RISK FACTORS FOR MALNUTRITION IN CHILDREN AGED 0 TO 5 YEARS IN LILONGWE DISTRICT, MALAWI

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ABSTRACT

The Malawi Multiple Indicator Cluster Survey (MICS) in 2007 indicated that the prevalence of underweight in Lilongwe District was 29%, stunting was 49% and Global Acute Malnutrition was 11%. The aim of the study therefore was to determine the risk factors for malnutrition amongst children aged 0 to 5 years in Lilongwe district in Malawi.

Study design

It was a case-control study, conducted in randomly selected Community Therapeutic Care (CTC) Sites (Nutrition Rehabilitation Units (NRUs)) and Under-five Clinics at health facilities of the district. The study sample was comprised of 50 underweight-for-age children (25 girls and 25 boys) aged 0 to 5 years from NRUs of the district selected randomly. The controls were comprised of 44 normal weight-for-age children (22 girls and 22 boys) randomly selected within the same age group, routinely attending under-five growth monitoring and immunization sessions during the same period as the cases. The cases and controls were identified using the NRU and under-five clinic registers respectively.

Data Collection

There was a face to face interview with the mother/guardians of the children, conducted by trained NRU nurse specialists, the researcher and a research assistant, using a structured questionnaire. Questions about socio-economic status of the mother/caregiver, child feeding practices, nutritional status and diseases of the child were asked.

Analysis of results

Data was analyzed using EpiInfo 2002 software. Ethical approval for the study was requested from the Ethical committee of the University of the Western Cape. Informed written consent was obtained from all the participants.

Results

The results showed that there was a statistically significant association between a couple of variables and the children's' being cases or controls and the variables were**:** Birth weight, highest education level reached, age of the child, number of pregnancies, marital status, type of area, type of house, water source, father support, HIV status, stress score, admission, re-admission, re-occurrence of malnutrition, access to food, BF, immunization, weaning food groups, feeding the sick child, household head's employment status, cleaning, cleaning materials, BMI, frequency of sickness and type of sickness.

Conclusion

It is therefore established that the associations of the variables and the children aged 0 to 5 years in the Lilongwe district possibly caused the malnutrition in the cases. These factors are therefore the risk factors of malnutrition and are as follows: the guardian's dropping from school at primary level ; living in rural area but not on farm; poverty (with dwelling in a grass thatched house as one of the indicators); having irregular or no father support; being HIV positive; born with birth weight less than 2.5 kg; being a child of 1.7 to 5 years; higher number (above 3) of pregnancies for the mother; mother staying without a husband; poor access to safe water; high stress for the mother; mothers' frequent attending to admitted cases; admission and re-admission of the child, household's poor access to food; not breastfeeding or being a weaned child; not getting full immunization; unbalanced weaning foods; guardian's poor knowledge of feeding the sick child; household head not employed; poor hygiene; lack of cleaning materials; the guardian's BMI of less than 18.5; frequent sicknesses for the child; and frequent malaria and diarrhea attacks to the child. It is therefore recommended that appropriate intervention programmes be formulated to sensitize and educate parents and guardians on the importance of providing adequate breastfeeding, nutrition and parental care to children aged 0 to 5 years for them to develop with good nutrition status.

DECLARATION

I declare that the mini-thesis is my own original work and that it has never been submitted anywhere else for any purposes. All other peoples' ideas that have been cited have been acknowledged.

05th March, 2013

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Signature Date

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Malnutrition

Breast feeding

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Community Therapeutic Care Feeding practices (CTC)

Nutritional Rehabilitation Units (NRU)

Supplementary Feeding Programme (SFP)

Outpatient Therapeutic Programme (OTP)

Malawi.

DEFINITION OF ABBREVIATIONS/ACRONYMS

AED	Academy for Education Development
BMI:	Body Mass Index
UNICEF:	United Nations Children Fund
WHO:	World Health Organisation
PMTCT	Prevention of Mother to Child Transmission
MPHC	Malawi Population and Housing Census
MNMS	Malawi National Micronutrient Survey
FAO	Food and Agriculture Organisation
MDHS	Malawi Demographic Health Survey
MICS	Multiple Indicator Cluster Survey
ILSI	Institute of Leading Social Indicators
SVD	Spontaneous Vaginal Delivery
CTC	Community Therapeutic Care
OTP	Outpatient Therapeutic Programme
RUTF	Ready-to-Use Therapeutic Food
NRU	Nutritional Rehabilitation Unit
SFP	Supplementary Feeding Programme
MoH	Ministry of Health
BASICS	Basic Support for Institutionalising Child Survival
HIV	Human Immuno-deficiency Virus
AIDS	Acquired Immuno-deficiency Syndrome
PMTCT	Prevention of Mother To Child Transmission
SD	Standard Deviation
OR	Odds Ratio
IQR	Inter-quartile Range
CI	Confidence Interval
MUAC	Mid Upper Arm Circumference
PEM	Protein Energy Malnutrition
HAZ	Height-for-Age Z-Scores
WAZ	Weight-for-Age Z-Scores

DEFINITION OF TERMS

Exclusive breastfeeding Feeding the infant with only breast milk as the source of nutrition with no other fluid or solids except vitamin/minerals drops, and medicines (WHO, UNICEF & BASICS, 1999)

CTC Community Therapeutic Care: Is a program that serves children less than 12 years of age, pregnant and lactating women. Includes OTP, NRU and SFP

OTP Outpatient Therapeutic Programme- treats severely acute malnourished children without medical complications, with ready-to-use therapeutic food (RUTF) and systematic medications. The children visit the OTP site weekly for check-up and resupply of RUTF.

NRU Nutritional Rehabilitation Unit- provides inpatient care to severely acute malnourished children with complications, until the patients are stabilized and suitable for OTP.

SFP Supplementary Feeding Programme: - provides dry take-home rations to moderately acute malnourished children, pregnant, lactating women and patients discharged from OTP or NRU.

CHAPTER 1

INTRODUCTION

RATIONALE FOR THE STUDY

AIMS OF THE STUDY

SPECIFIC OBJECTIVES

1.1. INTRODUCTION

Malnutrition is the condition that results from taking an unbalanced diet in which certain nutrients are in wrong proportions, either are inadequate or lacking, or are in excess (UNICEF, 1998). It is pointed out that a number of different nutritional disorders may arise, depending on which nutrients are under or overabundant in the diet. Malnutrition is caused by two mutually reinforcing factors which are insufficient nutrient intake and illness which are caused by poverty at the household, community and national levels (Bekere, 1998). FAO and ILSI (1997) suggested that the nutritional requirements of the human body reflect the nutritional intake necessary to maintain optimal body function and to meet the body's daily energy needs. They therefore defined malnutrition as literally, "bad nutrition" or "inadequate nutrition," and further points out that most people interpret it as either under-nutrition which is the falling short of daily nutritional requirements, or over-nutrition, meaning intake in excess of what the body uses. They indicated that under-nutrition is most damaging worldwide as it affects more than one-third of the world's children, and nearly 30% of people of all ages in the developing world. They pointed out that the etiology of malnutrition includes factors such as poor food availability and preparation, recurrent infections, and lack of nutritional education of which UNICEF (1998) suggest each of the factors is impacted by political instability and war, lack of sanitation, poor food distribution, economic downturns, erratic health care provision, and by factors at either community, regional and national level. According to Cohen *et al*. (1994), prejudice against women deprives them of their nutritional needs and care they require during pregnancy and lactation.

According to WHO (1998), Malawi faces higher incidence of poverty in rural areas; the central region of the country (Lilongwe inclusive); among female-headed households; and households whose head has no formal education. WHO further indicated that Malawi faces a number of challenges in its endeavors to eradicate extreme poverty including, inadequate finances to support poverty reduction programmes; high levels of illiteracy; and critical shortage of capacity in institutions implementing development programmes.

In Malawi, malnutrition is thought to be caused by three underlying factors namely: household food insecurity; care for children and women; and inadequate availability of health services (UNICEF, 1998). This study therefore looks at risk factors for malnutrition in children, aged 0 to 5 years, in Lilongwe district.

1.2. RATIONALE FOR THE STUDY

Lilongwe District in Malawi houses the political capital city of the Republic of Malawi, Lilongwe, which is also a booming centre of finance and commerce (Zijlma, 2010). The city started as a small village on the banks of the Lilongwe River and became a British Colonial Administrative Centre at the beginning of the 20th Century. Due to its location on the main north-south route through the country and the road to Northern Rhodesia (now Zambia), Lilongwe became the second largest city in Malawi and in 1975 the capital of the country was formally moved from Zomba to Lilongwe. Lilongwe has grown immensely since 1974 and recently, as part of political restructuring, the parliament has been shifted to Lilongwe and now it is also the political centre of Malawi (Gerke and Viljoen, 2009).

Lilongwe city has about 669,021 people and Lilongwe rural has 1,228,146 and the total population for the whole district is estimated at 1,897,167 (Malawi Population and Housing Census (MPHC) (2008). It is stated that 464,778 are women of child bearing age and 343,531 are under five children. The district comprises both formal and informal settlements with over half of its population in informal settlements and employment (MPHC, 2008). The Malawi Multiple Indicator Cluster Survey (MICS) (2007) indicated that the prevalence of underweight in Lilongwe District was 29%, stunting was 49% and Global Acute Malnutrition was 11%. The National Nutrition Survey done in 2005 found that 90 percent of the children between 0-5 years of age in Malawi were malnourished (National Statistics Office, 2005). According to the MNMS (2001), malnutrition, particularly Vitamin A deficiency in Lilongwe was 68% for the under fives, 38% for school aged children (5 to 10 years old), 38% for men and 57% for women. Vitamin A deficiency has a lot of negative consequences that increase children's risk to morbidity, mortality and night blindness (Scott, Chopra & Sanders, 2002).

According to the Malawi National Nutrition Policy and Strategic Plan (2007-2012), most of the nutritional intervention programmes in Malawi focus on treatment of malnutrition and the interventions that focus on prevention are not properly targeted and as such they do not have significant impact (The Republic of Malawi Department of Nutrition, 2007). These intervention programmes include Outpatient Therapeutic Programme (OTP), Nutritional Rehabilitation Unit (NRU) and Supplementary Feeding Programme (SFP). NRU provides in-patient care to severely acute malnourished children with complications, until the patients are stabilized and suitable for OTP.

The study centered on the NRUs because of easy accessibility of the cases. Lilongwe District has a total of 9 NRUs where malnourished children are admitted and all of them are attached to individual health facilities (MoH, 2010). This is where the assessment was done.

1.3. AIM OF THE STUDY

The main aim of the study was to determine the risk factors for malnutrition among children aged 0-5 years in Lilongwe District, Malawi.

1.3.1. Specific objectives

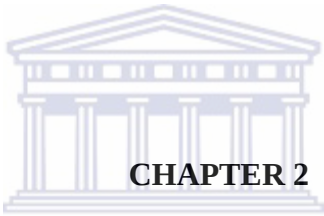
The specific objectives of the study were to determine for children aged 0-5 years, in Lilongwe district, Malawi:

- The anthropometric measurements (birth weight, weight and height and mid-upper arm circumference) of the children
- The weight and height/length of the mothers/caregivers.
- The socio-economic status of the mothers/caregivers of the children
- The household food security, including hunger of the children
- The health status of the children and the mother/caregiver
- The breast feeding practices of the mothers.
- The complementary feeding practices of the mothers/caregivers of the children.

1.4 LAYOUT

The layout of the following chapters is as follows:

- **Literature review:** A wide range of related research work carried out by other researchers before are consulted/studied so as to apply what is known globally about the risk factors for malnutrition (in children aged 0 to 5) to the local context in the present research.
- **Methodology:** the procedure followed and the tools used in data collection including the method of analyzing the data are outlined in this chapter**.**
- **Results:** results of the data analysis are outlined in this chapter.
- **Discussion:** in this chapter, results are discussed and compared with those in relevant studies. This includes information on study limitations and deviation from the methodology if any.
- **Conclusion and recommendation:** In this chapter, the results are contextualized with the health systems practices and recommendations are drawn.



CHAPTER 2

LITERATURE REVIEW

2.1. The Extent of Malnutrition

Malnutrition is indicated as the gravest single threat to the world's public health (WHO, 2002). Malnutrition accounted for 58% of the total mortality in 2006 and 8.3% of people worldwide were malnourished and more than 36 million died of hunger or diseases due to micronutrients deficiencies (Ziegler, 2008). Low birth weight and inter-uterine growth retardation caused 2.2 million child deaths annually, whereas malnutrition contributed 50% to child mortality (WHO, 2002). It is further stated that poor or non-existent breastfeeding caused 1.4 million deaths and deficiencies of vitamin A and zinc accounted for 1 million deaths. WHO (2002) warns of the irreversibility of malnutrition in the first two years of life and that besides exacerbating diseases such as measles, pneumonia and diarrhea, malnutrition actually cause them and can be fatal in its own right.

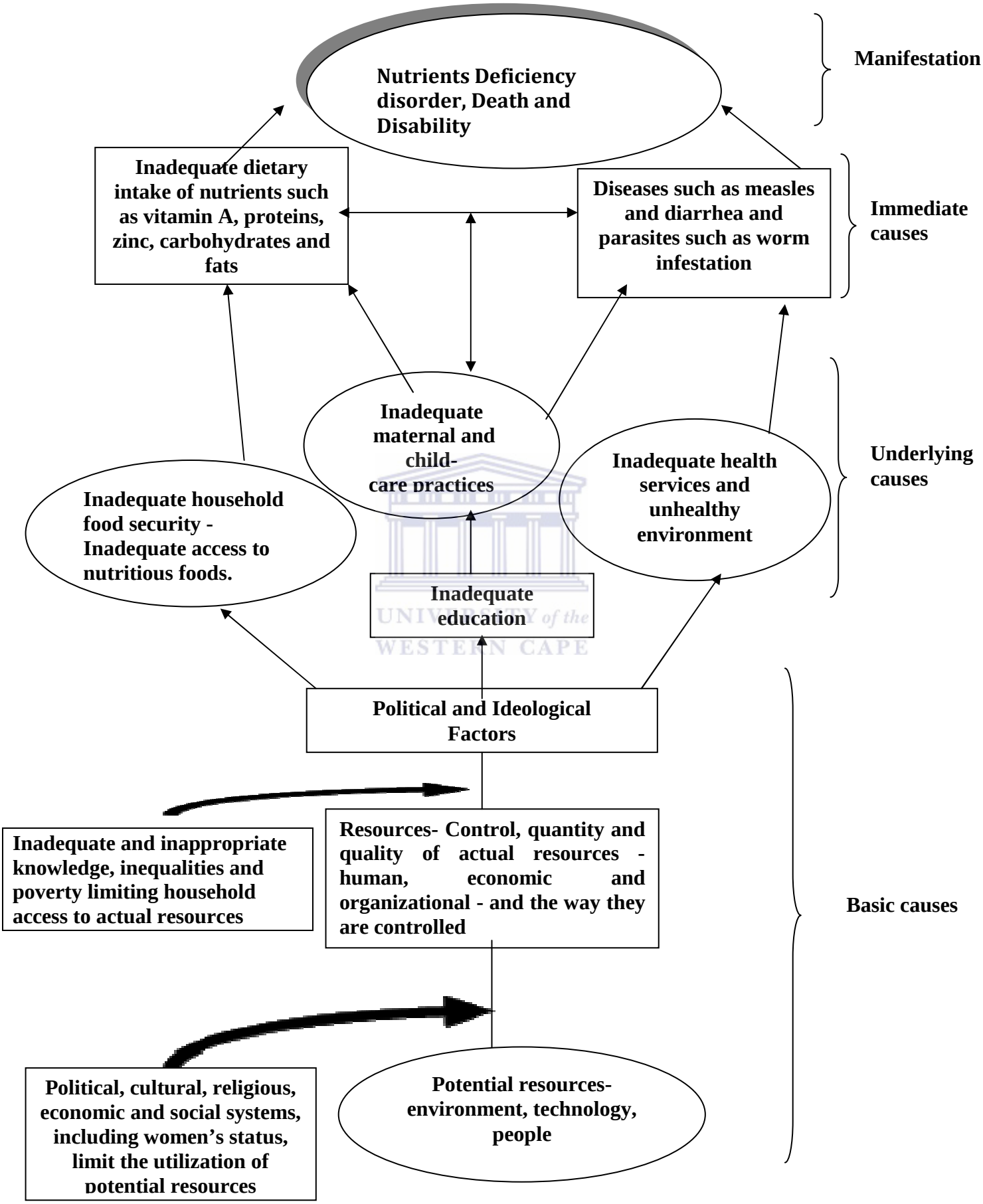
Worldwide, 226 million children are stunted, nearly 67 million are wasted and approximately 183 million children weigh less than what they should for their age. In the sub-Saharan Africa, 33% of the children were underweight, while 40% were stunted. Chronic malnutrition is also a persistent problem as there has been little improvement over a fifteen year period (Shepherd, 2009).

Malawi experienced increased severe under-five malnutrition with above 1,000 monthly NRU admissions, 46,000 severely malnourished children and 92,000 moderately malnourished children who could become severely malnourished if not immediately assisted (UNICEF, 2010). In Malawi, stunting is at 50%, underweight is at 25% and acute wasting at 6% (UNICEF, 2010). Malnutrition perpetuates a generational cycle of poverty, as malnourished girls tend to grow up and bear malnourished children who are likely to be intellectually impaired, with diminished productivity (Bekere, 1998). Malnutrition poses heavy future economic burdens to societies and recent studies suggest that full-term low-birth-weight babies are likely as adults to develop chronic illnesses such as heart disease, diabetes and hypertension (Shepherd, 2009).

