(COMPLETED RESEARCH)

THE PREVALENCE OF MALNUTRITION AMONG CHILDREN UNDER AGE OF 5 YEARS ATTENDING PRIMARY HEALTH CARE AT THE CLINICS IN THE BA-PHALABORWA SUB-DISTRICT, LIMPOPO PROVINCE, SOUTH AFRICA

by

CHESLY SHABANGU

[redacted]

Submitted in partial fulfilment of the requirements for the degree of

MASTER OF PUBLIC HEALTH

In the

FACULTY OF HEALTH SCIENCES

School of Health Care Sciences

at the

UNIVERSITY OF LIMPOPO

SUPERVISOR

SUPERVISOR: Mr. E. Maimela

CO-SUPERVISOR: Prof. L. Skaal

2019

DEDICATION

This study is whole heartedly dedicated to my son (Langutetani Shabangu) and my spouse (Mbally Mathebula) who have been the source of my inspiration and gave me strength when haunted with the thought of giving up, who continually provide their moral, emotional and financial support.

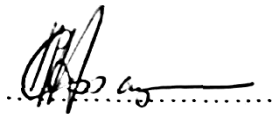
To my brother (Stanford Shabangu), who always provide me with his words of advice and financial support to finish this study?

And lastly, I dedicate this study to my sister (Alucia Shabangu) who provides me with spiritual support and guidance. All of these I offer to all of you.

DECLARATION

A research project submitted in partial fulfilment of the requirements for the degree of MPH by coursework and Research Report in the Faculty of School of Health and Sci- ences at the University of Limpopo 2019

I declare that this research is my own, unaided work. It has not been submitted before any other degree, part of degree or examination at this or any other university.



SHABANGU C

27/September 2019

ACKNOWLEDGEMENTS

I cannot express enough thanks to my supervisors, Dr Maimela and Prof Skaal, for their continued support and encouragement. I also owe the completion of my project to my brother, Stanford and my spouse Mbally Mathebula, who have been supportive of my objectives to finish my studies.

And finally, to my sister, Alucia, who provided me with spiritual support and who ensured that my project has the backing of my ancestors.

ABSTRACT

Background: Malnutrition has become a problem in the world, with 2.2 million deaths of children under five years of age globally have been linked to growth retardation, stunting and severe wasting, while other 600 000 children in the same age group are said to have died due to deficiencies in Vitamin A (Black, Allen, Bhutta, Caulfield, De Onis, Ezzati, Mathers, Rivera, and Maternal and Child Undernutrition Study Group, 2008).

Objectives: This study aimed at determining the prevalence of malnutrition in children below 5 years of age, and to quantify stunting, underweight, wasting, overweight and obesity of children in the same group.

Methods: This was a descriptive quantitative study. The data for the study was collected from 10 clinics, situated in the Ba-Phalaborwa District Municipality, using a standardized questionnaire. Stratified random sampling was used and stata program was used to analyse the data.

Results: A total of 404 of mothers gave positive responses for children to participate in the current study, yielding to 97.1% response rate. Fifty-two-point-two percent of these children were females. The average age of the mothers of these children was 28.3 ±7.0 years Fifty-three-point-four percent of the mothers were single, 27% were divorced, 18.6% were married and 0.5% were widowed. The overall prevalence of malnutrition among the children was 26.7%. Males had higher percentage of underweight with 19.1%, compared to females (9.9%*)*. The highest prevalence of malnutrition in females occurred in the age group 48-59 months, at 40.0%, followed by the age groups 0-11 months, 36-47 months, 24-35 months and 12-23 months at 26.9%, 25.0%, 24.0% and 17.5%, respectively. Of the different types of malnutrition, the occurrence of obesity was the lowest among the children.

Conclusion

The results of the findings are consistent with the findings of other studies. However, this study could not find that characteristics such as education, type of residence or financial background contribute immensely to child malnutrition.

ABBREVIATIONS

MUAC : Mid-Upper Arm Circumference

PEM : Protein-Energy Malnutrition

UN : United Nations

USAID : United States Agency for International Development

UNICEF : United Nations `Children Emergency Fund

WHO : World Health Organization?

SAM : Severe Acute Malnutrition

DEFINITION OF KEY CONCEPTS

The explanations for the below concepts are only meant for the purpose of this study:

Malnutrition: refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients (WHO, 2016)

Acute malnutrition: A state whereby a child suffers from bilateral pitting oedema or weight loss due to illness or insufficient consumption of food (WHO, 2005). This definition will be used as is.

Chronic malnutrition: A condition caused by a persistent lack of access to vitamins and minerals in early childhood, which and has health implications later in life, even when the person concerned is receiving adequate nutrition. (WHO, 2004) This definition will be used as is.

Stunting: it is a form of malnutrition that impacts on the development and growth of a child (WHO, 2005). In this study, it will mean children who are failing to thrive for their age. This definition will be used as is.

Wasting: WHO (2005), defines wasting as a state of gradual deterioration in an individual that result in a loss of strength and muscle mass. This definition will be used as is.

Child: A child is a human being between birth and age of puberty (WHO, 2005). For purpose of this study, a child will be a human being from 0 to 5 years of age.

Over-Weight/Obese: are defined as abnormal or excessive fat accumulation that may impair health (WHO, 2018)

Table of Contents

CHAPTER ONE: ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Malnutrition has become a priority in the public health system due to its impact on mortality and morbidity. Steenkamp, Nomvete, and Venter (2015) report that children under the age of five, who are malnourished are at a higher risk of dying than children who are well nourished. Moreover, under-nourished children are mostly found in low- and middle-income countries. Furthermore, 2.2 million deaths of children under five years of age, globally, have been linked to growth retardation, stunting and severe wasting, while other 600 000 children of the same age are said to have died due to deficiencies in Vitamin A (Black et al 2008). In Africa, Kenya alone has recorded a death rate of 77 per 1000 children under the age of five each year, despite global trends having declined (Steenkamp et al, 2015. According to Rodriguez, Cervantes and Ortiz (2011), 5,97 million deaths of children between the ages of 0 and 5, globally, are caused by diseases related to malnutrition, such as malaria, HIV, diarrhoea and measles, the majority of which are in Africa.

De Onis, Brown, Blossner, and Borghi, (2012) classify malnutrition in four categories, namely, stunting, underweight, wasting, and, overweight and obesity. Underweight is mainly marked by either a failure of a child to gain weight in relation to its age, or as a loss of weight in relation to height (Onyango and de Onis, 2008). Wasting is mainly caused by an inadequate consumption of nutritious food, or a lack of absorption of the food due to poor health status and disease (Virginia, 2012). There are 34 countries in the world that are burdened with malnutrition and Africa accounts to 90% of this burden, which is prevalent in 22 countries on the continent (de Onis, 2013). Malnutrition accounts for approximately 54% of the deaths recorded among the children under five years in Africa (Marathe, 2016). Furthermore, it was reported that more than 20 million children in Africa suffer from severe acute malnutrition and one million children perish every year as the result (Laghari, 2015).

Rodriguez et al (2011) revealed that children who are malnourished are more susceptible to infectious diseases than those who are not malnourished. Moreover, the risk of child mortality is closely linked to weight for age, and the risk is greater

among children with mild-to-moderate malnutrition (WHO, 2005). Furthermore, malnutrition places a greater burden on the health system, a system that is over-burdened with a multiple burden of disease (tuberculosis, HIV, AIDS, high levels of maternal and child mortality, other communicable diseases, injuries; and non-communicable diseases (NCDs) (Ataguba, Day & McIntyre, 2015). Bamford, L., Barron, P., Kauchali, S. and Dlamini, N., (2018) indicates that little improvements have been achieved in South Africa in relation to the nutritious status of children, thus also reducing the number of under-five deaths due to malnutrition related diseases, even though a lot still needs to be done. Therefore, based on the above, there is a need for solutions to eradicate malnutrition in South Africa.

1.2 PROBLEM STATEMEN OF THE STUDY

Malnutrition has contributed greatly to morbidity and mortality globally (Schaible & Stefan, 2007). Maternal and child malnutrition combined contributes to approximately 3.5 million deaths annually around the world (Horton, 2008). In addition, some sources have indicated that undernutrition is one of the main causes of morbidity and mortality in the world, especially in the developing continents (Bain, Awah, Geraldine, et al, 2013). Bain et al., (2013) further reported that, out of the ten million deaths among children every year globally, 49% are associated with malnutrition. Another study has reported that malnutrition contributed to approximately 35% of global deaths and 11% of global diseases among the children under five years old (Black et al, 2008). Furthermore 20 million children in Africa suffer from severe acute malnutrition and one million children on the continent perish every year as the result of malnutrition (Laghari, 2015). Other studies have reported that 161 million underweight children and 99 million children who are wasted were recorded in Africa (Tette, Sifah, and Nartey, 2015). The prevalence of malnutrition cases in South Africa is still above the target among children under five years old, which includes girls at a prevalence rate of 25% and boys at a prevalence rate of 26% (Seonandan & McKerrow, 2016). The prevalence of malnutrition among the children in this country still seems to be too high, especially in Gauteng and Free State with 34% respectively (Demographic, S.A., Health Survey, 2016) As a result, children in this category are rendered the most vulnerable to malnutrition, which is exacerbated by the fact that infants and children are dependent on others to provide and prepare foods, and even to be fed. As it stands the majority of South Africans

suffering from food poverty. Studies have found that 53 % of sampled rural households in the country have been declared to be severely food insecure. as a result, stunting has remained stubbornly high in the country (Said-Mohamed, Micklesfield, Pettifor, and Norris, 2015). This study, therefore, seeks to investigate the prevalence of malnutrition in the Ba-Phalaborwa Municipality. In order to do so, data will be collected from the local clinics.

1.3 LITERATURE REVIEW

1.3.1 Introduction

The literature was reviewed for the purposes of gaining insights into the subject under study. And according to sources, child malnutrition is one of the main causes of morbidity and mortality in the world, especially in the developing countries such as Asia and Sub-Saharan Africa (Bain et al., 2013). The impact of child malnutrition can also be found in the later developmental stages of a child. Children who suffered from malnutrition early in their childhood are likely to perform poorly in school and experience poor health later in childhood (Grantham-McGregor, Cheung, Cueto, Glewwe, Richter, Strupp, and International Child Development Steering Group, 2007). A detailed literature review will be presented in Chapter 2 of the study.

1.4 PURPOSE OF THE STUDY

1.4.1 Aim of the study

The aim of this study was to investigate the prevalence of malnutrition among children below the age of 5 years in the Ba-Phalaborwa sub-district of the Mopani District in the Limpopo Province.

1.4.2 Research Objectives

To determine the prevalence of malnutrition in children below 5 years of age in the Ba-Phalaborwa sub-district

To quantify stunting, underweight, wasting, overweight and obesity in children under the age of five years of age in the Ba-Phalaborwa sub-district.

To establish the socio-demographic characteristics of malnourished children in the Ba-Phalaborwa sub-district.

To determine the association between malnutrition and socio-demographic characteristics

1.4.3 Research questions

1. What is the Prevalence of Malnutrition in children under 5 years of age visiting clinics in the Ba-Phalaborwa dub-district of the Limpopo Province?

2. What socio-demographics are associated with Malnutrition in children visiting clinics in the Ba-phalaborwa sub-district of the Limpopo Province.

1.5 RESEARCH METHODOLOGY

The study employed a quantitative, descriptive design. The design and setting, including sampling methods, data collection and data analysis, together with validity, reliability and bias, will be elaborated on in Chapter 3.

1.6 ETHICAL CONSIDERATIONS

The aspects of ethical considerations such as ethical clearance, confidentiality, anonymity and protection of privacy will be dealt with in Chapter 3.

1.7 SIGNIFICANCE OF THE PROPOSED STUDY

The researcher will inform the Department of Health of the extent of malnutrition in the Ba-Phalaborwa sub-district. Malnutrition occurs as a result of poor nutrition and/ or poor feeding methods. This study will, therefore, benefit mothers who have the responsibility to prepare nutritious food for their children, as well choosing the correct method of feeding. Mothers will receive information about the fact that undernutrition can lead to delayed growth, while providing too much food can lead to obesity. According to Wemakor, Garti, Azongo, Garti, Atosona, (2018) teenage mothers were eight times more at risk of having undernourished children than adult mothers, hence this study will play such an important role in the prevention of Malnutrition among children under five.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

Many studies have found that child malnutrition is responsible for majority of deaths among children under the age of 5 worldwide. The literature points out Asia, Africa and, to some degree, Latin America, as continents which are immensely affected by child under-nutrition. Nearly one-third of children in the developing countries are malnourished. One research study has estimated that approximately 165 million children younger than 5 years of age from low and middle-income countries were malnourished, mainly due to poverty (Black, 2013). Malnutrition is visible mainly among children who are between the ages of 6 months and 2 years of age. Such signs may include weaning and severe or frequent infections. (Bhutta, et al, 2008). The reason why a child is vulnerable during this period is because that child is at a developmental stage where good nutrition and healthy growth have lasting benefits throughout life (Ruel, Alderman, and Maternal and Child Nutrition Study Group, 2013). In addition, some sources have indicated that undernutrition is one of the main causes of morbidity and mortality in the world, especially in the developing continents (Bain et al, 2013).

The impact of child undernutrition goes beyond the early visible signs and it also has an impact during the developmental stages of a child. Research studies have found that most children who have suffered from malnutrition early in their childhood are likely to perform poorly in school and experience poor health later in childhood (Grantham-McGregor et al, 2007). It was revealed that malnutrition also determines a child's chances to survive illnesses and other social challenges, as well as having an impact on the economic productivity of individuals in society (Marmot, and Bell, 2012). Sources have further noted that some countries in Sub-Saharan Africa, Latin America central Asia, Middle East and the Caribbean regions who have signed the Millennium Development Goals (MDG) have failed to make an impact in terms of reducing the number of cases of child undernutrition (Stevens, Finucane, Picilorex, Flaxman, White, Donner, and Ezzat, 2012). However, it seems that all is not lost since, according to some sources, it appears that there have been improvements over the years, although the major differences were recorded in developing countries, which South Africa is also part (Ajiye, 2014).

South Africa signed the United Nations (UN) MDG1, which aims was to end hunger by 2015, however, this target was not reached. The target was not reached despite the fact that there were different programs which were developed by the South African government to managed the crisis, including, among others, programs such as the foster care grant, school feeding schemes, the child support grant. It now appears that these efforts by government were inadequate to address some of the underlying matters when it comes to children under-nutrition (Ajiye, 2014.).

It is against this background that the researcher opted to gain insight into child malnutrition by reviewing several sources which discuss the subject of child malnutrition. This literature review will begin with giving a world perspective, an African perspective, a South African perspective and a Provincial perspective on the matter.
The following topics will be discussed" classification of child under-nutrition, factors contributing to child under-nutrition, effects of child under-nutrition, methods for the prevention and treatment of child under-nutrition, followed by a conclusion.

The South African Government developed special programs to deal with child under-nutrition, such as the introduction of child support grants and foster care grants in order to deal with hunger and poverty (Leibrandt, Wegner, and Finn, 2011). Despite these governmental efforts, many children in South Africa still face hunger and poverty. As a result, many cases of child undernutrition are still being reported (Labadarios, Mchiza, Steyn, Gericke, Maunder, Davids, and Parker, 2011) Perhaps this is due to the fact that governments are either unaware or ignorant of the presence of the factors which play a role in child under-nutrition.

