NUTRITIONAL STATUS AND FEEDING PRACTICES OF CHILDREN AGED 0 TO 36 MONTHS IN THULAMELA MUNICIPALITY, LIMPOPO PROVINCE.

By

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The dissertation is submitted in fulfilment/partial fulfilment of the requirements for the degree of Master of Science in Public Nutrition in the School of Health Sciences, Department of Nutrition at the University of Venda.

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Declaration

I, ANZANI MUGWARE, hereby declare that the dissertation for the Master of Science in Public Nutrition degree, at the University of Venda, hereby submitted by me, has not been submitted previously for a degree at this or any other University, that it is my own work in design and execution, and that all reference materials contained therein have been duly acknowledged.

18 December 2021

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Signature Date

Dedicated to

My mother, Patricia, my late father, Jameson, my wife Thabelo, my siblings Candy, Mpho, Fhulufhelo, and Arendwaho, for all their support, encouragement and prayers during my study. I will always be grateful to all of them for encouraging me to achieve my personal goal.

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Abstract

Introduction: Globally, it is estimated that only 44% of infants are exclusively breastfed for the first 6 months of life while most children are introduced to solid, semi-solid or soft foods late or earlier than recommended. Poor breastfeeding practices, and complementary feeding accounts for nutrients deficiency, illness and infections in children that lead to malnutrition at an early age. Globally, malnutrition is accountable for one out of three deaths among children under five years (WHO, 2016).

Aim: The study aimed to investigate the nutritional status and feeding practices of children aged 0 to 36 months at the Thulamela Municipality.

Methodology: A cross-sectional study design was used in this study. The target population was all mothers with children aged 0 to 36 months in the Vhembe district and the accessible population was mothers with children aged 0 to 36 months in the Thulamela Municipality. Simple random sampling was used to select three clinics per cluster to make a total of 18 clinics. A total number of 250 mothers and their children were selected using a convenience sampling technique. A structured questionnaire was used to collect data on socio-demographic characteristics, breastfeeding and complementary feeding practices. Anthropometric and biochemical measurements of children were assessed using standard procedure. Anthropometric measurements were calculated using WHO Anthro version 3.2.2. The data obtained were analysed using SPSS version 26.

Results: The study was carried out on 250 children aged 0 to 36 months and their mothers. The mean (± SD) age of children in months was 10.53 (8.39). The mean (± SD) age of mothers in years was 27.79 (±7.13SD). Most mothers (96%) initiated breastfeeding within one hour after birth. Exclusive breastfeeding up to six months was practised by only 7.6% of mothers. The majority (87.5%) were complementary feeding before the age of six months. The prevalence of stunting, wasting and underweight were 9.2%, 2% and 3.6% respectively. The prevalence of vitamin A among children was 21.7% (<10 µg/dl). The prevalence of anaemia (Hb <11 g/dL), and iron deficiency (serum ferritin < 12 *µ*g/l) amongst children was 53.6% and 13.1% respectively. About 38.1% of children who received water before six months of age were more likely to be stunted as compared to those who received water at six months and above (19.9%) (p=0.001). Children who were still breastfeeding were more likely to have normal haemoglobin (73.5%) as

compared to those who were no longer breastfeed (61.5%) (p=0.45). Children who were given complementary foods one week after birth, the odds of being underweight were 9.00 times as compared to those who were given complementary foods after six months (OR=9.00; 95% CI=1.325 - 61.138). Children who were initiated on breastfeeding immediately after delivery, the odds of having low ferritin were 0.11 times as compared to those who were initiated breastfeeding a day after delivery (OR=0.111; 95% CI=0.015 - 0.812.

Conclusion: Exclusively breastfeeding for the first six months was rarely practiced since the majority of infants were introduced to complementary fluids or foods before the age of six months. The prevalence of underweight, stunting and wasting among children were of low concern since the majority of children had normal anthropometric status. The prevalence of vitamin A deficiency, anaemia and iron deficiency remains prevalent among children. Health professionals should promote the use of mass media and mom-connect as the platforms that may be utilised more optimally to disseminate information on infant and young child feeding practices to young mothers.

Key Words: Exclusive breastfeeding, complementary feeding, nutritional status, infant feeding.

Table of Contents

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
AMDR	Acceptable Micronutrients Distribution Range
AOR	Adjusted Odds Ratios
BFHI	Baby Friendly Hospital Initiatives
BMI	Body mass index
BMI/A	Body mass index for age
CI	Confidence interval
cm	centimeter
COR	Crude Odds Ratio
CRP	C-reactive protein
CVD	Cardiovascular disease
DHIS	Department of Health Information System
dl	decilitre
DoH	Department of Health
FAO	Food and Agricultural Organization of the United Nations
FET	Further Education and Training
g	gram
HAZ	Z-scores for height for age
Hb	haemoglobin
HC	Head Circumference
HIV	Human Immune Virus
HSRC	Human Science Research Council
IDA	Iron Deficiency Anaemia

IFAD	International Fund for Agriculture Development
IYCF	Infant and Young Child Feeding
KCAL	kilocalorie
kg	kilogram
M^2	meter squared
MAM	Moderate Acute Malnutrition
MBFI	Mother Baby Friendly Initiatives
MDD	Minimum Dietary Diversity
ml	Millilitre
MUAC	Mid Upper Arm Circumference
NFCS-FB	National Food Consumption Survey Fortification Baseline
ng	nano gram
PAHO	Pan-American Health Organization
PHC	Primary Health Care
RNI	Recommended Dietary Intake
SA	South Africa
SADHS	South Africa Demographic Health Survey
SAM	Severe Acute Malnutrition
SANHANES	The South Africa National Health Nutrition Examination Survey
SAVACG	South Africa Vitamin A Consultative
SD	Standard deviation
SDGs	Sustainable Development Goals
SPSS	Statistical packages for social sciences
sTfR	Soluble Transferrin Receptor

TIBC	Total Iron-Binding Capacity
UN	United Nation
UNICEF	United Nation Children Fund
UNSCN	United Nations System Committee on Nutrition
VAD	Vitamin A deficiency
WAZ	Weight-for-age Z-scores
WBG	World Bank Group
WFP	World Food Programme
WHO	World Health Organization
WHZ	Weight-for-height Z-scores for
µg	microgram

CHAPTER ONE
INTRODUCTION

1.1. Background and motivation of the study

The first 1000 days of life, from conception to two years of age is a critical window for the promotion of optimal growth, health and development (Kabaran, 2018). The World Health Organisation (WHO, 2013b) recommends early initiation of breastfeeding within an hour after delivery, exclusively breastfeeding for the first six months of life, followed by the introduction of complementary foods at six months while continuing breastfeeding at least two years or even beyond. Globally, it is estimated that only 44% of infants are exclusively breastfed for the first 6 months of life while most children were introduced to solid, semi-solid or soft foods late or earlier than recommended (The United Nations Children's Fund (UNICEF, 2017). In South Africa, exclusive breastfeeding remains very low with only 7.4% of children exclusively breastfed for the first six months while most of the children received solid food and fluids before the age of six months (SANHANES-1, 2012).

Poor breastfeeding practices, and complementary feeding accounts for nutrients deficiency, illness and infections in children that lead to malnutrition at an early age (Bailey *et al*., 2015). Malnutrition in the early stage of life, has been directly linked with poor infant feeding practices, high rates of infectious diseases, especially in developing countries such as South Africa (Udo & Amodu, 2016; Mushaphi *et al*., 2017). Furthermore, malnutrition among infant and young children decreases chance of survival and delay growth and development (Molla *et al*., 2017). Early childhood malnutrition leads to growth retardation, delaying of mental development and impairment of intellectual level (Ma'alin *et al*., 2016). The long-term effects of nutritional deficiencies have been established and these include compromised educational achievement, low economic productivity, reproductive outcomes and overall health during adulthood which tends to be difficult to reverse later in life (Molla *et al*., 2017). In 2015, the world agreed to eliminate all forms of malnutrition by 2030 (UNSCN, 2017). To reduce malnutrition amongst children under five years, there is need to improve infant and young child feeding practices, since feeding practices is one of the most determinants of nutritional status of children.

Globally, malnutrition continues to be a major public health problem affecting infants and young children. Malnutrition is accountable for one out of three deaths among children under five years (WHO, 2016). Globally, malnutrition contributes to a major cause of up to 9.5 million mortalities among children under five years of age on an annual basis (WHO, 2015). Severe underweight, wasting, stunting and micronutrients deficiencies are the main contributing factors to child mortality (UNICEF, 2015). Malnutrition normally starts from the age of 6 to 23 months when children are not appropriately fed and contribute to high prevalence of malnutrition among under five children (WHO, 2015). About 155 million children under five years of age were reported to be stunted while 101 million were underweight and 52 million were wasted globally (UNICEF/WHO/World Bank Group, 2017). Furthermore, South Asia and Sub-Saharan African were reported to have the highest prevalence of stunting as well as wasting amongst children under five years in the world (UNICEF/WHO/World Bank Group, 2017).

Food and Agricultural Organisation, International Funds for Agricultural Development, World Food Programme (FAO/ IFAD/ WFP, 2015) reported that vitamin A and iron are the most common micronutrients deficiencies affecting infants and young children globally. According to United Nations System Standing Committee on Nutrition (UNSCN, 2017) micronutrient deficiencies affected more than two billion people worldwide, with 190 million children being vitamin A deficient and 600 million iron deficient. It was furthermore estimated that 200 million children fail to attain their full development potential due to vitamin A and iron deficiency (WHO/ WFP/ UNICEF, 2007; Bailey *et al*., 2015). Micronutrient deficiencies remain a public health concern in South Africa, with 38.7% of children are reported to be anaemic while 63.6% of children under-five are reported to be vitamin A deficient (NFCS-FB, 2005). In 2012, SANHANES-1 showed that 43.6% of children were suffering from vitamin A deficiency while 11% were suffering from iron deficiency (SANHANES-1, 2012).

1.2. Problem statement

Limpopo Province is experiencing high levels of child malnutrition, with 4.2% of children under the age of five years reported to have severe acute malnutrition (District Health Barometer, 2016). In the study conducted in Limpopo Province by Gavhi *et al*. (2020), it is reported that 25.9% of children died as results of severe acute malnutrition. According to SANHANES-1 (2012) the prevalence of underweight, stunting and wasting amongst children under five years in Limpopo Province was 5%, 15.5% and 5% respectively. Recent national survey reported that 22% of children under five years were stunted in Limpopo Province (SADHS, 2016). Inappropriate

feeding practices such as early introduction of complementary foods and mixed feeding were identified as a major contributor to child malnutrition in Limpopo Province (Mamobolo *et al*., 2004; Mushaphi *et al*., 2008). A study conducted by Mushaphi *et al*. (2017), reported that less than 1% of children in Limpopo Province, Dzimauli region were exclusively breastfed for up to 3 months, but none of the children were exclusively breastfed for up to 6 months.

Few studies have been conducted so far at district and provincial level on infant feeding practices and nutritional status of children under five years of age in Vhembe District. The researcher's interest grew when conducting an undergraduate research project, which focused on infant feeding practices and nutritional status of children aged 3 to 24 months (Mugware, 2014). The undergraduate research project did not determine the micronutrient status of children. Thus, the researcher had many questions about feeding practices and nutritional status of children as the research was conducted on a small scale. In addition, the research did not determine the relationship between infant feeding practices and nutritional status (micronutrients status) (Mugware, 2014). Therefore, it is important to investigate the nutritional status and feeding practices of mothers with children aged 0 to 36 months.

1.3. Research question

- What is the nutritional status and feeding practices of children aged 0 to 36 months in Thulamela Municipality?

1.4. Aim of the study

The study aims to investigate the nutritional status and feeding practices of children aged 0 to 36 months in Thulamela Municipality.

1.5 Objectives of the study

- To determine breastfeeding practices of mothers with children 0 to 36 months.
- To determine complementary feeding practices of mothers with children 0 to 36 months.
- To assess anthropometric status of children 0 to 36 months using weight, height and MUAC.
- To assess micronutrients status (vitamin A and iron) of children aged 3 to 36 months.
- To compare the relationship between nutritional status and infant feeding practices of children aged 0 to 36 months.

1.6 Significance of the study

The study results will provide evidence-based and recent information on the nutritional status and feeding practices of children under the age of five years. Information obtained in this study may assist in improving mothers' knowledge of infant and young child feeding practices. The research findings may be used to guide policy makers when improving infant and young child feeding policy. Information obtained may also make a significant contribution to the existing body of knowledge in the field of nutrition especially on infant and young child feeding practices. Furthermore, the findings may also assist local health workers when planning nutrition intervention strategies which may contribute to better health and nutritional status of children under five years in South Africa.