2.2. Risk Factors for Malnutrition

Risk has been defined in many ways. Unwin, Carr and Leeson (1988) defined risk as a hazard or a danger of any kind. Fjeld, Eisenberg and Compton (2007) defined risk as a challenging problem of any form or kind. The general definition of risk is therefore: *"the probability that a substance or situation will produce harm under specified conditions"* (Presidential / Congressional Commission on Risk Assessment and Risk Management, 1997:3). In epidemiology, Bonita, Beaglehole and Kjellström (2006), suggested that risk factors are aspects of personal habits or environmental exposures associated with increased probability of occurrence of a disease. Thus, risk factors for malnutrition amongst the children can therefore be aspects of personal habits or environmental exposures that do not seem to be a direct cause of the malnutrition, but associated with an increased probability of occurrence of the malnutrition amongst them. The UNICEF Conceptual Framework of Malnutrition is a nutrition strategy reflecting the multi-sectoral causes and describing the risk factors of malnutrition at three levels namely: immediate, underlying and basic causes (UNICEF, 1990). According to the UNICEF Conceptual Framework of malnutrition in figure 1 below, the immediate causes of malnutrition are inadequate dietary intake of nutrients, diseases and parasites infestation. The underlying causes are inadequate household food security (which may result into inadequate access to nutritious foods); inadequate maternal and child-care practices; inadequate health services; and unhealthy environment. According to the UNICEF Conceptual Framework, the underlying causes are consequences of the basic causes which are inadequate education; political and ideological factors; and resources control which includes quantity and quality of the actual resources (which may also include human, economic, environment, technological and organizational set up and the way the resources are controlled).

FIGURE 1: A CONCEPTUAL FRAMEWORK OF MALNUTRITION



2.2.1. Inadequate Dietary Intake of Nutrients

Shepherd (2009) suggests that inadequate dietary intake of nutrients can be caused by inadequate maternal and child-care practices, diseases and parasites infestation and socioeconomic factors limiting the household food security and consequently the availability of food for consumption for children.

2.2.1.1 Inadequate Maternal and Child-Care Practices

Meal frequency; food quantity per meal; energy and nutrient density; and biological utilization determine dietary intake (UNICEF, 1990). The women's work-load; limited caring time; inadequate childcare knowledge; inadequate education; poor status; and beliefs and practices (such as the belief that consumption of meat and fish is for men only); possibly contributed to poor provision of food, health care, exclusive breastfeeding and adequate complementary and weaning foods to the children. Introducing other foods to children within the first 6 months after birth compromises their intake of nutritious breast milk and may result in malnutrition (Academy for Education Development, 2000). Lack of breastfeeding support in health facilities and mistaken beliefs among health workers and family members may prevent mothers from establishing successful breastfeeding soon after birth (WHO, UNICEF and BASICS, 1999). In a cross-sectional study, Anderson *et al.* (2010) found that poor child care practices for children under 12 months of age was a risk of malnutrition in the Akwapim-North District in the Eastern Region of Ghana. In assessing factors attributing to inadequate maternal and child-care practices, Anoop, Saravanan, Joseph, Cherian and Jacob (2004) found evidence for association between postpartum maternal depression, low maternal intelligence and low birth weight with malnutrition in children aged 6–12 months in South India. In the study, 72 children with malnutrition were identified from a central register and 72 controls were matched for age, gender and residence. Sanghvi, Thankappan, SankaraSarma and Sali (2001) also found that current maternal weight (odds ratio = 8.25, p = 0.0009), current maternal body mass index (OR = 4.55, p = 0.03), infant birth weight (OR = 4.87, p = 0.01) and excessive maternal vomiting in pregnancy (OR = 4.48, p = 0.04) were significant risk factors for malnutrition or underweight status in children under 3 years of age in India. Similarly, Salah, Mahgoub, Nnyepi and Bandeke (2006) established that poor maternal income, poor maternal education and employment or economic engagements that compromise important child care

practices such as breastfeeding were risk factors of malnutrition children under 3 years of age in Botswana. In a cross-sectional study in Luangprabang province of Laos, Phengxay *et al*. (2007) found that male sex of a child, poor feeding practices for sick children and low maternal education were risk factors for malnutrition in children under 5 years of age.

2.2.1.2. Inadequate household food security -Inadequate access to foods

Socioeconomic causes of malnutrition are multi-factorial and they include geographical problems, for example, difficulties in accessing shops and increasing frailty contributing to difficulties in preparing meals (Shepherd, 2009). Poor access to factors of food crops production (such as land and inputs), poverty and deprivation have both a significant bearing on food availability, intake and the development of malnutrition (Shepherd, 2009). Wastage of the harvested food crops results from lack of knowledge in avoiding post-harvest losses which arise due to poor storage and preparation (or cooking) techniques coupled with poor food preservation and processing practices at household level (Scott *et al*., 2000). Dietary intake is determined by meal frequency; amount of food per meal; energy and nutrient density of the food; and biological utilization (UNICEF, 1990). Living and eating alone, for children who live alone, also diminishes food consumption (Shepherd, 2009).

In assessing factors attributing to inadequate household food security and inadequate access to foods, Owor, Tumwine and Kikafunda (2000) found a strong association with lack of breastfeeding, and poverty indicators such as living in a mud walled house, no land and livestock ownership by the caretaker of children aged 0 to 60 months at Mulago Referral and Teaching Hospital in Kampala, Uganda. Anderson *et al.* (2010) established that lack of exclusive breastfeeding during the first 6 months of life and being a child from home without electricity were risk factors of malnutrition in the Akwapim-North District in the Eastern Region of Ghana. Lack of electricity in a home is an indicator of poverty which is an attributing factor to food insecurity (Scott *et al*., 2000). Janevic *et al.* (2010) found that household poverty and stress were risk factors of malnutrition in the under-five children living in Roma settlements in Central and Eastern Europe in Serbia. (According to Holmes and Rahe (1967) stress is a condition or feeling experienced when a person perceives that demands exceed the personal and social resources the individual is able to mobilize.

One may feel stressed when he/she feels that things are out of control and may reduce food intake). Victora, Vaughan, Kirkwood, Martines, and Barcelos (1986*)* established that household food availability was compromised by factors such as family income, father's education level, mother's education level, employment status of the head of the family, number of siblings, parental birth place and family's ethnic background. They therefore concluded in the study that the factors were risk factors of malnutrition in children aged 12 to 35.9 months in urban and rural areas of southern Brazil.

2.2.1.3. Diseases and parasites

Diseases and parasites infestation may result from inadequate health services and health environment and they may directly deplete nutrient meant for the body or cause loss of appetite which reduce intake of foods (Shepherd, 2009). Scott *et al*., (2000) points out that fever, diseases such as measles and parasites such as intestinal worms increase the metabolic requirement for nutrients thus causing a deficiency if the requirement is not met.

2.2.1.4. Inadequate Health Services and Health Environment

Inadequate antenatal, family planning and immunization services due to lack of transport and time to go to the clinic may cause increased pregnancy complications, early and repeated pregnancies and infectious diseases for women and children respectively (Scott *et al*., 2000). Owor, Tumwine and Kikafunda (2000) found that failure to complete immunization is a risk factor of malnutrition in children aged 0 to 60 months at Mulago Referral and Teaching Hospital in Kampala, Uganda. Scott *et al*. (2000) holds the view that environments characterized by poor housing and working conditions; overcrowding; inadequate ventilation; poor water and sanitary facilities, compounded by inadequate micronutrients supplementation programmes, are most common in rural communities. According to MPHC (2008), 64.7% of the total population for Lilongwe District (1,228,146) is the rural poor communities. Victora *et al*. (1986*)* reported that degree of crowding, type of housing, type of sewage disposal and poor access to piped or treated water were risk factors of malnutrition among children aged 12-35.9 months in urban and rural areas of southern Brazil. Jeyaseelan and Lakshman (1997) investigated the impact of hygiene, housing and socio-demographic variables on acute malnutrition in children

aged 5 years living in urban and rural areas in India. They reported that older age, male sex, mother's poor education, lower family income, higher birth order of the child, use of dung or fire wood as fuel and defecation within the premises were significantly associated with malnutrition. Ferrari, Solymos, Castillo and Sigulem (1998) investigated health and nutritional conditions among children less than 72 months of age in a shantytown in the city of São Paulo. Among others they found that birth-weight, presence of upper respiratory tract infections, number of pregnancies, number of births, home building material, maternal age at the time of birth, the number of pre-natal medical visits, maternal height, father's employment and being unregistered were risk factors for malnutrition.

Kikafunda, Walker, Collett and Tumwine (1998) found that rural living, poor health, the use of unprotected water supplies, lack of charcoal as fuel, age of the child, prolonged breastfeeding (from >18 months to <24 months), lack of milk consumption, low socioeconomic status of the family, poor education of the mother of infants <12 months, consumption of food of low energy density (<350 kcal/100 g dry matter), presence of eye pathology, low intake of energy from fat, older mothers and consumption of small meals were also found be risk factors for marasmus and underweight in children <30 months of age in a central Ugandan community. Rayhan and Khan (2006) analyzed Bangladesh Demographic and Health Survey 1999-2000 (BDHS 1999-2000) data and found that previous frequent birth interval, small size at birth, low mother’s body mass index at birth and low parent’s education attributed to inadequate health environment to under-five children in Bangladesh and were risk factors of malnutrition.

2.2.2. Diseases and parasites infestation

Shepherd (2009) pointed out that disease-related malnutrition arises due to adverse effects on appetite of which Stratton (2003) suggest may include nausea, vomiting and pain which may alter or increase nutritional requirements. Many rural communities are also subject to erratic vaccination campaigns against diseases such as measles. Infectious diseases will deplete vitamin A stores and poor control of parasites such as intestinal worms will increase the metabolic requirement for nutrients thus causing a deficiency if the dietary requirement is not met (Scott *et al*., 2000). Children in such situations risk various infections and nutrient deficiencies.

According to Dunne (2008), alterations in taste and smell contribute to loss of appetite in the infected and children who are taking medications may experience nausea as side-effects and Shepherd (2009) suggest these accounts for malnutrition due to reduce food intake. This researcher also pointed out that increased loss of nutrients or impaired digestion and absorption are symptoms of gastrointestinal disease, are causes of malnutrition. Measles, respiratory and gastrointestinal disorders increases Vitamin A requirements resulting in deficiency if the requirement is not met (Scott *et al*, 2000). Besides, measles, diarrhea, roundworms and hookworms infestations cause loss of appetite, loss and reduction in nutrients and micronutrients intake and absorption resulting into inadequate levels which enhance diseases severity (Shepherd, 2009). Surprisingly, in a study conducted by Mamoun, Homedia, Mabyou, Muntasir, Salah and Adam (2005) in Mayoo displacement camp in Khartoum, Sudan it was found that age, sex, lack of immunization, lack of breastfeeding, history of fever and history of diarrhea were not risk factors for malnutrition in the camp children.

2.3 Summary of the Literature Review

The literature suggest that some of the risk factors of malnutrition in children which researchers established are: Low current maternal weight, Low current maternal body mass index, excessive maternal vomiting in pregnancy, poverty, lack of breastfeeding, failure to complete immunization, poor nutrition knowledge for mother, poor feeding practices for sick children, low birth-weight, presence of upper respiratory tract infections, bigger number of pregnancies, bigger number of births, poor parental birthplace, maternal age at the time of birth of above 45, number of pre-natal medical visits, short stature mothers, father unemployed, being unregistered, previous frequent birth interval, parent's poor education, male sex, higher birth order of the child, use of dung or fire wood as fuel , defecation within the premises, head of the family unemployed, high number of siblings, poor type of housing, over- crowding, poor type of sewage disposal, poor access to piped or treated water, rural living, poor health, lack of milk consumption, lack of personal hygiene, order age of the child above 2 years, prolonged breastfeeding (from >18 months to <24 months), consumption of food of low energy density (<350 kcal/100 g dry matter), consumption of small meals, lack of meat consumption, low intake of energy from fat, postpartum maternal depressing, family ethnic background, home

poor building materials, lack of charcoal as fuel, low socioeconomic status of the family, presence of eye pathology, young age of the care taker, no ownership of livestock, gender, marital status, family income, poor breast feeding practices and poor exclusive breast feeding practices.

CHAPTER 3

METHODOLOGY

3.1. Study Design

A case-control research design was used to determine the risk factors for malnutrition in the present study. According to Bonita *et al*. (2006), there are three research designs that can be used for the study of risk factors. These are cohort, cross-sectional analytic and case-control studies. A case-control provides a relatively simple way to investigate causes of diseases or risk factors (Bonita *et al*., 2006). It is suggested that selection of cases and controls should be based on the disease or other outcome variable which in the present study is under-nutrition in the children based on weight for age z-score. According to Bonita *et al*. (2006), data on disease occurrence and exposures are determined at one point in time.

3.2 Study Population

There are nine NRUs in Lilongwe District and the study population for the cases was all underweight-for-age children aged 0 to 5 years admitted over a two month period (1st December 2011 to 24th January 2012) to the nine NRU programmes. The study population for the controls comprised all children aged 0 to 5 years routinely attending under-five growth monitoring and immunization sessions at the same health facility as the NRUs.

3.3 Study Sample

Of the nine NRUs, five were randomly selected for the study by giving them numbers and the numbers were written on pieces of paper which were placed in a basket. Five members of staff from the Department of Nutrition were then asked to pick one piece of paper each from the basket. Therefore the NRUs chosen were Likuni, Kamuzu Central Hospital, Mitundu, Nkhoma and Kabudula. The study sample cases comprised a random sample of 50 underweight-for-age children (25 boys and 25 girls), aged 0-5 years, selected from the five randomly selected NRUs and 10 children were randomly selected in every NRU (5 boys and 5 girls). The controls comprised a random sample of 50 children (25 boys and 25 girls), aged 0-5 years, who were routinely attending under-five growth monitoring and immunization sessions at the same health facilities during the same period as the cases and 10 children were randomly selected in every under-five clinic (5 boys and 5 girls). The cases and controls, paired for gender and not paired for age, and of age 0 to 5 years were randomly sampled using the NRU admission and under-five Clinic attendance

registers for that period. The total number of children from the list (N) was divided by the sample size (n) to obtain a sampling interval (N/n) and every n^{th} child was selected for the study from the selected site for that time period.

3.4. Data Collection

3.4.1. Questionnaire

A structured questionnaire was developed in English and was translated in the local language (Chichewa) (See appendix E). The questionnaire contained questions on the children's and guardians' socio-economic and socio-demographic status, household food security variables including hunger of the children, health status variables and breastfeeding and complementary feeding practices. The questionnaire also contained questions which required the investigators to review child health passport and capture or verify information on issues such as HIV status, date of birth, birth weight and vaccination.

3.4.1.1 Piloting of questionnaire

The questionnaire was piloted amongst 6 women and care givers at Queen Elizabeth Central Hospital NRU in Blantyre after which adjustments were made before implementing the study.

3.4.1.2 Training of Fieldworkers

The field workers with a health background were recruited. The investigator and supervisor trained and standardized them in completing the questionnaire in all items including record review. Training for data collection included a comprehensive orientation, research objectives discussion, implementation plan and standardized questionnaire administering. The field workers were trained to asses stress using the Holmes and Rahe (1967) stress scale. In keeping with Holmes and Rahe (1967) stress scale of 1 to 7 was used whereby a score of 1 meant lowest stress and 7 meant overstress. The field workers were oriented to the causes of stress and on how to explain the scale to the respondents in the study who would in turn rate themselves.

3.4.1.3 Data Collection

Interviews were conducted in arranged secluded areas away from the other guardians or health workers and took 20 to 30 minutes. A sample of interviews were

duplicate recorded by the investigator who would sit in on the interviews to ensure data quality. HIV testing is mandatory in the antenatal clinic and recorded on the woman's antenatal card and Prevention of Mother to Child Transmission of HIV (PMTCT) register as part of the PMTCT programme in Malawi (MoH, 2010). HIV test results were therefore copied from the PMTCT register to the questionnaire. The questionnaires were checked on site after the interview. The areas that were covered in the questionnaire included age of the child; the anthropometric measurements (birth weight, weight and height and mid-upper-arm circumference) of the children; the weight and height/length of the guardians; the socio-economic status of the guardians of the children; the household food security, including hunger of the children; the health status of the children; the breast feeding and the complementary feeding practices of the guardians of the children.

3.4.1.4 Management of Questionnaire Data

The data was captured in a database (Access 2000 file format) and analyzed using EpiInfo 2002 software (Centers for Disease Control (CDC) and Prevention, Atlanta, GA, USA EpiInfo, 2002). Data cleaning and sample duplicate data entry was used to ensure data quality.

3.4.2. Anthropometric Measurements

The weight, height/length and mid-upper-arm- circumference (MUAC) of the child were determined and the weight and height of the mother/caregiver.

3.4.2.1 Height/Length Measurement

For children less than 24 months old, recumbent length was measured to the nearest 0.1 cm, using a field appropriate shorr board. Shorr stadiometer was used to measure standing height to the nearest 0.l cm for children greater than or equal to 24 months and for the mothers/guardians. All research participants were measured without shoes.

3.4.2.2 Weight

Weight for mothers/care givers and children who were able to stand was determined to the nearest 0.05 kg using a Masskot UC 300 portable electronic scale (capacity 136 kg x 50 g). Infants were weighed to the nearest 0.05 kg on Salter weighing

scales. All the research participants were weighed in light clothing, without shoes. The children were weighed with dry nappies and the average of two readings was taken. Test of calibration of Salter scales was performed daily to ensure validity. The Salter scale was standardized after measuring every 10 children. Salter weighing scales were calibrated before and after each session.

3.4.2.3 Mid–upper- arm- circumference (MUAC)

MUAC was measured using a tape measure and was measured on the left arm and recorded to the nearest tenth of a centimeter (cm).

3.4.2.4 Training of Fieldworkers for Anthropometric measurements

The fieldworkers were trained and standardized on the use of the equipment and recording of the measurements.

3.4.2.5 Management of anthropometric data

The anthropometric measurements for the children (weight and height) and their date of birth and date of anthropometric data collection were captured onto the WHO Anthro 2007 software where they were converted to two indexes: height-for-age and weight-for-age. These indexes were then converted into standard deviation (SD) scores (Z-scores) relative to the international reference population to standardize the distribution (NCHS, 1978). The anthropometric indicators, z-scores for height- for -age (HAZ) and weight-for-age (WAZ)) were therefore realised. According to WHO (1995) z-score or standard deviation (SD) scores is the default classification system used to present child nutritional status and is capable to describe nutritional status including at the extreme ends of the distribution and allow derivation of summary statistics such as means and SDs of z-scores.

3.4.2.5.1 Height-for-Age Z-Scores (HAZ)

In accordance with WHO recommendations (WHO Anthropometric Manual, 2010), the calculated HAZ was considered plausible when it fell within Z-score -4 and Z-score +5 and any Z-score beyond these limits were considered implausible (extreme or potentially incorrect z-score values). Children with a Z-score below -2, were classified as stunted those with z-scores above -2 and below +2 were classified as

normal height for their age; whilst those above +2 were considered to be tall (WHO Anthropometric Manual, 2010).