2.2 CLASSIFICATION OF MALNUTRITION

According to Myatt, Khara, and Collins (2006) it is difficult to recognise signs the presence of malnutrition in the early stages. As a result, biochemical or anthropometric tests must be conducted to determine whether a child is malnourished or not (Secker & JeeJeebhoy, 2007). Malnutrition is classified according to the following categories: stunting, wasting, underweight, Obesity and Overweight (De Onis, Brown, Blossner, and Borghi, (2012). Bain et al. (2013) further reported that, out of the ten million deaths every year globally, 49% are associated

with malnutrition. A large share of these deaths occurs in the Sub-Saharan Africa and South Asia. Malnutrition is classified as mild, moderate or severe based on anthropometry, biochemistry and clinical assessment. Moreover, severe acute malnutrition in children is classified according to different standards and methods which have been established by the United Nations agencies, such as WHO, the Food and Agriculture Organization and the United Nations Children's Fund. (World Health Organization, 2013).

2.2.1 Wasting

According to Faber and Wenhold (2006), wasting is identified when an individual`s weight is lower than it should be when compared to the height of the individual, or when the child`s weight is below 60% of the expected weight for that age. Asfaw et al (2015) child with a low weight-for-height z-score is below -2SD of the reference population, indicates wasting, meanwhile a below −3SD on the z-score is indicative of severe wasting.

Such children are at higher risk of morbidity and mortality. Wasting also refers to the weight of the sick child compared to that of a normal child of the same age, as indicated by de Lange (2010). Furthermore, wasting is also used to measure acute malnutrition. A study conducted reveals that, worldwide there are about 60 million children who suffer from moderate acute malnutrition and about 13 million of these children suffer from with severe acute malnutrition (Asfaw, Wondaferash, Taha, & Dube, 2015).

The global estimate of wasting among children under five is approximately 10%, or approximately 55 million children in number. In South-Central Asia alone it is estimated that 16% of children under five are malnourished, which translates into about 29 million children. Globally, approximately 13% of children under the age of five are wasted and 5% are severely wasted. In India alone, approximately 28% of children under 5 years of age (over 5 million children) are severely wasted. In South-Central Asia, 70% of children under the age of 5 are wasted (Black et al., 2008). In South Africa, 3% of children are classified as wasted (Demographic, S.A., Health Survey, 2016) Despite the reported decline in cases of child wasting globally over the years, it is estimated that, in developing countries, approximately 19 million children below 5 years are severely wasted (Black et al, 2008)

The study conducted by Stevens (2012) indicated that the prevalence of severe wasting among children below 5 years in-Central Asia was 5.7% or 10.3 million children in number, whereas In Central Africa, Child Malnutrition accounted for 5.0% or 1 million deaths (Stevens et al, 2012). Children who suffer from wasting are usually those who are poorly fed, those who suffer from some kind of disease and infection or those who suffer from a combination of both (Faber & Wenhold, 2006) indicators of severe malnutrition in children include, among others, marasmus and chronic wasting. Some symptoms may include changes to hair and skin colour, oedema, and /or moon face (Mehta, Corkins, Lyman, Malone, Goday, Carney, Monczka, Plogsted, Schwenk, and American Society for Parenteral and Enteral Nutrition (ASPEN) Board of Directors, 2013).

2.2.2 Underweight

Underweight is measured with a weight-for-age z-score below -2SD of the reference population, and a child who is below -3SD is severely underweight (Asfaw, Wondaferash, Taha, & Dube, 2015). This criterion is used as a measurement for both acute and chronic malnutrition (Faber & Wenhold, 2006). A child is under weight for age if the child's weight is below the percentile but equal to or more than 60% of estimated weight for age on the Road-to-Health Chart (below 60% is severe malnutrition) (De Onis, Blössner, and Borghi, 2010). Approximately 165 million children who are under the age of 5 are reported to be underweight globally (Black et al, 2013). Moreover, the global estimates are that approximately 101 Million children under the age of five were reported to be underweight, even though the number of underweight children dropped by 36% between 1990 and 2011 (Wardlaw, Newby, Brown, and Cai, 2012). According to the Demographic, S.A., Health Survey (2016) approximately 6% of children are underweight. De Lange (2010) found that prevalence of underweight is quite common among children, though it is often missed. Furthermore, underweight often occurs when there is a slowing down of height growth, a failure to gain weight or a loss of weight.

2.2.3 Stunting

Stunting is measured with a height-for-age which is below -2SD of the reference population, and a result of the z-score which is -3SD indicates severe stunting. Asfaw, Wondaferash, Taha, & Dube, 2015

A child is considered to be stunted if his or her height is more than two standard deviations below the World Health Organization's standard (Kulaga, Litwin, Tkaczyk, Różdżyńska, Barwicka, Grajda, Świąder, Gurzkowska, Napieralska, and Pan, 2010). Stunting indicates a failure to achieve a child's genetic potential for height, which occurs in the first 2–3 years of children life. Stunting is mostly associated with repeated exposure to adverse economic conditions, poor sanitation, the interactive effects of poor energy and nutrient intake, and infections, although poor socio-economic circumstances are the main causes of stunting (Black et al, 2008.). Stunting is also seen as the worst form of malnutrition due its implications in the later life of children. Stunting occurs as a result of nutritional deficiency or illness that affects the child during the developmental stages (De Onis, Blössner, and Borghi, 2012). Stunting is exacerbated by poor nutrition during this time and the undernourishment during the foetal period. Stunting also contributes up to half of a child's failure to grow by the age of two (Popkin, Adair & Ng, 2012). Stunting is positively linked to short adult stature, reduced lean body mass, less schooling, diminished intellectual functioning, reduced earnings and lower birthweight of infants born to women who themselves have been found to be stunted as children (Dewey & Begum, 2011). Although a child may not be classified as 'stunted' until age two to three years, the process of becoming stunted typically begins in utero (Dewey & Begum, 2011).

Stunting is much more common type of malnutrition globally, and it is estimated that approximately 171 million, or 27% of children aged 0–5 years, were recorded to be stunted in 2010. A decrease in the number of stunted children was recorded in the past two decades. (Christian, 2014). However, there are still a large number of cases of stunted children under five in South Asia and in Sub-Saharan Africa, as well as in India, (Rah, Akhter, Semba, De Pee, Bloem, Campbell, Moench-Pfanner, Sun, Badham, and Kraemer, 2010). In addition, 195 million children under the age of five in the developing world are stunted, at a rate of one in three children (Qadri, Bhuiyan, Sack, and Svennerholm, 2013). Stunting is estimated to affect 34% of

children younger than 5 years in low- and middle-income countries. Moreover, stunting has been found to be higher among under-five males with 30% than females, 25% (Demographic, S.A., Health Survey., 2016) Stunting should be used to as an indication of the overall child health and nutritional status (Bhutta et al., 2013). Individuals who are stunted at 2 years of age are likely to grow up to be stunted adults (De Onis, and Branca, 2016.). In developing countries, stunting is more prevalent than underweight or wasting, possibly because height gain is even more sensitive to dietary quality than weight gain is. The prevalence of stunting among women is highest in South/Southeast Asia and in parts of Latin America (Dewey & Begum, 2010; de Onis, & Branca, 2016).

Stunting is usually irreversible in children that are two years older and above., Children who suffer from stunting are more likely to perform poorly academically and their cognitive development tends to be affected throughout their lives. (Rah et al., 2010). Stunting often goes unrecognized in children who live in communities where short stature is so common that it seems normal. This problem is exacerbated by health professionals who do not take it as a serious illness compared to underweight or wasting. Stunting only gets picked up when assessments for other diseases are being performed (de Onis & Branca, 2016). There is, nevertheless, evidence that children the world over can attain their full growth potential if they are nurtured in healthy environments and if their caregivers follow recommended health, nutrition and care practices (de Onis, Blössner, & Borghi, 2012). Childhood stunting is a challenge in the public health sector because of its negative impact on the affected population (Bhutta et al. 2013).

2.2.4 Overweight/ Obesity

The globally percentage of overweight or obese children has been increasing since the 1970s. It was estimated that approximately 41 million children below the age of 5 years were obese or overweight in 2016 (WHO, 2018). Obesity is measured using a health chart which indicates whether a child is obese or not. If a child scores a Z-score of ≥ 3, it is classified as obese, while if the Z-score of ≥2, the child is overweight (Taylor, Jones, Williams, and Goulding, 2000). Studies have claimed that overweight and obesity trends are likely to grow by almost 9·9% globally in 2025 (Black et al, 2013). Whereas in Africa, it is estimated that obesity trends have

increased from 4% in 1990 to 7% in 2011, and is expected to reach 11% in 2025 (Taylor et al., 2000). These increases will not only take place in well-off countries, but also countries that are under privileged. Moreover, Asia has a lower prevalence of children under five who were overweight (5%) in 2011, although the number of children who were affected was higher compared to Africa (17 million and 12 million, respectively) (Black et al, 2013).

In addition, countries in Southern Europe have been found to have higher rates of overweight and obesity among people with low income levels and low education. (Gallus, Lugo, Murisic, Bosetti, Boffetta. and Vecchia, 2015). In Europe, as a whole, it has been found that half of the adult population in its population is overweight (Gallus et al. 2015. Research has shown that the difference between poor and rich countries is very low when it comes to overweight and obesity, although, in general, numbers tend to be very high in the richer countries and in families that are well-off (Black et al., 2013, Pantasri & Norman 2014). Furthermore, the varying statistics between countries is also influenced by a lack of standardized measurement methods and differences in terms of the definitions, among other factors (Dee, Kearns, O'Neill, Sharp, Staines, O'Dwyer, Fitzgerald,and Perry, 2014).

2.3 POPULATION AT RISK

Infants and children have an additional risk of malnutrition because they are dependent on others to provide and prepare food, and even to be fed. Muzigaba, Puoane, and Sanders, (2016) reported that children between the ages of 6-24 months are at the greatest risk of malnutrition due to poor intake quality of supplementary food, as well as a decline in breastfeeding, especially in Africa. According to Davies, (2010), the neonatal period is critical for the survival of a child. Any child that falls under this category stands a good chance of suffering from malnutrition if not well cared for. Malnutrition has contributed to approximately 35% of deaths globally, and to 11% of global diseases among the children under five (Black et al, 2008). This renders children in this category the most vulnerable to malnutrition. Furthermore, a report on a study conducted in 2012 reveals that 44% of mortality cases among children happen during the neonatal period and among children who live in circumstances of deeply rooted poverty and deprivation (Lozano, Naghavi, Foreman, Lim, Shibuya, Aboyans, Abraham, Adair, Aggarwal, Ahn, and Al-

Mazroa, 2012). Stunting is a nutrition problem that affects mainly developing countries (de Onis et al., 2012).

2.4 PREVALENCE OF MALNUTRITION

2.4.1 Global perspective

Maternal and child malnutrition combined contribute to approximately 3.5 million deaths annually around the world (Horton, 2008). The problem of malnutrition has, in recent years, created a crisis within the global public health system. Research studies have reported that, in the developing countries, there has been approximately 11 million children under 5 years who have perished due to undernutrition (Liu, Johnson, Cousens, Perin, Scott, Lawn, Rudan, Campbell, Cibulskis, and Mathers, 2012). Even though child deaths are rarely reported to be directly caused by malnutrition, there is sufficient evidence to suggest that there is a strong association between these deaths and malnutrition (Bain et al., 2013). Data from the World Health Organisation evidently supports the argument by reporting an estimate of around 10.5 million of children under five who are said to die every year due to malnutrition (Bhatia, Puri, Swami, Gupta, & Singh, 2007).

Shrimpton, and Rokx, (2012) reported that malnutrition has become a problem globally, moreover one third of children are stunted globally (Bhutta, et al 2012). These sentiments are shared by Ishmail and Suffla (2013), who added to the discussion by reporting that child malnutrition is fast becoming a global killer among children under the age of five. Furthermore, 1 million children die from malnutrition and 20 million more suffer from malnutrition in the world annually (Irena, Mwambazi, and Mulenga, 2011). Another study by Demissie, and Worku, (2013) has revealed that 7.6 million children died in 2010 before reaching their fifth birthday). whereas another study added that, as a matter of fact, about 10 million children under the age of 5 years die every year due to illnesses associated with malnutrition, all or many of which are reversible and treatable Bain, L.E., Awah, Geraldine, Kindong, Siga, Bernard, and Tanjeko, 2013). Meanwhile, in 2010, there were approximately 100 million stunted children in Asia and 60 million in Africa. There was an expectation that the numbers would decrease in the near future, based on the programs implemented by different countries to fight-off the challenge of the disease (de Onis et al., 2010). Indeed, the prevalence of malnutrition in India, Bangladesh,

Afghanistan and Pakistan is much higher than in Sub-Saharan Africa (Anderson et al., 2010). In recent times, a study found that approximately 178 million children under the age of 5 suffer from some type of malnutrition, and that about 55 million of these children are acutely undernourished, meaning that their bodies were wasted – 19 million were severely wasted (Bhutta and Salam, 2012). In 2013, 161 million children under-five years were estimated to be suffering from some kind of malnutrition globally. Meanwhile the prevalence of undernutrition in rural areas which are far away from cities is much higher than in the urban areas (Black, 2013; Yang & Kanavos, 2012).

It is indicated that prevalence of overweight and obesity has been increasing over the years worldwide. Childhood overweight and obesity is estimated to be 11.7% in developed countries and 6.1% in developed countries (De Onis, et al 2010) The number of overweight and obese children will increase to 60 million in 2020, if preventative measures are not put in place (Wang. and Lim, 2012). The prevalence of overweight, especially in children younger than 5 years, has been increasing steadily, from 4.8% in 1990 to 6.2% in 2015. And almost half of all overweight children younger than 5 years lived in Asia, and one quarter lived in Africa. This might have been caused by the historical beliefs that a heavy child meant a healthy child, and the concept “bigger is better” which was widely accepted, especially in Africa. Moreover, obesity in childhood is associated with a wide range of serious health implications and an increased risk of premature illness, and death, later in life (Wang and Lim, 2012).

2.4.2 African Perspective

Africa has the largest prevalence of malnutrition globally, accounting for 52% of all deaths of young children (Tette, Sifah, & Nartey, 2015). De Onis (2013) noticed that, out of the 34 countries in the world that are burdened with malnutrition, Africa accounts to 90% of that proportion. Furthermore, 20 million children in Africa suffer from severe acute malnutrition and one million children perish every year as the result (Laghari, 2015). Studies have reported that one third of 161 million underweight children and one third of 99 million children who are wasted children, were recorded in Africa (Tette et al, 2015). In addition, it is estimated that 200 million children under 5 in Sub-Saharan Africa suffer from some form of slow cognitive

development due to their poverty background and nutritious deficiency. Moreover, malnutrition has been found to have a lasting negative impact on the motor development of children and lead to poor academic performance later in life (Grantham-McGregor et al. 2007; Tette et al. 2015). No wonder that some findings have reported that children who grow up under such circumstances tend to have intellectual deficiencies.

