritional programs in order to increase their awareness of nutritional needs.

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APPENDICIES

Appendix 11. Socio – demographic variables

1	Household sex	1= male 2= female
2	Marital status of household head	1= married monogamous 2= married polygamous 3= widowed 4= divorced 5=single 6= other
3	What is your education level	1= no education 2= adult education 3= primary education 4= secondary education 5= diploma/certificate 6= university
4	What is your occupation	1= farmer 2= employed in formal sector 3= self employed 4= other (specify)
5	Total number of members in this household	Enter number
6	Total number of children below 5 years of age	Enter number

Appendix 2. Nutritional knowledge

1	Have you received any education and /or training about nutrition before?	1= yes 2= no
2	Which is good way of eating healthy?	1= eat many different kinds of foods 2= eat some foods more than other foods 3= eat certain kinds of foods in moderate or small amounts 4= do not know
3	According to you, what is a balance diet?	1= Eat rich in protein 2= Diet poor in fat 3= diet without carbohydrates 4= diet containing all nutrients in proper quantities 5= do not know
4	Do you know which foods must be eaten to increase dietary intake of fibre? If yes, please give an example	1= yes 2= no 3= do not know
5	How do you recognize that someone is not having enough food?	1= lack of energy 2= becomes ill easy or becomes seriously ill

		3= loss of weight/thinness 4= growth faltering 5= other 6= do not know
6	To whom do you seek advice and opnion about whether your baby is growing well or not?	1= go to health center/ask a doctor or nurse 2 = go to relative 3= other 4= do not know
7	Green leafy vegetables and oranges, fruits or vegetables are healthy foods. Do you know the reason for it?	1= they are rich in protein 2= they are in vitamin A 3= they are rich in many nutrients 5= other (mention) 6= do not know

Appendix 3. Breastfeeding and Complementary feeding practices

1	Did you ever breastfeed this child?	1= yes 2= no 3= do not know	
2	Did you feed colostrums to this child?	1= yes 2= no 3= do not know	
3	Who offered any practical support or advice to help you start breastfeeding with this child?	1 = health professional 2= relative, family members, neighbor 3= other (specify)	
4	How many months old was this child exclusively breastfed, without water, gripe water, fruit juice, porridge or any other foods besides mother's milk?	Enter number of months	
5	Whta is the reasons for not exclusively breastfeed?	1= breast milk was not sufficient for the baby 2= mother busy with othe activities 3= Cultural norms 4= others (specify)	

Appendix 4. Anthropomentric Measurement of Children below five years

no	sex	Date of birth(dd/mm/yy)	Age*	Weight (kg)	Height/Leigth (cm)

Appendix 5. Guidelines for Measuring Household and Individual Dietary Diversity

Question number	Food group	Examples	YES=1 NO=0
1	CEREALS	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + *insert local foods e.g. ugali, nshima, porridge or paste*	
2	WHITE ROOTS AND TUBERS	white potatoes, white yam, white cassava, or other foods made from roots	
3	VITAMIN A RICH VEGETABLES AND TUBERS	pumpkin, carrot, squash, or sweet potato that are orange inside + *other locally available vitamin A rich vegetables (e.g. red sweet pepper)*	
4	DARK GREEN LEAFY VEGETABLES	dark green leafy vegetables, including wild forms + *locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach*	
5	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant) + *other locally available vegetables*	
6	VITAMIN A RICH FRUITS	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + *other locally available vitamin A rich fruits*	
7	OTHER FRUITS	other fruits, including wild fruits and 100% fruit juice made from these	
8	ORGAN MEAT	liver, kidney, heart or other organ meats or blood-based foods	
9	FLESH MEATS	beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects	
10	EGGS	eggs from chicken, duck, guinea fowl or any other egg	
11	FISH AND SEAFOOD	fresh or dried fish or shellfish	
12	LEGUMES, NUTS AND SEEDS	dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)	
13	MILK AND MILK PRODUCTS	milk, cheese, yogurt or other milk products	
14	OILS AND FATS	oil, fats or butter added to food or used for cooking	
15	SWEETS	sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
16	SPICES, CONDIMENTS, BEVERAGES	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	

Appendix 6. 24 Hour Dietary Recall – Mother/Women Responsible for Food Preparation

Meal time	Name of food or dish consumed	Ingredients	Amount served	Amount not served	Amount consumed	Units (g. Mls etc)	How consumed (1= cooked 2= raw)
Breakfast							
Late morning/snack							
Luch							
Snack							
Dinner							
Snack							