3.4.2.5.2 Weight-for-Age Z-Scores (WAZ)

In accordance with WHO recommendation (WHO Anthropometric Manual, 2010), the calculated WAZ was considered plausible when it fell within Z- score -4 and Z-score +5 and any Z-score beyond these limits were considered implausible. Children who fell below Z- score -2 were considered to be underweight for age, thus acute malnutrition; those with z-scores between -2 and +2 were considered to have a normal weight for their age; whilst those with Z- score above +2 were considered to be overweight (WHO Anthropometric Manual, 2010).

3.4.2.5.3 Mid-upper- arm- circumference (MUAC)

MUAC measurement of less than 11.0 cm was classified as Severe Acute Malnutrition (SAM); MUAC measurement of 11.0 cm to 12.5 cm was classified as Moderate Acute Malnutrition (MAM); MUAC measurement of ≥12.5 cm to <13.5 cm was classified as child at risk of malnutrition; and that of ≥ 13.5 cm was classified as properly nourished child (WHO Anthropometric Manual, 2010).

3.4.2.5.4 Body Mass Index (BMI)

BMI for the guardians was calculated by dividing their weight in kg by height in meters squared. The BMI was categorised as underweight when it was <18.5 kg/m^2, normal weight when it was 18.5 to < 24.95 kg/m^2, overweight when it was 25 to 29.95 kg/m^2 and obese when it was ≥ 30 kg/m^2 (WHO, 1998).

3.4.2.5.4 Statistical analysis of data

Statistical analysis was carried out in consultation with a statistician from University of Malawi. The data was analyzed using the statistical software package EpiInfo 2002. The analyses performed were: frequency distribution of all variables. Frequencies were tallied for categorical variables; chi-square test for the association of malnutrition with various variables; and univariate analysis with the odds ratio test to measure the power of association of those variables considered risk factors for malnutrition. A p-value of < 0.05 was considered significant. The calculated anthropometric indicators were also analysed using the EpiInfo 2002 software

package. A statistician double checked the analysis and advised no further advanced statistical procedures in view of the limited number of participants.

3.4.2.5.5 Change in Sample Size of the Controls

When the anthropometric measurements of the children were assessed, it was found that some of the controls were also malnourished. For instance some had low MUAC measurements and others had a low percentage for weight for age and height for age measurements. Consequently weight-for-age was used as the main nutritional status outcome variable to exclude the malnourished children in the control sample for the purpose of the study. Weight for age was used for the exclusion because it is the indicator commonly used in screening and determining the nutrition status of under-five children for admissions to all CTC programs in Malawi. Therefore in line with the study design and the inclusion into the control group, 12% (6% males and 6% females) of the malnourished controls according to their weight for age were withdrawn from the analysis to avoid confounding but were analyzed separately to compare the results with those of the cases. The actual study sample therefore comprised of 50 underweight-for-age children (25 boys and 25 girls) as cases and 44 normal weight-for-age children (22 boys and 22 girls) as controls.

3.5. RELIABILITY AND DATA VALIDITY

Reliability was enhanced by the piloting of the questionnaire and by training and standardization of the research assistant in the completion of the questionnaire and doing the anthropometric measurements. Questionnaires and recorded measurements were checked after completion and 98% agreement was seen. Data cleaning and sample duplicate data entering also enhanced the reliability and validity of the data.

3.6. ETHICAL CONSIDERATIONS

Approval was obtained from the Senate Higher Degrees Committee and Research and Ethical committee of the University of the Western Cape (Ethics registration number: 11/9/21), the Ethical committee of University of Malawi (College of Medicine) and National Health Sciences Research Committee before commencing the study. The purpose and process of the study was explained to all study participants (See Appendix A: Information sheet). Signed informed consent was obtained from all participating guardians before the start of data collection (See

Appendix B: Informed consent). In the consent the respondents were informed of the study details and their willingness to participate was asked for. All participants were assured of their right to participate, anonymity, confidentiality and the freedom to decline or indeed to withdraw from the study at any time they felt uncomfortable without any discrimination against them or withholding of services rendered to them. Mothers/guardians with concerns about themselves or their children were referred for medical attention or to social services.

CHAPTER 4

RESULTS

4.1 Age of the Children

The mean age and standard deviation (SD) for the cases was 28 and19 months (2.34(1.55) years) whilst for the controls was 20 and 15 months (1.70(1.28) years). The mean age and standard deviation for the cases was higher than that of the controls. Forty-eight percent and 63.6% of the cases and controls were below 24 months (2 years) old respectively and age was statistically significant p<0.04. Table 1 below shows the ages (in months) of the cases and controls desegregated by gender.

TABLE 1. AGE OF THE CASES AND CONTROLS

Sample Number	Males (age in months)		Females (age in months)	
	Cases	Controls	Cases	Controls
1	16	14	14	19
2	21	42	9	56
3	16	18	5	11
4	26	11	50	6
5	14	26	46	42
6	22	15	41	13
7	12	14	13	45
8	38	12	23	3
9	14	20	23	3
10	14	28	16	16
11	32	14	44	32
12	50	12	24	12
13	36	4	24	7
14	50	25	12	13
15	21	47	13	4
16	27	7	13	22
17	39	7	26	19
18	58	51	25	5
19	29	28	23	14
20	25	38	30	28
21	20	6	59	36
22	43	6	30	18
23	16	22	15	60
24	22	26	53	31
25	14	10	60	13
Mean	**27**	**20**	**28**	**21**

4.2 Anthropometric Status of the children and the guardians

Table 2 shows the anthropometric status of the cases and the controls and the BMI of the guardians. The anthropometric measurements differences between the cases and controls are also shown. .

Table 2: Anthropometric measurements results for the cases and controls and the BMI of the guardians.

Anthropometric Measurement	**Cases (n = 50)**		**Controls (n =44)***		**Total (n=94)**		**p-value****
Birth weight	No	%	No	%	No	%	
<2500 g (low birth weight)	14	28	5	11.4	19	20.2	p < 0.05**
>2500 g	36	72	39	88.6	75	79.8	
Weight-for-age Z-scores							
Z-score < -2 (underweight)	31	63.3	0	0	31	33.4	
Z-score -2 to 2 (normal weight)	18	36.7	42	95.4	60	64.5	p < 0.0001**
Z-score >2 (over weight)	0	0	2	4.5	2	2.2	
Height/length for age Z-scores							
Z-score < -2 (stunted)	33	67.3	12	27.3	45	48.4	
Z-score -2 to 2 (normal)	15	30.6	28	63.6	43	46.4	p < 0.0001**
Z-score >2 (tall)	1	2.0	4	9.1	5	5.5	
MUAC							
MUAC <11.0 cm (Severe Acute Malnutrition)	11	22	1	2.3	12	12.8	
MUAC 11.0 cm to 12.5 cm (Moderate Acute Malnutrition	24	48	8	18.2	32	34	p < 0.0001**
MUAC ≥12.5 cm to <13.5 cm (child at risk of malnutrition)	8	16	5	11.4	13	13.8	
MUAC ≥ 13.5 cm (Well nourished).	7	14	30	68.8	37	39.4	
BMI of the guardians							
BMI<18.5 (underweight)	11	22	2	4.5	13	13.8	
BMI 18.5 - <25 (normal weight)	17	34	24	54.5	41	43.6	p < 0.04**
BMI 25 - < 30 (overweight)	8	16	9	20.5	17	18.1	
BMI ≥ 30 (obese)	14	28	9	20.5	23	24.5	

*** See page 18 paragraph 3.4.2.5.5 for the explanation for this sample size.**

**** P-value is the level of significance**

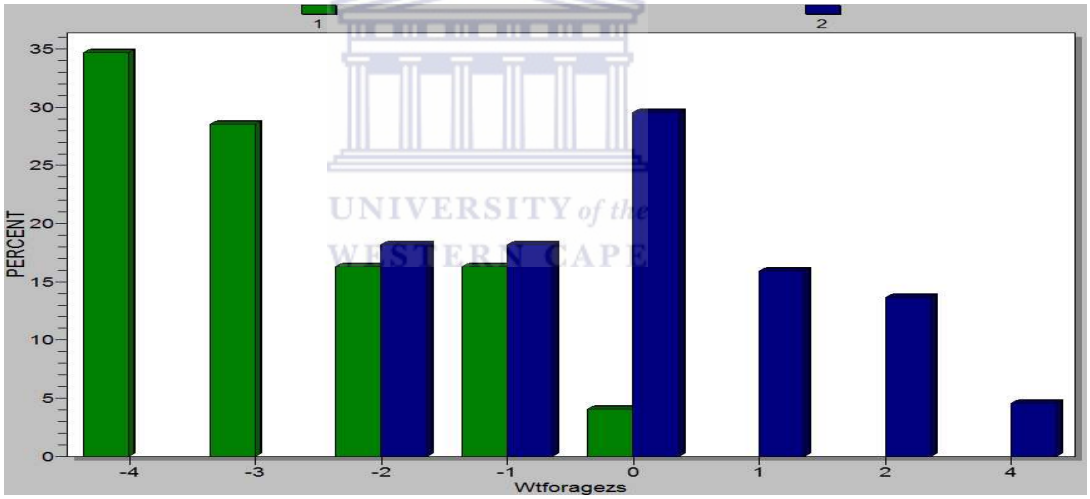
4.2.1 Birth Weight

The results from table 2 show a statistically significant association (p<0.05) between the birth weight of the children and their being a case or a control. Twenty-eight percent of the cases were born with birth weight less than 2.5 kg as compared to

11.4% of the controls. Thus significantly more cases were low birth-weight babies than the controls.

4.2.2 Weight- for- Age

The results from table 2 show that 63.3% of the cases and none of the controls weighed less than the recommended weight for their age. Thirty-six percent of the cases and 95.4% of the controls weighed normally and 4.5% of the controls were overweight. Thirty four percent of the weight-for-age Z-score were below -3 and 5% were above +3 reflecting extreme nutritional status which according to WHO Anthropometric Manual (2010) is plausible as the z-score values were not beyond any of the corresponding lower (-4) and upper (+5) boundaries limits which could be considered implausible. Figure 1 below graphically demonstrates the Weight-for-age Z-score graph.



1= cases and 2 = controls

Figure 2: **Weight- for- Age Z-Scores Graph**

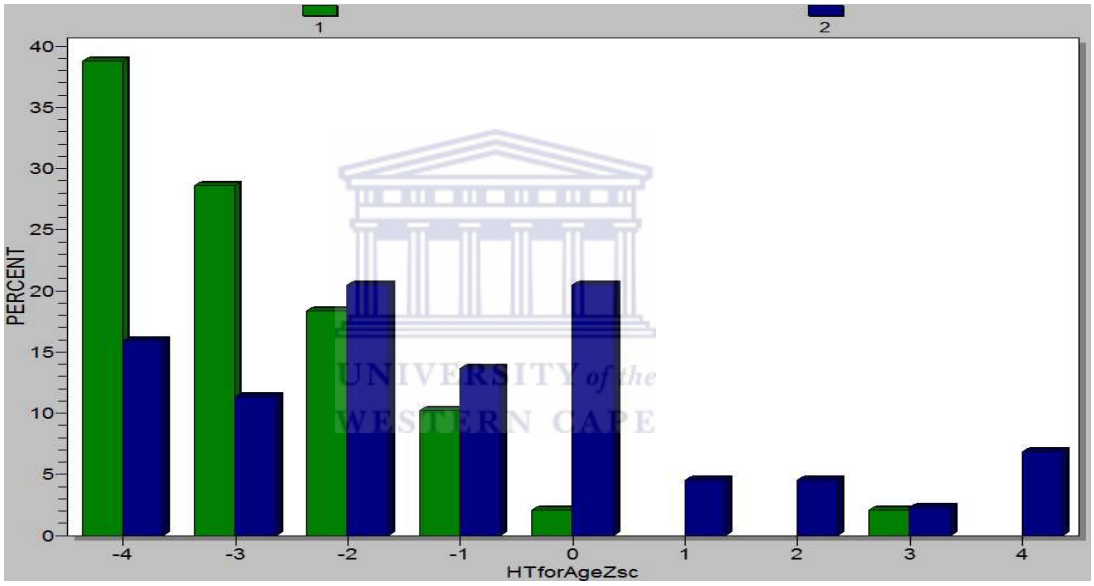
According to the results from figure 2 above the cases weight-for-age Z- scores ranges from 0 to -4 and the controls ranges from -2 to 4. It is shown that more controls than cases had normal weight-for-age Z-scores (between -2 and 2) whilst more cases than controls had low weight-for-age Z-scores (below -2). None of the controls were below -2 Z-Score since such were excluded from the study to avoid

confounding (See page 19 paragraphs 3.4.2.5.5). Thirty-six percent of the cases were above -2 Z-Score suggesting that they were recovering after treatment at the NRUs.

4.2.3 Height-/ Length- for- Age

The results from table 2 show that 67.3% of the cases were stunted in comparison to 27.3% of the controls. Although 39% of the height/length–for-age z-score were below -3 and 5% were above +3, they were not beyond boundary limits to be considered implausible.

Figure 3 below graphically demonstrates the Height/Length-for-age Z-score graphs for the cases and controls.



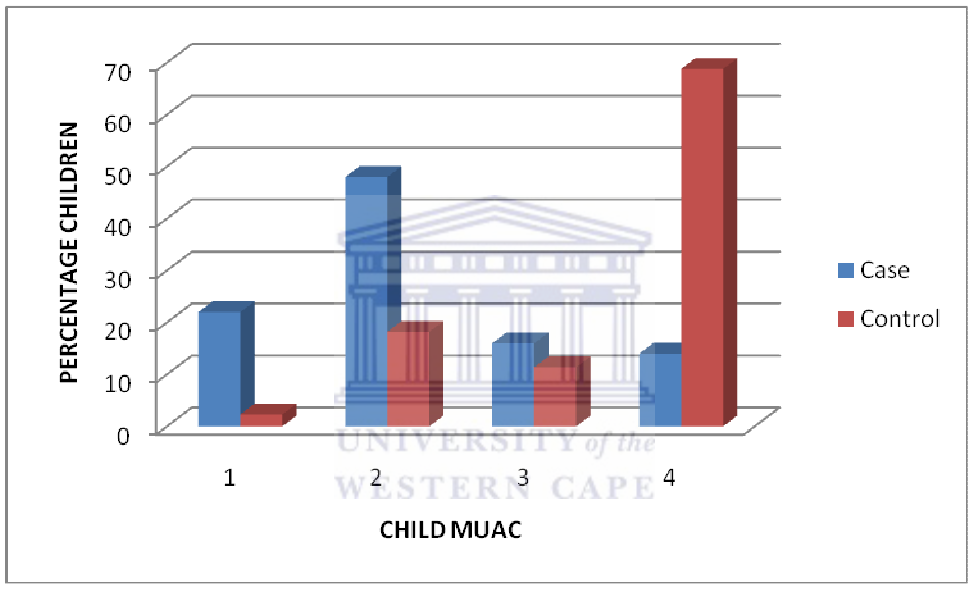
1 = cases and 2 = controls

Figure 3: Height/Length - for- Age Z-Scores Graph

The results from figure 3 show that more cases than controls were below -2 Z-Score suggesting that more cases than controls were stunted. Fewer cases than controls were above -2 Z-Score. Most of the controls were above -2 Z-Score and below +2 Z-Score suggesting that they had normal height for their age.

4.2.4 MUAC

According to the MUAC results from table 2 above, 22% of the cases had severe acute malnutrition and almost half of them (48%) had moderate acute malnutrition with 16% in the at risk category. The results further show that 68.8% of the controls were well nourished but 11.4% were found to be at risk, 18.2% were found with moderately acute malnutrition and 2.3% with severe malnutrition. It is shown that 20.5% of the controls were malnourished and 14% of the cases were well nourished. Figure 4 is a graphic demonstration of the percentage of cases and controls against MUAC measurement.



1 =MUAC <11.0 cm (Severe Acute Malnutrition (SAM)); 2 = MUAC 11.0 cm to 12.5 cm (Moderate Acute Malnutrition (MAM); 3= MUAC ≥12.5 CM to <13.5 cm (child at risk of malnutrition) and 4= MUAC ≥ 13.5 cm (Well nourished).

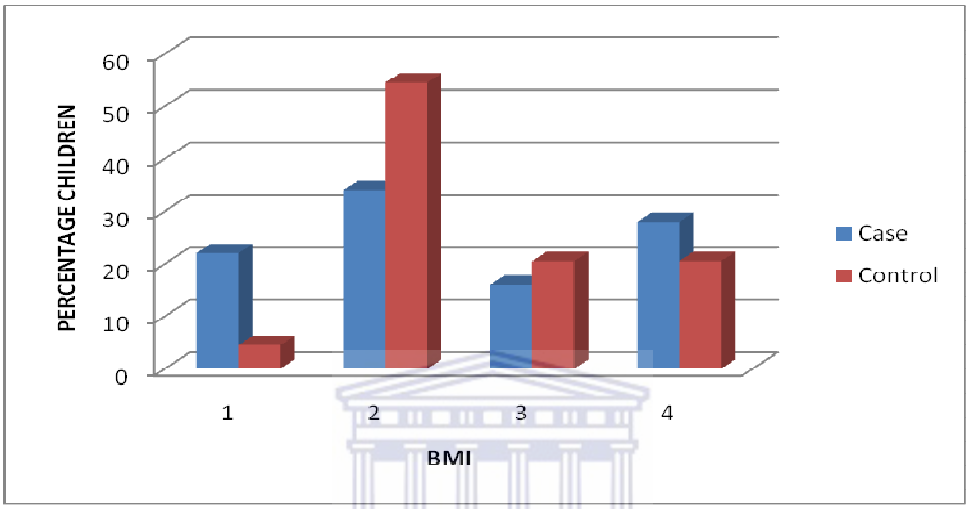
Figure 4 Child MUAC Measurements versus Nutrition Status of the Child

The results of MUAC in figure 4 above show that most of the cases had moderate acute malnutrition with a few in the at-risk and some of them recovered. The results further show that most of the controls were properly nourished.

4.2.5 BMI

The weights and heights of the mothers or care givers were measured and their BMI were determined. According to the results in table 2 it was established that there was a statistically significant association ($p < 0.04$) between the BMI of the guardians to

the cases and the guardians to the controls. It is shown that 22% of the guardians for the case were underweight in comparison to 4.5% of the guardians for the controls. The results further show that 44% of the guardians for the cases were either overweight or obese in comparison to 41% of the guardians for the controls. Figure 5 is a graphic illustration of the BMI of the guardians against the cases and the controls.