The estimated prevalence of overweight and obesity in Africa in 2010 was 8.5%, which is expected to increase to 12.7% in 2020. Asia is said to have lower percentages of overweight and obesity (4% in 2010). Despite new statistics showing a considerable improvement in global nutritional status, Africa seems to lag behind, as it accounts to almost one-third of malnutrition cases world-wide, consequently becoming the worst affected continent globally (de Onis et al., 2012). Over a period of 20 years (1990–2010), the prevalence of under 5-year-old stunting decreased by 15.1% in low- or middle-income countries. However, it seems that the decrease has not had an impact in Africa (Norris, Wrottesley, Mohamed, and Micklesfield, 2014.). Almost two out of five children suffer from malnutrition on this continent (de Onis et al., 2012).

A study has reported that Africa has 56 million who are stunted, and 13.4 million wasted children out of a total of 165 million children on the continent (Can, 2013). Out of the 34 countries that account for 90% of the global burden of malnutrition, 22 are found in Africa of the 26 developing countries that were dietary-energy deficit, 17 were from the Sub-Saharan Africa (Black et al, 2013). An observation has been made that shows that there has been an increase in stunted cases among children due to an almost stagnant prevalence rate of stunting over the past two decades. This is indicated by the fact that children in Africa are unable to access calories (de Onis et al, 2013).

Furthermore, Omilola (2011) reported that approximately 41% of children are malnourished in the Sub-Saharan Africa and death is recorded on a daily basis due to malnutrition. Stunting was highest in Burundi (57.7%) and Malawi (47.1%) in East Africa; Niger (43.9%), Mali (38.3%), Sierra Leone (37.9%) and Nigeria (36.8%) in West Africa; and Democratic Republic of Congo (42.7%) and Chad (39.9%) in

Central Africa. Wasting was highest in Niger (18.0%), Burkina Faso (15.50%) and Mali (12.7%) in West Africa; Comoros (11.1%) and Ethiopia (8.70%) in East Africa; Namibia (6.2%) in Southern Africa; Chad (13.0%) and Sao Tome & Principle (10.5%) in Central Africa. Underweight was highest in Burundi (28.8%) and Ethiopia (25.2%) in East Africa; Niger (36.4%), Nigeria (28.7%), Burkina Faso (25.7%), Mali (25.0%) in West Africa; and Chad (28.8%) in Central Africa (Akombi, Agho, Merom, Renzaho, and Hall, 2017). Other countries not listed above which are said to have a high prevalence of malnutrition include Zimbabwe due to shortage of food (Muderedzi and Ingstad, 2011). The malnutrition crisis remains one of the most common causes of the morbidity and mortality of children in Africa (Fanzo, 2012).

2.4.3 South African perspective

Despite the government`s effort to reduce cases of malnutrition by reducing hunger, there are still some challenges. The prevalence of the malnutrition cases in South Africa are still above the target in children under five. Prevalence rates for girls is 25% and for boys is 26% (Seonandan & McKerrow 2016). The prevalence of malnutrition among children under five still seems too high in Gauteng and Free State with 34% each. However, it must be noted that malnutrition affects almost all of the provinces in South Africa. Even though a study has suggested that approximately 2.5 million children under the age of six in the country are undernourished, almost a quarter of that number (22%) can be found in the Limpopo Province (Demographic, S.A., Health Survey, 2016. Bamford et al (2018) has estimated that one third of under five children die every year due to diseases that were found to have been aggravated by malnutrition. In response to the crisis, the South African government introduced programs such as the child support grant and exclusive breastfeeding initiatives in response to the Millennium Development Goal Number 1 (MDG1), which was aimed at eradicating poverty and hunger (Stevens et al 2012). However, Stevens et al., (2012) argued that many developing countries, especially those in Sub-Saharan Africa, would not manage to reach MDG1 by 2015, and that proved to be the case as South Africa did not manage to reach the MDG Goals (Mugambiwa, and Tirivangasi, 2017).

In the last 20 years, South Africa has experienced rapid nutrition and lifestyle transitions associated with an increased prevalence of obesity and non-

communicable disease, as experienced by western countries (Temple & Steyn, 2011). However, the number and percentage of children living below the poverty line is still unacceptably high, which is the case despite the fact that South Africa seems to be food secure as a country (Devereux & Waidler, 2017). This systematic review indicates that, despite the economic transition over the past 40 years, stunting has persisted in certain provinces and within certain communities, even though there has been a remarkable decline of stunting in the country (Said-Mohamed, et al 2015). The South African government has set up targets for each province to achieve of at least a 1 per 1000 rate of malnutrition in children under the age of five. Poverty among children was reduced from 30% in 2002 to 12% in 2014. Even though the intended target was not reached, there were some improvements. The improvement in reducing child poverty is primarily attributable to the success in extension of access to social assistance grants available to families in terms of the Social Assistance Act (DSD, and UNICEF, 2016.) As a result, undernutrition rates have stagnated for the past 15 years, although these improvements have also resulted in an increase in obesity in adults and children, especially in families who reside in urban areas (Devereux, & Waidler 2017). According to a recent South African Demographic and Health Survey, 27% of children under five suffer from stunting, 12% are underweight, 5% wasted, and 15% of infants are born with a low birth weight in South Africa (World Bank, 2011). A recent survey has reported that stunting in 0- to 3-year-olds is sitting on 26.5%, and that disparities can be found between different ethnic groups, despite the move in 1996 by South African government to implement the Integrated Nutrition Programme to combat the prevalence of early life malnutrition (Casale, Desmond, & Richter, 2014; Devereux & Waidler 2017).

2.5 MEASUREMENT OF MALNUTRITION.

The methods used to assess the nutritional status in children, in most cases, relies on a combination of objective anthropometric, dietary and biochemical diagnosis (Willett, 2012). These anthropometric measurements are also used in the determination of whether a child is wasted or stunted (de Onis et al., 2012) Furthermore, when conducting malnutrition assessments there are some important factors which need to be taken into consideration, such as the effect of ethnic differences on the growth of infants and young children in populations which are

smaller, compared with the effects of the environment. In addition, (Lesiapeto, Smuts, Hanekom, Du Plessis, and Faber, 2010). A critical criterion which can also be used to measure the presence or absence of malnutrition, is the inclusion factors such as whether a child shows any clinical signs of bilateral oedema when the examination is done on children who are between six to fifty-nine months (Nyeko, Kalyesubula, Mworozi, and Bachou, 2010). Another criterion, known as the mid-upper arm circumference indicator (MUAC), is also known as weight for height. A child who is found to be less than <115 mm is wasted. A child's weight for height which is less than <2 z-scores is reported to be underweight, whereas a ≥2 z-score indicates overweight and a ≥3 z-score indicates obesity. Moreover, infants who have a mid-upper arm circumference of less than 115 mm should be sent for a full assessment and further treatment (Black, et al). MUAC is also indicative of acute malnutrition, which contributes to child mortality, and is useful in the screening and admission into a community-based therapeutic care. This, in turn, also enables the community to participate in helping to delegate the responsibility for selecting patients (Tekeste, Wondafrash, Azene. and Deribe, 2012).

Even though there is enough evidence to suggest there is no single measure for malnutrition that has the sensitivity and specificity to be a reliable index of protein-energy malnutrition, MUAC has been proven to be a reliable tool that can also provide for some kind of accuracy. MUAC is less costly, non-invasive, has low inter-observer variability and is easy to administer (Chaput, Katzmarzyk, Barnes, Fogel-holm, Hu, Kuriyan, Kurpad, Lambert, Maher, Maia, and Matsudo,2017.) MUAC is a useful instrument to use within a community setting or when there is an emergency situation. Other observations may be made out of the MUAC assessment process, such as when a child is failing to gain weight which, in most cases, may be an indication of the presence of a chronic disease such as HIV, tuberculosis or anaemia. (Desta, 2015). Another study presented another form of measurement called immunologic measures. Immunologic measures are useful in most cases, although it has been found to have several shortcomings that can hamper effectiveness in clinical practice (Cederholm, Bosaeus, Barazzoni, Bauer, Van Gos-sum, Klek, Muscaritoli, Nyulasi, Ockenga, Schneider, and de van der Schueren, 2015)

2.6 FACTORS CONTRIBUTING TO MALNUTRITION

Zwane (2015) suggests that elements, such as poverty, ignorance, faulty feeding practices and stressed care-workers, play a large role in the creation of malnutrition among children. Meanwhile a report by Tette et al., (2015) mentioned inadequate dietary intake, infections, house hold food insecurity and dietary practices as strongly associated with malnutrition among children under five. Puoane et al. (2010) identified the immediate causes of malnutrition as an inadequate dietary intake and presence of infectious diseases, inadequate maternal childcare, inadequate health services and an unhygienic environment. These conditions also aggravate other morbidities interfering with growth.

1.1.1. Lack of education

There is sufficient evidence that indicates a lack of education as one of the contributing factors to child malnutrition (Asfaw et al., 2015). Vollmer Bommer, Krishna, Harttgen, and Subramanian, (2016) found that the prevalence of child undernutrition increases with a lower education level of the mother. children whose mothers have a junior high school education were more likely to be underweight than children whose mothers have an education level of senior high school or higher (Asfaw et al., 2015).

1.1.2. Poverty

It is already known that poverty is the main underlying cause of malnutrition and is one of its determinants. However, contrary to popular perception, the great majority of malnutrition-related deaths do not necessarily occur during sudden food crises and famines, but are as a result of long-term, chronic hunger which gradually depresses the immune system of the affected population (Knoetze, 2015).Furthermore, Poverty, world conflicts, natural disasters and poor access to health care further contribute to a high rate of undernutrition in Africa and Economic recessions, which result in fuel hikes, and an increase in food prices, are mainly caused by lack of investment, which contributes to poverty (World Health Organization, 2016).

1.1.3. Infectious diseases

Infectious diseases are one of the most common causes of child undernutrition and contributes to approximately 5,970 million (68%). The most common diseases that are positively linked to malnutrition include pneumonia with diarrhoea, Anaemia, which is mainly caused by an iron deficiency due to low intake of meat and fish, HIV/ AIDS and malaria. In 2015, Pneumonia and diarrhoea were the leading cases of under-five deaths accounting to 16% and 9% respectively. (Bamford et al 2018, Abu-Saad et al 2010, Puoane et al. 2010 & Haddad, Hawkes, Webb, Thomas, Beddington, Waage, and Flynn, 2016.) Some of these diseases are mainly caused by household unhygienic practices, such as caregivers not washing their hands before feeding. These diseases adversely affect the growth and nutritional status of children, especially in their first 2 years of life. Moreover, poor storage of food also reduces the appetite of the affected children and compromise the intestinal absorption, which deviates nutrients away from growth towards immune response and some of the Infectious diseases can be directly linked to stunted growth and poor mental development (Rodriguez, Cervantes Ortiz 2011).

1.1.4. Poor feeding Practices

it is significant that a mother should delay the initiation of non-exclusive breastfeeding, as exclusive breastfeeding reduces the risk of morbidity and mortality because the mother`s natural milk contains vitamin A, iodine, thiamine, riboflavin, and pyridoxine. (Garner, 2017; Dror & Allen, 2018). The first two years of life is the most critical period in determining the nutritional status of the child, especially because during this period a child has a high requirement for nutrients, and there may be limited availability of such quality and quantity foods after the period of exclusive breast feeding (Victora, Bahl, Barros. França, Horton, Krasevec, Murch, Sankar, Walker, Rollins, and Group, 2016). Rollins. Bhandari., Hajeebhoy, Horton, Lutter, Martines, Piwoz, Richter, Victora. and Group, (2016) further reported that the declining rates of mothers who do not breastfeed has contributed to the problem of malnutrition.Only 37% of children younger than 6 months of age are exclusively breastfed in low- and middle-income countries, while only a few mothers opting to breastfeed for a shorter period in high-income communities (Victora et al., 2016). This is the case, despite guidance from the World Health Organization about the

benefits of exclusive breastfeeding (Holla-Bhar, Iellamo, Gupta, Smith. and Dadhich, 2015).

1.1.5. Inadequate diet

Ishmail and Suffla (2013) reported that an adequate diet helps to maintain healthy growth and is a critical foundation for prevention of malnutrition among children and, the quality and quantity of food also plays a significant role in the cause of malnutrition (Rodriguez, Cervantes Ortiz 2011). Meanwhile, there are certain communities whose beliefs are such that they do not realize that elements, such as large family house-holds, may contribute to a shortage of resources and a lack of quality food (Asfaw et al., 2015, Rodríguez et al., 2011). It has been found that, in most rural areas, there is a high prevalence of malnutrition due to large families. Moreover, overpopulation in developing countries has been found to have a direct link to poverty, lack of quality food intake, excessive disease and poor health status (Pascoe, Wood, Duffee,Kuo 2016).. An inadequate diet may include poor quality food, excessively diluting, food with low energy density, inadequate feeding during illness, and providing insufficient quantities of food (Faber, Laubscher, and Berti, 2016.) use of tobacco and other unhygienic conditions, may also result in poor foetal growth and low birthweight (Abu-Saad. and Fraser, 2010). Furthermore, the first nine months of a foetus in the womb has an impact on the malnutrition status of the child after birth. Therefore, it is important that the mother ensures that she adheres to a good nutritional intake and engages in hygienic behaviour, because failure to do that may have a lasting negative impact on the baby (Abu-Saad et al 2010). The body-mass index (BMI) of the mother during pregnancy also plays a significant role in determining the birthweight of the child, and may also determine the health status of the baby (Garner, 2017; Dror & Allen, 2018). It is, therefore, significant that care-givers prioritize good nutrition for the children, because inadequate feeding may impair the child's health, slow down normal growth and development of physical activity and compromise the response to serious illness (de Onis, 2017)

1.1.6. Civil Wars and Natural Disasters

Violence, political instability and civil wars in Africa disrupt food production and distribution networks. These societal challenges contribute, to a large extent, to food shortages and resulting in malnutrition (Brinkman, and Hendrix, 2011).

1.1.7. Unhygienic environment

Bain (2013) explains that the environment plays a role as a provider of an opportunity for breeding insecticides which may create infections in children, who later become vulnerable to malnutrition due to the health status.

1.2. EFFECTS OF MALNUTRITION.

In the developing world, mortality, morbidity, and impaired cognitive development, as consequences of malnutrition, are severe and wide-ranging (de Onis 2017). As a result, approximately 45% of child deaths recorded in 2011 were due to malnutrition, including foetal growth restriction, suboptimal breastfeeding, stunting, wasting, and deficiencies of vitamin A and zinc (Branca, Piwoz, Schultink & Sullivan, 2015) This mostly happens when malnutrition is in its severe form (Ibrahim, Zambruni, Melby, and Melby, 2017). In 2013 alone, 161 million children under the of 5 were recorded to be stunted due to chronic undernutrition, thus leading to stalled cognitive and physical development. as well as poor health, and an increased risk of different kind of diseases (Branca, et al., 2015). Moreover, undernourished children have a lower dose tolerance and reduced absorption capacity of chemotherapeutical drugs used during the cancer treatment. However, there is still a huge gap in our knowledge of the interaction between cancer and child malnutrition (Triarico, Rinninella, Cintoni, Capozza, Mastrangelo, Mele, and Ruggiero, 2019).