1.7. Definition of operational terms

Anthropometric status: The status in question refers to the current body status of an individual, or to a population group, in terms of their state of nourishment (as regards the consumption and utilisation of nutrients), as assessed by body length/height, weight and MUAC measurements in comparison with the World Health Organization Child Growth Standards (WHO, 2015).

Continued breastfeeding at 2 years: The proportion of children 12 to 23 months of age who are fed breast milk is covered by this term (WHO, 2013c).

Complementary feeding: Refers to the process starting when breast milk is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are introduced to the infant, along with breast milk (WHO 2010a).

Exclusive breastfeeding: This refers to the feeding practice of giving the infant only breast milk from birth to 6 months. No other liquids or solids are given, not even water with the exception of oral rehydration solution, or drops/syrups of vitamins, minerals or medicines (WHO, 2010a).

Infant formula: A breast milk substitute that is manufactured according to the standards of the Codex Alimentarius International Food Standards to satisfy by itself and meet the nutritional requirements of infants during the first six months up to introduction of complementary feeding (WHO, 2019b).

Infant: A child not more than 12 months of age (WHO, 2009c).

Malnutrition: The cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions. It includes both undernutrition and overnutrition (WHO, 2014; Bhutta *et al*., 2017).

Minimum dietary diversity: Proportion of children 6–23 months of age who receive foods from four or more food groups during the previous day (WHO, 2010a).

Minimum meal frequency: Proportion of breastfed children aged 6-23 months who received solid, semi-solid or soft foods the minimum number of times or more during the previous day (WHO, 2010a).

Nutritional status: The balance between nutritional adequacy and nutritional requirements, reflecting the degree to which a toddler's nutritional needs are met (Hammond, 2012; WHO, 2015).

Stunting: Refers to low height/length-for-age Z-scores (H/LAZ). It reflects linear growth retardation used to describe long term nutritional status; stunting is when H/LAZ is equal to or less than minus 2 SD of the WHO reference point for children of same sex (WHO, 2015).

Underweight: Refers to low weight-for-age Z-scores (WAZ) and represents a global measure of under nutrition; underweight is when WAZ is equal to or less than minus 2 SD of the WHO reference point (WHO, 2015).

Wasting: Refers to low weight-for-height/length Z-scores (WH/LZ) that reflect current nutritional status and the degree of thinness in a child; wasting is when WH/LZ is equal to or less than minus 2 SD of the WHO reference point (WHO, 2015).

1.8 Outline of the dissertation

The structure of this dissertation is subdivided into six main chapters:

Chapter one - This chapter provides the background information, problem statement, research questions, aim and objectives, significance of the study and definition of terms.

Chapter two - This chapter provides relevant literature on infant and young child feeding practices, and nutritional status of children.

Chapter three – Methodology followed in this study were described including the study design used, sample and sampling procedures, methods for data collection, and data analysis.

Chapter four - This chapter presents the results of the study. The results include socio-demographic characteristics of study participants, breastfeeding practices, complementary feeding practices, nutritional status and the relationship between feeding practices and nutritional status.

Chapter five - Results of the study are discussed in the context of the latest relevant literature. The current obtained results are compared with previous studies conducted in the different settings.

Chapter Six - Conclusions are drawn from the results of this study. The recommendations for improvements, as well as for the implementation of strategies to ensure optimal feeding practices and improvement of nutritional status of children under five children were made.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The first two years of life are a vital period to promote the growth and development of infants and young children (Schwarzenberg *et al*., 2018). The period from birth to two years is considered as the critical period in which malnutrition can occur (Black *et al*, 2013; Kabaran, 2018). According to the World Health Organisation (WHO, 2014) malnutrition includes over nutrition which is an excess of more nutrients and undernutrition which refers to a deficiency in essential nutrients. Malnutrition has a negative impact on the health status, growth and development of young children especially in the first two years of life (Bhutta *et al*., 2017). Malnutrition may result in long-lasting and irreversible consequences such as impairment of growth and development and poor resistance to infections (Prado & Dewey, 2014; Victora *et al*., 2016).

Appropriate infant and child feeding practices from birth have an important role to determine nutritional status, growth and development, imprinting physiological and metabolic mechanisms that lower the risk for infectious diseases among infants and young children (Budree *et al*., 2017). WHO/UNICEF (2003) jointly developed the Global Strategy on Infant and Young Child Feeding, and guidelines principle for complementary feeding practices. The primary aim of these guidelines is to improve the nutritional status, growth and development of infants and young children through the promotion of optimal feeding (WHO & UNICEF, 2003; WHO, 2010a). Promotion of optimal feeding practices and meeting micronutrient requirements is a crucial step in combating malnutrition particularly in the first two years of life (UNICEF, 2015). Inappropriate infant and young child feeding practices along with repeated illness and infections pose a high risk of malnutrition at the early stage of life and more specifically during the first 1,000 days (Victora *et al*., 2016; Maciel *et al*., 2018).

The literature review in this study will focus on young child feeding practices, and nutritional status of children under five years. Relevant literature will be gathered from different sources such as peer-reviewed publications, books, website of the different organisation such as WHO, UNICEF, WFP, and FAO. This chapter is concluded by the summary of all the reviews.

2.2 Breastfeeding practices

The benefits of breastmilk have been documented extensively. Breastmilk is a unique and ideal food to start life of an infant and it contains all the essential nutrients such as protein, fats,

carbohydrates, vitamins, minerals and water, and these nutrients are as essential for growth and development (Liben *et al*., 2016). Breastmilk provides immune-related components and various biologically active substances that contribute to efficient nutrient utilisation and gives the child active and passive protection against infections (Hornell *et al*., 2013; Harmancıoğlu & Kabaran, 2019). Breastmilk contains long-chain polyunsaturated fatty acids, including docosahexaenoic acid and arachidonic acid which are essential for infant growth and development (Brenna *et al*., 2007; Koletzko, 2016). Moreover, breastmilk contains bioactive factors such as anti-infection, anti-inflammatory agents, growth factors and prebiotics (Ballard & Marrow, 2013; Vass *et al*., 2019).

WHO/UNICEF (2021) recommended that mothers should continue breastfeeding up to two years and even beyond. Furthermore, continued breastfeeding helps to maintains good nutrition and continues to prevent different infections amongst children. In a study carried out in Ghana by Asare *et al*. (2018) reported that 77.3% of mothers continued to breastfeed until children were 12 months. A cohort study conducted in Italy reported that 73% of mothers were still breastfeeding their children at the time of the study (Carletti *et al*., 2017). A study conducted in Kenya reported that 58.8% of mothers were still breastfeeding their children at the time of the study, 95% of those children within the 6 to 11 months age group (Macharia *et al*., 2019). Similarly, in the longitudinal study conducted in South Africa, it was revealed that 58% of mothers were still breastfeeding their children at the age of 12 months (Budree *et al*., 2017). A previous study conducted in the Vhembe District of Limpopo Province, it was found that 97% of mothers were still breastfeeding their children who were 12 months and younger at the time of study (Mushaphi *et al*., 2008). Breastfeeding up to two years and beyond seems very challenging in South Africa. The majority of mothers stop breastfeeding at 12 months while only few mothers breastfeed up to two years or even beyond as recommended by WHO (Mushaphi *et al*., 2008; Goosen *et al*., 2014; Budree *et al*., 2017).

The discussion focused on the core indicators as recommended by the WHO for assessing breastfeeding practices which are early initiation of breastfeeding, exclusive breastfeeding for the first six months, and continued breastfeeding up to two years or even beyond (WHO, 2010a; WHO, 2013c).

2.2.1 Breastfeeding initiation

WHO (2013c) define early initiation of breastfeeding as “the proportion of children who latched the breast within one hour of birth”. WHO/UNICEF (2021) recommend that a child should be

initiated to the breast within an hour after birth to enable mothers to establish breastfeeding. Early initiation of breastfeeding has lifetime benefits for both the mother and new-born. Children who are exposed to early initiation of breastfeeding have a lower risk of post-neonatal mortality (Smith *et al*., 2017; Yaya *et al*., 2020). Timely initiation of breastfeeding plays critical role to stimulates the mother's production of breastmilk and ensures intake of the colostrum breastmilk produced during the first few days after birth (Lakew *et al*., 2015). Breastmilk, especially colostrum provides infants with white cells, antibodies, proteins, minerals and fat-soluble vitamins, A, D, E and K (Riorden & Wambach, 2010; Koletzko, 2016; Harmancıoğlu & Kabaran, 2019). Evidence shows that new-borns who are exposed to early initiation of breastfeeding are more likely to adhere to exclusive breastfeeding compared to those who are exposed to late initiation of breastfeeding (Engebreten *et al*., 2014; Exavery *et al*., 2015).

Breastfeeding initiation within an hour after birth can be influenced by multiple factors. Initiation of breastfeeding can be delayed by individual factors, conditions of the birth (e.g. preterm, low birthweight), cultural factor, or barriers at the health facility, including complications during vaginal and caesarean section (C-section) delivery (Rollins *et al*. 2016; Takahashi *et al*. 2017). Similarly, Aakre *et al*. (2016) reported that factors such as home delivery, C-section, breast pain, discarding initial milk, illiteracy, lack of support from medical staff are associated with barriers to achieve initiation of breastfeeding within hour after birth (Aakre *et al*., 2016). In support, a study carried out in South Sudan by Tongun *et al*. (2018) revealed that mode of birth, marital status, place of residence, and discarding of colostrum were associated with delay in initiating breastfeeding within an hour after birth. In Democratic Republic of Congo, delayed initiation of breastfeeding within an hour after birth was associated with caesarean delivery and counselling by a non-health professional (Kambale *et al*., 2018). Late initiation of breastfeeding increases the risk of illnesses and infectious diseases and respiratory infections such as pneumonia, meningitis, neonatal sepsis (Beyene *et al*., 2016).

Despite all this challenges, it is estimated that 77 million (50%) of mothers globally initiate breastfeeding within an hour after birth every year (WHO, 2016b). Furthermore, breastfeeding initiation within an hour after birth remains less than 50% in most regions, except Eastern and Southern Africa (65%) and Eastern European and Central Asia (56%) (UNICEF, 2018). A cohort study carried out in India by Sindhu *et al*. (2019) reported that only 59% of mothers initiated breastfeeding within an hour after birth. A rate of breastfeeding initiation within an hour after birth in Tanzania, Southern Ethiopia and Malawi was 78%, 83.7%, 95.4% respectively (Exavery *et al*.,

2015; Beyene *et al*., 2016; Chipojola *et al*., 2020). In South Africa, the national breastfeeding initiation rate was estimated to be 92.6% (SANHANES-1, 2012). A similar observation was made in the study conducted in four Provinces in South Africa, North-West, Free State, Gauteng and Eastern Cape where 90% of mothers had initiated breastfeeding within an hour after delivery (Siziba *et al*., 2015). In the study conducted in Limpopo Province, the majority (90%) of mothers had initiated breastfeeding within an hour after delivery (Mushaphi *et al*., 2017).

2.2.2 Exclusive breastfeeding

WHO (2013c) define exclusive breastfeeding as "when an infant receives only breastmilk and no other liquids or solids, not even water, except for drops or syrups consisting of vitamins, mineral supplements or medicines prescribed by a health worker". Exclusive breastfeeding for the first 6 months has a range of health benefits to the child including nutritional, immunological and cognitive (Motee & Jeewon, 2014; Khan & Islam, 2017). According to UNICEF (2017) children who exclusively breastfed up to six months are more likely to survive compared to non-exclusively breastfed children. Moreover, children who are exclusively breastfed for the first six months are protected against diarrhoeal diseases, respiratory infections, gastrointestinal infections, pneumonia, urinary tract infection and otitis media (Victora *et al*., 2016). Exclusive breastfeeding also conveys health benefits to the mothers such as bonding with their children, provision of a natural contraceptive, weight loss and protection against other negative health outcomes such as cervical cancer and breast cancer (Black *et al*., 2013; Victora *et al*., 2016).

Globally, exclusive breastfeeding for the first six months is poorly practiced. Only 44% of children were exclusively breastfed for the first six month (UNICEF, 2017). The rate of exclusive breastfeeding for the first six months in West Africa, East Africa, Central Africa and Southern Africa was 32.6%, 53.4%, 23.7% and 56.5% respectively (Issaka *et al*., 2017). In the systematic review done in Iran by Behzadifar *et al*. (2019) show that the rate of exclusive breastfeeding for first six months was 53%. The rate of exclusively breastfeeding for the first six months in Western Nigeria and Ethiopia was 31.9%, 64.5% (Olodu *et al*., 2019; Beyene *et al*., 2019). In South Africa, the trends of practicing exclusive breastfeeding among lactating mothers remained mostly unchanged for a long time. According to SANHANES-1 (2012), the national rate of exclusive breastfeeding for the first six months has dropped to 7.4% from 8.3%, which was reported by the South Africa Demographic Health Survey done in (2003). In the recent South African Demographic and Health Survey found that exclusive breastfeeding has increased to 32% in 2016 (SADHS, 2016). Limpopo Province was reported to have the lowest rate of exclusive

breastfeeding (4.1%) when compared to other provinces such as Western Cape (6.0%) and KwaZulu-Natal (11.0%) (Mamobolo *et al*., 2004; Cape *et al*., 2007; Goosen *et al*., 2014). The highest rate of exclusive breastfeeding in South Africa was reported in Western Cape Province, with 13% of children were exclusively breastfed up to six months (Budree *et al*., 2017). World Health Assembly targeted to increase the rate of exclusive breastfeeding in the first six months up to at least 50% worldwide (UNSCN, 2017).