1= BMI <18.5 (underweight); 2= BMI 18.5 - <25 (normal weight); 3= BMI 25 - < 30 (overweight); 4= BMI ≥ 30 (obese).

Figure 5: BMI of the guardians Versus Nutrition Status of the Children

The results of BMI in figure 5 above show that more guardians for the controls had normal weight than of the cases whilst more guardians to the cases were underweight than of the controls. The results further show that almost equal numbers of guardians for both the cases and controls were overweight or obese.

4.3 The Socio-Economic Status of the Guardians of the Children

The socio-economic characteristics of the guardians are shown in Table 3A and 3B. The socio-economic characteristics included the relationship between the child and the guardian; employment status; household income; literacy level of the guardian; source of drinking water; ethnic tribe; guardian stress score, ability to clean their surrounding and the type of house the cases and the controls lived in. The level of significance for the difference between the cases and controls are also indicated.

Table 3A: Socio-economic Characteristics of the guardians.

Variable	Cases (n = 50)		Control (n=44)**		Total (n=94)		p-value***
Ethnic Tribe	**No**	**%**	**No**	**%**	**No**	**%**	
Chewa	30	60	23	52.3	53	56.4	p < 0.37
Tumbuka,Lomwe, Tonga, Yao, Sena, Nkhonde, Ngoni	20	40	21	47.8	41	43.6	
Relationship between the child and the guardian							
Parent	48	96	43	97.7	91	96.8	
Relative to the parents	2	4	0	0	2	2.1	p < 0.20
Neighbour	0	0	1	2.3	1	1.1	
Completed level of education							
None, Some primary and Primary completed. –(low literacy level)	42	84	22	50	64	68.1	p < 0.0001***
Some secondary, Secondary completed and Tertiary-(higher literacy level)	8	16	22	50	30	31.9	
Father's availability							
Father present	38	76	36	81.8	74	78.7	p < 0.7037
Father not present	12	24	8	18.2	20	21.3	
Employment status							
*guardian employed)	13	26	11	25.6	24	25.8	p < 0.96
*Household Head employed	14	28	29	59.1	40	42.6	p < 0.002***
***Number of Pregnancies**							
One to three times	33	66	35	79.5	68	72.3	p < 0.01***
Four to ten times	17	34	9	20.5	26	27.7	
Marital Status of the Guardian							
Married	33	66	31	72.1	64	68.8	p < 0.03***
Widowed	9	18	6	14	15	16.1	
Single -Never Married	2	4	5	11.6	7	7.5	
Co-habiting	5	10	1	2.3	6	6.5	
Divorced/Separated	1	2	0	0	1	1.1	
Father Support							
Father supports the baby	31	62	38	86.4	69	73.4	p < 0.009***
Father doesn't support the baby	11	22	4	9.1	15	16	
Father sometimes supports baby	8	16	2	4.5	10	10.6	

***The variable had 1% missing data**

**** See page 18 paragraph 3.4.2.5.5 for the explanation for this sample size.**

***** P-value is the level of significance**

Table 3B. Other socio-economic characteristics regarding the mother/guardian

Variable	Cases (n = 50)		Control (n=44)**		Total (n=94)		p-value***
Type of Area Lived							
In a rural area (not a farm).	31	62	12	27.3	43	45.7	p < 0.01***
In a township -Informal settlement	13	26	19	43.2	32	34	
On a farm	2	4	2	4.5	4	4.3	
In a city/ town	4	8	6	13.6	10	10.6	
In a township- formal settlement	0	0	5	11.4	5	5.3	
Guardian Stress Score							
One	16	32	29	65.9	45	47.9	
Two	4	8	6	18.2	12	12.8	
Three	3	6	2	4.5	5	5.3	
Four	6	12	2	4.5	8	8.5	p < 0.0001***
Five	4	8	1	2.3	5	5.3	
Six	5	10	0	0	5	5.3	
Seven	12	24	2	4.5	14	14.9	
Type of House Lived							
Brick and Iron sheets	22	44	27	61.4	49	52.1	
Grass thatched	25	50	13	29.5	38	40.4	p < 0.02***
Brick house	2	4	4	9.1	6	6.4	
A shack in the squatter area	1	2	0	0	1	1.1	
Source of drinking water							
Own tap, Communal tap, Water from borehole- (safe)	35	70	41	93.2	76	80.8	p < 0.0004***
Water from stream/river/dam and from open well – (unsafe)	15	30	3	6.8	18	19.2	
***Household income**							
None	31	62	28	65.1	59	63.4	
MK4,000.00 or less	6	12	2	4.7	8	8.6	
MK6,000.00- MK10,000.00	5	10	3	7	8	8.6	
MK12,000.00- MK14,000.00	1	2	3	7	4	4.3	p < 0.93
MK16,000.00-MK20,000.00	0	0	1	2.3	1	1.1	
>MK20,000.00	0	0	3	7	3	3.2	
Don't know	7	14	3	7	10	10.8	
First babies							
Those who were first babies	11	22	18	40.9	29	30.9	P<0.03***
Those who were not	39	78	26	59.1	65	69.1	
Other Socio-Factors							
*Having knowledge of cleaning the surrounding	42	84	43	97.7	85	90.4	p < 0.02***
*Having cleaning materials	30	60	35	79.5	6 5	69.1	p < 0.04***

The results from table 3A above show that of the total (94) mothers/caregivers interviewed, 56.4% were from the Chewa tribe. This may possibly be because Lilongwe district's main tribe is Chewa and that the other tribes do come in search for jobs in the tobacco estates and in companies in the city. It is shown that there was no statistically significant association between the type of relationship of the guardian and the children and their nutritional status ($p = 0.23$). It was established that 96% of the guardians to the cases were their parents (mothers) and 84% of them were primary school dropouts. The results show that 97.7% of the guardians to the controls were their mothers but only 50% were primary school dropouts and 50% reached secondary and tertiary education. According to the results 76% of the household heads for the cases are fathers and 72% of the fathers were not employed as compared to the controls where 81.8% of the household heads were fathers and 40.9% of them were not employed. It is shown that 28% of the household heads for the cases are employed as compared to 59.1% for the controls.

4.3.1 The Number of Pregnancies

According to the results from table 3B, the number of pregnancies of the mothers to the children (cases and controls) was found to be significantly associated with the nutritional status of the children (p-value < 0.01). It is shown in the table that more mothers for the cases were characterized by having given birth for 4 times or more before than those of the controls. For instance 34% of the mothers for the cases had given birth four to ten times before as compared to 20.5% of the mothers to the controls. Figure 6 below graphically demonstrates the distribution of number of pregnancies for the mothers of both the cases and the controls.

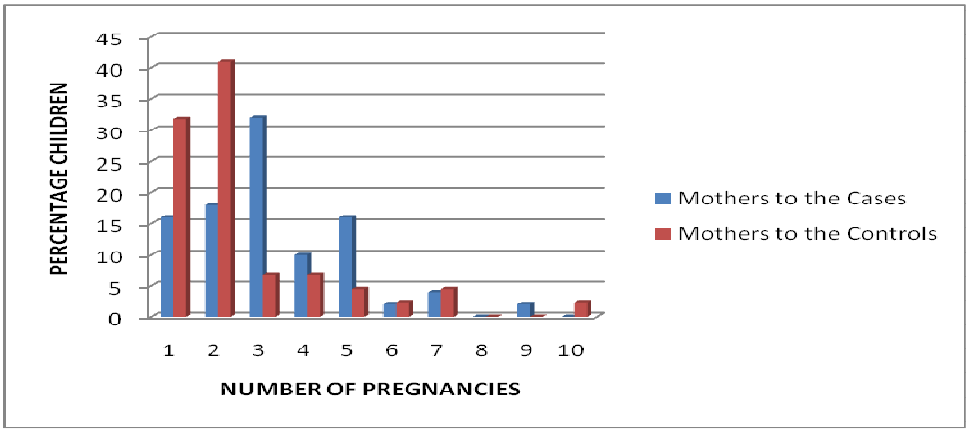
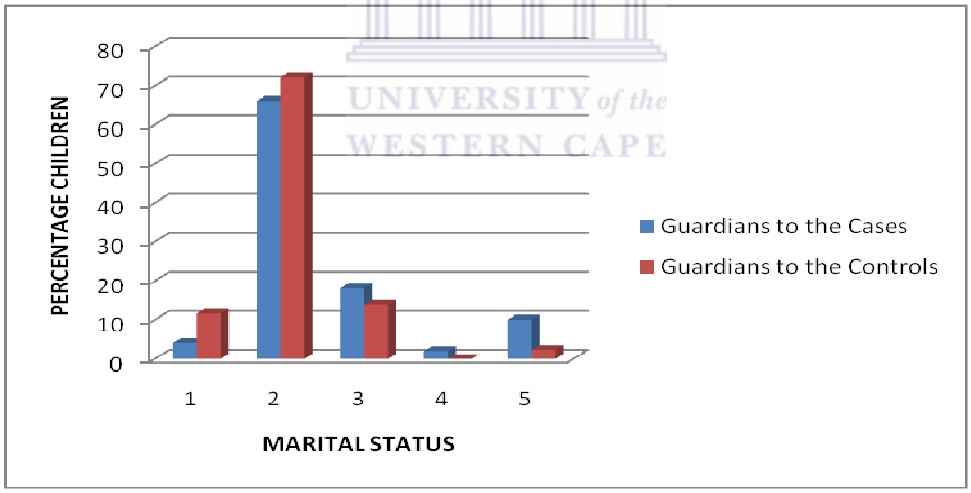


Figure 6: Number of Pregnancies versus Nutrition Status of the Children

According to the results from figure 6, more mothers to the controls had fewer pregnancies than the mothers to the cases. Most of the mothers to the controls had had pregnancies ranging from 1 to 3 with a few from 4 to 10. More mothers to the cases had had pregnancies ranging from 3 to 10 than those of the controls.

4.3.2 The Marital Status of the Guardians

According to the results from table 3B, the marital statuses of the guardians (96.8% of who were the mothers of the children) were found to be associated with the cases and controls (p-value < 0.03). According to the results, 72.1% of the guardians to the controls were married in a monogamous relationship in comparison to 66% of the guardians to the cases. It is shown that 18% and 12% of the guardians to the cases were widows and either divorced or separated compared to 14% and 0% of the guardians to the controls respectively. Figure 7 below is a graphic illustration of the association of the marital statuses of the guardians against the cases and the controls.



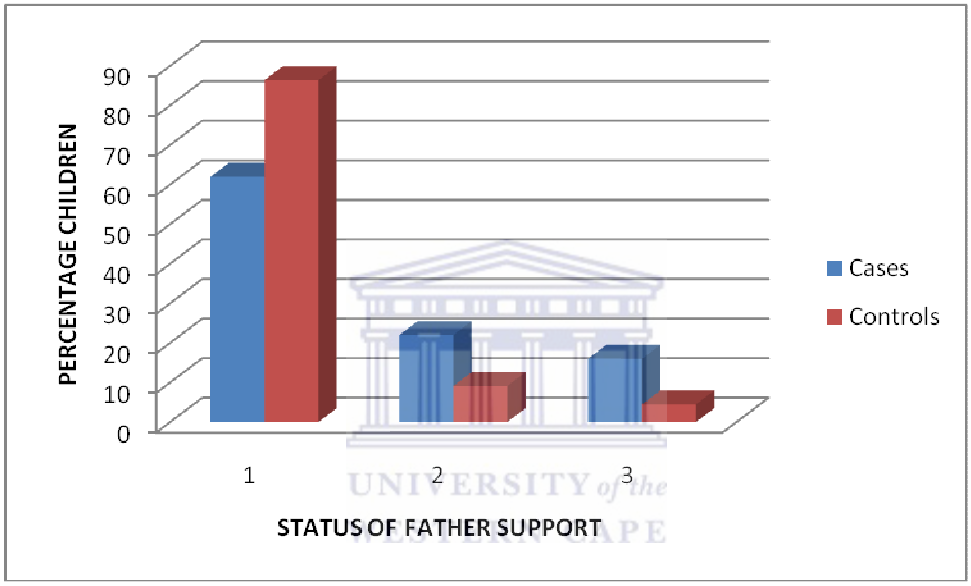
Where 1 =Single-Never Married; 2 =Married-Monogamous relationship; 3= Married- polygamous relationship; 3= Widowed; 4 = Divorced/Separated; and 5 = Co-habiting.

Figure 7: Marital Status of the Guardians versus Nutrition Status of the Children

According to figure 7 above, most of the mothers to the cases and the controls were married in a monogamous relationship but more mothers to the cases were widowed, divorced/separated, or cohabiting than the mothers for the controls.

4.3.3 The Support of the Fathers

The results from table 3B show that there was a statistically significant association between the status of father support to the child and the child's being a case or a control (p-value < 0.009). The results further showed that 22% of the cases were not being supported by their fathers in comparison to 9.1% of the controls and 16% of the cases' fathers sometimes supported them in comparison to 4.5% of the controls. Figure 8 below is a graphic demonstration of the results showing the distribution of the cases and controls against the status of the father support.



Where 1 = father supports the baby; 2 = father doesn't support the baby; and 3 = father sometimes supports the baby.

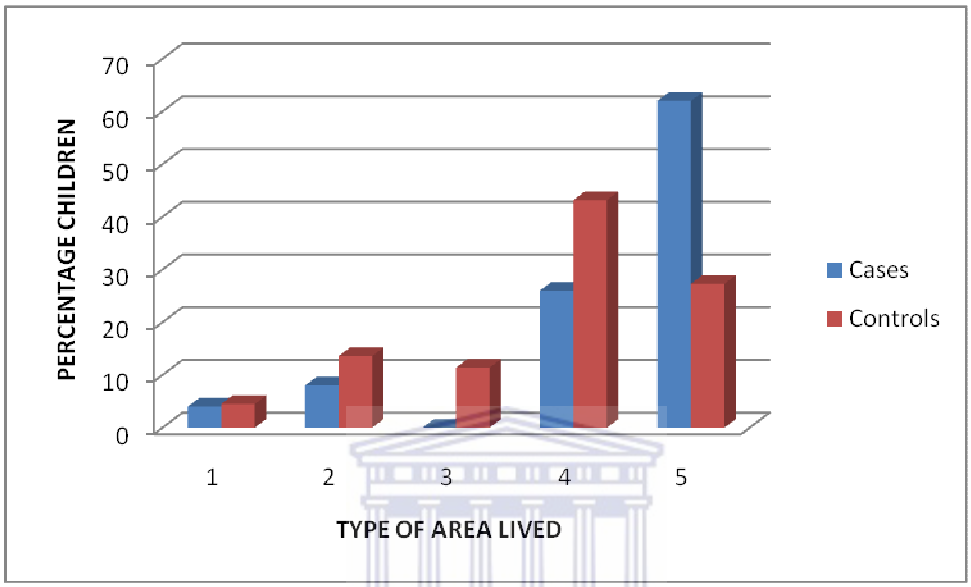
Figure 8: Father Support versus Nutrition Status of the Children

According to the results from figure 8 above, more fathers for the controls supported their children as compared to the fathers for the cases and that more of the fathers for the cases either never or sometimes supported their children as compared to the fathers for the controls.

4.3.4 The Type of Areas the Cases and the Controls Lived

The results from table 3B above show that there is a statistically significant association between the cases and controls and the type of area they lived (p-value < 0.01). According to the results, 62% of the cases were coming from rural areas (but

not on a farm) in comparison to 27.3% of the controls and 43.2% of the controls were township-informal settlement dwellers in comparison to 19% of the cases. None of the cases came from township-formal settlement in comparison to 11.4% of the controls. Figure 9 below demonstrated the distribution of the cases and controls over different types of areas they lived.



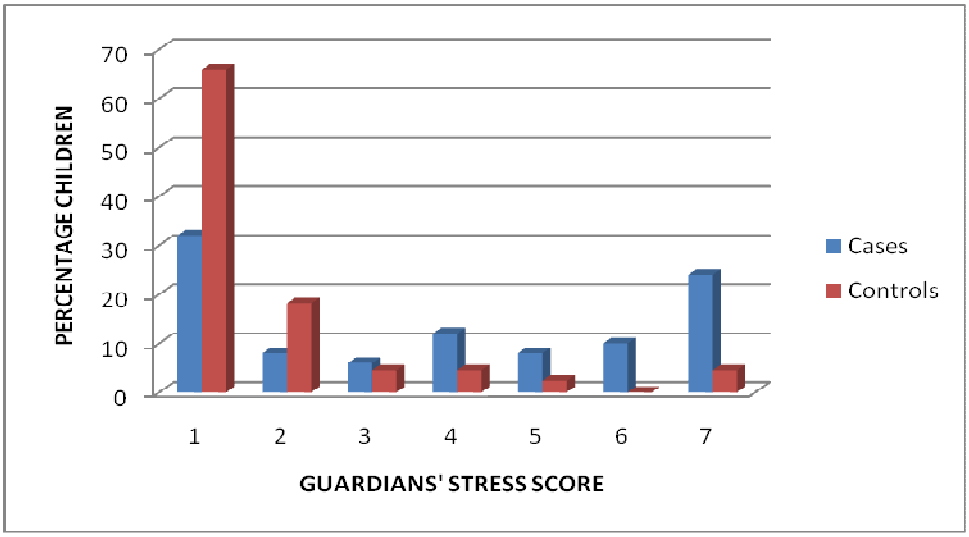
1 = On a farm; 2= In a city/ town; 3 = In a township- formal settlement; 4 = In a township -Informal settlement; and 5 = In a rural area (not a farm).

Figure 9: Type of Area Lived Versus Nutrition Status of the Children

According to the results from figure 9 above most of the cases lived in poor areas as compared to the controls most of who lived in much better and privileged areas.

4.3.5 Stress Score

The results from table 3B show that there is a statistically significant association between the stress score of the guardians and the children's being cases or controls (p-value < 0.0001). From the results it is established that 24% of the guardians for the cases had stress score of 7 in comparison to 4.5% of the guardians for the controls. Sixty five percent of the guardians for the controls scored 1 (which is the lowest score) in comparison to 32% of the guardians for the cases. Figure 10 below graphically illustrates the distribution of the cases and controls against the guardians stress scores.