Mortality risk among affected children can be closely linked to acute malnutrition, which is related to severity and moderate wasting (de Onis, 2017). In addition, some 51 million children were reported to be wasted due to acute undernutrition and about two million deaths occurred as the result (Branca et al., 2015). In cases where children manage to survive death, they are then more likely to become stunted adults. If the children are female, the chances are that they are likely to produce babies of low birth weight, or babies that would be frequently sick. Both conditions would adversely affect the children's nutritional status and lock them into a vicious cycle of sickness, faltering growth and poor learning ability (Lenters, Wazny &

Bhutta, 2016.) Moreover, childhood malnutrition reduces a child's ability to learn and grow to their full potential, leading to them becoming less productive as an adult, unable to participate fully in economic activity (Tette et al., 2015). This is mainly due to insufficient energy which is obviously sourced from proper diet. As a result, these children enter the risk of living lives with a lack of activity (Tette et al., 2015). Some of the short-term consequences of stunting may include poor psychomotor and mental development, and damage to the brain, resulting in delay in the development of cognitive functions, as well as a permanent cognitive impairment (Petry, Olofin, Boy, Donahue Angel, and Rohner, 2016). There is sufficient evidence to back the knowledge that malnourished children suffer more from frequent illnesses than children who are well nourished (Lenters et al., 2016). Children who are overweight or obese are at a higher risk of developing serious health problems, including type 2 diabetes, high blood pressure, asthma and other respiratory problems, sleep disorders, and liver diseases.

It is clear that malnutrition poses a serious risk for mortality and morbidity, especially in children under five in low- middle-income countries (Kimani-Murage, Kahn, Pettifor, Tollman, Dunger, Gómez-Olivé & Norris, 2010) Interventions are, therefore, required to eradicate the scourge of malnutrition in South Africa, to avoid its negative impact which, other than mortality and ill-health, may include, impaired cognitive development and function, reduced work capacity and poor academic performance (Nannan, Norman, Hendricks, Dhansay, Bradshaw & Collaboration, 2007).

1.3. TREATMENT AND MANAGEMENT OF MALNUTRITION

There is a global consensus that the first 24 months of the child`s life is the most critical period in which to implement prevention strategies The World Health Organization has put forward a number of prevention strategies in order to deal with child malnutrition (de Onis & Branca, 2016). Some of these strategies include providing a micronutrient supplement to pregnant women to ensure that they are adequately nourished. This follows the view that mothers who are poorly nourished during pregnancy are more likely to give birth to babies who are under-nourished (Barker, Dombrowski, Colbourn, Fall, Kriznik, Lawrence, Norris, Ngaiza, Patel, Skordis-Worrall, and Sniehotta, 2018). As a result, many governments have established a policy that advocates for the fortification of food that is highly

accessible by, and affordable to, the majority of the people, such as maize and salt (Osendarp, Martinez, Garrett, Neufeld, De-Regil, Vossenaar, and Darnton-Hill, 2018).

On the other hand, the South African government has embarked on a campaign to promote exclusive breastfeeding of children who are six months and below, and further breastfeeding until a child reaches 24 months (Horwood, Haskins, Engebretsen, Phakathi, Connolly, Coutsoudis, and Spies, 2018). In addition, educational support for mothers has been provided globally, giving them information about nutritional food that should be provided to the children (Britto, Lye, Proulx, Yousafzai, Matthews, Vaivada, Perez-Escamilla, Rao, Ip, Fernald, and MacMillan, 2017). A study has put forward a proposal that babies should be put on the breast within one hour after birth and be exclusively breastfed for the first 6 months of life, and from six to 18 months or longer with complementary foods (Chattha, Mazhar, Ahmad, S.A.G.H.E.E.R., Latif, and Rai, 2016).

However, there are many research findings which report the benefit of breastfeeding for up to two years as being beneficial to the health of the child, as recommended by WHO (Mosca & Giannì, 2017). Furthermore, the management of hunger which, in most cases, is a direct cause of malnutrition, can happen on different levels, such as the improvement of agricultural production, the provision of clean water and sanitation adequate, the provision of healthcare and the regulation of the world food markets (Garrett & Ruel, 2018). Education through awareness campaigns could be vital in the prevention and reduction of child undernutrition. A study revealed that malnutrition was reduced all over the world in recent years due to educated care-givers (World Health Organization, 2013.) Therefore, more strategies to reduce child under-nutrition should focused on improving caregiver-knowledge on complementary feeding as a means to improve child growth and nutrition. In addition, there is reliable evidence that adequate training of health care providers in the management of Severe Acute Malnutrition (SAM) is essential if the implementation of the WHO guidelines is to be effective (World Health Organization, 2013) Other methods, which are supported by action against hunger, involve conducting of home visits to identify children that are potentially at risk of becoming under-nourished, so that timely interventions can be implemented with immediate effect (Ndlovu, 2017).

National nutrition promotion programs, which include the feeding schemes at primary schools, are some of the successful nutritional interventions that have been implemented by government in South Africa as a direct intervention to deal with hunger and its consequences (Lesley, Alice & Donald, 2016.) Additionally, there have been proposals by some academics that countries, such as South Africa, need to start exploring indigenous food, which would be easy to cultivate and resistant to drought, and which should be made available to communities as a poverty fighting strategy (Modi & Mabhaudhi, 2016) Other methods may involve community-based models used for the management of acute malnutrition. This model provides a framework for public-health to respond comprehensively to acute malnutrition, and to the treating most patients with SAM solely as outpatients, reserving inpatient care for the few with SAM complications (Moramarco, Amerio, Ciarlantini, Chipoma, Simpungwe, Nielsen-Saines, Palombi, and Buonomo, 2016) Although addressing general deprivation and inequity would result in substantial reduction s in undernutrition, and should be a global priority, major reductions in undernutrition can also be made through programmatic health and nutrition interventions (Britto, 2017). Experience shows that the scourge of chronic malnutrition can be rapidly reduced if income among the poor rises. Hobbs and Bush (2014) indicated that it is surprising that, despite the world knowing the necessary prevention methods, such as food security, gender equality, health, and access to clean water and sanitation, eradication of acute malnutrition fell by only 11% between 1990 and 2011.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Design

Bryman (2012) defines research design as a tool that provides a framework for the collection and analysis of data. Whereas Bless, Higson-Smith, and Kagee, (2006) explains research design as relating directly to the testing of a hypothesis; and, that it specifies an operation to be performed in order to test a hypothesis under a certain condition. The context of research indicates that the function of research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible (Rukwaru, 2015). Quantitative research methodology was used in the conducting of the current study. Quantitative research methodology focuses on the collection of numerical data and uses mathematical methods for analysis (Aliaga & Gunderson, 2006). The study design for this study was a cross-sectional descriptive study design, the purpose of which was to make an educated guess of the prevalence of the outcome of interest; and also, to investigate and described the association between variables and the outcome of interest (Levin, 2006). A systematic random sampling approach was employed to select the participants in the study from the selected clinics.

3.2 Study area

The study was conducted at 10 clinics that are situated in the Ba-Phalaborwa sub-district. The choice the study area was influenced by the fact that the participating children would be easily accessible for data collection at the clinics, as they report for primary health care on a daily basis.

3.3 Sampling

The study population is children from the age of 0 to 5 years who permanently reside in Ba-Phalaborwa. According to the Department of Health registers, the average number of children in the Ba-Phalaborwa sub-district municipality for the financial year 2015- 2016 was 6 844.The ten clinics found in the Ba-Phalaborwa area have all been selected for the study in order to satisfy representability. The Ba-Phalaborwa sub-district municipality is classified as rural, urban and peri-urban, having different characteristics of all three. The sample size was derived from the total number of

children, as indicated above. A sample is defined as a group of people, objects or elements that are taken from the larger population to be studied (Johnson & Christensen, 2008).

3.4 Sampling Method

Stratified sampling was utilized, whereby 10 clinics were grouped into three Stratums, Rural, Urban and Peri-Urban, which was mainly based on the characteristics of the area they come from, and this was also done so that each stratum contains participants with similar characteristics. A sample size was then drawn per stratum using the Krejcie and Morgan (1970) formula. The formula was derived from the following equation: $N\frac{X^{2x}N^{x}P^{x}(1-P)}{M\,E^{2x}(N-1)+¿¿}$. The sample size of each stratum was then calculated using the stratified random sampling calculation, determined by the following equation $N_{h=¿¿}(N_h/$ N) *n. Systematic random sampling was utilized to select participants for the study in each stratum, where every second child who met the requirements was selected for the study. The table below indicates the breakdown of the sample size calculation.

n= Sample size

X²= Chi- Square for the specified confidence level at 1 degree of freedom

N=Population size

P= Population proportion

N_h = Population size for strata

ME=Desired margin of error (expressed as a proportion)

Stratums	Clinics	Population size for stratum (N_h¿		Sample size for each stratum (N_h¿	Sample size for clinic stratum	Sampling fraction (N/n)
	a	b		c	d	
Urban	1	575	575	35	35	16
Peri-Urban	2	950			57	17
	3	1177			71	17
	4	703	3738	226	43	16
	5	908			55	17
Rural	6	399			24	17
	7	366			22	17
	8	307	2568	155	19	16
	9	886			54	16
	10	610			37	16
Total population size (N)	10	6881	6881			
Total sample size (n)		416		416	416	

3.5 Exclusion and Inclusion criteria

Children who did not fall within the age range 0 to 5 years were not included in the study. In addition, children who did not permanently reside in the Ba-Phalaborwa area were also excluded, as were children whose parents/caregivers refused to sign the consent form.

3.6 Data collection

A data collection procedure is the process of gathering data in a systematic fashion (Stellenbosch University, 2015). A data collection sheet was used to collect data. Data collected included the socio-demographic status of the children and their parents/mothers/care-givers, such as employment status of parents, age of child, age of the mother, feeding method, level of education of parents, and number of children in the household. Anthropometric measurements such MUAC, height and Weight were undertaken to determine the nutritional status of the children. Soft Measuring tape was used to measure MUAC, height of children who were one year old and below were measured in a lying positioned scale and the standing scale was used to measure the height of children who were from one year old and above, and baby scales was used for children who were two year old and below and the normal weight scale was used for Children who were two years and older. The instruments which were used belonged to the clinics where data was collected and care workers who work with children at the respective clinics assisted in doing the measurements. The presence of wasting was indicated by a minus 2 or 3 of standard deviation from median weight for height of reference population. Stunting was indicated by a below minus 2or 3 of the standard deviation from median height for age of reference population. Underweight was indicated by a minus 2 or 3 standard deviation from median weight for age of reference population (World Health Organization, 2006).

The WHO Global Database on Child Growth and Malnutrition was used to determine the cut-off-points for different types of malnutrition. This used a Z-score cut-off point of <-2 sd="" to="" classify="" low="" weight-for-age,="" low="" height-for-age="" and="" low="" weight-for-height="" as="" moderate="" and="" severe="" undernutrition,="" and=""><-3 sd="" to="" define="" severe="" undernutrition.="" the="" cut-

off="" point="" of="">+2 SD classifies high weight-for-height as overweight in children.

3.7 Data analysis

Data analysis is the process where the researcher inspects and understands the meaning of the data (Blandford & Ann, 2013). Bless, Higson and Kagee (2006) indicate that the purpose of data analysis is for the researcher to detect consistent patterns within the data. Stata program was used as a data analysis tool. A statistician assisted in the interpretation of the data. After consulting with a biostatistician from the University of Limpopo, analyses of the data were done to make comparisons between the socio-demographic characteristics and malnutrition, and between the clinics and malnutrition in the study participants. The following statistical techniques was employed in the data analysis.

3.7.1 Frequency distributions

The analysis involved descriptive analysis whereby frequency distribution of variables was determined to display distributions of the study participants in relation to the outcome measure which is malnutrition into different classes. The mean and median were also used.

3.7.2 Coding of variables

The coding of variables was used in such a way that the number 1 would be a coding for an event occurring (the focus of the analysis/study) and 0 for coding the absence of an event (the reference category) for the dependent variable. For independent variables, the researcher also used coding 1 and 0 for the category that is the focus of the study and for the category of reference, respectively.

3.7.3 T-test

An independent t-test was used to analyse variables with two categories as this test assesses whether the means of two groups are statistically significant. This test is performed at the 95% confidence level. A p-value of less than 0.05, in the study, was

used to indicate statistically significant differences in means between the categories investigated.

3.7.4 Categorical data

The grouping of variables to describe categories of individuals was used in the form of a cross-tabulation, which explained the relationship between two or more categorical variables. A Pearson chi-square was used to appraise the data for independence. Furthermore, the data is presented in a form of charts, graphs and tables. The purpose for employing inferential statistics is applied to enable the researcher to generalize the findings to a larger population.

3.8 Reliability and Validity

3.8.1 Reliability

Drost, (2011) indicated that validity refers to a situation where an instrument is able to achieve the same results when used for a different population at different times. Moreover, validity means that the measuring instrument is able to be consistent and repeatable. Bryan (2012) classifies validity into three categories: face validity, content validity, construct validity. According to Drost, (2011) internal reliability refers to the consistence of the indicators on the scale. Meanwhile, Bryan (2012) further explained that internal reliability is achieved when there is a high degree of similarity between items which are supposed to measure a common construct. Reliability will be ensured by making sure that only relevant questions are asked.

A pilot study was conducted which included 30 participants before final commitment to the design to ensure the reliability of the instrument that was used to collect. A research questionnaire was used during the pilot study. The said pilot study was conducted in one clinic in the Phalaborwa area in order to determine if the questionnaire is able to obtain the information that was intended to obtain and check if the responses will satisfy the objective of the study. Results from the pilot study informed the researcher about the unreliability of measuring height on children who are below the age of one, in that most children who are below that age appear to be stunted. Furthermore, the pilot study was able to ensure that only the relevant

questions were asked to the participants. The participants in the pilot study were therefore not included in the main study.

3.8.2 Validity

Bryan (2012) explains validity as a concept that refers to whether an instrument is able to measure what it intends to measure. Validity is divided into four categories: Face validity, content validity, construct validity and criterion validity.

3.8.2.1 Face validity

Drost (2011) defines face validity as when an instrument appears to be valid at face value. Bryman (2012) defines face validity as when the measure reflects the content of the concept to be measured. This form of validity is not quantifiable or tested.

3.8.2.2 Content validity

Drost (2011) explains content validity as when an instrument covers all the aspect of the content that it seeks to measure. The researcher should present a provisional version to the experts before the final draft to ensure that the instrument is content valid. The instruments which was used to measure the presence or absence of malnutrition among the participant as well as the questionnaire was referred to the experts for authentication.

3.8.2.3 Construct validity

According to (Kimberlin, and Winterstein, 2008) construct validity is required for standardization. Moreover, it relates to how much a construct measured by an instrument can be measured through different groups of related items. For an instrument to be confirmed as standard the researcher must ensure that it is tested before implementation. The questionnaire which was used for the used was tested during the pilot study and it was standardised for the benefit of the study.

3.8.2.4 Criterion validity

This type of validity is a final test to check whether an instrument does measure what it is supposed to measure. A correlation between an instrument and a criterion indicates criterion validity of the instrument (Creswell, 2007). Bryman (2012) refers to criterion as concurrent validity which is explained as when the researcher uses a criterion whereby cases differ but are relevant to the concept understudy. To ensure validity, the researcher submitted the data collection tool to his supervisor and another expert for assessment. This ensured that the tool used in the data collection addressed the objectives of the research study.