The exclusive breastfeeding factors have been shown to vary between countries and within the same country as well. In most developing countries, exclusive breastfeeding is influenced by various factors such as socio-economic, cultural, and individual factors especially in middle-income, and low-income countries (Rollins *et al*., 2016). In the previous studies, religion and cultural norms were amongst the factors impeding the success of exclusive breastfeeding in Uganda, Burkina Faso and Kenya (Engebretsen *et al*., 2014; Wanjohi *et al*., 2017). In the cross-sectional study carried out in Ethiopia by Belachew *et al*. (2018), it was reported that mothers who were not influenced by traditional or cultural beliefs towards exclusively breastfeeding were 11 times more likely to exclusively breastfeed for the first six months. On the other hand, Kebede *et al*. (2020) reported that having short duration of maternity leave, lack of flexible work time, lack of a lactation break were significantly associated with cessation of exclusive breastfeeding for the first six months in Ethiopia. Several studies done in a rural setting in South Africa revealed that perception of insufficiency of breastmilk, breast and nipple problems, poor maternal knowledge, going back to work/school, and lack of family support were the most common barriers to exclusive breastfeeding (Du Plessis, 2013a; Siziba *et al*., 2015; Mushaphi *et al*., 2017). According to Kavle *et al*. (2017) mothers who perceive their breastmilk as nutritionally inadequate are more likely to stop exclusive breastfeeding.

Lack of exclusively breastfeeding for the first six months is linked with infant and childhood morbidity and mortality (Hassan *et al*., 2018). Children who are not exclusively breastfed for the first six months are at high risk of childhood illness such as acute respiratory tract infections, meningitis diarrhoea and pneumonia (Kebede *et al*., 2020). In the study conducted in Ethiopia by Nigatu *et al*. (2019), found that odds of children who terminated exclusive breastfeeding in the ages between 0 and 3 months who were reported to have diarrhoea was 3.57 times higher than exclusively breastfed children for the first months. Long term consequences of non-exclusive breastfed children include poor academic performance, decreased productivity and impaired cognitive and social development (Tadesse *et al*., 2016).

2.2.4 Interventions to promote breastfeeding.

The Baby Friendly Hospital Initiative (BFHI) was developed and implemented by World Health Organisation as a 10-step model (WHO 1999). Furthermore, the model was implemented in the public birthing facilities to protect, promote and support breastfeeding by creating an enabling environment for breastfeeding in order to address the challenges of suboptimal breastfeeding practices. In countries such as Scotland, Belarus, Switzerland, Brazil, evidence based shows that Baby-Friendly Hospital Initiative (BFHI) has positively influenced breastfeeding rate on a local or national level (Munn *et al*., 2016). South Africa has adopted different policies, and programmes aimed to promote and support breastfeeding practices among mothers. Furthermore, one of the main resolutions of the Tshwane Declaration for support of breastfeeding held in 2011, was to ensure that all the public hospitals and health facilities should be Baby-Friendly Hospital Initiative-accredited by 2015. Moreover, it was also recommended that private hospitals and health facilities should be partnered with BFHI accredited by 2015 and all communities should be supported to be "Baby-Friendly". The BFHI has been renamed the "Mother-Baby-Friendly Initiative" (MBFI), renaming aimed to shift the focus from the sole context of the hospital setting (Du Plessi, 2013a).

WHO (1981) published the international Code of Marketing of Breastmilk Substitutes policy frame to regulate the marketing of breastmilk substitutes to protect breastfeeding. Furthermore, regulates the marketing of breastmilk substitutes which includes infant formulas, follow-on formulas and any other food or drink, together with feeding bottles and teats, intended for babies and young children. South African government has adopted the International Code of Marketing of Breastmilk Substitutes in 1995. South African National Department of Health issued that Tshwane Declaration on support for breastfeeding in South African in 2011 (DoH, 2011). Furthermore, the Declaration indicated that the issuing of free formula at public health facilities would be phased out. In 2012, the South African National Department of Health also legislated regulation 991, which govern the Code of Marketing of Breastmilk Substitutes and other foodstuffs for infant and young children. In addition, South African government made R991 compulsory for all food manufacturers including manufacturers of infant formulas. The studies conducted in South Africa reported that the implementation of this Declaration at national level was not as effective as the introduction of infant formula before the age of 4 months is common practices (Du Plessis, 2013a; Goosen *et al*., 2014).

South Africa has adopted the 2010 WHO guideline on HIV and infant feeding, which recommends that all HIV infected mothers should breastfeed their children while receiving antiretroviral drugs

to prevent HIV transmission to their children (WHO, 2010c). The current updated guidelines recommend that mothers living with HIV can breastfeed their children for at least 12 months or continue breastfeeding up to 24 months (WHO, 2016a). If the child is already HIV infected, mothers should exclusively breastfeed for the first six months of life and continue breastfeeding until the age of two years or even beyond (WHO, 2010c). Strong evidence indicates that exclusive breastfeeding carries a lower risk of HIV transmission from mother to child than mixed feeding especially when the mother is on antiretroviral treatment (Hazemba *et al*., 2016). Although WHO made recommendations, 14% of HIV infected mothers in the Western Cape never breastfed their children (Goosen *et al*., 2014; WHO, 2016a). A study conducted in four provinces of South Africa, North-West, Free State, Gauteng and Eastern Cape reported that 6% of mothers never breastfed their children because of their HIV status (Siziba *et al*., 2015). The findings from studies done in South Africa give a clear indication that mothers still hesitate to breastfeed their children because of their HIV positive status (Goosen *et al*., 2014; Siziba *et al*., 2015).

2.3 Artificial Infant Feeding

WHO (2009b) indicated that health conditions of the child or mother may justify recommending that mothers should not breastfeed temporarily or permanently. Furthermore, the conditions concern children include classic galactosemia, maple syrup urine disease, phenylketonuria and mother who is HIV infected may give infant formula only if is acceptable, feasible, affordable, sustainable and safe. Furthermore, mothers who choose not to breastfed should be provided with counselling on the risks of artificial feeding. WHO/UNICEF (2003) recommended the use of standard whey-based infant formula in the first 12 months unless, medically indicated by a health professional to support normal growth and development of the child. Furthermore, the mother should exclusively give the infant formula for the six months. Moreover, the standard whey-based infant formula that is recommended is needed to have whey casein protein ration of 60:40 (Betoko *et al*., 2014).

Infant formula can also compromise the nutritional status and health of children due to improper preparation, poor hygiene, misleading information on the labelling as well as mix feeding with breast milk (Smith *et al*., 2016). Infant formula is hard for infants' gut to absorb compared to breastmilk (UNICEF, 2013). Furthermore, infant formula contains a high content of protein as compared to breastmilk, over-concentration of infant formula can result in renal solute load to the children (Trahsm & Mackean, 2008; Totzauer *et al*., 2018). Infant formula has a lower content of

iron compared to breastmilk, these could increase the risk of iron deficiency among infant aged 0 to 6 months (Burke *et al*., 2014).

Although infant formula is not an acceptable substitute for breastmilk, 18% of new-born received breastmilk substitute such as infant formula, and animal milk globally (UNICEF, 2016). Furthermore, the rate of children who received infant formula in Northern Africa and Southern Africa was 14% and 4% respectively. In South Africa, approximately nearly one third (31%) of children in the Western Cape Province were given infant formula at an early age (Goosen *et al*., 2014). In the study conducted in urban township outside Bloemfontein revealed that 21% of mothers gave their children infant formula because breastmilk was insufficient, while 23.2% believed that infant formula is the best and it promotes growth compared to breastmilk (Kassier & Veldman, 2013). Furthermore, 84.6% of bottles that were used to feed children were reported to be contaminated with bacteria. Contaminated bottles with bacteria are major causes of diarrhoeal diseases to infants and young children (WHO, 2009b). Several factors that influence a mother's decision to give infant formula include lack of breastfeeding knowledge and experience as well as perceived insufficiency of breastmilk (Kassier & Veldman, 2013; Smith *et al*., 2016).

2.4 Complementary feeding practices

WHO (2010a) defined complementary feeding as "the process that when breastmilk is no longer enough to meet the nutritional requirement of child, during this period other foods and liquid are needed along with breastmilk to meet the infant's nutrition". Complementary feeding should start at the age of six months onwards while the mother is continuing to breastfeed until two years of age or even beyond (WHO/UNICEF, 2021). The core indicators recommended by the WHO for assessing complementary feeding practices included: introduction of solid semi-solid or soft food, minimum dietary diversity, minimum meal frequency, minimum acceptable diet and consumption of iron-rich or iron-fortified foods (WHO, 2010a). According to WHO/UNICEF (2021) complementary feeding should be timely, adequate and appropriate. Therefore, complementary foods should have variety, consistency, safe to meet child nutritional needs. Breastmilk alone becomes nutritionally insufficient for the child at the age of six months; therefore, complementary foods should start and assist to achieve a well-balanced diet to maintain a child's optimal growth (Dewey, 2016).

The WHO recommends that children from aged 6 to 23 months must eat food from at least four of the seven food groups, to attain a minimum dietary diversity (WHO, 2010a). The seven food

groups include grains, roots and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables (FAO, FHI 360, 2016; Du Plessis *et al*., 2013). Consumption of complementary foods made from at least four food groups has been shown to be associated with increased nutrient adequacy of diet for both breastfed and non-breastfed children (Issaka *et al*., 2015). The global estimate that 28.2% of children under five years attained minimum dietary diversity (White *et al*., 2017). Furthermore, in Eastern Africa and Southern Africa, 19.3% and 23.1% of children under the age of five years attained the minimum dietary diversity. A study carried out in Indonesia by Ahmad *et al*. (2018) reported that 50% of children aged 0 to 23 months had attained minimum dietary diversity. In South Africa, children are provided complementary foods which are mainly maize soft porridge with one or none added item (Mushaphi *et al*., 2008; Faber *et al*., 2016; Sayed & Schönfeldt, 2020). Maize meal soft porridge is the most common type of food introduced in rural areas, whereas commercial infant cereal is commonly introduced in urban areas (Du Plessis *et al*., 2013; Sayed & Schönfeldt, 2020). In most developing countries, complementary foods are commonly based on traditional and unfortified foods, which make it very hard for an infant to achieve an adequate intake of several nutrients (Sayed & Schönfeldt, 2020).

Complementary foods should be nutritionally adequate to provide enough energy, protein and micronutrients to meet the child's nutritional requirements (Du Plessis, 2013b; Faber *et al*., 2016; Budree *et al*., 2017). Complementary foods with poor diversity and substandard in low quality are associated with the high incidence of growth faltering (Okeyo, 2018). Most of the complementary foods provided to children in most middle-income countries contained poor micronutrients such as iron, vitamin A and zinc (Dewey, 2013; Mitchodigni *et al*., 2018). Strategies to meet the dietary requirement during complementary feeding include the selection of nutrient-rich foods, fortified staple foods and dietary diversification (Dewey, 2013; Mitchodigni *et al*., 2018). The recommended energy intake of children aged 6 to 8 months is 615Kcal, 9 to 11 months is 686kcal while for children aged 12 to 23 months is 894kcal (WHO & PAHO, 2003). The table below illustrates the recommended nutrients intake of complementary feeding practices for children aged 6 to 23 months.

Table 2.1: Recommended Nutrients Intake (RNI) of complementary feeding for children.

Nutrients	Age (months)		
	6 – 8	9 – 11	12 – 23
	RNI		
Protein (g)	9.9	9.9	13
Calcium (mg)	400	400	500
Iron2 (mg)	9.3	9.3	5.8
Zinc3 (mg)	4.1	4.1	1.1
Vitamin C (mg)	30	30	30
Thiamin (mg)	0.3	0.3	0.5
Riboflavin (mg)	0.4	0.4	0.5
Niacin (mg)	1.5	4	6
Vitamin B6 (mg)	0.3	0.3	0.5
Folate (mcg)	80	80	160
Vitamin B12 (mcg)	0.5	0.5	0.9
Vitamin A RAE (mcg)	500	500	300
Vitamin A, RE	400	400	400

Energy and recommended nutrient intakes and densities used are those proposed by FAO/WHO (2002); or protein and AMDR those proposed by Otten *et al.* (2006).