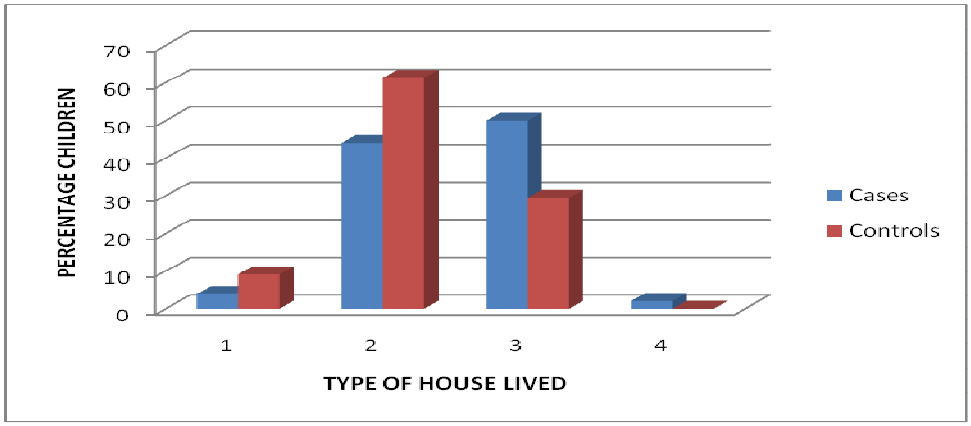
Where 1 is the lowest steress score and 7 is the highest

Figure 10: Guardian Stress Score versus Nutrition Status of the Children

According to the results from figure 10 above the distribution of the stress scores for the guardians for both the cases and the controls ranged from the lowest score (1) to the highest score (7). Most of the guardians for the controls were less stressed with many of them on score 1 and a few distributed across the other scores from 2 to 7. The results show that the guardians for the cases were highly stressed and were almost evenly distributed across all stress scores with most of them on stress scores between 4 and 7.

4.3.6 The Type of House the Cases and the Controls Lived in

Results from table 3B showed that there was an association between the cases and the controls and the type of their dwelling houses (p-value < 0.02). The results demonstrate that 50% of the cases lived in grass thatched house in comparison to 29.5% of the controls and 61.4% of the controls lived in brick and iron corrugated sheets houses in comparison to 44% of the cases. Figure 11 below is a graphic display of the results showing the distribution of the cases and controls against the type of dwelling houses.



Where 1 = Brick house ; 2 = Brick and Iron sheets; 3 = Grass thatched and 4 = A shack in the squatter area.

Figure 11: Type of House Lived Versus their Nutrition Status

Results from figure 11 above show that half of the cases lived in grass thatched houses as compared to the controls whereby only about a quarter of them lived in grass thatched houses. The results show that more of the controls lived in brick and iron sheets houses than the cases. The results therefore suggest that most of the controls lived in better houses than the cases.

4.3.7 Source of Drinking Water, Household Income, First Baby, Knowledge of Cleaning the Surrounding and Having Cleaning Materials

The results from table 3B further showed that 64% of the cases did not have access to safe water in comparison to 29.5% of the controls. Despite intensive probing most respondents concealed information on their household income or claimed had no income though the fathers were working. This was possibly because they anticipated some free hand outs as a result of their response. More controls (40.9%) were first babies than the cases (22%).

4.4 The Household Food Security, Including Hunger of the Children

Household food security data focused on household assets, access to food, food consumption patterns for the babies and coping mechanisms such as source of income. The questionnaire explored employment status of the guardian as well as household head, source of income for the household, access to food, child feeding times, number of food groups in the weaning food given to the child, water and food

related assets such as type of house and area lived. Results for some of these indicators are already given out in tables 3A and 3B.

The household food security also including indicators such as knowledge of nutrition which according to Sen (1999) may determine household food security and hunger of the children are shown in table 4. The level of significance for the difference between the cases and controls are also indicated.

Table 4: Household Food Security and Nutrition Status of the Children

Household Food Security and some Poverty Indicators	**Cases (n = 50)**		**Control (n =44)***		**Total n=94)**		**p-value****
Knowledge of Nutrition and access to food	No	%	No	%	No	%	
Those who have knowledge of nutrition	33	66	33	75	66	70.2	p < 0.35
Those who have easy access to food	15	30	29	65.9	44	46.8	p <0.0004**
Babies' Feeding Frequency							
One to two times a day	40	80	3	6.8	18	19.2	p < 0.0004***
Three or more times	10	20	41	93.2	76	80.8	

*** See page 18 paragraph 3.4.2.5.5 for the explanation for this sample size.**

**** P-value is the level of significance**

The results from table 4 above show that 66% of the guardians to the cases had knowledge of nutrition in comparison to 75% of the controls. Poor knowledge of nutrition on the part of the guardians for the cases therefore might possibly be the reason why 44% of the guardians for the cases were either overweight or obese (see table 2 on page 24). Eighty percent of the cases had poor frequency of feeding in comparison to 6.8% of the controls. Besides 30% of the guardians for the cases claimed to have easy access to food in comparison to 65.9% of the guardians for the controls. These results correlate with the results on the other food security and poverty indicators which are in tables 3A and 3B as already indicated above.

4.5 The Health Status of the Children

The health related characteristics of the children such as HIV status, type of birth, immunization status, frequency of sickness, disease type, frequencies of admissions

and reoccurrence of malnutrition are shown in table 5. The level of significance for the difference between the cases and controls are also indicated.

Table 5: The Health Status of the Children

Variable	Cases (n = 50)		Control (n =44)**		Total (n=94)		p-value***
HIV Status	**No**	**%**	**No**	**%**	**No**	**%**	
HIV positive	14	28	2	4.5	16	17	p < 0.002***
HIV negative	36	72	42	95	78	83	
The babies who were being readmitted	25	50	1	2.3	26	27.7	p < 0.0001***
Those who had reoccurrence of malnutrition	13	26	0	0	13	13.8	p < 0.0002***
The babies who got fully immunized	32	72.7	44	88	76	80.9	p < 0.06
***Frequency of sickness per month**							
One time	20	40	24	54.5	44	46.8	p < 0.003***
Two times	12	24	6	13.6	18	19.1	
Three times	6	12	1	2.3	7	7.4	
Four times	1	2	2	4.5	3	3.2	
Five times	0	0	0	0	0	0	
Six times	9	18	1	2.3	10	10.6	
None	2	4	10	22.7	12	12.8	
***Disease Type**							
Malaria	22	44	17	38.6	39	41.5	p < 0.006***
Diarrhea	13	26	5	11.4	18	19.1	
Coughing	2	4	8	18.2	10	10.6	
Measles	0	0	0	0	0	0	
Anemia	1	2	0	0	1	1.1	
Others	10	20	4	9.1	14	14.9	
None	2	4	10	22.7	12	12.8	
Type of birth							
Caesar	3	6	4	9.1	7	7.4	p < 0.57
SVD	47	94	40	90.9	87	92.6	

***The variable had 1% missing data**

**** See page 18 paragraph 3.4.2.5.5 for the explanation for this sample size.**

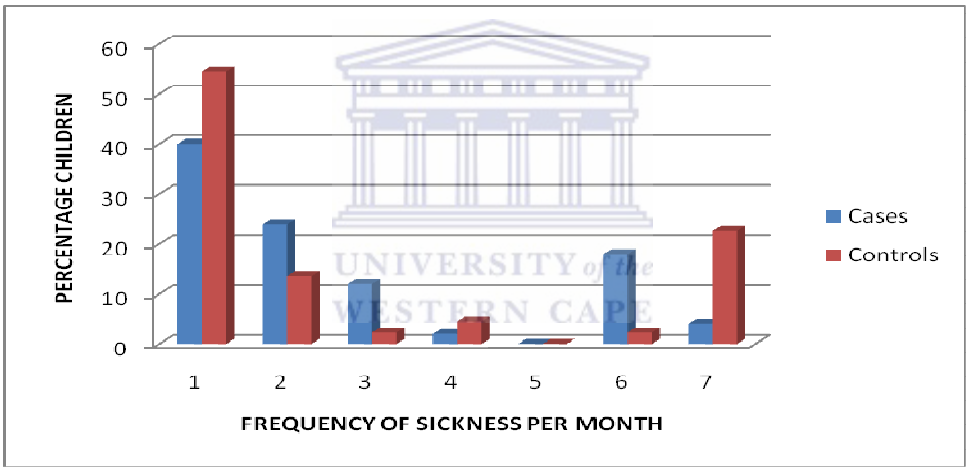
***** P-value is the level of significance**

The results from table 5 show that there is an association between the HIV status of the cases or controls (p-value < 0.002). The results further indicated that 28% of the cases were HIV positive in comparison to 4.5% of the controls who were HIV positive. There was no significant association between being born through Caesar or Normal Spontaneous Vaginal Delivery (SVD) and the cases and the controls. Fifty percent of the cases' guardians admitted having been admitted to the hospital before with the same children and 26% of them with the same problem of malnutrition in

comparison to 2.3% and 0% of the controls respectively. The results show that 88% of the controls got fully immunized in comparison to 72.7% of the cases.

4.5.1 Frequency of Sickness per Month

The results from table 5 show a significant association between the frequency of sickness per month and the cases and the controls (p-value < 0.003). It is shown that 54.5% of the controls fell sick once a month and 22.7% of them never felt sick at all in comparison to 40% and 4% of the cases respectively. It is further shown that 56% of the cases felt sick ranging from two to six times a month in comparison to 22.8% of the controls. Figure 12 below is a graphic demonstration of the association showing the distribution of the cases and controls against the frequency of sickness per month.



Where 1 to 6 are the number of sick times per month and 7 is none.

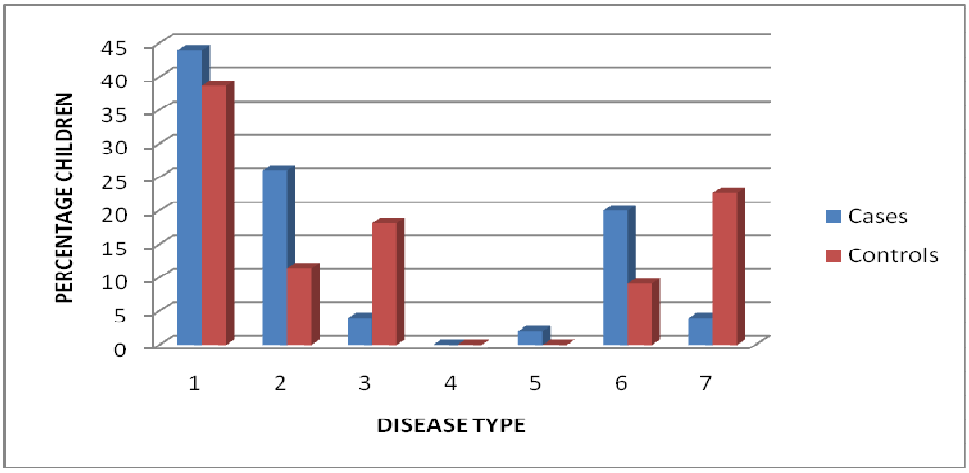
Figure 12: Frequency of Sickness versus Nutrition Status of the Children

Results from figure 12 above show that more controls than cases fell sick once per month or never felt sick at all and more cases than controls fell sick more than once to six times.

4.5.2 Disease Type

The results from table 5 demonstrate a statistically significant relationship between the disease type and the cases and the controls (p-value < 0.006). The results show that 44% of the cases were frequently attacked by malaria and 26% with diarhea as compared to 38.6% and 11.4% of the controls respectively The results further show that 22.7% of the controls never got sick at all as compared to 4% of the cases.

Figure 13 bellow is a graphic demonstrate the association showing the distribution of the cases and controls against the type of diseases that affected them.



1.Malaria; 2. Diarrhea; 3. Coughing; 4. Measles; 5. Anemia. 6. Others 7. None

Figure 13: Disease Type versus Nutrition Status of the Children

According to the results from figure 13, the most severe diseases affecting both cases and controls were Malaria and Diarrhea. More cases than controls were affected by diarrhea and Malaria. The frequent diarrhea bouts affecting 26% of the cases might possibly have been because 64% of the cases had poor access to safe drinking water (see table 3A on page 29). The figure further demonstrates that more controls than the cases were affected by cough and more controls than cases never got sick at all.

4.6 The Breastfeeding and Complementary Feeding Practices of the Guardians of the Children

The breastfeeding and complementary feeding practices of the guardians of the cases and the controls which include exclusive breastfeeding, the weaning food groups and knowledge of feeding the sick child are shown in table 6. The levels of significance for the difference between the cases and controls are also indicated.

Table 6: Feeding Practices and Weaning Food Groups versus the cases and the controls

Variables	Cases (n = 50)		Control (n =44)		Total n=94)**		p-value***
Breastfeeding	**No**	**%**	**No**	**%**	**No**	**%**	
Those who were on breast feeding	23	46	33	75	56	59.6	p < 0.004***
*Exclusive breastfeeding	45	90	42	97.7	87	93.5	p < 0.14
Weaning Food Groups							
One Food group	6	12	0	0	6	6.4	p < 0.004***
Two Food groups	8	16	7	15.9	15	16	
Three Food groups	15	30	10	22.7	25	26.6	
Four Food groups	7	14	3	6.8	10	10.6	
Five Food groups	5	10	2	4.5	7	7.4	
Six Food groups	7	14	20	45.5	27	28.7	
breast milk only	2	4	2	4.5	4	4.3	
Knowledge of feeding the sick child							
*The guardians who had knowledge of feeding the sick child.	6	12	24	54.5	30	31.9	p < 0.0001***

***The variable had 1% missing data**

****** **See page 18 paragraph 3.4.2.5.5 for the explanation for this sample size.**

******* **P-value is the level of significance**

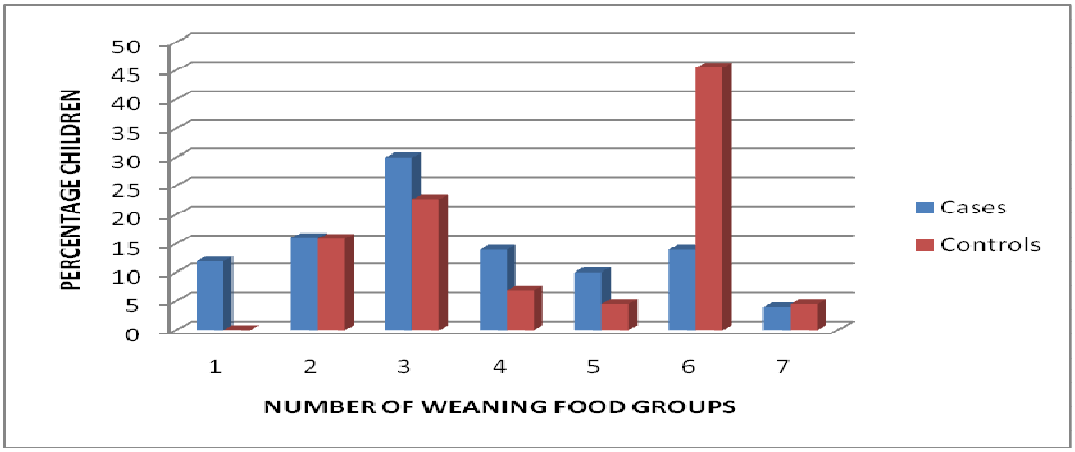
4.6.1 Breastfeeding

The results from table 6 demonstrate a statistically significant relationship between breastfeeding and the cases and the controls (p-values < 0.004). According to the results, it is found that 46% and 75% of the cases and controls respectively were on breastfeeding. Since 48% and 63.6% of the cases and controls respectively were below 2 years old (page 23 paragraph number 4.1), therefore 2% of the cases were weaned before the 2 years recommended weaning age and 11.4% of controls continued to breastfeed past 2 years. Exclusive breastfeeding was found not to be significantly different between the cases and the controls (p-values < 0.14). About 90% of the cases and 97% of the controls eligible for exclusive breastfeeding were such breastfed.

4.6.2 Weaning food groups consumed by the children

The results from table 6 demonstrate a statistically significant relationship between the weaning food groups and the cases and the controls (p-values < 0.004). About 54% and 25% of the cases and controls respectively were weaned. The results also show that 82% of the cases were not having all the six food groups in their weaning foods in comparison to 50% of the controls. It was established that the problems of

feeding practices were mostly on the weaning foods combinations both for the cases and the controls the worst affected being the cases. Figure 14 bellow is a graphic demonstrate the association showing the distribution of the cases and controls against the weaning food groups consumed.



Where 1 to 6 are the number of food groups consumed and 7 is breast milk only

Figure 14. Weaning Food Groups versus Nutrition Status of the Children

The results from figure 14 show that both the cases and the controls had the problem of weaning foods diversification with more cases than controls being fed on only three food groups. According to the results, closer to 50% of the controls were being fed on well balanced weaning foods (weaning foods composed of all the six food groups).

4.6.3 Guardians' knowledge of feeding the sick child

The results from table 6 showed that there was an association between the cases and the controls and the guardians' knowledge of feeding the sick child (p-values < 0.0001). It is shown in the table that 12% of the guardians for the cases had knowledge of feeding the sick child in comparison to 54.5% of the guardians for the controls. The results further show that 66% of the guardians to the cases had knowledge of nutrition as compared to 75% of the controls. This can be possibly the reason why some of the guardians to the cases were obese.

4.7 ODDS RATIO

Table 7 below displays single table analysis results for the variables, showing the cross-product ratios (odds ratios), confidence interval and the p-values.