3.9 Bias

Bias is defined as any propensity which prevents fair consideration of a request. In research bias occurs when a systematic error is introduced into sampling or testing by selecting or encouraging one outcome or answer over others (Pannucci & Wilkins, 2010). Selection biases were minimised through selecting participants from Ten different clinics that were chosen to form part of the study. Instrument biases were minimised by ensuring that the instruments used to measure the weight and height of children, as well as the demographic questionnaire, were calibrated. Sampling bias was eliminated by employing simple random sampling consistently on all the clinics that have been marked for the study (Pannucci & Wilkins 2010).

3.10 ETHICAL CONSIDERATIONS

3.10.1 Ethical clearance

To ensure that the research was completely ethical, the research proposal was submitted to the Turfloop Research Ethics Committee (TREC) of the University of Limpopo for ethical clearance. Approval was obtained from Limpopo Department of Health to collect data. Permission was also obtained from the operational managers at participating health facilities.

3.10.2 Obtaining Permission from Department of Health.

The researcher submitted a research proposal for evaluation to the University of Limpopo Turfloop Research Ethics Committee for Ethical clearance. After getting an approval, permission to conduct the study was requested by a letter from the Department of Health before commencing with data collection.

3.10.3 Informed parental consent

Consent was sought from the parents/guardians of children selected to participate in the study in terms of the Children Act 38 of 2005 and the National Health Act of 2003. These Acts indicate that, if a child is a minor (below 18), the parent or guardian of the minor may be approached to give an informed consent. The researcher explained to the parents/guardians the risk and benefits of participating in the study. The researcher informed the participants of their rights, which included the right to withdraw their participation at any stage of the study. The participants were informed of what was expected of them and they were given a form to sign to demonstrate that they understood the implications of being part of the study. The research questionnaire was translated into the language of the participants so that the respondents to be able to answer the questions without the interference of the researcher.

3.10.4 Protecting the rights of individuals

The dignity of the participants was preserved by ensuring that the collection of data did not in any way violated their rights. The researcher ensured the protection of the rights of individuals by ensuring that their identity was concealed to the public.

3.10.5 Privacy and Confidentiality

Personal and sensitive information of the participants was not made available to anyone. Codes were used on the questionnaire to protect the identity of the participants. Data collected from the participants were kept in a secure place, which is not be accessible to anyone else other than the researcher.

3.10.6 Discontinuance

The participants were given an assurance that they were free to withdraw their participation from the research study without providing any reasons to do so. The researcher informed the participants that they were not going to be affected in any way should they decide to stop, and they would continue to receive service at the clinic.

CHAPTER 4: RESULTS

4.1 Introduction

The results of the analysis of collected data from clinics in Ba-Phalaborwa sub-district in the Mopani District in the Limpopo Province of South Africa are presented in this chapter. Stata Version 15 was used to analyse the data. The results are presented in the form of graphs and tables.

4.2 Sociodemographic characteristics of children

A total of 404 of mothers gave responses for children's participation in the current study, yielding to 97.1% response rate. Fifty-point-two percent of the children were females. The mean age of the children was 39 months. Further analysis showed a statistical difference between average age of female and male children in months to be 35.6 months and 41.7 months, respectively (*p<0.001)*. The average MUAC for females is 15.0 CM, whereas males had an average MUAC of 14.5 CM. Weight average of females was recorded at 9.8 Kg, and at 8.6 Kg for males. The average height for females was 70.5% and for males it was 69.6% for males. These results are presented in Table 4.1 below.

Table 4.1: Demographics of children

		Females (n= 203)		Males (n= 201)		P-value
		Mean	±SD	Mean	±SD	
Age (months)		35.6	3.4	41.7	2.7	<0.001
MUAC (cm)		15.0	2.8	14.5	2.1	0.63
Weight (Kg)		9.8	4.3	8.6	3.5	0.26
Height (cm)		70.5	16.7	69.6	18.2	0.17
Malnutrition		n	%	N	%	
	Underweight	20	9.9	38	19.1	0.008
	Stunting	9	4.4	5	2.5	0.290
	Wasting	6	3.0	4	2.0	0.541
	Overweight	12	6.4	11	5.5	0.711
	Obese	8	3.9	6	3.0	0.612

Malnutrition was higher among males compared to females. Males had a higher percentage of underweight, at 19.1%, compared to the 9.9% of females (*p=0.008*). Interestingly, females seemed to have a higher percentage of overweight, at 6.4% compared to the 5.5% of males (*p=0.541*), however, there was no statistical significance in terms of the differences between the two genders.

Table 4.2: Demographics of mothers

		Females (n= 203)	
		Mean	±SD
Age (years)		28.3	7.0
Marital status		n	%
	Single	215	53.4
	Married	75	18.6
	Divorced	111	27.5
	Widowed	2	0.5
Occupation			
	Employed	53	13.2
	Unemployed	182	45.2
	Grants	168	41.7
Educational level			
	Primary education	30	7.4
	Secondary education	273	67.7
	Tertiary education	100	24.8

This analysis in Table 4.2 above shows that the average age of mothers was 28.3 ±7.0 years Single mothers accounted for 53.4% of the mothers, 27% were divorced, 18.6% were married and 0.5% were widowed. Moreover, 45.2% of the mothers were unemployed, 41.7% were grant recipients and 13.2% were employed. The educational background of the mothers shows that 67.7% had secondary school education, whereas 24.8% had tertiary education and 7.4% had primary education.

Table 4.3: Prevalence of malnutrition amongst children

Age in months	Overall	Females	Males

		% (95 CI)	% (95 CI)	% (95 CI)
	0 - 11	29.7 (23.8 – 36.2)	26.9(19.2-36.3)	32.3(24.1– 41.9)
	12 – 23	18.3 (12.4 – 26.0)	17.5 (9.6-29.8)	18.8(11.1- 29.9)
	24 – 35	32.5 (19.7 – 48.5)	24.0 (10.9 – 44.7)	46.6(23.3 – 71.5)
	36 – 47	16.7 (5.3 – 41,8)	25.0 (7.7- 56.8)	-
	48 – 59	44.4 (16.5 – 76.4)	40.0 (24.4-83.2)	50.0 (9.3 – 90.6)

The overall prevalence of malnutrition was found to be 26.7%. Table 4.3 above indicates that there were differences in the prevalence of malnutrition in terms of age groups. It is notable that children who were between 48-59 months had the highest overall prevalence of malnutrition, at 44.4%. This could be due to the fact that there was a small sample drawn from this category. Children who were in the age group 36-47 months had somewhat a lower prevalence of malnutrition, at 16.7%. The highest prevalence of malnutrition found in females is recorded in the age group 48-59 months, at 40.0%, followed by age group 0-11 months, 36-47 months, 24-35 months and 12-23 months at 26.9%, 25.0%, 24.0% and 17.5%, respectively. A similar trend as seen in males, with the highest prevalence of malnutrition recorded in the age group 48-59 months, at 50.0%, followed by the age group 24-35 months, 0-11 months and 12-23 months at 46.6%, 32.3% and 18.8%, respectively. No observations of malnutrition were made among males in the age group between 36-47 months.

Table 4.4: Prevalence of stunting, wasting, underweight, overweight and obesity amongst children by age

Age in months		Overall % (95 CI)	Females % (95 CI)	Males % (95 CI)
Stunting				
	0 - 11	-	-	-
	12 – 23	-	-	-
	24 – 35	20.0 (10.2- 35.4)	16.0 (5.9- 36.3)	26.6(9.9- 4.4)
	36 – 47	16.6 (5.2- 41.8)	25.0 (7.7- 56.8)	-
	48 – 59	33.3 (10.2 -68.5)	40.0(8.1- 83.2)	25.0(2.3–2.2)
Wasting				
	0 - 11	3.3 (1.5 - 6.8)	5.7 (2.5 – 12.3)	0.9 (0.1 – 6.5)
	12 – 23	1.5 (0.3 - 6.1)	-	2.8 (0.7– 11.0)
	24 – 35	2.5 (0.3 -16.1)	-	6.6 0.8 – 37.1)
	36 – 47	-	-	-
	48 – 59	-	-	-
Underweight				
	0 - 11	19.1 (14.3 – 25.1)	12.5 (7.3– 20.4)	25.7(18.15.0)
	12 – 23	10.3 (6.1- 17. 0)	8.7 (3.6 – 19.6)	11.5(5.921.6)
	24 – 35	10.0 (3.7 – 24.1)	4.0 (0.5 – 24.5)	20.0(6.3– 8.3)
	36 – 47	5.5 (0.7 – 32.0)	8.3 (1.0 – 43.8)	-
	48 – 59	-	-	-
Overweight				
	0 - 11	5.2 (2.9 - 9.2)	4.8 (1.9 – 11.1)	5.7(2.5-12.2)
	12 – 23	8.7 (4.8 – 15.1)	12.2 5.9 – 23.8)	5.7(2.1-14.6)
	24 – 35	2.5 (0.3 – 16.1)	4.0 (0.5 – 24. 5)	-
	36 – 47	-	-	-
	48 – 59	11.1 (1.3 – 53.3)	-	2.5(2.3-8.2)
Obesity				
	0 - 11	5.7 (3.2 – 9.8)	6.7 (3.2 – 13.5)	4.7 1.9 – 11.0)
	12 – 23	-	-	-
	24 – 35	5.0 (1.2 – 18.2)	4.0 (0.5 – 24.5)	6.6 0.8 – 37.1)
	36 – 47	-	-	-
	48 – 59	-	-	-

The highest prevalence of stunting among both females and males between the ages of 48-59 months, at 33.3%, whereas the lowest prevalence, at 16.6%, was among children between the ages of 36-47 months. There were no observable results in either males and females between the age categories 0-11 and 12-23 months. This was due to the fact that no measurements were taken due to the unreliability of the test when used on children of this age group (MWANGOME, M.K., FEGAN, G., MBUNYA, R., PRENTICE, A.M. AND BERKLEY, J.A., 2012). Meanwhile percentages of females who were stunted were higher in the age category 48-59 months, at 40%, and the lowest in the category of female children between the ages of 24-35 months, at 16.0%. In the male category, the pattern seems to change, in that it is male children between ages of 24-35 months who have the highest prevalence of stunting, at 26.6%. However, no observations were made in the category of male children who are between the ages of 36-47 months.

When it comes to wasting, it seems that both males and females have a higher prevalence in categories 0-11, 12-13 and 24- 35 months, which is completely different from observations made with respect to stunting. The overall percentage of wasting among both females and males were higher in the category between 0-11 months, at 33%, and lower in category 12-23 months, at 1.5%. There were no observations made in categories 36-47 months and 48-59 months. Among females, observations were only made in the category 0-11 months, at 5.7%, whereas males who are between the ages of 24-35 months were found to have higher percentages of wasting, at 6.6%, and the lowest wasting prevalence was observed in the category 0-11 months, at 0.9%. This result shows differences between females and males in that wasting affects children of both genders in the different age groups. However, the fact that there were on observations made in both genders in categories 36-47 months and 48-59 months may be indicative of the fact that these might new diagnoses and the old ones which have been referred to hospital for further management.

An analysis of underweight among children of both genders indicates that the most affected are children who are in the age category 0-11 months, at 19.1%, whereas the lowest is 5.5%, which was observed in category 36-47 months. No observations made in the category 47-59 months. Meanwhile, the prevalence of underweight was

higher among females in the category 0-11 months, at 12.5%, and lowest in category 24-35 months, at 4.0%. The results are consistent with a later finding that, among males, the prevalence of underweight is also higher in the category 0-11 months, at 25%, and lower in category 12-23 months. These findings could mean that children at an early age are more likely to be underweight, possibly due to poor feeding, as displayed in the table.

The above table further indicates that children are more likely to be overweight when between the ages of 48-59 months. The overall prevalence of overweight shows that children between the ages of 12-23 months were more likely to be overweight, at 11.1%, the lowest percentages were found among children in category 24-35 months, at 2.5%. No overweight observations made in category 36-47 months. It is worth noting that, when it comes to females, children who are in category 12-23 months seem to have a higher percentage of overweight, at 12.2%, whereas the lowest observation was made in category 24-35 months, at 4.0%. No obesity observation results were found in the categories 36-47 months and 47-59 months. The highest prevalence of overweight among males children was found in categories 0-11 months and 12-23 months, at 5.7% each. No overweight observation made in categories 24-35 months and 36-47 months. These findings are indicative of the fact that children of any age group can become overweight, if over-fed, even though children who are between ages 47-59 months have a higher chance of becoming overweight.

Obesity showed the lowest prevalence of all the different types of malnutrition. However, children of both genders who are in age category 0-11 months were found to have the highest prevalence of malnutrition, at 5.7%, followed by category 24-35 months, at 5.0%. No obesity observations were made in other categories 12-23 months, 36-47 months and 48-59 months. These findings were consistent with findings among females, which indicate that age category 0-11 months had the highest prevalence, ath 6.7%, followed by category 24-35 months, at 4.0%. No obesity observations were made in the other categories. The results show that males have the highest prevalence in category 24-35 months, at 6.6%. This is completely a different picture from females. In the male category there are no observations made

in categories 12-23 months, 36-47 months and 48-59 months, which is similar to the female results.

Table 4.5: Association of mother's demographics with stunting, wasting, underweight, overweight and obesity of children

Variables	Undernutrition	Stunting	Wasting	Overweight	Obesity
Age in years					
< 20	12 (27.3)	2 (4.6)	1 (2.3)	3 (6.8)	0(0.0)
20 – 34	77 (27.6)	10(3.6)	7 (2.5)	13 (4.7)	14 (5.2)
≥ 35 – 44	16 (20.3)	2 (2.3)	2 (2.5)	8 (10.1)	0 (0.0)
Marital status					
Single	54 (25.1)	5 (2.3)	4 (1.9)	9 (4.2)	6 (2.8)
Married	23 (30.7)	3 (4.0)	2 (2.7)	6 (8.0)	4 (5.3)
Divorced	28 (25.5)	6 (5.5)	4 (3.6)	9 (8.2)	4 (3.6
Widowed	0(0.0)	0(0.0)	0(0.0)	0 (0.0)	0(0.0)
Education					
Primary	7 (23.3)	1 (3.3)	1(3.3)	0 (0.0)	2 (6.7)
Secondary	74 (27.2)	9 (3.3)	6 (2.2)	20(7.4)	10(3.7)
Tertiary	24 (24.0)	24 (24.0)	3(3.0)	4 (4.0)	2 (2.0)
Occupation					
Employed	11(21.2)	0(0.0)	3(5.8)	2(3.9)	0(0.0
Unemployed	47(25.8)	6(3.3)	5(2.8)	13(7.1)	6(3.3)
Grants	47(27.10)	8(4.8)	2(1.2)	9(5.4)	8(4.8)
Birth order					
1st	39 (27.9)	5 (3.6)	4(2.9)	8(5.7)	4(2.9)
2nd	34 (27.9)	6(4.9)	2(1.6)	5(4.10)	4(3.3)
3rd	15(19.2)	1(1.3)	1(1.3)	6(7.7)	0(0.0)
4th	8(24.2)	1(3.0)	0(0.0)	1(3.0)	6(18.2)
5th and higher	9 (31.0)	1(3.5)	3(10.3)	4(13.8)	0(0.0)

The findings show that malnutrition, in terms of age, is much higher in the category of parents who are between 20-34 years. at 27.6%, which shares the same prevalence (2.5%) of wasting with mothers between ages of 35-44 years. The findings also show that mothers who are 20 and below have the second highest prevalence of malnutrition, at 27.3, and the highest prevalence rate in stunting, at 4.6%. Whereas mothers between the ages of 35-44 have the highest prevalence rate of overweight, at 10.1%. However, the prevalence of malnutrition is indicated to be 26.12%, inclusive of all categories of mothers. This result might be a reflection of the fact that that the mothers who are in the affected categories either lack the skills on proper and adequate feeding, while majority of them were living on their own at the time of the study. It should be noted that the differences that were recorded among the different age groups indicate that a statistically sound inference can be drawn from the results.