The WHO/UNICEF (2021) recommends that complementary foods should be introduced at six months of age to ensure that the child attains all the required nutrients for growth and development. Early introduction of complementary foods is common practices especially in Latin America, East Asia where nearly half of infant between 4 and 5 months of age are already consuming solids (White *et al*., 2017). In contrast, a study conducted in United Arab Emirates reported that 72.2% of children were timely introduced to complementary feeding between the ages of 6 to 8 months (Taha *et al*., 2020). Similarly, a study conducted in Benin, Ghana and Guinea-Bissau reported that more than 70% of children were timely introduced to complementary feeding between the age of 6 to 8 months (Mitchodigni *et al*., 2018). In South Africa, complementary foods are often introduced early (Cape *et al.,* 2007; Ghuman *et al*., 2009; Kassier & Veldman, 2013; Goosen *et al*., 2014; Sayed & Schönfeldt, 2020). A national survey conducted by SANHANES-1 found that approximately 75% of children were introduced to solid, semi-solid or soft foods before the age of six months (SANHANES-1, 2012). A similar trend was observed in the study conducted in four provinces of South Africa, North-West, Free State, Gauteng and Eastern Cape and revealed that the majority (92%) of children were introduced to semi-solid or solid foods before the age of six months (Siziba *et al*., 2015). In the study conducted in KwaZulu-Natal Province, it was found that 84% of children were introduced to solid, semi-solid or soft foods before the age of six months (Seonandan & Mckerrow, 2016). In a study conducted in the Vhembe District of Limpopo Province, it was reported that 43.2% of children were introduced to complementary feeding as early as 3 months (Mushaphi *et al*., 2008).

The early introduction of solid, semi-solid or soft food before six months may result in reducing the ingestion of protective factors present in breastmilk and increasing the exposure to sources of contamination (Belew *et al*., 2017). Children who receive solid, semi-solid or soft foods before six months are at high risk of diarrhoea diseases or gastrointestinal infection and food allergies (Okeyo, 2018). Previous studies reported that early introduction of solid. Semi-solid or soft foods is associated with poor linear growth and neurodevelopment (Krebs *et al*., 2017; Campoy *et al*., 2018). According to Kavitha *et al*. (2014) children who are introduced solid, semi-solid or soft food before six months are more likely to be malnourished due to displacement of breastmilk.

Complementary feeding practices is often associated with numbers of determinates such as cultural practices, beliefs and illiteracy, and misconceptions (Osaman *et al*., 2009; Du Plessis *et al*., 2013). In the study conducted in Netherlands by Wang *et al*. (2019), reported that maternal age, lower maternal education level was the most common influence of early introduction of solid, semi-solid foods. A previous study conducted in the Limpopo Province revealed that poor maternal education and nutritional knowledge influenced the early introduction of solid, semi-solid foods (Mushaphi *et al*., 2017). Similarly, Kavitha *et al*. (2014) claimed that mother's knowledge about complementary feeding practices is often a greater determinant of child malnutrition. Mothers who practice optimal complementary feeding have shown to have a higher education level, exposed to media and have received feeding practices advice in immunization (Kassa *et al*., 2016). Although complementary feeding counselling by health workers increase the mother's knowledge and improve their feeding practices, most of this counselling in South Africa is primarily conducted by nurses or volunteers instead of nutrition professionals (Reinsma *et al*., 2016). Nutrition education is considered as one of the most effective strategies to increase knowledge regarding complementary practices (Majamanda *et al*., 2014; Mushaphi *et al*., 2015).

Children are vulnerable to illness, growth faltering from the age of six months during the transition period from breastmilk to complementary feeding (Sayed & Schönfeldt, 2020). Globally, approximately 100, 000 death of children under five years could be prevented each year if appropriate complementary feeding is practised (Bhutta *et al*., 2013). According to Kassa *et al*. (2016), appropriate complementary feeding practices reduce the incidence of stunting among children under the age of five years (Kassa *et al*., 2016). A study done by Hornell *et al*. (2013) reported that children who received complementary foods at the age of six months had better growth compared to those who were introduced to solid foods before the age of 4 months. Similarly, Disha *et al*. (2012) reported that children who were introduced to timely complementary

feeding had weight-for-height Z-score than those who were introduced to early or late complementary feeding in Zambia. Long term health benefits of proper complementary feeding include prevention of infections, allergies, type 1 diabetes mellitus as well as celiac and non-communicable diseases (Campoy *et al*., 2018).

2.5 Consequences of poor infant feeding practices.

Inappropriate infant and young child feeding practices have a lot of direct implications for the health status, growth and development of the child. Malnourished children are more likely to suffer from illness, impaired learning abilities, impaired growth and development and micronutrients deficiencies (Wu *et al*., 2014; Hashmi *et al*., 2019). According to Sterwart *et al*. (2013) infections and illness due to poor feeding practices are associated with poor nutritional status of infant and young children as a result of malabsorption of nutrients and reduction of appetite. The negative outcome of suboptimal feeding practices includes an increased risk of obesity later in life (Maciel *et al*., 2018). Furthermore, long term consequences of poor child feeding practices have been established and these include impaired intellectual performance, reproductive performance, work capacity and increase the risk of chronic diseases (Radwan *et al*., 2013; Okeyo, 2018).

2.6 Nutritional status of children

Nutritional status is defined as the balance between nutritional adequacy and nutritional requirements, reflecting the degree to which a toddler's nutritional needs are met (Hammond, 2012; WHO, 2015). Nutritional status of children can be determined by anthropometric measurements, biochemical, clinical, and dietary method (Gibson, 2005: 6; Lee & Nieman, 2010: 3). The nutritional assessment of children plays a critical role in determining health status, productive life, physical growth and developments (Dhungang, 2017). In the long-term, poor nutritional status of children is associated with a negative impact on lost human capital, economic productivity, social goals and school performance (Prendergast & Humphrey, 2014).

2.6.1 Anthropometric status of children

Anthropometric assessment of infant and young children involves the use of growth standard and growth reference for monitoring growth and nutritional status (Wang & Chen, 2012; WHO, 2015). Measurements such weight, recumbent length (used in children from birth to 24 months), standing height (used in children aged 24 months and older), mid-upper arm circumference (MUAC), tricep skinfold and head circumference (HC) are used to assess anthropometric status of infants and young children. The measurements are key building blocks of anthropometric and are very vital

for measuring and classifying nutritional status in children under five years (Lee & Nieman, 2010: 161). The anthropometric indicators that can be used to assess growth status of children includes weight-for-height/length, height/length-for-age, weight-for-age, and BMI-for-age (WHO, 2009a). Anthropometric indicators are tools to measure and quantify the severity of malnutrition as well as providing the summary of the nutritional status of children under five years of age and can be interpreted using percentile and Z-scores (WHO, 2006). The percentiles and Z-scores in anthropometric measure have been used classify if the child is underweight, wasted, stunted, overweight and obese (Wang & Chen 2012; WHO, 2015). The z-score classification of anthropometric indictors in children according to the WHO standards is shown in below table 2.1 (WHO, 2009a).

Table 2.2: Z-score classification to determine the nutritional status of the children (WHO, 2009a).

Z-score classification	WAZ	WH/LZ	H/LAZ	BMI/A
<-3SD	Severely underweight	Severely wasted	Severely stunted	Severely wasted
-3SDto<-2SD	Underweight	Wasted	Stunted	Wasted
-2SDto<-1SD	Mild underweight	Mild wasted	Mild stunted	Normal
-1SDto+1SD	Normal WAZ	Normal WH/LZ	Normal length	Normal BMI/A
>+1SDto<+2SD	Possible growth problem	Possible risk of overweight	Normal length	Possible risk of overweight
+2SDto<+3SD	Possible growth problem	Overweight	Normal length	Overweight
>+3SD	Possible growth problem	Obese	Above normal	Obese

2.6.1.1 Weight-For-Age

A weight-for-age indicator is used to describe a child's weight in relation to his/her current age. Weight-for-age helps to identify children who are underweight or overweight. A child is classified as underweight when the weight-for-age is below -2 standard deviations of WHO child growth standard median for children aged under five years (Table 2.2) (WHO, 2009a). Furthermore, a child is classified as severely underweight when weight-for-age is below -3 standard deviations below the WHO child growth standard median for children aged under five years. Underweight present among infant and young children reflects both acute and chronic malnutrition (Mgongo *et al*., 2017). Underweight became a public health problem when ≥ 10% of the population are affected (WHO, 2015). The prevalence cut-off values of <10% of underweight population is classified as low prevalence, 10-19% is classified as medium prevalence, 20-29% is classified as high prevalence, while ≥30% is classified as very high prevalence (WHO, 2015).

Globally, the rate of underweight amongst children under five years has dropped, between 1990 and 2010 the prevalence declined from 29% to 18% (WHO, 2014). A study conducted in Bangladesh reported that 33% of children aged 0 to 24 months were underweight (Nahar *et al*., 2020). The prevalence of underweight among under five years children in Kenya and Southern-Western Nigeria was 19.1%, 29.5% respectively (Macharia *et al*., 2019; Olodu *et al*., 2019). In 2005, the National Food Consumption Survey showed that 11% of children aged 1 to 3 years were underweight (NFCS-FB, 2005). In South Africa, SANHANES-1, (2012) showed the declined prevalence of underweight from 11% to 6.1% of the children aged 1 to 3 years. In Provincial level, the higher prevalence of underweight in children under five years of age were reported in Limpopo Province (5%), Gauteng Province (5%) followed by Eastern Cape Province (4%) (SANHANES-1, 2012). The current study done by Mushaphi *et al*. (2015) reported that 8.2% of children aged 3 to 5 years in Limpopo Province were underweight.

Chronic malnutrition in early age can result in poor cognitive and physical development (Campbell *et al*., 2018). A combination of infection and inadequate dietary intake are amongst the primary causes of underweight in children especially the first two years of life (Adhikari *et al*., 2017). In the study conducted in Bangladesh by Nahar *et al*. (2020) shown that underweight children were more likely to have poor cognitive and motor (fine motors, gross motors).

2.6.1.2 Weight-Length/Height.

A Weight-for-length/height indicator is used to describe a child's weight compared to his/her current length/height. According to WHO (2009a) weight-for-length/height helps to identify children who are at risk of wasting, overweight as well as obesity. A child is classified as wasting when the weight-for-length/height is below -2 standard deviations of WHO child growth standard median for children aged under five years (Table 2.2) (WHO, 2009a). In addition, weight-for-length below -3 standard deviation may be used as criterion to identify severe acute malnutrition in children. Wasting present rapid reduction or loss of weight, it is a measure of acute malnutrition (Wang & Chen, 2012; Briend *et al*., 2015). According to WHO (2015), wasting becomes a public health problem when ≥ 5% of the population is affected. The prevalence cut-off values of <5% wasted population is classified as acceptable, 5-9% classified as poor, 10-14% classified as serious while ≥15% is classified as critical (WHO, 2015). The causes of wasting are not different from that of stunting (UNICEF/WHO/UN/WBG, 2015).

Wasting is responsible for up to 2 million deaths annually worldwide. Asia remains the worst continent with the highest prevalence of wasting (UNICEF/WHO/World Bank Group, 2017). Globally, the World Health Assembly target to reduce and maintain childhood wasting to less than 5% (WHO/UNSCN, 2017). Furthermore, it was estimated that 35.9 million children under five years were wasted in Asia followed by 14 million in Africa. A study conducted in Bangladesh reported that 9.6% of children age 0 to 24 months were wasted (Nahar *et al*., 2020). The prevalence of wasting among the under five children in Kenya and Western Nigeria was 14.7%, 25.3% respectively (Macharia *et al*., 2019; Olodu *et al*., 2019). In South Africa, the prevalence of wasting among children under five years was reported to be 3% (SANHANES-1, 2012). Furthermore, Limpopo Province has a lower prevalence (2.5%) of wasted children as compared to Northern Cape Province (11%) (SANHANES-1, 2012; Mushaphi *et al*., 2015). Previous studies established that South Africa is still experiencing a high prevalence of wasting among under five years' children.

Wasting at an early age is associated with increased rates of morbidity and mortality. Children who are wasted are more likely to die in the early stage of life (Mgongo *et al*., 2017). Wasting during early childhood is associated with delayed child growth and development (UNICEF/WHO/WBG, 2017). Furthermore, wasting impairs the functioning of the immune system and can lead to increased severity and duration of and susceptibility in infectious diseases and increased risk for death. A study conducted in Bangladesh found that children who are wasted have poor motor skills as compared to those who are not wasted (Nahar *et al*., 2020). According to Dewey (2013), effective strategies to prevent wasting amongst infants and young children include promotion and support of breastfeeding, appropriate complementary feeding practices and use of fortified foods.