TABLE 7A: ODDS RATIOS

VARIABLE	Status	ODDS RATIO	Confidence Interval (95%)	P-VALUE
Birth order	First baby	0.39	0.17 – 1.00	p <0.03
	Not first baby	1.00		
Planned pregnancy or not	Planned	0.67	0.29 – 1.46	p <0.32
	Not planned	1.00		
Birth control	birth controlled	0.59	0.24 – 1.32	p <0.21
	Not controlled	1.00		
Delivery age	Teen aged	0.76	0.41 – 35.57	p <0.60
	Normal aged	1.00		
Birth weight	<2500g	3.03	0.99 – 9.27	p <0.02**
	>2500g	1.00		
Exclusive breastfeeding	Exclusive	0.38	0.02 – 1.91	p <0.25
	Not exclusive	1.00		
Work	Worked	0.97	0.40 – 2.60	p <0.95
	Don't work	1.00		
Father present	Father present	0.69	0.26 – 1.92	p <0.46
	Not present	1.00		
Social support	Received	0.54	0.17 – 1.23	p <0.22
	Don't receive	1.00		
Alcohol consumption	don't drinks	5.44	0.54 – 42.58	p <0.09
	guardians drink	1.00		
Vomit	Baby vomit	1.00	0.33 – 2.20	p <1.0000**
	Don't vomit	1.00		
Admissions status	Re-admitted	5.33	5.49-336.94	p < 0.0001**
	Not re-admitted	1.00		
Reoccurrence of malnutrition	Reoccurrence	43.0	Undefined	p < 0.0002**
	Not reoccurrence	1.00		
Smoker	Guardian smokes	2.04	0.16 – 20.46	p <0.56
	Don't smoke	1.00		
HIV status	HIV positive	8.17	1.74 – 38.36	p <0.002**
	HIV negative	1.00		
Abuse	Guardian abused	2.47	0.91 – 6.78	p <0.06
	Not abused	1.00		
Food Access	Having access	0.24	0.09 – 0.53	p <0.0007
	Inadequate access	1.00		

TABLE 7B: ODDS RATIOS

VARIABLE	Status	ODDS RATIO	Confidence Interval (95%)	P-VALUE
Breastfeeding	Baby breastfeeding	0.33	0.12 – 0.68	p <0.008
	Not breastfeeding	1.00		
Immunization status of the babies	Not fully immunized	2.75	0.93 -8.90	p < 0.06
	Fully immunized	1.00		
Weaning	Babies weaned	2.14	0.45 – 8.94	p <0.29
	Babies not weaned	1.00		
Guardians' nutrition Knowledge	Has knowledge	0.68	0.26 – 1.59	p <0.38
	Has no knowledge	1.00		
Guardians knowledge of feeding sick baby	Has knowledge	0.09	0.04 – 0.32	p <0.0000
	Has no knowledge	1.00		
Household head employment status	Head employed	0.27	0.11 – 0.64	p <0.002
	Head not employed	1.00		
Household having a toilet or not	Has toilet	0.40	0.11 – 1.86	p <0.19
	Don't have toilet	1.00		
Cleaning of the surrounding	Surrounding clean	0.11	0.01 – 1.02	p <0.02
	Not clean	1.00		
Household having cleaning materials	Has material	0.38	0.15 – 0.97	p <0.03
	Doesn't have	1.00		

**=Odds ratio ≥ 1 and p-value of 0.05 or less

P-value is the level of significance

The results from table 7A and 7B show that birth weight <2500g, HIV positive status, re-admission to health facility and babies not fully immunized are significantly related to malnutrition. The results show that malnourished children (the cases) are over three times more likely to have started off with low birth weight (i.e. below 2500 g) and over eight times more likely to be HIV positive than the controls. Re-admitted children were over five times more likely to be due to under-nourishment. The results further show that the re-admitted children were 43 times more likely to be a re-occurrence of malnutrition.

4.8 Findings from the Malnourished Children in the Control Group

The malnourished children in the control group that were withdrawn from the study were analyzed separately using EpiInfo. The results were that 83.4% of their guardians reached secondary school level. Their mothers were characterised by late booking at the clinic when they were pregnant. Fifty percent booked at the clinic when they were 4-6 months pregnant and 33.3% booked at 7-9 months. Sixty-six percent of the guardians were not working to earn money and did not have any source of income and 83.3% did not have any other financial support. Although 83.3% of the children had their fathers present, 60% of the fathers were not employed thus though 66.7% had the father support, the kind of support was not adequate. About 66.7% were living in township informal settlement and 50% were using communal taps while 33% were using water from borehole. The children were 100% from poor urban households suggesting that the health surveillance assistants may not have been thoroughly screening the urban children for malnutrition. Fifty percent of the children did not have easy access to food. Eighty-three percent of the children were weaned and their weaning diet was not balanced and was inadequate (50% had 2-3 food groups in the weaning foods and 50% were fed only 3 times a day). Forty percent were regularly sick and 60% were affected with malaria. The MUAC and height-for-age z-scores assessments showed that 66.7% of the children were malnourished and the weight-for-height showed that 33.3% were malnourished. Weight-for-age z-scores obviously showed that all were malnourished as this was their exclusion criteria from the main sample (See page 20 paragraph 3.4.2.5.5).

4.9 Comparison of the Findings from the Malnourished Children in the Control Group with the Cases

In comparison, most of the case children are poor rural dwellers whilst the malnourished children in the control group are poor urban dwellers. The malnourished children in the control group have completely different initial risk factors for malnutrition from the cases and these factors are: late booking at the clinic when the mother is pregnant, guardian not working, household head not employed, lack of income, lack of financial support. The initial risk factors boil down to the subsequent risk factors which are similar to those of the cases and these are poverty, poor access to food, unbalanced weaning foods, frequent sicknesses and frequent attacks from malaria.

CHAPTER 5.

DISCUSSION

DEVIATIONS FROM THE METHODOLOGY

STUDY LIMITATIONS

5.0 DISCUSSION

5.1 Risk Factors for Malnutrition

5.1.1 Child Age

The mean age and standard deviation for the cases which was 2.34(1.55) years was higher than that of the controls which was 1.70(1.28) years. However, the differences in ages as well as in standard deviation were not statistically significant and the distributions for the children in the cases and controls groups were normal. According to Bonita *et al.* (2006), a normal distribution has extremely useful characteristics enabling a large number of statistical tests and calculations. A statistically significant difference was found between the ages of the cases and that of the controls ($p< 0.04$). Significantly more cases (52%) were above 2 years old than the controls (36.4%) (Page 22 paragraph number 4.1). The findings imply that older age is a risk factor for under-nutrition in this study population. According to MoH (2010), 95% of breastfeeding mothers in Malawi stop breastfeeding their babies by two years of the babies' life. Since 52% of the cases had grown up past the breastfeeding age (two years), possibly they were being fed on inadequate and poorly balanced weaning foods thus the under-nutrition. Salah *et al*. (2006) also found that poor child care practices in weaning were risk factors for malnutrition in children less than 3 years of age in Botswana.

5.1.2 Anthropometric Measurements of the Children and the guardians

The anthropometric assessments (MUAC, height for age z-scores and weight for age z-scores) suggest that the cases were more malnourished than the controls. For the cases that were found to have normal anthropometric indicators other than weight for age, possibly could have been because they were recovering after receiving treatment at the NRU. It is found that there is possibly a slack in the screening process by frontline community worker as evident from the 12% of children from the control sample that were found to be malnourished using the weight for age and were not belonging to any supplementary feeding program.

5.1.2.1. Birth-weight

A statistically significant difference was found between the birth-weights of the cases and that of the controls (Table 2). Significantly more cases (28%) were low birth-weight babies than the controls (11.4%). The odds ratio (see table 7A page 43) also

demonstrated that the cases were 3.03 ($p < 0.05$) times more likely than the controls to have been low birth-weight babies. These findings imply that low birth-weight is a risk factor for under-nutrition in this study population. Sanghvi *et al*. (2001) also found that birth-weight less than 2.5 kg (OR = 4.87, p = 0.01) was a significant risk factor for malnutrition in children under 3 years of age in Indian rural area. Low birth-weight is closely associated with inhibited growth and cognitive development, and chronic diseases later in life (Stevens-Simon and Orleans, 1999). Diseases may directly deplete nutrient meant for the body or cause loss of appetite which reduce intake of foods (Shepherd, 2009). It is established that the cases were sicker than the controls (paragraph 4.5.1 pages 39 to 40) and this possibly was one of the reasons for the malnutrition in the cases.

5.1.2.2. BMI

A statistically significant difference was found between the BMI of the guardians to the cases and that of the guardians to the controls ($p < 0.05$) (Table 2). Significantly more guardians for the cases (22%) than the controls (4.5%) had BMI of less than 18.5 suggesting that more guardians for the cases than the controls were under weight. Since 96% and 97.7% of the guardians to the cases and controls respectively were their mothers (paragraph 4.3, page 31), the findings imply that low BMI (of less than 18.5) for the mothers is a risk factor for under-nutrition in the study population. The low BMI is a sign that among other causes, their dietary intake of nutrients was possibly poor and they possibly have hunger (UNICEF, 1990). Breastfeeding mothers with low BMI may not produce adequate milk for their babies and they possibly have hunger thus may compete with their babies in consuming weaning foods (Scott, Chopra, and Sanders, 2000). Possibly this can be one of the reasons why 82% of the cases were being given poorly balanced and inadequate weaning foods. Sanghvi *et al*. (2001) also found that current maternal weight and current maternal body mass index of less than 18.5 were significant risk factors for malnutrition in children less than 3 years of age in India.

5.1.3 The Socio-Economic Status of the Mothers/Guardians of the Children

5.1.3.1 Education Level

A statistically significant difference was found between the literacy level of the guardians of the cases and that of the guardians to the controls ($p < 0.0001$) (Table

3A). The literacy level of the guardians for the cases is significantly lower (16%) than that of the guardians to the controls (50%). These findings imply that low literacy level for the guardians is a risk factor for under-nutrition in this study population. UNICEF (1990) suggested that the women's inadequate education and inadequate childcare knowledge among others contribute to poor provision of food, health care, exclusive breastfeeding and adequate complementary and weaning foods to children and may cause malnutrition. Jeyaseelan and Lakshman (1997) also found that mother's poor education was a risk factor for malnutrition in children aged 5-7 years in Indian urban and rural areas. According to Jonsson (1995) education influences the usage of any kind of information and it is a key to the appropriate breastfeeding and complementary feeding practices.

5.1.3.2 Employment Status of the Household Head

A statistically significant difference was found between the employment status of the household heads for the cases in comparison to that of the household heads for the controls ($p < 0.002$) (Table 3A). Significantly more household heads for the cases (72%) were not employed and had poor or no other source of income than those of the controls (39.9%). The economic base of the households for the cases is therefore weak thus affecting their support to the households as well as the children. These findings imply that the unemployment of the household head is a risk factor for under-nutrition in this study population. Victora, Vaughan, Kirkwood, Martines and Barcelos (1986) also found that employment status of the head of the family and family income among others were risk factors for malnutrition in children aged 12-35.9 months in urban and rural areas of southern Brazil. The household heads in this regard may possibly not be able to provide food to the households and the children consistently as they are poor. According to UNICEF (1990), the lack of food may cause malnutrition and the most vulnerable may be the pregnant and breastfeeding women, the infants and young children. Malnutrition weakens the body immunity of the affected individuals (Stratton, 2003). According to Irwin *et al*. (2006), poor households usually have less access to health resources, get sicker and the members die earlier than the members in more privileged households. It is further pointed out that poor people are more vulnerable as they are most of the time ignored by governments.

5.1.3.3 Number of Pregnancies

A statistically significant difference was found between the number of pregnancies of the mothers and the children's being cases or controls ($p < 0.01$) (Table 3A). The results further showed that significantly more mothers for the cases (34%) had given birth 4 to 10 times before than the mothers to the controls (20.5%). These findings imply that bigger numbers of pregnancies of the mothers are a risk factor for under-nutrition in this study population. Rayhan and Khan (2006) also found that previous frequent pregnancies intervals were a risk factor for malnutrition in under-five children in Bangladesh. According to UNICEF (1990), the mothers interest to take good care of babies decreases with increase in number of births. It is pointed out that the mother's body becomes increasingly weaker with increase in number of children she gives birth to. As a result the mother is prone to frequent sicknesses which further compromise her ability to adequately breastfeed and take good care of the baby. UNICEF (1990) therefore concluded that the more the number of pregnancies and subsequent deliveries the more the malnourished children may result implying that a higher number of pregnancies and subsequent deliveries are risk factors for under-nutrition in the children born.

5.1.3.4 Marital Status and Father Support

It is found that there is a statistically significant difference between the marital status of the guardians for the cases and their fathers' support in comparison to those of the controls ($p < 0.03$ and $p < 0.009$ respectively) (Table 3A). Significantly more guardians to the cases (30%) were not living with their husbands than the controls (14%). Significantly more cases than controls had minimum father support as their guardians were divorced, widowed, cohabiting or never married at all. These findings imply that the absence of the father and lack of father support to the baby are risk factors for under-nutrition in this study population. The children could not have lacked support if even though absent, the fathers were sending financial support to them but according to the results most of the absent father to the cases either did not or irregularly supported the children in comparison to those of the controls. Salah, Mahgoub, Nnyepi and Bandeke (2006) also found that the marital status of the guardians and father support to the baby were risk factors for malnutrition among children under 3 years of age in Botswana. Sen (1999) described fathers as the most successful bread winners of the household and their absence therefore meant

inadequate or absolute lack of their support to the children. This possibly contributed to the households' food insecurity and consequently the malnutrition in the cases.

5.1.3.5 Type of Area lived, Dwelling House and Cleanliness of their Surrounding

A statistically significant difference was found between the areas and the houses the cases lived in comparison to that of the controls ($p< 0.01$ and $p< 0.02$ respectively) (Table 3B). Significantly more cases (62%) than the controls (27.3%) came from the rural areas and significantly more cases than the controls (50% and 29.5% respectively) lived in grass thatched houses implying that living in rural areas (but not on a farm) and dwelling in grass thatched houses are risk factor for under-nutrition in this study population. Both living in rural areas and dwelling in grass thatched houses are indicators of poverty which according to Sen (1999) are associated with food insecurity which may cause malnutrition. Kikafunda *et al*. (1998) also found that rural living and living in poor houses coupled with poor health and low socioeconomic status of the family among others were risk factors for malnutrition among children<30 months of age in a central Ugandan community.

It is also found that there is a statistically significant difference in the knowledge of cleaning the surrounding and the using of cleaning materials between the guardians of the cases and the controls ($p< 0.02$ and $p< 0.04$ respectively) (Table 3B). Significantly fewer guardians for the cases (84%) had knowledge of cleaning the surrounding and use of cleaning materials than for the controls (97.7%) and significantly fewer households for the cases (60%) claimed to use cleaning materials than the controls (79.5%). These findings imply that poor knowledge of cleaning the surrounding as well as lack of cleaning materials are risk factors for under- nutrition in this study population. Ferrari, Solymos, Castillo and Sigulem, (1998) also found that poor knowledge of cleaning the surrounding and lack of cleaning materials were risk factors for malnutrition among children less than 72 months of age living in a shantytown. The poor knowledge of cleaning the surrounding and the lack of cleaning materials may result in unhygienic living conditions which may attract diseases such as diarrhea which may lead to malnutrition (UNICEF, 1990). Sen (1999) suggest that poor knowledge of cleaning the surrounding and lack of cleaning materials are characteristics of inadequacies in resources for sustaining a normal living. Most of the

cases therefore had poor living condition of a rural set up. Naidoo and Will (1994) suggested that the poor living condition may possibly be an attribute of poverty which includes exclusion, marginalization, low income and inability to participate in society. It is further pointed out that such conditions are typical of the rural societies which are neglected by most administrations and as a result the rural people may subsequently end up neglecting themselves. Naidoo and Will (1994) therefore pointed out that:

*"**Poor people bring illness upon themselves. They don't care about their health, they smoke, drink too much and eat junk food. They could spend the little money they have on health activities if they really wanted" (Naidoo and Will, 1994:79).***

It may therefore be the reason why most of them failed even to simply sweep and clean their surroundings. The British Department of Health (1997) pointed out that across the society the poorer you are, the less healthy you are likely to be if the welfare system is not designed to ensure that no one falls through absolute want or destitute. This implies that governments have to strategize on how to care for the less privileged.

5.1.3.6 Stress Score

A statistically significant difference was found between the stress scores of the guardians to the cases in comparison to those of the guardians to the controls ($p < 0.0001$) (Table 3B). According to the results significantly more guardians to the cases (76%) than the controls (35%) were highly stressed. These findings imply that the high stress of the guardians is a risk factor for under-nutrition in this study population. Anoop, Saravanan, Joseph, Cherian and Jacob (2004) also found that high stress was a risk factor for malnutrition among children aged 6–12 months in South India. Highly stressed mothers cannot produce enough breast milk for their babies and their ability to take good care of the children is most of the time greatly compromised (Gallagher, 2004). The high stress to the guardians of the cases therefore possibly caused the malnutrition in the cases.

5.1.3.7 Access to Safe Water

A statistically significant difference was found between the sources of drinking water of the cases in comparison to that of the controls ($p < 0.0004$) (Table 3B).

Significantly more cases (30%) did not have access to safe water than the controls (6.8%). These findings imply that poor access to safe water is a risk factor for under-nutrition in this study population. Kikafunda, Walker, Collett and Tumwine (1998) also found that the use of unprotected water supplies was a risk factor for malnutrition among children less than 30 months of age in a central Ugandan community. The absence of safe water for domestic use presage poor sanitation and hygiene and may trigger the proliferation of diseases such as diarrhea which may result in malnutrition (WHO, BASICS and UNICEF, 1999).

5.1.4 The Household Food Security, including Hunger of the Children

5.1.4.1 Access to Food

A statistically significant difference was found between the cases' ability to access food in comparison to that of the controls ($p< 0.0004$) (Table 4). The results from table 4 show that significantly more households for the cases (70%) had poor access to food than those of the controls (34.1%). These findings imply that poor access to food is a risk factor for under-nutrition in this study population. Victora *et al*. (1986*)* also found that poor household food availability was a risk factor for malnutrition in children aged 12 to 35.9 months in urban and rural areas of Southern Brazil. Poor access to food in a household compromises dietary intake of nutrients by the household members and as a result breastfeeding mothers may not be able to produce adequate milk for the breastfeeding baby (UNICEF, 1990). It is further indicated that households may also fail to provide adequately balanced weaning foods to babies and this may cause malnutrition in the babies.

5.1.4.2 Babies' feeding frequency

The results also show that there is an association between the feeding frequency of the cases or controls (p-value < 0.0004). Food consumption frequency was significantly lower for the weaned babies in the cases group than those in the control group. Eighty percent of the cases had lower frequency of feeding (not more than 2 times a day) in comparison to 6.8% of the controls suggesting that the parents to the cases had either poor access to food or lacked knowledge of nutrition. UNICEF, (1990) pointed out that a feeding frequency of less than two times a day for weaned babies is a sign of household food insecurity and this causes hunger and malnutrition in the weaned child.