The findings show that married mothers have a higher percentage of malnourished children, at 30.7%, and children with obesity, at 5.3%. Whereas, the children of divorced mothers registered higher percentages in stunting, at 5.5%, wasting, at 3.6% and overweight, at 8.2%. In addition, the children of single mothers have the second highest percentages of malnutrition as a whole. These results could mean that divorced and single parents may be short of either adequate financial support, or it could be a matter of simple negligence, which might contribute to their children suffering from malnutrition. These findings further demonstrate that single mothers and divorced mothers carry the biggest burden when it comes to malnutrition. However, the results also indicate that no statistically sound inferences can be drawn from the figures due to the fact that the differences are not vast.

The findings further show that mothers who have secondary education have the highest percentages of malnourished children, at 27.2%, and overweight children at, 3.7%. Whereas, the children of mothers with tertiary education have the second highest percentages of malnutrition, at 24%, and highest percentages in stunting, at 24% and wasting at 3.0%. Meanwhile, the children of mothers with primary education have scored highest in obesity, at 6.7%. These results might be reflective of the fact that mothers who have secondary school education might still be in school and, therefore, have to leave their children with care-givers, who lack feeding knowledge; or it might be the case that these mothers, themselves, do not have the knowledge on proper feeding. Interestingly enough, though, is the fact that mothers who have primary education have the highest percentage of obese children.

This analysis further indicates that the children of mothers who receive grants scored higher percentages in malnutrition, at 27.10%, stunting at 4.1% and, surprisingly, also have the highest percentages of obesity. The children of employed mothers on the other hand, have surprisingly scored higher in wasting, t 5.8%, while unemployed mothers scored higher in overweight, at 7.1%. This might be better explained by the faced that unemployed mothers and mothers who receive grants do not feed their children a healthy diet, due to insufficient income. These mothers are, therefore, forced to feed their children the most available and cheapest food. However, the differences which are indicated by these results do not allow the researcher draw any statistically sound inferences, due to the fact that the differences are not far apart. The findings indicate that 5th born children and higher are more likely to suffer from malnutrition, at 31%. These children also scored higher in wasting, at 10.3%, and in overweight, at 13%. However, 2nd and 3rd born children have the second highest percentages of malnutrition, at 27.9% each. The 2nd born children also score higher in stunting, t 4.9%, whereas the 4th born children scored higher in obesity, at 18%.

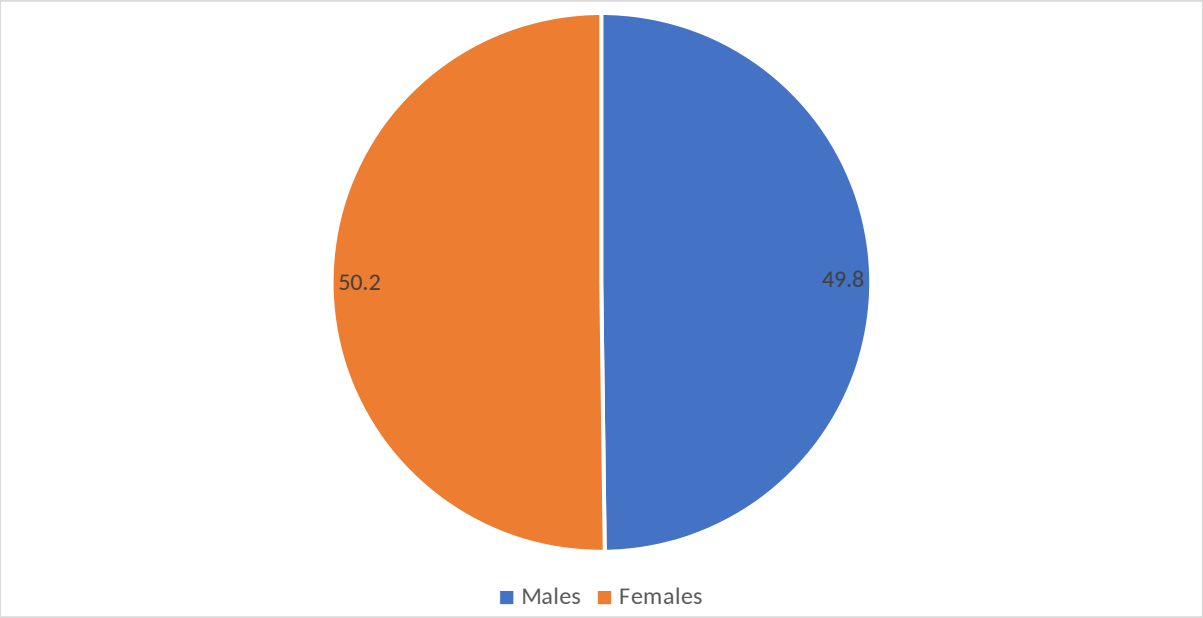


Figure 4.1: Prevalence of malnutrition according to gender

There seems to be little difference in the prevalence of malnutrition in terms of gender, although males have a slightly higher percentage, at 50.2%, with females

scoring 49.8%. As a result, no statistically sound inferences can be drawn from these results.

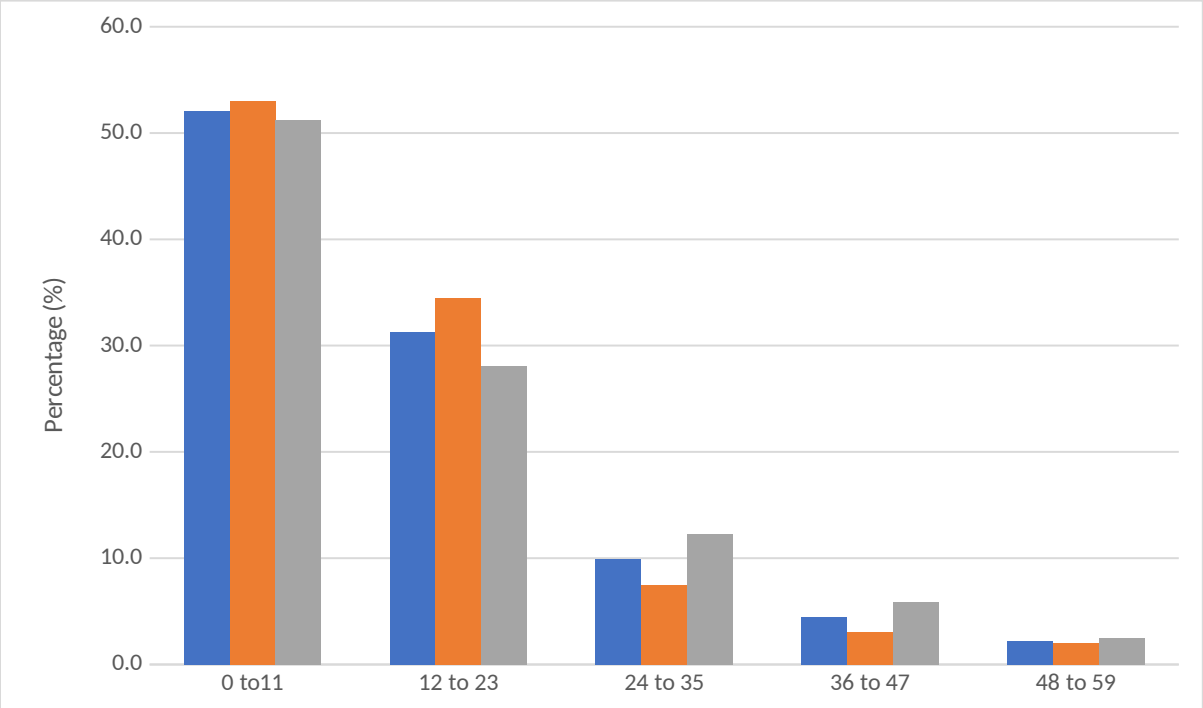


Figure 4.2: Prevalence of malnutrition in terms of gender in each age category

The results indicate that males have a higher prevalence of malnutrition in the younger ages (0-11, and 12-23 months). The pattern seems to change as age increases in that, from ages 24 months up to 47 months, females tend to have a higher prevalence of malnutrition. From ages 48-59 months, both genders have an almost equal prevalence. However, no statistically sound inferences can be drawn from these results.

CHAPTER 5: DISCUSSION OF SUMMARY AND INTERPRETATION, CONCLUSION AND RECOMMENDATIONS

4.1 INTRODUCTION

This chapter presents a discussion of the findings, the conclusion, as well as the recommendations based on the data analysis done in Chapter 4. The prevalence of malnutrition among children below 5 has been researched with the guidance of research objectives. Furthermore, limitations of this study have also been identified.

4.2 RESEARCH DESIGN AND METHODOLOGY

The research design for the study was a descriptive research design, with prospective data being used. Systematic random sampling was used as the method of data collection. The study had 403 participants who were below the age of 5 and formal permission was sought from their parents or guardians. Structured questionnaires were used for data collection.

4.1 SUMMARY OF THE STUDY

The focus of the study was on the prevalence of malnutrition in the Ba-Phalaborwa District. This study was undertaken because of the crisis of malnutrition which has spread across the Republic of South Africa, in particular, and across Africa, in general. The literature was perused in order to form a basis for the background of the study. The objectives of the study were established by undertaking a literature review, which can be found in Chapter 2. These objectives were:

To determine the socio-demographic characteristics of children and mothers in the Ba-Phalaborwa sub-district;

To determine the prevalence of child malnutrition in the Ba-Phalaborwa sub-district;

To quantify stunting, underweight, wasting, overweight and obesity of children under 5 years of age in the Ba-Phalaborwa sub-district.

These objectives were meant to establish whether there was any association between the socio-demographic characteristics of the mothers and their children in relation to malnutrition. Secondly, the study was undertaken to determine the prevalence of different kinds of malnutrition within the Ba-Phalaborwa District Municipality.

4.1 INTERPRETATION OF RESEARCH FINDINGS

The prevalence of malnutrition in Ba-Phalaborwa was found to be 26.7% on the basis of the sample that was drawn from the clinics within the district. These data are representative of data from both rural and peri-urban areas. The data was collected in accordance with the objectives of the research. The study found that the prevalence of malnutrition was at 26%, with combined results from both urban and peri-urban areas. The results further demonstrate that children who were stunted had the highest prevalence (20%), followed by underweight children (19.1%), overweight children (8.7%), obese children (5.7%) and children who were wasting (5%).

The findings of the study showed that male children had a higher rate of malnutrition than females, even though the sample was almost equally distributed in terms of gender, while female children have higher rates of stunting, wasting and overweight than male. children These findings contradict the findings of Mgongo, Chotta, Hashim, Uriyo, Damian Stray-Pedersen, Msuya, Wandel, and Vangen (2017) who found that male children below the age of five years have higher rates of malnutrition than female children. The findings further indicated that the majority of the mothers were young adults, at an average age of 28.3, and that majority of them were single, while the minority were widowed. Moreover, the majority of the mothers were unemployed, followed by those who were grant recipients. In addition, majority of the mothers had secondary education, followed by those with tertiary and primary education, despite the fact that the majority of the sample was drawn from rural areas.

The findings of the study indicate that children who have mothers who are 20 years and below have higher percentages of stunting compared to mothers in the other categories. On the other hand, the children mothers between the ages of 20-34 have higher percentages of wasting and obesity. In addition, the children of mothers who are between the ages of 35-44 are associated with a higher rate of overweight compared to mothers in the other age categories. However, the overall percentage of malnutrition indicates that many mothers in the age category 20-34 are associated

with children with higher percentages of malnutrition compared to mothers in other categories. These findings were further corroborated by a study conducted by Wemakor et al (2018) which found that teenage mothers were eight times more at risk of having undernourished children than adult mothers.

The findings further demonstrate that divorced mothers are associated with stunted, wasting and overweight children. The children of these mothers have a higher prevalence rate in the above-mentioned categories compared to the children of mothers in the other categories. Married mothers are more readily associated with children who are obese compared to mothers in other categories. With respect to education, the findings show that mothers who have secondary education are associated with higher percentages of overweight and obese children, whereas mothers who have tertiary education are associated with children who have higher percentages of stunting and wasting. The above findings contradict the findings of Vollmer et al (2016), who found that the prevalence of child undernutrition increases with a lower education level of the mother. The findings of this study further demonstrate that unemployed mothers and mothers receiving grants have children with higher rates of wasting, stunting and underweight than do employed mothers. It is interesting that mothers who are unemployed also tend to have higher percentages of children who are overweight than mothers who are employed. It is unsurprising, though, that mothers who receive grants have a higher percentage of stunted children, but surprisingly the children of the same mothers tend to score higher in obesity.

Stunting affected mostly female children in the age category between 48-59 months. The most affected males are those that are in the age category between 24-35 months. Wasting also affected mostly males in the age category between 24-35 months, which is similar to the pattern with stunting. Wasting affected mostly female children who were in the age category 0-11 months. Underweight seems to affect mostly males who are between the ages of 0-11 months. Although females also have higher percentages in that same category (0-11), the percentage of male children is almost double the percentage of female children. These findings, although slightly different, resemble the findings of Mgongo, et al (2017), who found that male children are more likely to be stunted and females are more likely to be wasted and underweight. Overweight tends to have affected mostly females in the

age category 12-23 months Even though male children are also affected in the same category as females, the percentage of male children is almost lower by half compared to female children. Lastly, obesity affects mostly female children in the age category 0-11 months, while male children are affected in the 24-35 months category. However, there is only 1 percent difference between males and females. According to the research findings, first born and second born children have the highest rate of malnutrition compared to children in other categories. With respect to third born children and up, there is a higher association with overweight and obesity. The findings in this category are consistent with many studies with regards to the tendancy of overweight in female children most of them coming from well off families (Pantasri & Norman, 2014).

4.1 CONCLUSIONS

According to the findings, no statistically significant differences could be drawn from the demographic characteristics of children and their mothers. This, despite the fact that there were differences in terms percentages. The findings also highlighted the fact that stunting and underweight were the major challenges in the area. The research further demonstrated that child malnutrition is by no means caused by one factor. There are different factors that might be responsible for its occurrence. This is shown by the fact that, despite the sample being drawn from areas that have different backgrounds in terms of income and other factors, the findings did not demonstrate any significant differences.

4.1 RECOMMENDATIONS

Further studies in this field are required to determine the proportion of co-morbidities in relation to children who are malnourished. An investigation into circumstances that contribute to child malnutrition in different circumstances, such children of divorced or single parents, needs to be undertaken. Lastly, further research is needed to evaluate the severity of malnutrition, especially in stunting, wasting and underweight.