According to WHO (2009a) weight-for-length/height helps to identify children who are at risk of wasting, overweight as well as obesity. Globally, 38 million of children under five years are overweight. Furthermore, in Eastern Europe and Central Asia, Middle East and North Africa at least 1 in every 10 children under five years is overweight (UNICEF, 2020). In South Africa, SANHANES-1 (2012) reported that 17.5% of children under five years were overweight. In the recent national survey, SADHS (2016) reported that 13.3% of children under five years were overweight. A study conducted by Rothman *et al*. (2018) in Peri-urban community of South Africa reported that 20.9% of children under five were overweight. Childhood overweight is associated with higher probability of obesity in adulthood, which can lead to a variety of disabilities and

diseases, such as diabetes and cardiovascular diseases (Sahoo *et al*., 2015). The United Nations Sustainable Development Goal (SDG) target 2.2 enjoins the global community to end all forms of malnutrition by 2030, including overweight and obesity (WHO, 2018).

2.6.1.3. Length/height-for-age

Length/height-for-age indicator is used to describe child's length/height compared to his/her current age. Length/height-for-age focus on the long-term malnutrition as well as identifying child with failure to grow adequately (Agedew & Chane, 2015). A child is classified as stunting when length/height-for age is below -2 standard deviation of WHO child growth standard median for children under the age of five years (WHO, 2009a). In addition, a length/height-for age of below -3 standard deviation of WHO child growth standard median for children under the age of five years is classified as severely stunted. Stunting reflects a failure to reach genetic height potential. Stunting becomes a public health problem when ≥ 20% of the population is affected. The prevalence cut-off values of <20% stunted population is classified as low prevalence, 20-29% as medium prevalence, 30-39% as high prevalence while ≥40% is classified as very high prevalence (WHO, 2015). Children are likely to be stunted between the age of 6 to 23 months (Agedew & Chane, 2015). The vulnerability of children to stunting between the age of 6 to 23 months is often associated with high demand for nutrients requirement, limitations in the quality and quantity of their diets and high incidence of infections (Faber, 2005; Dewey, 2013, Moges *et al*., 2015). Additionally, poverty, low educational level of the mother, poor infant feeding practices, infections and birth interval are amongst the causes of stunting in children under five years (Birhanu *et al*., 2017).

Globally, World Health Assembly target to reduce stunting by 40% end of 2030 (WHO/UNSCN, 2017). Africa ranked second highest continent with a high prevalence of stunting among children under five years. In recent joint child malnutrition reports, Asia had 86.5 million of children under five years who were reported to be stunted followed by Africa with 59 million of children (UNICEF/WHO/WBG, 2017). A study conducted in Bangladesh reported that nearly half (48%) of children age 0 to 24 months were stunted (Nahar *et al*., 2020). The prevalence of stunting among the under-five children in Western Nigeria and Kenya was 18.6%, 33.8% respectively (Olodu *et al*., 2019; Macharia *et al*., 2019). In South Africa, stunting remains prevalent among children under the age of five years. Nationally, 22% of children under the age of five years were reported to be stunted while 1.2% were reported to be severely stunted (SANHANES-1, 2012). The prevalence of stunting in a rural setting of the Eastern Cape and KwaZulu-Natal was 20% in children aged

between 6 to 11 months and 30.9% between ages 12 to 24 months (Lesiapeto *et al*., 2010). According to SANHANES-1, (2012), Mpumalanga Province (30%) had the highest prevalence of children who are stunted followed by Northern Cape Province and Free State with 28%. In Limpopo Province, 15.2% of children were stunted while 4.6% were severely stunted (Mushaphi *et al*., 2015).

Stunting at an early age has serious health implications and contributes to morbidity and mortality rate during the life course. Children who are stunted may never grow to their full height and their brain may never develop to their full cognitive potential (UNICEF/WHO/World Bank Group, 2017). Stunting is often associated with impaired brain development, low IQ, weakened immune system and a high risk of diseases later in life (UNICEF, 2017). Long term consequences of stunting include deficits in school achievement, low intelligence scores, reduced work capacity and reduced earnings (Agedew & Chane, 2015; Akombi *et al*., 2017; Birhanu *et al*., 2017). Stunting may also result in reduced lean body mass especially in under-five children (Victora *et al*., 2008; Briend *et al*., 2015). Children who are stunted are at high risk of repeated infections such as diarrhoea, pneumonia, measles and cardiovascular diseases later in adulthood (Black *et al*., 2013). Strategies such as optimal breastfeeding, complementary feeding and disease control can prevent or combat stunting at an early age (Bhutta *et al.*, 2013; Agedew & Chane, 2015).

2.6.2 Micronutrients status of children

Micronutrients deficiency is referred to “hidden hunger” as the results it often go unnoticed. (Bailey *et al*., 2015). Children who are suffering from micronutrients deficiency are often presented with poor learning and cognitive ability, impairs growth, reduces immunity and decrease working capacity (Berrti *et al*., 2011; Harding *et al*., 2018). Micronutrients deficiency is typically the results of inadequate dietary intake, increased physiological demands and high incidence of infectious diseases (Gibson *et al*., 2010; Burchi *et al*., 2011; Berti *et al*., 2014; Bailey *et al*., 2015). The global estimate indicate that more than two billion people are suffering from micronutrients deficiencies (WHO/UNICEF/WBG, 2017). The deficiency of micronutrients such as vitamin A, iron, zinc, folate, iodine affects people worldwide. Vitamin A and iron deficiency remain most common micronutrient deficiencies that affect children under five years particularly in middle-income countries including South Africa (Cape *et al*., 2007; Mushaphi *et al*., 2015).

Despite the implementation of several initiatives such as vitamin A supplementation, growth monitoring and promotion, deworming and food fortification, micronutrients deficiency still a major

public health problem affecting children under five years in South Africa (SANHANES-1, 2012). According to the South African Vitamin A Consultative Group (SAVACG, 1995), National Department of Health (2007), National Food Consumption Survey (2005) vitamin A and iron deficiency has doubled between 1994 and 2005 in South Africa. Micronutrient deficiency can result in a high mortality rate, inadequate growth, infections, reduce mental capacity and productivity during early childhood (Prado & Dewey, 2014; Bailey *et al*., 2015).

2.6.2.1. Vitamin A status

Vitamin A has multiple roles in the body, including functions of the visual system, growth and development, maintenance of epithelial cellular integrity, and immune function (WHO, 2011d). Vitamin A can be found in two forms, namely carotenoids and retinol (Wickramasinge, 2013). Vitamin A can be assessed with two sets of indicators: clinically assessed eye sings (xerophthalmia) and biochemically to determine the concentration level of serum retinol (WHO, 2011d). According to WHO (2011d), serum retinol of < 0.35 µmol/L is classified as severe vitamin A deficiency, Moderate 0.35 - 0.69 µmol/L as a moderate vitamin A deficiency, < 0.70 µmol/L as mild vitamin A deficient whereas ≥ 0.70 µmol/L is defined as vitamin A sufficient serum retinol (Table 2.3). The prevalence of vitamin A deficiency (serum retinol <0.70 µmol/L) in population indicates the level of public health concern, 2 to 9% is a mild public health concern while 10 to 19% is moderate public health concern and above 20% is a severe public health concern (WHO, 2011d).

Table 2.3: Interpretations of vitamin A status of children (WHO, 2011d).

Serum retinol	Cut-off values
Severe vitamin A deficiency	< 0.35 µmol/L
Moderate vitamin A deficiency	0.35 - 0.69 µmol/L
Mild vitamin A deficiency	< 0.70 µmol/L
Vitamin A sufficient	≥ 0.70 µmol/L

During childhood vitamin A requirement increases because of growth and development and it is also needed to combat infections (Wickramasinge, 2013; Chouraqui *et al*., 2020). Low dietary intake of vitamin A, rapid growth and repeated infections are the major causes of vitamin A deficiency especially in early childhood (Gibson, 2005: 480). Children with measles, acute diarrhoea, acute respiratory infection, and protein-energy malnutrition are more vulnerable to vitamin A deficiency (Wickramasinge, 2013: Bharadva *et al*., 2019). Furthermore, non-breastfed infants are also venerable to vitamin A deficiency (Bharadva *et al*., 2019). Furthermore, children who have low vitamin A status at birth are more likely to develop vitamin A deficiency.

Vitamin A deficiency (VAD) affects 190 million children under 5 years of age worldwide and is associated with increased risk of morbidity and mortality (UNSCN, 2017). In systematic review done in China revealed that 9.2% of children between age 0 to 4 years had vitamin A deficiency (Song *et al*., 2017). In systemic review done in three African countries by Harika *et al*. (2017), shown that prevalence of vitamin A deficiency among children aged 0 to 9 years in Kenya, Nigeria and Ethiopia was 14%, 16%, 19% respectively. Despite the implementation of vitamin A supplementation programme in 2002, vitamin A deficiency remains a public health concern in South Africa. Nationally, 63.6% of children under five years were reported to be vitamin A deficiency (NFCS-FB, 2005). In a national survey conducted in South Africa, showed that 43.6% of children at the age of five were vitamin A deficiency (SANHANES-1, 2012). Most children living in rural areas are more vulnerable to micronutrients deficiency such as vitamin A compared to those living in urban areas in South Africa (Cape *et al*., 2007). In Limpopo Province, Mushaphi *et al*. (2015) revealed that 7.7% of children under five years were vitamin A deficiency.

Vitamin A deficiency is the leading causes of night blindness, Bitot's spots, corneal xerosis and xerophthalmia (Gibson, 2005: 480). Furthermore, the consequences of vitamin A deficiency during childhood include poor appetite, poor growth as well as an impaired immune response with lowered resistance against infection (Gibson, 2005: 481). Vitamin A also linked with loss of cilia in the respiratory track, loss of microvilli in the gastrointestinal tract and loss of mucin and goblet cells in the respiratory (Bharadva *et al*., 2019).

Vitamin A can be naturally found in different food such as dairy product, egg yolk, yellowish fruits, and vegetables such as spinach, carrots and pumpkin (WHO, 2009c). Adequate breastfeeding, daily intake of vitamin A rich foods together with vitamin A supplementation from 6 to 59 months are the most effective interventions to prevent vitamin A deficiency amongst children under five years (WHO, 2013a). Vitamin A supplementation can prevent diarrhoea and measles amongst children between the age of 6 to 59 months (Haider & Bhutta, 2011; Bhutta *et al*., 2013). In South Africa, vitamin A coverage remains very low. Mpumalanga Province had the lowest vitamin A coverage (30%) followed by Limpopo Province (32%), Northern Cape Province (32%) and Northwest Province 33% (DHIS, 2009). In Limpopo Province, Mushaphi *et al*. (2017) revealed that consumptions of indigenous vegetables, fruits and legumes reduced the prevalence of micronutrients deficiency such as vitamin A, vitamin C and calcium.

2.6.2.2 Iron status

Iron deficiency is the state where there is insufficient iron to maintain the normal physiological function of tissue, such as blood, brain and muscle (WHO, 2011b). Iron plays a vital role in oxygen transportation, energy metabolism, immune response and brain development (WHO, 2007). Other roles of iron include enzymatic processes, haemoglobin production, cell differentiation and mitochondrial energy generation (McDermid & Lonnerdal, 2012). According to Wickramasinghe (2013) iron is also required for the metabolism of neurotransmitters, myelination and memory function. Iron deficiency can be classified by 3 stages, 1 (depletion of iron stores), 2 (Iron deficiency without anaemia), and 3 (Iron deficiency anaemia) (Gibson, 2005: 443; Lee & Nieman, 2010: 320). Biochemical indicators that are recommended for assessing iron deficiency status include serum iron, total iron-binding capacity (TIBC) and serum transferrin saturation, serum ferritin, haemoglobin and serum mean cell volume/mean cell haematocrit (Gibson, 2005: 446-466; Lee & Nieman, 2010: 319-323).

Haemoglobin (Hb) is the iron-containing oxygen transport protein in the erythrocytes. Haemoglobin is the key indicator to assess the prevalence of anaemia and iron deficiency anaemia (WHO, 2011b). According to Gibson (2005: 449), measurement of blood haemoglobin (Hb) is a common widely used method to diagnose anaemia and is often determined through laboratory analysis of venous sample. In addition, anaemia is assessed through a photometric method using HemoCue® Hemoglobin system on small blood samples. The cut-off value of haemoglobin concentration 10.9–10.0 g/dL is classified as mild anaemia, 9.9–7.0 g/dL is classified as moderate anaemia while <7 g/dL is classified as severe anaemia (Table 2.4) (WHO, 2011b). The anaemia prevalence of <4.9% is considered as normal public health problem, 5.0 - 19.9% is considered as a mild public health problem, 20.0 - 39.9% is considered as moderate public health problem while >40% is considered as a severe public health problem (WHO, 2011b). Anaemia can be caused by iron deficiency but also other such as deficits in other nutrients like vitamin A, B12, C and folic acid (WHO, 2001).