5.1.4.3 Other food security indicators

It is established that significantly more cases lived in poor houses and in rural areas but not on farm in comparison to the controls most of who were town dwellers and living in good houses (p-values <0.02 and <0.01 respectively) (table 3B). This according to Sen (1999) is a sign that the households for the cases were generally poor. This implies that their purchasing power for food and inputs for food production was also poor. This caused food insecurity in the households for the cases. The food insecurity affected both the weaned babies and the breast feeding babies as the breast feeding mothers potential to produce enough milk for the babies was possibly compromised by inadequate food intake. This implies that the cases were more likely to be affected by hunger than the controls. The results also show that 82% of the cases were not having all the six food groups in their weaning foods in comparison to 50% of the controls (Table 6). This is a sign of either unavailability of the food stuffs or lack of knowledge of infant feeding on the part of the guardian for the cases. Significantly more cases had poor access to food (thus food insecure) than the controls (p<0.004) (Table 6).

5.1.5 The Health Status of the Children and the Guardians

5.1.5.1 HIV Status

A statistically significant difference was found between the HIV statuses of the cases in comparison to that of the controls (Table 5). Significantly more cases (28%) were HIV positive babies than the controls (4.5%). The odds ratio (table 7A) also indicated that the cases were 8.17 (p< 0.002) times more likely to have HIV than the controls. These findings imply that having HIV is a risk factor for under-nutrition in this study population. HIV positive individuals' immune system eventually becomes weak and are thus prone to frequent infections and diseases (Centre for Disease Control (CDC), 2008). Stratton (2003) pointed out that diseases affect the children's appetite and induce nausea, vomiting and pain which consequently increase nutritional requirements. Shepherd (2009) therefore suggests that this may consequently cause disease-related malnutrition if the requirement is not met.

5.1.5.2 Re-admission to the Health Facilities

A statistically significant difference was found between the children's history of re-admission to a healthy facility and their being cases or controls (Table 5).

Significantly more cases (50%) were re-admitted to the health facilities than the controls (2.3%). The odds ratio (Table 7A) also demonstrated that the cases were 5.33 ($p< 0.0001$) times more likely to have been re-admitted to the health facility than the controls. It is shown in the results that half of the cases were readmitted to the hospital. These findings imply that being re-admitted to a health facility is a risk factor for under-nutrition in this study population. Weinisier, Hunker, Krumdieck and Butterworth (1979) found that malnutrition was related to the length of hospitalization. They further found that the longer the patient remains in the hospital the greater the chance of poor nutritional status due to increased metabolic demands, depression, or the patient may dislike food. Their study showed that 81.1% of the patients who were in the hospital for more than 15 days were malnourished.

5.1.5.3 Re-occurrence of Malnutrition

The results from table 5 demonstrate a statistically significant difference in the causes of the re-admissions between the cases and the controls. Significantly more of the re-admitted cases (26%) were as a result of a re-occurrence of malnutrition than any other causes in comparison to the controls. The odds ratio (Table 7A) also showed that the readmitted cases were 43.0 ($p< 0.0002$) times more likely to be due to re-occurrence of malnutrition than the controls. UNICEF (1990) suggested that the immediate causes of re-occurrence of the malnutrition are inadequate dietary intake of nutrients, diseases and parasites infestation. The diseases and parasites infestation also affect intake and utilization of nutrients. The admissions and re-admissions possibly made the guardians busy nursing the child at the hospital and failed to concentrate on works that could bring food to the household. This might have caused food insecurity in the household and the subsequent re-occurrence of malnutrition in the children. These findings imply that admission and re-admission to the health facility are risk factors for under-nutrition in this study population. Besides, the re-admission is a sign of frequent illness which has already been found to cause malnutrition (paragraph 5.1.5.2 on page 55).

5.1.5.4 Immunization

A statistically significant difference was found between the immunization statuses of the cases in comparison to the controls (Table 5). Significantly more cases (27.3%) were not fully immunized than the controls (12%). The odds ratio (Table 7B) also

demonstrated that the cases were 2.75 ($p < 0.06$) times more likely to be not fully immunized than the controls. These findings imply that being not fully immunized is a risk factor for under-nutrition in this study population. Owor *et al.* (2000) also found that failure to complete immunization was associated with malnutrition among children under-five years of age in a case-control study conducted in Uganda. This is possibly because the children's immunity becomes weak and as a result they may frequently be attacked by diseases which consequently affect their nutrient intake and demand. The failure to complete immunization coupled with the HIV positive status of 28% of the cases (table 4) might have therefore severely weakened their immunity thus triggering the more frequent disease attacks (page 51, paragraph 5.1.5.2) and the malnutrition.

5.1.5.5 Frequency of Sickness per Month

A statistically significant difference was found between the frequencies of sickness per month of the cases in comparison to the controls ($p < 0.003$) (Table 5). The weakening of the immune system due to HIV (paragraph 5.1.5.1 on page 54 to 55) among others might have been possibly one of the reasons why the cases population was significantly sicker than the control. These findings imply that frequent sickness is a risk factor for under-nutrition in this study population. Janevic, Petrovic, Bjelic and Kubera (2010) also found that frequent sickness per month was a risk factor for under-nutrition in under-five children living in Roma settlements in Central and Eastern Europe in Serbia

5.1.5.6 Type of Sickness

A statistically significant difference was found between the type of diseases that the cases suffered from in comparison to those that the controls suffered from ($p < 0.006$) (Table 5). Significantly more cases were attacked by Malaria (44%) and diarrhea (26%) than the controls which were 38.6% and 11.4% respectively. These findings imply that Malaria and diarrhea are risk factors for under-nutrition in this study population. The malaria parasite (plasmodium) breaks down red blood cells which are responsible for the transportation of nutrients and oxygen throughout the body for metabolism (CDC, 2008). It is further pointed out that malaria attack increases energy demand in the body, decreases appetite and increases nausea. Consequently there is decreased food intake with increased energy demand and this might have caused the

malnutrition in the cases. WHO, BASICS, UNICEF (1999) indicated that diarrhea attacks drain out nutrients and water from the alimentary canal before it is absorbed by the villi and used by the body. It is further indicated that a person with frequent bouts of diarrhea risks falling into the trap of malnutrition and dehydration within a short period of time if the situation is unchecked.

5.1.6 The Breastfeeding and Complementary Feeding Practices of the Mothers/guardians of the Children.

5.1.6.1 Breastfeeding and Weaning

A statistically significant difference was found in the results of whether the children were being breastfed or not between the cases and the controls ($p < 0.004$) (Table 6). The results from table 6 show that significantly fewer cases (46%) were on breastfeeding than the controls (75%). The findings imply that lack of breastfeeding is a risk factor for under-nutrition in this study population. From the results, 11.4% of the controls continued to breastfeed past the 2 years recommended weaning age. Fifty four percent of the cases were not breastfeeding (were weaned earlier than recommended) possibly because of the following reasons:

- Most of the cases had grown up past the breastfeeding age as it has been found that most of them were about 2.34 years old whilst most of the controls were about 1.70 years old (paragraph 5.1.1 on page 48);
- The mothers may have stopped breastfeeding earlier because 50% of the mothers in Malawi introduce other foods and fluids earlier than six months and 30% stops breastfeeding when the child is two years old (MDHS, 2004);
- According to MoH (2010), 25% of the HIV infants and young children do get the virus from their mothers when delivering and breastfeeding them. It is therefore recommended to mothers not to breastfeed anymore when there are breast problems such as sores. Having found that more of the cases than the controls were HIV positive, the views of MoH (2010) might therefore be one of the reasons for most of the mothers to the cases not to breastfeed.

Besides, the results showed that the children who were breastfeeding were at an advantage as their nutrition status was mostly normal as compared to those who were weaned. These findings imply that breast-feeding is associated with better nutritional status in this population.

5.1.6.2 Weaning Food Groups

A statistically significant difference was found between the number of weaning food groups given to the cases in comparison to those give to the controls ($p< 0.004$) (Table 6). The results also show that significantly more cases (82%) were not having all the six food groups in their weaning foods than the controls (50%). The findings imply that unbalanced weaning foods (not having the six food groups) are risk fact**o**r for under-nutrition in this study population. AED (2000) suggested that introducing other foods or liquid to children within the first 6 months after birth compromises their intake of vitamin A rich breast milk and may result in malnutrition. WHO/FAO (2004) suggest that children who do not adequately breastfed in accordance with their age and are not provided with appropriate supplementary and weaning foods respectively risk being malnourished. Salah *et al*. (2006) also found that poor child care practices in breastfeeding and weaning were risk factors for malnutrition in children less than 3 years of age in Botswana.

5.1.6.3 Knowledge of Feeding the Sick

A statistically significant difference was found between the knowledge of feeding the sick child of the guardians to the cases in comparison to that of the guardians to the controls ($p< 0.0001$) (Table 6). It is demonstrated from the table that significantly more guardians for the cases (88%) had no knowledge of feeding the sick child than the guardians for the controls (45%). The findings imply the guardians' lack of knowledge of feeding the sick children is a risk factor for under-nutrition in this study population. WHO (2010) is of the view that during illness children are more likely to have problems with feeding due to loss of appetite and vomiting. It is therefore suggested that special care is needed when feeding them as they may possibly develop malnutrition. Since the cases group was sicker than the controls (page 55, paragraph 5.1.5.2), the lack of knowledge of feeding the sick child by the guardians for the cases therefore possibly worsened the malnutrition in them.

5.2 Deviations from the Methodology

5.2.1 Study Sample

The major deviation was that the malnourished children (based on weight for age) were withdrawn from the control sample (See page 20 paragraphs 3.4.2.5.5). The study sample for controls was therefore reduced by 12% (6% males and 6% females) thus from 50 to 44. The actual study sample therefore comprised of 50 underweight-for-age children (25 boys and 25 girls) as cases and 44 normal weight-for-age children (22 boys and 22 girls) as controls. The total study sample was 94 instead of 100. The data for the withdrawn children were analyzed separately and results were compared with those of the cases. In comparison with the cases, the withdrawn malnourished children from the control group were found to be from poor urban households whilst the cases were mostly from poor rural households. The two groups had completely different sets of risk factors for malnutrition but all were basically caused by poverty.

5.2.2 Missing Data

Despite being properly set in the methodology to correct all the necessary data using a questionnaire (a copy of which can be sourced from the Appendix E), there were a number of missing data (1.2% on average) from various variables either because the respondents could not recall anything on some of the questions or chose not to answer the questions. The missing data did not affect the outcome of the analysis of the affected variables because not much was missing.

5.3. Study Limitations

By limiting the study to Lilongwe District, results cannot be generalized to rest of the children of Malawi. Not all malnourished children visit the health facilities or CTC programmes where the sampling was done. Consequently the results may not be a complete reflection of the situation in the entire district either, but that of the clients of the health facilities or CTC programmes.

CHAPTER 6.

CONCLUSION

RECOMMENDATIONS

6.1 CONCLUSION

6.1.1 The Risk Factors for Malnutrition among the Children.

The risk factors found are as follows: the guardian's dropping from school at primary level ; living in rural area but not on farm; poverty (with dwelling in a grass thatched house as one of the indicators); having irregular or no father support; being HIV positive; born with birth weight less than 2.5Kgs; being a child of 1.7 to 5 years; higher number (above 3) of pregnancies for the mother; mother staying without a husband; poor access to safe water; high stress for the mother; mothers' frequent attending to admitted cases; admission and re-admission of the child, household's poor access to food; not breastfeeding or being a weaned child; not getting full immunization; unbalanced weaning foods; guardian's poor knowledge of feeding the sick child; household head not employed; poor hygiene; lack of cleaning materials; the guardian's BMI of less than 18.5; frequent sicknesses for the child; and frequent malaria and diarrhea attacks to the child.

6.1.2 Variable that had no association with the under-nutrition in the study.

In the present research the following variable were found not to be associated with the malnutrition in the children: age of the mother, relationship between the child and the guardian, birth type, sex of the child, tribe of the child, period between inception of the pregnancy and booking at the clinic, whether the pregnancy was planned or not, use of birth control measures, number of live births from the mother, age of the mother at delivery, number of antenatal visits by the mother, birth order of the child, birth interval of the child, exclusive breast feeding, household income, race, number of rooms in a residential house, number of household adults, number of household children, the presence of the father of the child in the household, financial support, alcohol consumption of the guardians or parents, food insecurity in the household, parents smokes or use drugs, guardian abused, vaccines type that was not given to the child, whether the child is weaned or not, nutrition knowledge of the guardian, who the household head is and having a toilet. These findings are not in keeping with the findings of other studies.

Some of the findings from the present study as well as other studies are not consistent with each other. For example, Phengxay *et al*. (2007) found that male sex of a child was a risk factor for malnutrition in children less than 5 years of age in a cross

sectional study conducted in Luangprabang province of Laos. In a case-control study, Mamoun *et al*. (2005) found that age, sex, lack of immunization, lack of breast-feeding, history of fever and history of diarrhoea were not risk factors for malnutrition in under-five children living in Mayo displacement camp in Sudan. The findings are not consistent with the findings of some of the researchers highlighted in the literature review and not in keeping with the present research. Mamoun *et al*. (2005) therefore suggests that that the risk factors for malnutrition in children of a given age group in one area may not necessarily be the same as those for children of the same age group in another area at a particular time. This implies that the findings in the present research do not necessarily need to be similarly to other previous research findings as the research was conducted in different ecosystem and at different times.

These findings have important implications for nutritional interventions in Lilongwe. The risk factors found are basically consequences of poverty and are multidimensional. The commitment to tackling the inequalities resulting from poverty requires an integrated response at many different levels through a comprehensive anti-poverty strategy (Naidoo and Will, 1994). Ensuring food security, for example is closely aligned to combating poverty and poverty is multidimensional requiring combined efforts of many sectors for its sustained alleviation (WHO, 1998). Therefore, all players in the generation of living conditions that are safe and hygiene have to be brought together to create a supportive environment to combat malnutrition among the children.

6.2 RECOMMENDATIONS

- As there is need for integrated response at many different levels combining efforts of many sectors in order to deal with the risk factors, there is need to call for a meeting of all stakeholders in Lilongwe district to brief them on the risk factors found and their roles in tackling them.

- The government has to come up with an integrated comprehensive anti-poverty strategic response to alleviate the poverty of the poor urban and rural households in Lilongwe. This can be done through social cash transfer

programmes where household member will do some public works for money or food (food for work programme).

- The government sectors including their stakeholders should improve service delivery to the people of Lilongwe as follows:

  - The education sector should improve the provision of education to reduce illiteracy levels.
  - The agriculture sector should improve food security through improving access to improved farm inputs for the poor rural households.
  - The Water and Public works sector should improve the provision of safe water to the poor urban and rural households.

- The health sector should improve primary health care service delivery to the poor urban and rural households by carrying out the following:

  - Should launch a campaign in Lilongwe to advocate for principles of good hygiene to prevent the spread of diarrhea. Community Health Workers should encourage guardians to provide insecticide treated bed nets to children when sleeping at night to protect them from mosquito bites which transmit malaria.

  - Should launch an awareness campaign in Lilongwe on the importance of exclusive breastfeeding to children aged between 0 to 6 months, and adequate balanced complementary and weaning foods to children above 6 months of age. The campaign should targeting all guardians or mothers with children aged 0 to 5 years.

  - Should educate the mothers and guardians of children aged between 0 to 5 years on the importance of vaccine and should encourage them to bring their children to the health facilities for vaccination when due until they complete all the required vaccines. All mothers should also be oriented to the importance of family planning, family planning methods and basic nutrition including nutrition for the sick child.

- The 12% of the controls that were found to be malnourished suggest that screening for malnutrition is not properly done particularly in the urban areas where the children came from. It is therefore recommended that the health surveillance assistant should also intensify the screening process for malnutrition amongst children aged 0 to 5 years in the urban areas as is done in the rural areas.

- Has to implement a nutrition care and support program targeting children with HIV to prevent them from falling into the trap of malnutrition and should intensify PMTCT of HIV.

The interventions need to be complemented by community based programmes that reach the most vulnerable.

- Since not all malnourished children visit the health facilities or CTC programmes where the sampling was done and that the results may not be a complete reflection of the situation in the district then it is recommendable that there be another similar study conducted covering all the catchment areas of Lilongwe so as to have a representative sample of the district.

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APPENDICES

APPENDIX A

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2232, Fax: 27 21-959 3686

E-mail: ekunneke@uwc.ac.za

INFORMATION SHEET

Project Title: ***Risk Factors for Malnutrition in children, aged 0 to 5 years, in Lilongwe District, Malawi***

What is this study about?

This is a research project being conducted by Blessings Muwalo, an M Sc (Nutrition management) student from the University of the Western Cape. We are inviting you to participate in this research project because you are the parent/guardian of a child, 0 to 5 years of age The purpose of this research project is to determine the risk factors for malnutrition among children, aged 0-5 years, in Lilongwe District in Malawi. The results of this study would be used to determine and guide the development of plans and implementation strategies to address the problem of malnutrition in Malawi.

What will I be asked to do if I agree to participate?

Your child's and your nutritional status, thus height and weight, will be determined and you will be asked questions about your socio-economic status, feeding of the child and diseases the child has experienced Interviews shall be conducted in Chichewa local language and shall take about 20-30 minutes. The interviews will be done in consultation rooms or any other secluded area away from the other guardians or health workers.

Would my participation in this study be kept confidential?

Your information will be kept confidential and after signing the informed consent form, you and your child will be assigned a code number on the questionnaire and your name and the child's name will never be used in the analysis and reporting of the results. The signed consent forms will be stored in a locked cupboard that only the researcher has accessed to.

In accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning child neglect or potential harm likely to have caused the malnutrition or sickness.

What are the risks of this research?

There are no known risks associated with participating in this research project.

What are the benefits of this research?

This research is not designed to help you personally, but the results may help the investigator learn more about the risk factors of malnutrition in Lilongwe District. We hope that, in the future, other people might benefit from this study through improved understanding of the problem of malnutrition and developing intervention programs to alleviate this challenge.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

Is any assistance available if I am negatively affected by participating in this study?

Given the nature of the research, it is unlikely that the respondents will be negatively affected and it is anticipated that the research will cause no harm to the respondents.

In case you need assistance you can inform the researcher who will refer you for assistance.

What if I have questions?