5.7 LIMITATIONS OF THE STUDY

The study was not able to determine the direct causes of malnutrition in the areas from which samples were drawn. As a result, only associations could be drawn. In addition, the study was not able to quantify the severity of the type of malnutrition,

which limited the study. Furthermore, the study was not able to further examine co-morbidities with regards to the malnourished.

Annexure 1: DATA COLLECTION SHEET

Demographic data of the Child						
1.	Name of Clinic					
2.	Date of Completion of Questionnaire					
3.	Sex of Child	Male			Female	
4.	Child Birth Order	1.	2.	3	4	5^{th} up
5.	Date of Birth					
Demographic Data of Mother						
6	Relationship with Child					
7	Name of residence					
8	Age of Mother					
9	Marital Status					
10.	Level Of Education					
11	Occupation					
12	Number of children in the house-hold					
Anthropometric Measurements						
Height						
Weight						
MUAC						

Annexure 2: CONSENT FORM

RESEARCH TITTLE: THE PREVALENCE OF MALNUTRITION AMONG CHILDREN AGED 0-5 YEARS OLD IN BA-PHALABORWA DISTRICT MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA

INVITATION TO PARTICIPATE

You are kindly being asked to participate in the above-mentioned study.

PURPOSE OF THE STUDY

The purpose of the study is to know the prevalence of malnutrition and factors that are associated with it.

RISKS

If at any point you feel uncomfortable with some of the questions asked, you will be permitted to stop your participation. The researcher will make an effort to make the questions as comfortable as possible to you.

COSTS AND FINANCIAL RISKS

There are no financial costs that are directly associated with participation in the study. And there will be no financial reward to you for taking part in the study.

CONFIDENTIAL

The researcher will make every effort to keep all information collected in this study as confidential as possible, except if it is required by court order. Your identity will always be kept confidential and your name will not be used in the study.

WITHDRAWAL

You agree that your participation in this study is strictly voluntarily and that you may choose to withdraw at any point of the study if you deem fit without having to provide any justification.

CONCLUSION

By signing below, you agree that you have read and understood the consent form and that you agree to participate in the study.

_____

_____

Participant`s signature Date

_____

_____

Interviewer`s signature Date

_____

_____

Witness`s signature Date

Annexure 3: Letter to request for permission

PO BOX 67
MKHUHLU
1246

Limpopo Department of Health

Provincial Research and Ethics

POLOKWANE

LETTER FOR PERMISSION TO CONDUCT A STUDY

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CARRY OUT A RESEARCH STUDY IN THE BA-PHALABORWA DISTRICT MUNICIPALITY.

I am hereby requesting for a permission to carry out a research study in the Ba-Phalaborwa District municipality. My study concerns an investigation to uncover the prevalence of malnutrition among children aged 0- 5 years. I am currently registered for Master in Public Health at the University of Limpopo; therefore, I am required to submit a research report in order to certify the requirements of my degree.

The title of my study is: The prevalence of malnutrition among children aged 0-5 years in Limpopo, Ba-Phalaborwa district municipality.

The research protocol has been approved by the UL Research Ethics Committee (Attached see proof of Ethical clearance). The findings of the study will be shared among others with your department and will also become a source of scientific information.

Yours Sincerely

Shabangu C

Contact no: 0748549962

Email Address: Swichezi@gmail.com

Annexure 4: ETHICAL APPROVAL

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 2212, Fax: (015) 268 2306, Email:noko.monene@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE CLEARANCE CERTIFICATE

MEETING: 03 November 2016

PROJECT NUMBER: TREC/229/2016: PG

PROJECT:

Title: The prevalence of malnutrition among children under five Years attending primary health care at the clinics in the Ba-Phalaborwa Sub-District Municipality, Limpopo Province, South Africa

Researchers: Mr C Shabangu
Supervisor: Prof L Skaal
Co-Supervisor: Mr E Maimela
School: Health Care Sciences
Degree: Masters in Public Health

PROF TAB MASHEGO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:
i) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.**
ii) **The budget for the research will be considered separately from the protocol.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

SR&EC2017/443

Annexure 5: APPROVAL FROM DEPARTMENT OF HEALTH

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH

Enquiries: Stols M.L (015 293 6169) Ref:4/2/2

Shabangu C (LP_2017RP41 470)
Private Bag X1106
Sovenga
0727

Greetings,

RE: The prevalence of malnutrition among children under five years attending Primary Health Care at the clinics in the Ba-Phalaborwa sub-district municipality, Limpopo Province South Africa.

The above matter refers.

1. Permission to conduct the above mentioned study is hereby granted.
2. Kindly be informed that:-
    - Research must be loaded on the NHRD site (http://nhrd.hst.org.za) by the researcher.
    - Further arrangement should be made with the targeted institutions, after consultation with the District Executive Manager.
    - In the course of your study there should be no action that disrupts the services.
    - After completion of the study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
    - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
    - The above approval is valid for a 3 year period.
    - If the proposal has been amended, a new approval should be sought from the Department of Health.
    - Kindly note, that the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated.

Head of Department

11/12/2017
Date

18 College Street, Polokwane, 0700, Private Bag x9302, POLOLKWANE, 0700
Tel: (015) 293 6000, Fax: (015) 293 6211/20 Website: http/www.limpopo.gov.za

REFERENCES

Abu-Saad, K. and Fraser, D, 2010. Maternal nutrition and birth outcomes. *Epidemiologic reviews*, *32*(1), pp.5-25.

Ataguba, J.E.O. Day, C, &McIntyre, D, 2015, *"Explaining the role of the social determinants of health on health inequality in South Africa*". Global health action, 8

Ajiye, S., 2014. Achievements of millennium development goals in Nigeria: *A critical examination. International Affairs and Global Strategy*, 25, pp.24-36.

Akombi, B.J, Agho, K.E., Merom, D, Renzaho, A.M. and Hall, J.J, 2017. *Child malnutrition in sub-Saharan Africa:* A meta-analysis of demographic and health surveys (2006-2016). PluS One, 12(5), p.e0177338.

Asfaw, M, Wondaferash, M., Taha, M. and Dube, L., 2015. Prevalence of undernutrition and associated factors among children aged between six to fifty-nine months in Bule Hora district, South Ethiopia. BMC Public health, 15(1), p.41.

Bain L.E, Awah, P.K., Geraldine, N, et al, 2013. *Malnutrition in Sub-Saharan Africa: Burden Causes and Prospects, Causes and Prospects*. The Pan African Medical Journal

Barker, M, Dombrowski, S.U, Colbourn, T, Fall, C.H, Kriznik, N.M, Lawrence, W.T, Norris, S.A., Ngaiza, G., Patel, D., Skordis-Worrall, J. and Sniehotta, F.F., 2018. *Intervention strategies to improve nutrition and health behaviours before conception*. The Lancet.

Bhatia, V, Puri, S, Swami, H.M, Gupta, M. and Singh, G., 2007. *Malnutrition among under-six children in Chandigarh*: Scarcity in plenty. Journal of Clinical and Diagnostic Research [serial online], 1(6), 483-487.

Bhutta, Z.A, Das, J.K., Rizvi, A, Gaffey, M.F, Walker, N, Horton, S, Webb, P, Lartey, A., Black, R.E, Group, T.L.N.I.R. and Maternal and Child Nutrition Study Group, 2013. *Evidence-based interventions for improvement of maternal and child nutrition*: what can be done and at what cost? *The lancet*, *382*(9890), pp.452-477.

Black, R.E, Allen, L.H, Bhutta, Z.A, Caulfield, L.E, De Onis, M, Ezzati, M, Mathers, C, Rivera, J. and Maternal and Child Undernutrition Study Group, 2008. *Maternal and child undernutrition: global and regional exposures and health consequences*. The lancet, 371(9608), 243-260.

Bless, C., Higson-Smith, C. and Kagee, A, 2006. *Fundamentals of social research methods: An African perspective*. Juta and Company Ltd.

Brinkman, H.J. and Hendrix, C.S, 2011. Food Insecurity and Violent Conflict: Causes. *Consequences, and Addressing the Challenges, World Food Prgramme*.

Bryman A. 2012, *Social Science Methods 4th ed*: Oxford University press.

Biehl, E, Buzogany, S., Huang, A, Chodur, G. and Neff, R, 2017. *Baltimore food system resilience advisory report*. Baltimore, MD: Johns Hopkins Center for a Livable Future and Baltimore Office of Sustainability.

Branca, F, Piwoz, E, Schultink, W. and Sullivan, L.M, 2015. *Nutrition and health in women, children, and adolescent girls.* British Medical Journal, 351, p.h4173.)

Britto, P.R., Lye, S.J, Proulx, K., Yousafzai, A.K., Matthews, S.G, Vaivada, T, Perez-Escamilla, R, Rao, Ip, P, Fernald, L.C. and MacMillan, H, 2017. *Nurturing care: promoting early childhood development*. The Lancet, 389(10064), pp.91-102.

Cederholm, T, Bosaeus, I, Barazzoni, R, Bauer, J, Van Gossum, A., Klek, S, Muscaritoli, M., Nyulasi, I., Ockenga, J, Schneider, S.M. and de van der Schueren, M.A, 2015. *Diagnostic criteria for malnutrition–an ESPEN consensus statement*. *Clinical nutrition*, *34*(3), pp.335-340.

Casale, D, Desmond, C. and Richter, L, 2014. *The association between stunting and psychosocial development among preschool children: a study using the South African Birth to Twenty cohort data. Child: care, health and development*, *40*(6), pp.900-910.

Chattha, M.N, Mazhar, I, Ahmad, S.A.G.H.E.E.R., Latif, A. and Rai, M.E, 2016. *Breast Feeding Knowledge and Practices in Sialkot*. Pakistan J Med Heal Sci, 10(4), pp.1272-5.

Chaput, J.P, Katzmarzyk, P.T, Barnes, J.D, Fogelholm, M, Hu, G., Kuriyan, R, Kurpad, A, Lambert, E.V, Maher, C, Maia, J. and Matsudo, V, 2017. *Mid-upper arm circumference as a screening tool for identifying children with obesity*: a 12-country study. *Pediatric obesity*, *12*(6), pp.439-445.

Christian, P, 2014. *Fetal growth restriction and preterm as determinants of child growth in the first two years and potential interventions*. In International Nutrition: *Achieving Millennium Goals and Beyond* (Vol. 78, pp. 81-91). Karger Publishers.

Creswell J.W, Ebersohn, L, Eloff, I et al 2007, *First steps in research*. Van schaik publishers: Pretoria

Davies, D, 2010. *Child development: A practitioner's guide*. Guilford Press.

Demissie, S. and Worku, A, 2013. *Magnitude and factors associated with malnutrition in children 6-59 months of age in pastoral community of Dollo Ado district, Somali region, Ethiopia*. *Sci J Public Health*, *1*(4), pp.175-83.

Dewey, K.G. and Begum, K, 2011. *Long-term consequences of stunting in early life.* Maternal & child nutrition, 7, pp.5-18

De Onis, M, Blössner, M. and Borghi, E, 2010*. Global prevalence and trends of overweight and obesity among preschool children*. *The American journal of clinical nutrition*, *92*(5), pp.1257-1264.

De Onis, M, Blössner, M. and Borghi, E, 2012. *Prevalence and trends of stunting among pre-school children, 1990–2020*. Public Health Nutrition, 15(1), pp.142-148.

De Onis, M, Dewey, K.G, Borghi, E, Onyango, A.W, Blössner, M, Daelmans, B., Piwoz, E. and Branca, F., 2013. *The World Health Organization's global target for reducing childhood stunting by 2025*: rationale and proposed actions. Maternal & child nutrition, 9, pp.6-26.

De Onis, M. and Branca, F, 2016. *Childhood stunting: a global perspective*. Maternal and Child Nutrition, 12, pp.12-26

De Onis, M, 2017. *Child growth and development. In Nutrition and Health in a Developing World* (pp. 119-141). Humana Press, Cham

De Lange J.C, 2010, *Factors contributing to malnutrition in children 0-60 months admitted to hospitals in the Northern Cape*.

Demographic, S.A., Health Survey (SADHS), 2016. *Key indicators report 2016*.

Dee, A., Kearns, K., O'Neill, C, Sharp, L, Staines, A, O'Dwyer, V, Fitzgerald, S. and Perry, I.J, 2014. *The direct and indirect costs of both overweight and obesity: a systematic review.* BMC research notes, 7(1), p.242.

Desta, K, 2015. *Survival status and predictors of mortality among children aged 0–59 months with severe acute malnutrition admitted to stabilization center at Sekota Hospital Waghemra Zone*. *J Nutr Disord Ther*, *5*, p.160.

Devereux, S. and Waidler, J, 2017. *Why does malnutrition persist in South Africa despite social grants, in centre of excellence in food security*? working paper 1.

Drost, E.A., 2011. *Validity and reliability in social science research*. *Education Research and perspectives*, *38*(1), p.105.

DSD, S. and UNICEF, 2016. *Removing Barriers to Accessing Child Grants: Progress in Reducing Exclusion from South Africa's Child Support Grant*. Pretoria: UNICEF South Africa.

Grantham-McGregor, S, Cheung, Y.B, Cueto, S., Glewwe, P, Richter, L., Strupp, B. and International Child Development Steering Group, 2007. *Developmental potential in the first 5 years for children in developing countries*. *The lancet*, *369*(9555), pp.60-70.

Faber, M, Laubscher, R. and Berti, C, 2016. Poor dietary diversity and low nutrient density of the complementary diet for 6-to 24-month-old children in urban and rural KwaZulu-Natal, South Africa. *Maternal & child nutrition*, *12*(3), pp.528-545.

Fanzo, J, 2012. *The nutrition challenge in sub-Saharan Africa* (No. 2012-012). United Nations Development Programme, Regional Bureau for Africa

Gallus, S, Lugo, A., Murisic, B, Bosetti, C, Boffetta, P. and La Vecchia, C, 2015. Overweight and obesity in 16 European countries. *European journal of nutrition*, *54*(5), pp.679-689.

Garner, C.D, 2017. *Nutrition in pregnancy. Uptodate; Post, TW, Ed.; UpToDate: Waltham, MA, USA*.

Haddad, L, Hawkes, C., Webb, P, Thomas, S., Beddington, J., Waage, J. and Flynn, D, 2016. *A new global research agenda for food. Nature News,* 540(7631), p.30.

Holla-Bhar, R, Iellamo, A, Gupta, A., Smith, J.P. and Dadhich, J.P, 2015. *Investing in breastfeeding–the world breastfeeding costing initiative. International breastfeeding journal*, *10*(1), p.8.

Horwood, C, Haskins, L, Engebretsen, I.M, Phakathi, S, Connolly, C, Coutsoudis, A. and Spies, L, 2018. *Improved rates of exclusive breastfeeding at 14 weeks of age in KwaZulu Natal, South Africa: what are the challenges now*? BMC public health, 18(1), p.757.

Garrett, J. and Ruel, M, 2018. *Background paper (Annex 3: Linking Nutrition with Sustainable Cities and Communities-SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable).*

Ibrahim, M.K, Zambruni, M, Melby, C.L. and Melby, P.C, 2017. *Impact of childhood malnutrition on host defense and infection.* Clinical Microbiology Reviews, 30(4), pp.919-971.