Table 2.4: Interpretation of haemoglobin concentration (WHO, 2011b).

Haemoglobin concentrations	Cut-off values
Any anaemia	<11.0 g/dl
Mild anaemia	10.0–10.9 g/dl
Moderate anaemia	7.0–9.9 g/dl
Severe anaemia	<7.0 g/dl

Serum ferritin is the recommended indicator of iron deficiency in populations and is a measure of iron stores. Serum ferritin is the only measure or iron status that can reflect a deficient, excess, or normal iron status (Gibson, 2005: 459). The function of ferritin is not an intermediate protein during haemoglobin synthesis but also as a storage protein for iron released during haemoglobin denaturation. According to WHO (2011c), the cut-offs value of serum ferritin <12 µg/L is classified as iron deficiency (Table 2.5). Serum ferritin levels increase in the presences of acute and chronic infections, inflammatory diseases and liver disorder due to an increase of serum ferritin synthesis (WHO, 2011c).

Transferrin saturation is the serum iron divided by the total iron-binding capacity (TIBC) which corresponds to circulating iron. The iron capacity reflects transferrin, the protein to which virtually all iron in the blood is bound. Furthermore, transferring saturation is used to differentiate between iron deficiency anaemia and other types of anaemia and is a more sensitive indicator of iron deficiency. According to Gibson (2005: 471), saturation transferrin cut off value of 10 – 20% is classified as normal, <15% is classified as low while >20% is classified as high (Table 2.5).

Serum iron measures the amount of circulating iron that is bound to transferrin. Serum iron can be used for assessing iron overload or acute iron poisoning (Gibson, 2005: 471). It is a relatively poor index of iron status because of large day-to-day variations, even in healthy individuals, and it should be evaluated in the light of other laboratory values (Litchford, 2008). According to Gibson (2005: 471) the cut-offs value of serum iron <40 µg/dL was classified as iron depletion, <60 µg/dL was classified as mild depletion while ≥115 µg/dL was classified as normal (Table 2.5).

The soluble transferrin receptor (sTfR) is an indicator of iron insufficiency when iron stores are depleted (and assuming the absence of other causes of abnormal erythropoiesis) (Skikne *et al*., 2011). The sTfR is expressed by iron-requiring cells and reflects cellular iron demands and erythropoietic activity. In populations with a high prevalence of infection/inflammation and concomitant severe IDA, sTfR is less affected by an acute-phase response than ferritin and provides more information on the extent of iron deficiency once iron stores are depleted (WHO, 2011c). The cut-off value of serum transferrin < 1.0 g/L was classified as Severe depletion, 1.5 – 2.0 g/L was classified as depletion while > 2.0 g/L was classified as normal serum transferrin (Table 2.5) (Gibson, 2005: 415). It is analysed at low cost using the ELISA method (WHO, 2011c).

Table 2.5: Interpretation of iron status of children. (Gibson, 2005: 415, 471; WHO, 2011c)

Iron indicators	Cut-off values
Serum iron (Gibson, 2005: 471)	
Depletion	< 40 µg/dL
Mild depletion	< 60 µg/dL
Normal	≥115 µg/dL
Serum ferritin (WHO, 2011c)	
Iron deficiency	<12 *µ*g/l
Normal iron stores	≥12 *µ*g/l
Serum transferrin (Gibson, 2005: 415)	
Severe depletion	< 1.0 g/L
Mild depletion	1.5 – 2.0 g/L
Normal	> 2.0 g/L
Saturation transferrin (Gibson, 2005: 471)	
Low	< 15%
Normal	10 - 20%
High	> 20%

Iron is an essential micronutrient that occurs in the diet as heme (organic) and non-heme (non-organic). Heme iron can be found in animal food source, including meat, poultry, fish and eggs while non-heme iron can be found in both animal and plant foods (Schonfeldt & Hall, 2013). According to Hurrell and Egli (2010), ascorbic acid found in fruits, juices, potatoes and other vegetables such as green leaves are enhancer of non-heme iron absorption. On the other hand phytates found in cereals and pulse, polyphenols found in beverages such as tea and proteins such as milk proteins, eggs and soybeans were reported to be Inhibitors of non-heme iron absorption (Burke *et al*., 2014).

Iron deficiency has been associated with increased risk of morbidity rates among infants and young children. The severity of iron deficiency can result in anaemia (Abbaspour *et al*., 2014). Infants and young children are particularly vulnerable to iron deficiency because of the rapid rate of growth with a corresponding increase in the red cell (WHO, 2007). The most common causes of iron deficiency amongst children are infectious diseases, poor dietary intake or absorption of dietary iron and deficiencies of other vital micronutrients such as folate, vitamin B12 and vitamin A (WHO, 2011c; Camaschella, 2015). Children suffering from iron deficiency are at an increased risk of delayed mental and physical development, reduced auditory and visual function, impaired physical performance as well as impaired immune status and lowered resistance of infections (Bailey *et al*., 2015; Rothman *et al*., 2018) (Figure 2.1). Long term consequences of iron deficiency during childhood include poor school performance, reduced physical work capacity (Wickramasinghe, 2013; Chouraqui *et al*., 2020).

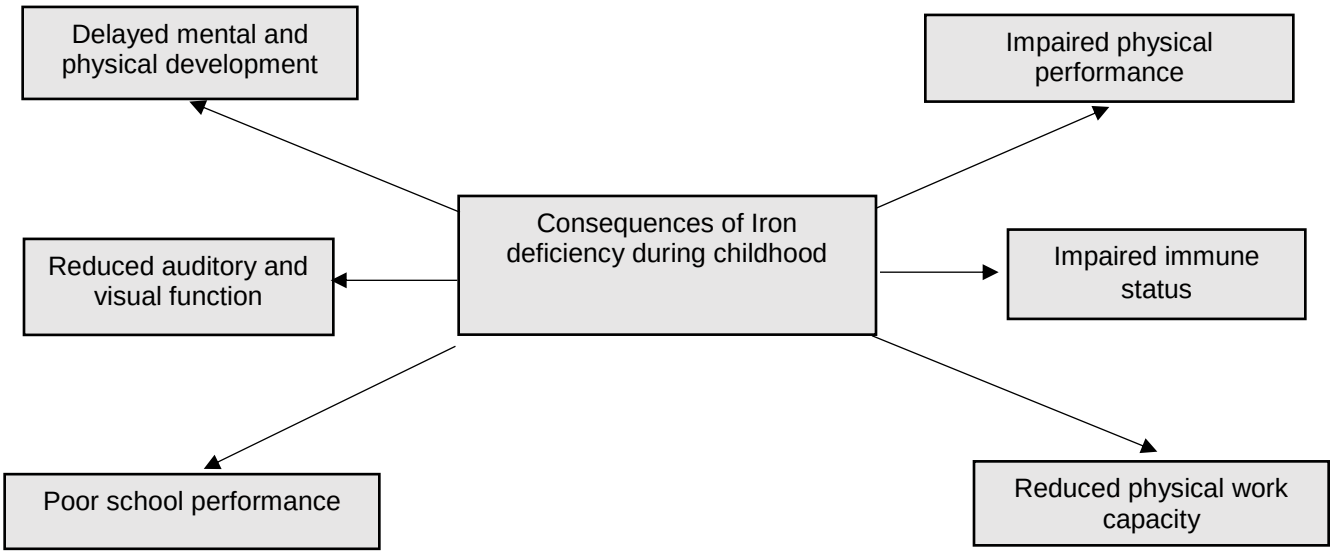

Figure 2.1: Consequences of iron deficiency during childhood (Bailey *et al*., 2015; Rothman *et al*., 2018).

Anaemia and Iron deficiency remain prevalent amongst children in most of African countries. In a study conducted by Kuziga *et al*. (2017) it was reported that 68.8% of children under five were anaemic in Uganda. A study conducted in Northern Angola reported that 44.4% of children had anaemia while 46% had iron deficiency (Fançony *et al*., 2020). According to SANHANES-1 (2012), the prevalence of anaemia, iron deficiency, and iron deficiency anaemia among children under five years was 10.5%, 11%, 2.1% respectively. In the recent survey, South African Demographic and Health Survey reported a higher prevalence of 61% of anaemia among children under five years (SADHS, 2016). The highest prevalence of iron deficiency among children under five years was found in Free State Province (16%) followed by Limpopo Province (14%) Mpumalanga and Western Cape with 12% (NFCS-FB, 2005). In Limpopo Province, 3.5% of children aged 3 to 5 years were iron deficient (Mushaphi *et al*., 2015). Rothman *et al*. (2018) revealed that 20.7% of children in Peri-Urban community of South Africa had Iron deficiency. Nutrition education, dietary diversification iron supplementation and fortification of staple foods are the most effective strategies to prevent iron deficiency (Wickramasinghe 2013; Dewey, 2016; Bharadva *et al*., 2019).

2.8 Summary of literature review

The first two years of life are a vital period to promote growth and development of the infants and young children. Malnutrition has a negative impact on the health status, growth and development

of infant and young children especially in the first two years of life. Malnutrition may result in long-lasting and irreversible consequences such as impairment of growth and development and poor resistance to infections. Appropriate infant and child feeding practices from birth have an important role to determine nutritional status, growth and development, imprinting physiological and metabolic mechanisms that lower the risk for infectious diseases among infants and young children.

WHO/UNICEF together developed the Global Strategy on Infant and Young Child feeding, and guidelines principle for complementary feeding practices. The primary aim of these guidelines is to improve nutritional status, growth and development of infants and young children through the promotion of optimal feeding. WHO/UNICEF recommended that child should be initiated to the breast within an hour after birth, exclusively breastfed for the first to six months. Therefore, mothers should continue breastfeeding up to two years or even beyond. The core indicators recommended by the WHO for assessing complementary feeding practices included: introduction of solid semi-solid or soft food at the age of six months, minimum dietary diversity, minimum meal frequency, minimum acceptable diet and consumption of iron-rich or iron-fortified food. Complementary feeding should be timely, adequate and appropriate. Therefore, complementary foods should have variety, consistency, safe to meet child nutritional needs. Breastmilk alone becomes nutritionally insufficient for the child at the age of six months; therefore, complementary foods should start and assist to achieve a well-balanced diet to maintain a child's optimal growth.

Inappropriate infant and young child feeding practices have a lot of direct implications for the health status, growth and development of the child. Infections and illness due to poor feeding practices are associated with poor nutritional status of infants and young children as a result of malabsorption of nutrients and reduction of appetite. The negative outcome of suboptimal feeding practices includes an increased risk of obesity later in life. Furthermore, long term consequences of poor child feeding practices have been established and these include impaired intellectual performance, reproductive performance, work capacity and increase the risk of chronic diseases.

The nutritional status of children can be determined by anthropometric measurements, biochemical, clinical, and dietary methods. Nutritional assessment of children plays a critical role in determining health status, productive life, physical growth and developments. In the long-term, poor nutritional status of children is associated with a negative impact on lost human capital, economic productivity, social goals and school performance. The anthropometric indices that can

be used to assess growth status of children include weight-for-height, height/length-for-age, weight-for-age, and BMI-for-age. The percentiles and Z-scores in an anthropometric measure were used to classify if the child is underweight, wasted, stunted, overweight and obese.

Micronutrients deficiency is referred to “hidden hunger” as the results it often go unnoticed. The micronutrient deficiencies such as vitamin A, iron, zinc, folate, iodine affects people worldwide. Vitamin A and iron deficiency are the most common micronutrient deficiencies that affect children under five years particularly in middle-income countries including South Africa. Despite the implementation of several initiatives such as vitamin A supplementation, growth monitoring and promotion, deworming and food fortification, micronutrients deficiency is still a major public health problem affecting children under five years in South African. Micronutrients deficiency can result in a high mortality rate, inadequate growth, infections, reduce mental capacity and productivity during early childhood.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter describes the research methodology employed in this study. The research methodology was described under the following sub-heading: study design, population and study area, sampling, inclusion and exclusion criteria, subject recruitment, measurements and tools, data collection procedures, validity and reliability, pre-testing, pilot study, statistical analysis, ethical consideration and dissemination of results.

3.2 Study design

A cross-sectional study design was used in this study. A cross-sectional study is defined as "a type of research design in which the investigator measures the outcome and the exposures in the study participants at the one point" (Polit & Beck, 2012: 277). In this research data was collected at one point. The researcher described nutritional status and feeding practices of children aged 0 to 36 months in Thulamela Municipality. The quantitative research approach was used. Quantitative research is defined as "research yielding information that is inherently numerical in nature or can be easily reduced to numbers" (Leedy & Ormrod, 2010:25). The study is quantitative research approach because the information was collected by quantifiable measures such as weight and length/height and biochemical variables.