This research is being conducted by ***Blessings Muwalo*** from the Division Dietetics; Department of Human Ecology and Dietetics at the University of the Western Cape. If you have any questions about the research study itself, please contact ***Blessings Muwalo*** at:

Cell phone Number: 00265999566003

Email Number: muwalo2000@yahoo.com

Telephone at work: 002651773831

Fax number: 002651773846

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of Department: Prof Rina Swart

Dean of the Faculty of Community and Health Sciences: Prof R Mpofu

University of the Western Cape

Private Bag X17

Bellville 7535

This research has been approved by the University of the Western Cape's Senate Research Committee and Ethics Committee.

APPENDIX B

UNIVERSITY OF THE WESTERN CAPE
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E-mail: ekunneke@uwc.ac.za

INFORMED CONSENT

Project Title: ***Risk Factors for Malnutrition in children, aged 0 to 5 years, in Lilongwe District, Malawi***

The purpose of the study has been explained to me in a language that I understand and I also understand that my participation in this research is entirely voluntary. I also understand what is going to be asked of me and refusal to participate or withdraw from the study will not result in penalty or any loss of benefit to which I am otherwise entitled.

I also understand that the information collected in this interview will be kept strictly confidential.

CONSENT

I have read the information about this research study on the participant information sheet, or it has been read to me. I have had the opportunity to ask questions about it and any question I asked has been answered to my satisfaction. I consent voluntarily to participate in this study and I understand that I have the right to end the interview at any time and to choose not to answer particular questions that are asked in the study.

My signature says that I am willing to participate in this research.

Participant Name (Printed): …….

Participant Signature: …… Consent Date: ……

Researcher Name (Printed): ……..

Researchers Signature: ……

APPENDIX C

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Participant information sheet (Chichewa Version)

Mutu wa Kafukufuku: ***Kufufuza za zodzetsa kunyentchera pakati pa wana osaposera zaka zisanu zobadwa mu boma la Lilongwe, Malawi*****.**

CHOLINGA CHA KAFUKUFUKUYU NDI CHIYANI?

Kafukufukuyu adzapangidwa ndi a Blessings Muwalo womwe akuchita maphunziro a ukakachenjede a zamadyedwe ku School ya Ukachenjede ndi Ukadaulo ya Western Cape. Inuyo mukupephedwa kutengapo mbali pa kafukufukuyu chifukwa ndinu kholo kapena mlezi wa mwana osaposera zaka zisanu zobadwa amene mulinayeyu. Cholinga cha kafukufukuyu ndi kufufuza za zodzetsa kunyentchera pakati pa wana osaposera zaka zisanu zobadwa mu boma la Lilongwe mu dziko la Malawi. Pali ganizo loti zotsatila za kafukufukuyu zidzatha kuthandiza popanga ndondomeko zoyenera pofuna kuchepetsa vuto la kunyentchera kwa ana mu Malawi.

KODI NDIDZAFUNSIDWA KUPANGA CHIYANI NGATI NDITAVOMEREZA KUTENGAPO MBALI PA KAFUKUFUKUYU?

Thanzi lanu ndinso mwana wanuyo choncho kulemera ngakhalenso nsinkhu wa mwana wanuyo zidzapimidwa ndipo mudzafunsidwa mafunso omwe adzakhudzana ndi mfundo za chuma ndi chikhalidwe cha pa banja, kadyetsedwe, thanzi ndi umoyo wa mwanayo ndinso mitundu ya matenda amene amamuvuta mwanayo. Kuchezaku kudzachitika mu chichewa ndipo padzatenga nthawi yosaposera ola limodzi kuti kuchezaku kuthe. Kuchenzaku kudzachitikira pa malo oduka mphepo omwe adzakonzedwe kutali ndi anthu ena onse.

KODI KUTENGA GAWO KWANGA PA KAFUKUFUKUYU KUDZAKHALA KWA CHINSISI?

Zonse zomwe mudzafotokoze zidzasungidwa mwachinsisi ndipo mukadzasaina kalata yosonyeza kuvomera kwanu kuchita nawo kafukufukuyu mudzapatsidwa nambala yomwe idzagwilitsidwa ntchito m'malo mwa dzina lanu ndi la mwana wanu mpaka atatha. Kalata yovomera kuchita nawo kafukufukuyu yomwe mudzapemphani kusaina posonyeza kuvomereza kupanga nawo kafukufukuyu idzatsekeredwa moti okhawo opanga kafukufukuyu ndi amene adzatha kuyiwona.

Malinga ndi malamulo adzikolino ndinso lunso lomwe tilinalo, tidzatha kudziwitsa oyenera kutenga gawo populumutsa moyo wa mwana ngati titapeza kuti pali chipsyinjo kapena chiopsezo pachisamalilo kapena moyo wa mwana zomwe zadzetsa kunyentcherako kapena kudwala

KODI PALI CHIOPSEZO CHANJI PA KAFUKUFUKUYU?

Palibe chiopsezo chinachilichonse ngati mutatenga mbali pa kafukufukuyu.

KODI PALI CHOLOWA NGATI WATENGAPO MBALI PA KAFUKUFUKUYU?

Palibe chilinganizo choti kafukufukuyu akupezetseni cholowa china chili chonse payinu nokha kamba kotengapo mbali. Koma kuti zotsatira zomwe tidzapeze pa kafukufukuyu dzidzathandidza a zakafukufuku kudziwapo zambiri pa zomwe zimadzetsa kunyentchera mu boma la Lilongwe. Mkutheka kuti m'tsogolo muno ena a inu mudzapindulapo kudzera mu kafukufukuyu pamene padzakhala kumvetsa ndinso kupanga njira zabwino zolimbikitse ntchito yothana ndi kunyentchera.

KODI PALI UFULU WOLOLA KUPANGA KAFUKUFUKUYU KAPENA KUSIYA?

Muli ndi ufulu wolola kukhala m'modzi mwa anthu opanga nawo kafukufukuyu kapena ayi. Mukasankha kutenga nawo mbali pa kafukufukuyu muli ndi ufulu wosiya mutafuna kutero nthawi ina iliyonse ndipo palibe mlandu kapena chovuta china chili chonse mutatelo. Ngati simukufuna kutenga mbali pa kafukufukuyu kapena mwafuna kusiyira panjira muthanso kutelo ndipo simudzapeza vuto linalililonse ngakhale kumanidwa kathu kena kalikonse pachifukwa choti mwatero.

PALI CHITHANDIZO CHANJI NGATI MUTAPWETEKEKA NKATI MOTENGA GAWO PA KAFUKUFUKUYU?

Malingana ndi mmene kafukufukuyu wakonzedwera, nkosayembekezeka kuti mungapeze vuto lina lililonse mukasankha kutenga nawo mbali pa kafukufukuyu. Mwina mkutheka kuti mwafunabe thandizo lina lapadera, mutha kufunsa amene adzachititse kafukufukuyu kuti akulondoleleni kwa oyenera kukuthandizani.

NANGA NGATI TILI NDI MAFUNSO?

Kafukufukuyu akupangidwa ndi a bambo **Blessings Muwalo** omwe akuchokera ku Division Dietetics: Dipatimenti ya Human Ecology and Dietetics ya ku School ya Ukachenjede ndi Ukadaulo ya Western Cape. Ngati mungakhale ndi mafunso, mutha kuwafunsa a bambo **Blessings Muwalo** podzera pa manambala a lamya amene nalembedwa apawa:

Nambala ya telefoni ya m'manja : 265 (0) 999566003
Telefoni yaku ntchito: 002651773831
Fax number: 002651773846
E-mail: muwalo2000@yahoo.com

Ngati mungankhale ndi mafunso monga mwa ufulu wanu ngati wotenga mbali pa kafukufukuyu ngakhalenso ngati mwafuna kunena nkhawa zanu pa zomwe mwakumana nazo pa kafukufukuyu mutha kutero podzera pa adilesi imene yalembedwa apai:

Head of Department: Prof Rina Swart
Dean of the Faculty of Community and Health Sciences: Prof R Mpofu
University of the Western Cape
Private Bag X17
Bellville 7535

Kafukufukuyu ndi wovomerezeka ndi gulu lowona za kafukufuku la ku sukulu ya Ukachenjede ndi Ukadaulo ya Western Cape lotchedwa Senate Research Committee and Ethics Committee.

APPENDIX D

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INFORMED CONSENT (Chichewa Version)

Mutu wa Kafukufuku: ***Kufufuza za zodzetsa kunyentchera pakati pa wana osaposera zaka zisanu zobadwa mu boma la Lilongwe, Malawi.***

Zolinga za kafukufukuyu zafotokozedwa kwa ine mu chinenero chomwe ndamvetsetsa bwino ndiponso ndamvetsetsa kuti kutengapo gawo pa kafukufukuyu ndikufuna kwanga ndipo sindinakakamizidwe kutero. Ndikumvetsanso zomwe ndidzafunsidwa pa kafukufukuyu ndinso ngati ndikana kutenga mbali kapena kusiyira panjira pa kafukufukuyu sindidzapeza vuto linalililonse ngakhale kumanidwa kathu kena kalikonse pachifukwa choti ndatero. Ndikudziwanso kuti zonse zomwe ndidzanene pa kafukufukuyu zidzasungidwa mwa chinsisi.

CHIVOMEREZO

Ndawerenga zonse zokhudza kafukufukuyu mu ndondomeko yomwe yaperekedwa kapena kuwerengedwa kwa ine. Ndinapatsidwa mwayi wofunsa mafunso pakafukufukuyu ndipo funso lililonse ndinafunsa ndinakhutira ndi mayankho ake. Ine ndikuvomereza mosakakamizidwa kutengapo mbali pakafukufukuyu ndipo ndikudziwitsitsa kuti ndili ndiufulu kusiya kutenga mbali nthawi ina iliyonse ngakhalenso kusankha kusayankha mafunso ena angafunsidwe mu kafukufukuyu.

Siginechala yanga yikuimira kuvomereza kwanga kutengapo mbali pakafukufukuyu.

Dzina:……

Siginechala/chidindo cha chala changa Tsiku lovomerezera

…….

……..

Dzina la ofunsa:

……

Siginechala ya ofunsa Tsiku

……

APPENDIX E

THE RISK FACTORS FOR MALNUTRITION STUDY
CONFIDENTIAL QUESTIONNAIRE

STUDYNU : Study Number

CASE/CNRTL : Case or Control

Case (Malnourished) : 1

Control (not malnourished) : 2

Date of Interview

DD	MM	YY

Name of Health Facility……

Facility Code NRU (1)……..Under Five Routine Clinic (2)……..

Name of Mother……

Date of Birth of Mother

DD	MM	YY

What is the name of the child?

Gender of the child

Male	**1**
Female	**2**

CHILDAGE What is the age of the child at last birthday (in years)?.....

Date of birth of child

DD	MM	YY
-	-	-

BIRTWT Birth weight of child……..

Grams from card

-	-

Grams from recall

-	-

<2500g	**1**
>2500g	**2**

BIRTHTYPE-Type of birth (Caesar or gave birth through a normal spontaneous vaginal delivery - SVD)

Caesar	**1**
SDV	**2**

RELATIONSHIP-How related are you to the child?

Parent	**Relative to the parents**	**Nun**	**Care taker**	**Others**
1	2	3	4	5

TRIBE-What is your tribe or ethinic group?

Chewa	Tumbuka	Lomwe	Tonga	yao	sena	Nkhonde	ngoni	other
1	2	3	4	5	6	7	8	9

Village where family lives:……..

Contact details:

……

……

Contact details of two friends/relatives

One	**Two**

STD -standard what is the highest standard the guardian passed at school?

No formal	**Some**	**Primary**	**Some**	**Secondary**	**Tertiary**

education	Primary	completed	Secondary	completed	
1	2	3	4	5	6

FIRSTBABY was this the first baby to the mother?

Yes 1

No 2

FIRSTBOOK How many months pregnant was the mother when first booked at the clinic?

1-3 months 1

4-6 months 2

7-9 months 3

PLANNED Was the pregnancy planned?

Yes 1

No 2

BTHCONTROL Were any form of contraception/ birth control used when the mother became pregnant?

Yes 1

No 2

PREGNUM How many pregnancies did the mother have?

……..

NUMLIVEBIRTH How many live births did the mother give?

……..

DELIVAGE What was the age of the mother when she gave birth to this child?.....

Below 18 years	Above 18 and below 49 years	49 and above
1	2	3

ANTNVISIT How many times did the mother visit the antenatal clinic?.....

BIRTORD What is the birth order of this child?

……..

BIRTHINTV What is the age difference with the previous baby (birth interval)?

……

EXBRSTF Was the baby exclusively breastfed during the first 6 months of life?

Yes	**1**
No	**2**

WORK Do you currently work and earn money?

Yes	1
No	2

SALARY What is your approximate monthly salary/income of the guardian?

None	1
MK4,000.00 or less	2
MK6,000.00- MK10,000.00	3
MK12,000.00- MK14,000.00	4
MK16,000.00-MK20,000.00	5
>MK20,000.00	6
Don't Know	7

MARSTATUS Marital status (Please tick the appropriate box)

Single -Never Married	1
Married- Monogamous relationship	2
Married- polygamous relationship	3
Widowed	4
Divorced/Separated	5
Co-habiting	6

RACE Maternal race/ Ethnicity (Choose one)

a) Black	1
b) Coloured/ Mixed race	2
c) White	3
d) Asian	4
e) Other, specify	5

TYPEAREA What type of area do you live in (Choose one which best applies)

On a farm	1
In a city/ town	2
In a township- formal settlement	3
In a township -Informal settlement	4
In a rural area (not a farm)	5

TYPEHOUSE what type of house do you live in?

Brick house	1
Brick and Iron sheets	2
Grass thatched	3

A shack in the squatter area 4

Other, specify…… 5

ROOMS How many rooms (including kitchen and toilet) are there in your house?

NUMHHCHILD How many children live with you in the house?

NUMHHADULT How many adults live in your household?

WATERSOURCE What is your main source of drinking water?

1. Own tap	**2. Communal tap**	**3. Open well in yard/plot or public**	**4. Water from Borehole**	**5. Water from River/Stream/Dam**	**6. Other**

FATHERPRES Do you currently live with the father of the baby?

Yes 1

No 2

FTHSUPPRT Does the father of the baby support you financially?

Yes 1

No 2

Sometimes 3

FINANSUPP Which of the following financial support do you receive?

a) social support grant (Other than child support grant) 1

b) child support grant 2

c) None 3

d) Other, specify…… 4

SOCIALSUPRT Do you participate in a women's support group?

Yes 1

No 2

SHEBEEN Do you ever visit a shebeen or any beer drinking places?

No 1

Sometimes 2

Weekly 3

ALCOHOL Do you drink alcohol?

Yes 1

No 2

MALNB What is the problem with the baby?

Malnutrition 1

Others 2

Anthropometric Measurements for the baby

MUAC ……..

MUAC <11.0 CM (Severe Acute Malnutrition (SAM)) 1

MUAC 11.0 CM to 12.5 CM (Moderate Acute Malnutrition (MAM) 2

MUAC ≥12.5 CM to <13.5 CM (child at risk of malnutrition) 3

MUAC ≥ 13.5 cm (Properly nourished) 4

Height/length (cm)	**Weight (Kgs)**

Z-scores for height for age (HAZ)

< -2 1

-2 to 2 2

>2 3

Z-scores for weight for age (WAZ)

< -2 1

-2 to 2 2

>2 3

What is the current weight and height of the mother/caregiver
Weight in Kg ……..
Height in CM……..
BMI What is the current maternal body mass index BMI ……. cm/kg

BMI

BMI <18.5 1
BMI 18.5 - <25 2
BMI 25 - < 30 3
BMI ≥ 30 4

MALNG Is the mother or guardian malnourished?

Yes 1

No 2

VOMIT Was there any maternal vomiting in pregnancy?

Yes	**1**
No	**2**

MALNR Did any of your relative have malnutrition before?

Yes 1

No 2

MALNO Did any of your babies have malnutrition before?

Yes 1

No 2

MALNH Does anyone who lives in your household ever have malnutrition?

Yes 1

No 2

SMOKER Do you smoke cigarettes?

Yes 1

No 2

HIVSTATUS HIV Test Results for the child

HIV Positive 1

HIV Negative 2

DRUGS Do you use any drugs?

Yes 1

No 2

ABUSE Have you ever suffered from any mental or physical abuse?

Yes 1

No 2

STRESSSC Stress Score (scale 1-7)?

ADMIS Have you ever been admitted to the hospital with a baby before?

Yes	**1**
No	**2**

RE-ADMIS If yes who was the baby

The same baby	**1**

Different baby	**2**

MALNREOCC What was the problem

Malnutrition	**1**
Other Problems	**2**

Food Access - Do you easily access adequate food of all six groups for consumption at home?

Yes	**1**
No	**2**

BF Is the baby currently being breast fed?

Yes	**1**
No	**2**

IMMUNE was the baby fully immunized?

Yes	**1**
No	**2**

VACINETYPE Which vaccines were not given?

None	**1**
One type	**2**
Two types	**3**
Three types	**4**
Four types	**5**
Five types	**6**
Others	**7**

WEANING Have you started introducing other foods to the baby?

Yes	**1**
No	**2**

WEANINGFOODS Which foods do you feed the child.

One food groups	Two food groups	Three food groups	Four food groups	Five food groups	Six food groups	Breast milk
1	**2**	**3**	**4**	**5**	**6**	**7**

FEEDTIMES How many times do you feed the child in a day?

Once	Twice	Thrice	Four times	Five times	<five

1	2	3	4	5	6

NUTRKNOW Do you have any knowledge of Nutrition?

Yes	**1**
No	**2**

FEEDSICK How do you feed a child when he/she is sick?
……..……
……
……
1. Properly. 2. Not properly
SICKTIMES How regular does your child get sick in a month?

Once	**Twice**	**Three**	**Four times**	**Five times**	**<five**	**None**
1	2	3	4	5	6	7

SICKTYPE What type of sickness affect your child?

1. Malaria;
2. Diarrhea;
3. Caughing;
4. Measles;
5. Anaemia.
6. Others
7. none

HHHEAD Who is the head of the family?.....

Father	**Mother**	**Child**	**Relative**	**Others**
1	**2**	**3**	**4**	**5**

HEADEMPLOY Is the head of the family employed?

Yes	**1**
No	**2**

TOILET Do you have a toilet at home?

Yes	**1**
No	**2**

CLEANING How do you clean the surrounding?

.....
.....……
……..

Knowledge of Cleaning the surrounding	**1**
No knowledge of Cleaning the surrounding	**2**

CLEANMAT Do you easily access soap for general cleanliness?

Yes	**1**
No	**2**