Ishmail G. & Suffla S. 2013, *Child safety, peace and health promotion. Child malnutrition*: UNISA

Irena, A.H, Mwambazi, M. and Mulenga, V, 2011. *Diarrhea is a major killer of children with severe acute malnutrition admitted to inpatient set-up in Lusaka*, Zambia. *Nutrition journal*, *10*(1), p.110.

Johnson, B. & Christensen, L, 2008, *Education Research, Quantitative, Qualitative and mixed Approaches*. Sage

Knoetze, C, 2015. *Feasting on foreign aid: a political economic examination of foreign aid's potential role in perpetuating chronic hunger and starvation in Malawi* (Doctoral dissertation, University of Cape Town).

Kimani-Murage, E.W, Kahn, K., Pettifor, J.M, Tollman, S.M, Dunger, D.B, Gómez-Olivé, X.F. and Norris, S.A., 2010. *The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children*. BMC public health, 10(1), p.158.

Kimberlin, C.L. and Winterstein, A.G, 2008. Validity and reliability of measurement instruments used in research. *American journal of health-system pharmacy*, *65*(23), pp.2276-2284.

Krejcie, R.V. and Morgan, D.W, 1970. *Table for determining sample size from a given population. Educational and Psychological Measurement*, 30, pp.607-610.

Kulaga, Z, Litwin, M, Tkaczyk, M, Różdżyńska, A., Barwicka, K., Grajda, A, Świąder, A, Gurzkowska, B, Napieralska, E. and Pan, H, 2010. The height, weight, and BMI-for-age of Polish school-aged children and adolescents relative to international and local growth references. *BMC Public Health*, *10*(1), p.109.

Labadarios, D, Mchiza, Z.J.R, Steyn, N.P, Gericke, G, Maunder, E.M.W, Davids, Y.D. and Parker, W.A, 2011. Food security in South Africa: a review of national surveys. *Bulletin of the World Health Organization*, *89*, pp.891-899.

Laghari Z.A, 2015, 1(13), *Journal of medical sciences, Malnutrition among children under five years in District Saugher, Suda and Pakistan*

Linsell, L, Malouf, R., Morris, J, Kurinczuk, J.J. and Marlow, N, 2015. *Prognostic factors for poor cognitive development in children born very preterm or with very low birth weight:* a systematic review. *JAMA pediatrics*, *169*(12), pp.1162-1172.

Lozano, R, Naghavi, M, Foreman, K., Lim, S., Shibuya, K, Aboyans, V, Abraham, J, Adair, T, Aggarwal, R, Ahn, S.Y. and AlMazroa, M.A, 2012. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: *a systematic analysis for the Global Burden of Disease Study 2010*. *The lancet*, *380*(9859), pp.2095-2128.

Leibbrandt, M, Wegner, E. and Finn, A, 2011. *The policies for reducing income inequality and poverty in South Africa.*

Lenters, L, Wazny, K. and Bhutta, Z.A, 2016. Management of severe and moderate acute malnutrition in children. *Reproductive, Maternal, Newborn, and Child Health*, *205*.

Lesiapeto, M.S, Smuts, C.M., Hanekom, S.M, Du Plessis, J. and Faber, M., 2010. Risk factors of poor anthropometric status in children under five years of age living in rural districts of the Eastern Cape and KwaZulu-Natal provinces, South Africa. *South African Journal of Clinical Nutrition,* 23(4).

Lesley, D, Alice, W. and Donald, B. eds, 2016. *Global school feeding sourcebook: Lessons from 14 countries. World Scientific*.

Levin, K.A, 2006. Study design III: Cross-sectional studies. *Evidence-based dentistry*, 7(1), pp.24-25.

Liu, L, Johnson, H.L., Cousens, S, Perin, J., Scott, S., Lawn, J.E, Rudan, I, Campbell, H., Cibulskis, R., Li, M. and Mathers, C., 2012. Global, regional, and national causes of child mortality: *an updated systematic analysis for 2010 with time trends since 2000.* The Lancet, 379(9832), pp.2151-2161.

Marmot, M. and Bell, R., 2012. Fair society, healthy lives. *Public health*, *126*, pp.S4-S10.

Mehta, N.M, Corkins, M.R, Lyman, B, Malone, A, Goday, P.S, Carney, L, Monczka, J.L., Plogsted, S.W., Schwenk, W.F. and American Society for Parenteral and Enteral Nutrition (ASPEN) Board of Directors, 2013. *Defining pediatric malnutrition: a paradigm shifts toward etiology-related definitions. Journal of Parenteral and Enteral Nutrition*, 37(4), pp.460-481.

gongo, M, Chotta, N., Hashim, T, Uriyo, J, Damian, D, Stray-Pedersen, B, Msuya, S, Wandel, M. and Vangen, S., 2017. Underweight, stunting and wasting among children in Kilimanjaro Region, Tanzania; a population-based cross-sectional study. *International journal of environmental research and public health*, *14*(5), p.509.

Mwangome, M.K., Fegan, G., Mbunya, R., Prentice, A.M. and Berkley, J.A., 2012. Reliability and accuracy of anthropometry performed by community health workers among infants under 6 months in rural Kenya. *Tropical Medicine & International Health*, *17*(5), pp.622-629.

Moramarco, S, Amerio, G, Ciarlantini, C, Chipoma, J, Simpungwe, M, Nielsen-Saines, K, Palombi, L. and Buonomo, E, 2016. Community-based management of child malnutrition in Zambia: HIV/AIDS infection and other risk factors on child survival. *International journal of environmental research and public health*, *13*(7), p.666.

Muderedzi, J. and Ingstad, B, 2011. *Disability and social suffering in Zimbabwe. Disability and poverty*: A global challenge, pp.171-188.

Mugambiwa, S.S. and Tirivangasi, H.M, 2017. Climate change: A threat towards achieving Sustainable Development Goal number two'(end hunger, achieve food security and improved nutrition and promote sustainable agriculture) in South Africa. *Jàmbá: Journal of Disaster Risk Studies*, *9*(1), pp.1-6.

Myatt, M, Khara, T. and Collins, S, 2006. A review of methods to detect cases of severely malnourished children in the community for their admission into community-based therapeutic care programs. *Food and nutrition bulletin*, *27*(3_suppl3), pp.S7-S23.

Muzigaba, M, Puoane, T. and Sanders, D, 2016. *The paradox of undernutrition and obesity in South Africa: A contextual overview of food quality, access and availability in the new democracy. In Food Poverty and Insecurity: International Food Inequalities* (pp. 31-41). Springer, Cham.

Nannan, N, Norman, R, Hendricks, M, Dhansay, M.A, Bradshaw, D. and Collaboration, S.A.C.R.A., 2007. Estimating the burden of disease attributable to childhood and maternal undernutrition in South Africa in 2000.*South African Medical Journal*, 97(8), pp.733-739

Ndlovu, P.G, 2017*. Experiences of community care givers on nutritional assessment of children under 5 years in eThekwini District* (Doctoral dissertation).

Norris, S.A, Wrottesley, S, Mohamed, R.S, and Micklesfield, L.K, 2014. Africa in transition: growth trends in children and implications for nutrition. *Annals of Nutrition and Metabolism*, *64*(Suppl. 2), pp.8-13.

Nyeko, R, Kalyesubula, I, Mworozi, E. and Bachou, H, 2010. Lactose intolerance among severely malnourished children with diarrhoea admitted to the nutrition unit, Mulago hospital, Uganda. *BMC pediatrics*, *10*(1), p.31.

Moramarco, S, Amerio, G, Kasengele Chipoma, J, Nielsen-Saines, K., Palombi, L. and Buonomo, E, 2018. Filling the Gaps for Enhancing the Effectiveness of Community-Based Programs Combining Treatment and Prevention of Child Malnutrition: Results from the Rainbow Project 2015–17 in Zambia. *International journal of environmental research and public health*, 15(9), p.1807.

Orsmond G.I & Ellen S.C, 2015, *The distinctive of feasibility study*: Objectives and guiding questions

Osendarp, S.J, Martinez, H., Garrett, G.S, Neufeld, L.., De-Regil, L.M, Vossenaar, M. and Darnton-Hill, I, 2018. Large-scale food fortification and biofortification in low- and middle-income countries: a review of programs, trends, challenges, and evidence gaps. *Food and Nutrition Bulletin*, 39(2), pp.315-331.

Onyango A.W and De Onis M, 2008, Training courses on child growth assessment: *WHO child Growth indicators*

Pannucci, C.J. and Wilkins, E.G, 2010. Identifying and avoiding bias in re-search. *Plastic and reconstructive surgery*, *126*(2), p.619.

Pascoe, J.M, Wood, D.L, Duffee, J.H, Kuo, A. and Committee on Psychosocial Aspects of Child and Family Health, 2016. *Mediators and adverse effects of child poverty in the United States. Pediatrics*, 137(4), p.e20160340.

Petry, N, Olofin, I, Boy, E., Donahue Angel, M. and Rohner, F, 2016. The effect of low dose iron and zinc intake on child micronutrient status and development during the first 1000 days of life: *A systematic review and meta-analysis. Nutrients*, 8(12), p.773.

Qadri, F., Bhuiyan, T.R., Sack, D.A. and Svennerholm, A.M., 2013. *Immune responses and protection in children in developing countries induced by oral vaccines*. *Vaccine*, *31*(3), pp.452-460.

Rah, J.H, Akhter, N, Semba, R.D., De Pee, S., Bloem, M.W, Campbell, A.A., Moench-Pfanner, R., Sun, K., Badham, J. and Kraemer, K., 2010. Low dietary diversity is a predictor of child stunting in rural Bangladesh. *European journal of clinical nutrition,* 64(12), p.1393.

Rodriguez L, Cervantes E, Ortiz R, 2011, Malnutrition and Gastrointestinal and Respiratory infections in children*: A public health problem.*

Rollins, N.C, Bhandari, N, Hajeebhoy, N, Horton, S, Lutter, C.K., Martines, J.C, Piwoz, E.G, Richter, L.M, Victora, C.G. and Group, T.L.B.S, 2016. W*hy invest, and what it will take to improve breastfeeding practices*? *The Lancet*, *387*(10017), pp.491-504.

Ruel, M.T., Alderman, H. and Maternal and Child Nutrition Study Group, 2013. Nutrition-sensitive interventions and programmes: *how can they help to accelerate progress in improving maternal and child nutrition? The lancet*, 382(9891), pp.536-551.

Rukwaru M, 2015*, Social research methods*, A complete guide

Said-Mohamed, R, Micklesfield, L.K, Pettifor, J.M. and Norris, S.A, 2015. Has the prevalence of stunting in South African children changed in 40 years? A systematic review. *BMC public health*, 15(1), p.534.

Secker, D.J. and Jeejeebhoy, K.N, 2007. Subjective global nutritional assessment for children. *The American journal of clinical nutrition*, 85(4), pp.1083-1089.

Shrimpton, R. and Rokx, C, 2012. The double burden of malnutrition*: a review of global evidence.*

Steenkamp, L, Nomvete, A. and Venter, D, 2015. Catch-up growth in children with severe acute malnutrition: comparison of two therapeutic feeding approaches at a

district hospital, South Africa. *Africa Journal of Nursing and Midwifery*, *17*(2), pp.46-59.

Stellenbosch University, 2015, *Library and information service*. From: http://Libguides.sun.ac.za (Accessed 13 March 2016)

Stevens, G.A, Finucane, M.M, Paciorek, C.J, Flaxman, S.R, White, R.A, Donner, A.J. and Ezzati, M, 2012. Trends in mild, moderate, and severe stunting and underweight, and progress towards MDG 1 in 141 developing countries: *a systematic analysis of population representative data. Lancet*,380, pp.824-34.

Taylor, R.W, Jones, I.E, Williams, S.M. and Goulding, A, 2000. Evaluation of waist circumference, waist-to-hip ratio, and the conicity index as screening tools for high trunk fat mass, as measured by dual-energy X-ray absorptiometry, in children aged 3–19 y. *The American journal of clinical nutrition*, 72(2), pp.490-495.

Tekeste, A, Wondafrash, M, Azene, G. and Deribe, K, 2012. Cost effectiveness of community-based and in-patient therapeutic feeding programs to treat severe acute malnutrition in Ethiopia. *Cost Effectiveness and Resource Allocation*, *10*(1), p.4.

Temple, N.J. and Steyn, N.P., 2011. The cost of a healthy diet: *A South African perspective. Nutrition*, 27(5), pp.505-508.

Tette, E.M, Sifah, E.K. and Nartey, E.T, 2015. *Factors affecting malnutrition in children and the uptake of interventions to prevent the condition. BMC pediatrics*, 15(1), p.1.

Traissac P, Martin-Prével Y, Delpeuch F, Maire B. 1999. *Logistic regression vs other generalised linear models to estimate prevalence rate ratios*. RevEpidemiol Sante Publique 47(6):593-604

Triarico, S, Rinninella, E, Cintoni, M., Capozza, M.A, Mastrangelo, S, Mele, M.C. and Ruggiero, A, 2019. Impact of malnutrition on survival and infections among pediatric patients with cancer: a retrospective study. *European review for medical and pharmacological sciences,* 23, pp.1165-1175.

UNICEF, 2010. *Progress for children: achieving the MDGs with equity* (No. 9).

UNICEF, 2007, *Statistical Data on the status of children aged 0-4 in South Africa*

University of Limpopo, 2014.Research development and administration. *Manual guideline for post graduate students.*

Victora, C.G, Bahl, R, Barros, A.J, França, G.V, Horton, S, Krasevec, J, Murch, S., Sankar, M.J, Walker, N, Rollins, N.C. and Group, T.L.B.S, 2016. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *The Lancet*, *387*(10017), pp.475-490.

Vollmer, S, Bommer, C, Krishna, A., Harttgen, K. and Subramanian, S.V, 2016. The association of parental education with childhood undernutrition in low-and middle-income countries: comparing the role of paternal and maternal education. *International journal of epidemiology*, *46*(1), pp.312-323.

Wang, Y. and Lim, H, 2012. *The global childhood obesity epidemic and the association between socio-economic status and childhood obesity.*

Wardlaw, T, Newby, H, Brown, D. and Cai, X, 2012. Onis DM, Borghi E, Blössner M (World Health Organization, Geneva); Mistiaen J, Feng J, Hiraga M (The World Bank, Washington DC). *Levels and trends in child malnutrition: UNICEF-WHO-The World Bank joint child malnutrition estimates*.

Wemakor, A, Garti, Azongo, T, Garti, H. and Atosona, A., 2018. Young maternal age is a risk factor for child undernutrition in Tamale Metropolis, Ghana. *BMC research notes*, *11*(1), p.877.

World Bank. 2011. South Africa - Nutrition at a glance (English). Nutrition at a glance; South Africa. Washington DC; World Bank. http://documents.worldbank.org/curated/en/413801468334804797/South-Africa-Nutrition-at-a-glance

World Health Organization, 2006. *WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development.*

World Health Organization, 2013. *Guideline: updates on the management of severe acute malnutrition in infants and children. World Health Organization*.

World Health Organization, 2013. *Essential nutrition actions: improving maternal, newborn, infant and young child health and nutrition*.

Yang, W. and Kanavos, P., 2012. The less healthy urban population: income-related health inequality in China. *BMC public health*, *12*(1), p.804.