3.3 Population and study area

The target population was all mothers with children aged 0 to 36 months in Thulamela Municipality. The mothers in this study were the primary source of information while the age category (0 to 36 months) of children was identified because of WHO guidelines for infant and young child feeding practices (WHO, 2008; WHO, 2010a).

The study was conducted in Thulamela Municipality, which is one of the four local municipalities found in the Vhembe District Municipality of the Limpopo Province. In 2016, Thulamela had an estimation of 497 237 population, with 163884 being children from the age of zero to four years (Statistics SA, 2016). According to the Department of Health Information System (2018) Thulamela Municipality has approximately 2234 of children who are attending well-baby clinic services. Health care services in Thulamela Municipality are delivered by three hospitals, one specialised psychiatric hospital, 43 clinics and 6 mobile clinics (Figure 3.1 and Table 3.1).

Thulamela Municipality comprises of six local areas which are: Ha-Madala, Tshaulu, Sibasa, Mutale, Shayandima and William Eadie local areas (Table 3.1). The languages that are commonly spoken in Thulamela Municipality are Tshivenda and Xitsonga.

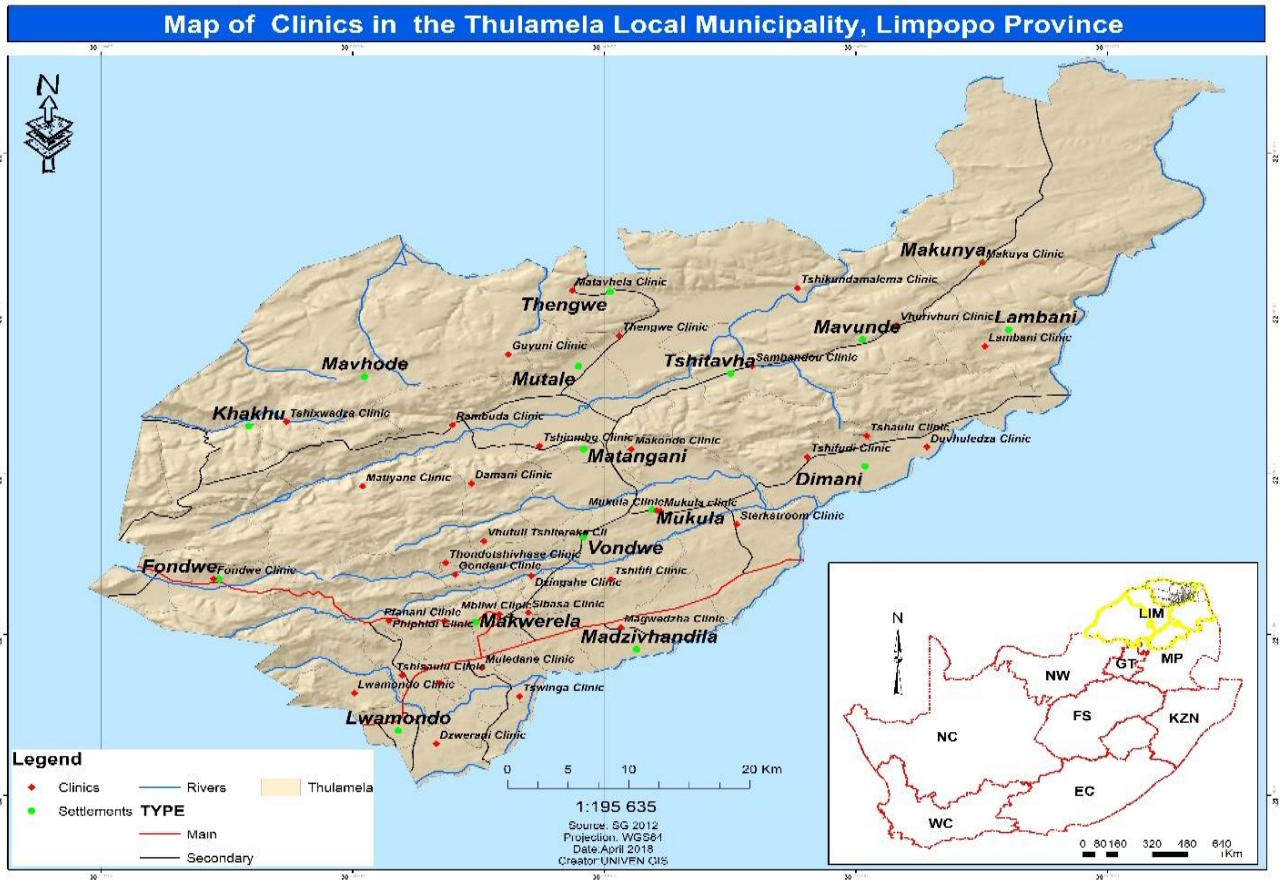

Figure 3.1: Map showing clinics in Thulamela Municipality (Univen GIS, SG 2012).

Table 3.1: Local areas and number of clinics.

Khakhu LA	Mutale LA	Tshaulu LA	Sibasa LA	William Eadie LA	Shayandima LA
Clinics	**Clinics**	**Clinics**	**Clinics**	**Clinics**	**Clinics**
Khakhu	Mutale CHC	Tshaulu	Sibasa	Thondo	Shayandima
Fondwe	Thengwe	Tshifudi	Magwedzha	Makonde	Tshilidzini
Murangoni	Tshikundamalema	Duvhuledza	Tshififi	Damani	Muledane
Madala	Rambuda	Vhuri-vhuri	Dzhingahe	Mukula	Dzwerani
Tshixwadza	Guyuni	Sambandou	Pfanani	Gondeni	Lwamondo
Phiphidi	Tshiombo	Makuya	Mbilwi	Tshivhase	Tshisaulu
	Matavhela	Lambani	Thohoyandou CHC	William Eadie CHC	Tswinga
				Vhufulwi	
				Sterksroom	

**CHC=Community Health Centre, LA=Local Area.*

3.4 Sampling

Probability sampling was used to select local areas and clinics. Local areas in Thulamela municipality were regarded as a cluster (Table 3.1). According to Kruger. (2003: 200) cluster sampling is used when a sampling frame such as a list of names is not available, but only a map of the relevant geographical area. Simple random sampling was used to select three clinics per cluster to make a total of 18 clinics. Simple random sampling is defined as "situation each individual case in the population theoretically has an equal chance of being selected for the sample" (Kruger, 2003: 200). The clinics were assigned a number which was written on a small piece of paper, folded and placed into a container. To prevent bias, a neutral person was requested to pick one paper from a container until the desired number of clinics was reached in the presence of researcher and supervisors. Convenience sampling technique was used to select mothers with children aged 0 to 36 months during well-baby clinic visit. Convenience sampling is a non-probability sampling technique where respondents are usually those who are nearest and most easily available (Leedy & Ormrod, 2010: 212). The researcher interviewed mothers who were available on the day of data collection.

The researcher applied Slovin's formula to calculate number of clinics and the total sample size to be surveyed in the current study (Ryan, 2013). $n = N/ (1 + (N \times e^2))$ where n represents sample size, N = total number of clinics in Thulamela Municipality and e = accepted level of error.

n=N/ (1+ (N X e2))

n=43/ (1+ (43 x 0.0025)

n=43/1,1075

n=39 clinics

The formula yielded a total of 39 clinics. Data was collected from 18 clinics in Thulamela Municipality. The sample size was reduced to due to financial constraints. To determine the number of clinics used per cluster, the number of clinics was divided by the number of clusters (18 clinics/6 clusters = 3 clinics per cluster).

Slovin's formula was again used to calculate the number of participants to participate in the current study. $n = N/ (1 + (N X e^2))$ where n represents sample size, N is the total number of children who are attending well-baby clinic services in Thulamela Municipality and e is the accepted level of error.

n=N/ (1+ (N X e2))
n=2234/ (1+ (2234 x 0.0025)
n=2234/6.585
n=339 ≈ 340

The formula yielded a total number of 340 participants. Data was collected from 250 participants in 18 clinics of Thulamela Municipality. The sample size was reduced to due to financial constraints. To determine the number of participants surveyed per clinic, the number of participants was divided by the number of clinics (250 participants/18 clinics = 14 participants per clinic). During data collection some of the clinics had less 14 participants while other clinics had more than 14 participants. The blood samples were collected from 138 children, because some of the mothers refused to give consent for drawing blood. The table 3.2 below shows number of participants per clinic.

Table 3.2: Number of participants per clinic.

Local areas (Cluster)	Clinics sampled	Number of participants	Blood collection
Khakhu	Khakhu	9	4
	Fondwe	8	3
	Murangoni	8	4
Mutale	Mutale CHC	12	8
	Thengwe	22	10
	Guyuni	12	12
Tshaulu	Tshaulu	18	10
	Tshifudi	21	11
	Makuya	11	6
Sibasa	Tshififi	14	7
	Pfanani	21	12
	Mbilwi	14	7
William Eadie	William Eadie CHC	12	7
	Mukula	12	6
	Makonde	8	7
Shayandima	Shayandima	14	7
	Tshisaulu	14	7
	Lwamondo	20	10
Total	**18**	**250**	**138**

CHC=Community Health Centre,

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

All mothers with children aged 0 to 36 months who agreed to participate and signed the consent form were included in the study (Appendix 1 and 1A). In a case where the mother was younger than 18 years, if father or grandparents were available on the day for data collection were requested to sign the informed consent form.

3.5.2 Exclusion criteria

Mothers whose children were severely ill were excluded from the study. When the child is sick, it is difficult for mothers to be subjected to questioning as it may be painful for them. Mothers with children aged 0 to 36 months who did not live in study area were excluded from the study.

3.6 Subject recruitment

Visit 1: The researcher visited the selected clinics after obtaining ethics clearance certificate, approval letter from provincial Department of Health and Vhembe district to conduct the study. The researcher held the meeting with the PHC managers to explain, the aim, objectives and data collection procedures.

Visit 2: The researcher together with PHC managers had meeting with mothers to explain data collection procedure, the aim and objectives of the study during well-baby clinic visit. The information sheet and consent forms were distributed to the mothers to sign before data collection. The researcher read translated information sheet and consent form to those who could not read and more explanation and clarity were given before participation. Data collection commenced at this stage.

3.7 Measurements and tool (techniques)

3.7.1 Instrument development

The structured questionnaire was used to collect data. The questionnaire was developed based on the aim, objectives and literature of the study. The socio-demographic questionnaire was adapted from the questionnaire of a study titled “Infant feeding practices and anthropometric status of children aged 3 to 24 months at Mukula village, Vhembe District, Limpopo Province of South Africa” (Mugware, 2014). The questionnaire consisted of the following sections: Socio-demographic characteristics (Section A), breastfeeding practices (Section B), complementary feeding practices (Section C) and nutritional status (Section D) (Appendix 3). Breastfeeding and complementary feeding practices questionnaire was developed based on WHO’s Indicators for assessing infant and young child feeding practices (IYCF) (WHO, 2008, WHO, 2010a) and the guiding principles for complementary feeding (WHO & PAHO, 2003). The questionnaire was developed in English and translated into local language, (Tshivenda) by an expert, from the MER Mathivha Language at the University of Venda and back to English to ensure accuracy of the translation (Appendix 3A). The questionnaire was given to the supervisors to check for content and appropriateness. The questionnaire was pre-tested to check for anything that could impede the instrument's ability to collect data in economical and systematic fashion.

(i) Section A: Socio-demographic characteristics

Socio-demography provides information about the background of the study population. In this study, socio-demographic characteristics included variables such as child’s gender, age, marital status, educational level, employment status, source of cooking fuel, source of drinking water and ownership of livestock.

(ii) Section B: Breastfeeding practices.

Breastfeeding practices key variables included breastfeeding initiation, exclusive breastfeeding, breastfeeding cessation, breastfeeding replacement, source of breastfeeding information, frequency of breastfeeding as well as the duration of breastfeeding.

(iii) Section C: Complementary feeding practices.

Complementary feeding practices key variables included introduction of solid, semi-solid and soft food, age of introducing solid, semi-solid and soft food, source of complementary feeding information, types of food given to the child, minimum dietary diversity, and minimum meal frequency.

(IV) Section D: Nutritional status

Nutritional status refers to the anthropometric and biochemical status of the children. Anthropometric measurements of children key variables included weight, height/length and MUAC. Micronutrients status of children key variables included vitamin A and iron.

3.7.2 Techniques

This section focus on techniques used to conduct the interview, taking anthropometric and biochemical measurements.

3.7.2.1 Interview

The researcher interviewed mothers using structured questionnaire. Mothers were interviewed by the researcher face to face using the local language (Tshivenda) in a private room at the clinic. The interview method was chosen to increase accuracy as some mothers were unable to read and write. According to Statistics South Africa (2014), 17% of mothers in Thulamela Municipality are illiterate.

3.7.2.2 Dietary assessment

The Minimum Dietary Diversity (MDD) of children was assessed using 24-hour recall method. Mothers were asked to recall all the foods that the child consumed during the previous 24 hours. The researcher used food cards to assist mothers to remember the food items they fed their children in the previous 24 hours. The Minimum Dietary Diversity (MDD) indicator was based on the following seven food groups: (a) grains, roots and tubers; (b) legumes and nuts; (c) dairy products (milk, yoghurt and cheese); (d) flesh foods (meat, fish, poultry and liver/organ meats);

(e) eggs; (f) vitamin A-rich fruits and vegetables; and (g) other fruits and vegetables (FAO & FHI 360, 2016). The minimum dietary diversity (MDD) score was interpreted using the WHO recommended cut-off point with a value of "1" indicates if the child had consumed four or more groups of foods and "0" if less.

3.7.2.3 Anthropometric measurements for children.

Anthropometric measurements of children were taken by the researcher following the standard procedures described by Lee and Nieman (2010: 161-165). In this study, anthropometric measurements included weight, height/length and MUAC. Anthropometric measurements were taken twice. However, in the case of large variances the measurements were repeated until an acceptance variance was obtained. This was done to reduce error and to increase accuracy. The anthropometric measurements were recorded on a record sheet (Appendix 4, section D).

(a) Length of children.

The length was measured using Seca 417 length board for children less than 24 months who could not stand correctly without assistance. The child was placed on the measuring board lying on his/her back with the crown of the head touching the fixed headboard and the shoulders touching the base of the board. The researcher was assisted by the mother to ensured that the child's heels touched the board and the legs were straight (knees not bent), before the sliding the footboard against the soles of the child's feet. The measurement was taken on the inside of the footboard to the nearest 0.1 cm. The two measurements were taken and recorded in the record sheet. If the two measurements differed by more than 0.1 cm, a third measurement was taken, the two measurements that were nearest to each other were selected for further analysis (Lee & Nieman, 2010: 161-165).

(b) Height

Height was measured using a Seca 213 stadiometer for children who could stand correctly without assistance. The stadiometer was placed on an even and uncarpeted area. The children were standing without shoes, with heels together, arms to the sides, legs straight, shoulders relaxed and head in the frankfort horizontal plane (looking straight ahead). The researcher ensured that each child's heels, buttocks, scapulae (shoulder blades) and back of the head was against the vertical surface of the stadiometer. Before the measurement was taken, children were requested to maintain an erect posture while the headboard was lowered to the highest point of the head with enough pressure to compress the hair. The two measurements were taken and recorded in

the record sheet. If the two measurements differ by more than 0.1 cm, a third measurement was taken, the two measurements that were nearest to each other were selected for further analysis (Lee & Nieman, 2010: 161-165).

(c) Weight

Weight of children less than 24 months of age was measured using a Seca 354 pan infant scale while weight of children from 24 months to 36 months was measured using a Seca 876 weighing scale. The scales were placed on a flat, hard surface that allowed children to be measured securely without rocking or tipping. The scales were calibrated using the known weight (3kg) and set on zero before each measurement. The accuracy of the weight scale was checked periodically and after the scale has been moved against known weight. All children were weighed with light clothes without shoes. For children less than 24 months, the researcher with the assistance of the mother ensured that child was placed on his/her back or sitting on the tray scale and sitting securely without rocking or tipping. Children from 24 to 36 months were requested to stand still in the middle of the scale's platform without touching anything and with the weight equally distributed on both feet. The two measurements were taken and recorded in record sheet to the nearest 0.01 Kg. The two reading could not vary by more than 10g, if they did, the scale had to be checked for accuracy. The procedures were repeated until the two reading agreed within 10g (Lee & Nieman, 2010: 161-165).

(i) Interpretation of child anthropometric measurements.

Anthropometrics indicators expressed as weight-for-age (WAZ), height/length-for-age (H/LAZ), weight-for-height/length (WH/LZ) and Body Mass Indices for age (BMI/A). Anthropometric status was interpreted using WHO child growth standards. According to the WHO (2009a), Z-score classification cut-off point below -2SD for WAZ, WH/LZ, H/LAZ referred as underweight, wasting and stunting respectively. In addition, the cut-off points below -3SD is referred severe underweight, severe wasting and severe stunting respectively. Furthermore, the cut-off points between +2SD to <+3SD for WH/LZ is referred as overweight while cut-off point above >+3SD is referred as obese. The Z-score classification and interpretations are presented in table 3.3.

Table 3.3: Z-score classification to determine the nutritional status of the children (WHO, 2009a).

Z-score classification	WAZ	WH/LZ	H/LAZ	BMI/A
<-3SD	Severely underweight	Severely wasted	Severely stunted	Severely wasted
-3SDto<-2SD	Underweight	Wasted	Stunted	Wasted
-2SDto<-1SD	Mild underweight	Mild wasted	Mild stunted	Normal
-1SDto+1SD	Normal WAZ	Normal WH/LZ	Normal height/length	Normal BMI/A
>+1SDto<+2SD	Possible growth problem	Possible risk of overweight	Normal height/length	Possible risk of overweight
+2SDto<+3SD	Possible growth problem	Overweight	Normal height/length	Overweight
>+3SD	Possible growth problem	Obese	Above normal	Obese

(d) Mid-upper Circumference (MUAC).

Mid-upper arm circumference was measured using a non-stretchable measuring tape on the right arm. The midpoint of the middle-upper arm was identified and marked. Child lie down by the side with the palm facing upwards. The researcher was assisted by the mother to place a folded towel under the child's elbow to raise it slightly off the surface. Flexible, non-stretchable measuring tape was used and positioned perpendicular to the long axis of the arm and tightened, avoiding the tape from cutting into the child's skin. All measurements were conducted by the researcher, recorded to the nearest 0.1 cm and repeated three times, using the average value, in order to assure reliability and decrease measurement error (Lee & Nieman, 2010: 161-165).

(i) Interpretation MUAC

Mid-Upper Arm Circumference measurement was interpreted using National Department of Health Road to Health Booklet classification. The cut-off point of MUAC less than 11 cm was classified as Severe Acute Malnutrition (SAM); MUAC between 11 cm and 12.5cm was classified as Moderate Acute Malnutrition (MAM) (DoH, 2007). The cut-off-points of MUAC are indicated in table 3.4.

Table 3.4: Mid Upper Arm Circumference (DoH, 2007).

Classification	Interpretation
MUAC less than 11 cm	Severe acute malnutrition
MUAC between 11.0cm and 12.5 cm	Moderate acute malnutrition
MUAC between 12.5cm and 13.5cm	At risk of acute malnutrition
MUAC over 13 .5 cm	Well-nourished

3.7.2.4 Biochemical measurements.

A Professional Paediatric Nurse collected 138 blood samples from 18 PHC facilities in Thulamela Municipality. The blood samples were analysed using standard procedures in the Ampath Pathology Laboratory (Drs Du Buisson, Kramer Inc./Ing). Ampath Pathology Laboratory is SANAS (South African National Accreditation System) accredited. The blood samples were used to assess vitamin A and iron status of children. The results were recorded on a record sheet (Appendix 4, section D).

(a) Procedure for blood sample collection

A blood sample was drawn from children following the standard procedures stipulated in the WHO guidelines for drawing blood (WHO, 2010d). The Professional Paediatric Nurse was assisted by the mother to immobilise the child. Therefore, Professional Paediatric Nurse had put the tourniquet on the child about two finger widths above the venepuncture site. Professional Paediatric Nurse wore well-fitting non-sterile gloves. The collection site was disinfected with alcohol and allowed to air dry. Professional Paediatric Nurse used a thumb to draw the skin tight, about two finger widths below the venepunture site, vacuum tube was pushed completely onto the needle. Blood began to flow into the tube, fill the tube until it was full or until the vacuum was exhausted. Tourniquet was released after 5ml of the blood was collected. Dry gauze was placed over the venepunture site and slowly withdrawing the needle. Mothers were asked to continue applying mild pressure so that butterfly was removed from the vacuum tube holder.

All test tubes were labelled with the name of the child and date of collection. All blood samples were wrapped immediately after collection with aluminium foil to protect against sunlight exposure and was placed in a plastic bag with the name and code of the child. Room light or sunlight can metabolize the samples to a different compound (NFCS-FB, 2005). Blood samples were transported in cooler boxes containing ice packs from the study site to Ampath laboratory at Thohoyandou within 24 hours from the time blood samples were collected. Table 3.5 below presents the blood analysis method used.

Table 3.5: Blood analysis methods

Biochemical indicators	Blood analysis method
Vitamin A µg/dl	HPLC Method
Haemoglobin (g/dl)	HemoCue
Iron (µg/dL)	AU5800 (Beckman)
Transferrin (mg/l)	AU5800 (Beckman)
Ferritin (µg/l)	DXI800 (Beckman)

(i) Interpretation of vitamin A.

Serum retinol concentration indicator was used to assess vitamin A status of children. The cut-off value of serum retinol concentration <10 µg/dl were classified as vitamin A deficiency, 10 – 19.9 µg/dl were classified as marginal vitamin A status, 20 – 29.9 µg/dl were classified as adequate status while > 30 µg/dl was classified as normal/ well-nourish status (Table 3.6).

Table 3.6: Interpretations of vitamin A status of children (NFCS-FB, 2005).

Serum retinol concentration	Cut-off values
Vitamin A deficiency	<10 µg/dl
Marginal vitamin A status	10 – 19.9 µg/dl
Adequate status	20 – 29.9 µg/dl
Normal/ well-nourished status	> 30 µg/dl

(ii) Interpretation of Iron

Haemoglobin concentration was used to assess the prevalence of anaemia among children. The cut-off value of haemoglobin <11.0 g/dl was classified as anaemia, 10.0–10.9 g/dl was classified as mild anaemia, 7.0–9.9 g/dl was classified as moderate anaemia while <7.0 g/dl was classified as severe anaemia (Table 3.7).

Table 3.7: Interpretation of haemoglobin concentration (WHO, 2011b).

Haemoglobin concentrations	Cut-off values
Any anaemia	<11.0 g/dl
Mild anaemia	10.0–10.9 g/dl
Moderate anaemia	7.0–9.9 g/dl
Severe anaemia	<7.0 g/dl

Iron status of children were assessed using the four iron indicators: concentration serum iron, serum ferritin, serum transferrin and transferrin saturation. The cut-off value of serum iron < 40 µg/dL was classified as iron depletion, < 60 µg/dL was classified as mild depletion while ≥115 µg/dL was classified as normal (Gibson, 2005: 471). The cut-off value of serum ferritin <12 µg/l was classified as iron deficiency while ≥12 µg/l was classified as normal iron store (WHO, 2011c). The cut-off value of serum transferrin < 1.0 g/L was classified as Severe depletion, 1.5 – 2.0 g/L was classified as depletion while > 2.0 g/L was classified as normal serum transferrin (Gibson, 2005: 415). The cut-off value of saturation transferrin < 15% was classified as low saturation transferrin, 10 – 20 % was classified as normal saturation transferrin while > 20% was classified as high saturation transferrin (Gibson, 2005: 471) (Table 3.8).

Table 3.8: Interpretation of iron status of children.

Iron indicators	Cut-off values
Serum iron (Gibson, 2005: 471)	
Depletion	< 40 µg/dL
Mild depletion	< 60 µg/dL
Normal	≥115 µg/dL
Serum ferritin (WHO, 2011c)	
Iron deficiency	<12 *µ*g/l
Normal iron stores	≥12 *µ*g/l
Serum transferrin (Gibson, 2005: 415)	
Severe depletion	< 1.0 g/L
Mild depletion	1.5 – 2.0 g/L
Normal	> 2.0 g/L
Saturation transferrin (Gibson, 2005: 471)	
Low	< 15%
Normal	10 - 20%
High	> 20%

3.8 Data collection procedures

A separated room was requested to be used to ensure privacy. Three stations were arranged for data collection. In the first station, mothers were interviewed on the socio-demographic characteristics, breastfeeding practices and complementary feeding practices. In the second station anthropometric measurements weight, height, and MUAC were measured following the standard procedures described above. In the third station, a Professional Paediatric Nurse was drawing blood from children following the procedures that was described above. The blood samples were collected to assess vitamin A and iron status.

3.9 Fieldworkers

Professional Paediatric Nurse was recruited as a fieldworker. Professional Paediatric Nurse was responsible for drawing blood as it is a requirement by the South African Nursing Council. A researcher was responsible for interviewing mothers and taking anthropometric measurements. The appointment of Professional Paediatrics Nurse was based on her expertise, which was required for the study and for good general practice. Table 3.9 illustrates the responsibilities of the professional paediatric nurse and researcher.

Table 3.9: Personnel responsibilities during data collection

Person responsible	Responsibilities
Supervisors	Quality control
Researcher	Making appointments with clinics managers Arranged all resources needed for data collection. Interviewed mothers and taking anthropometric measurements. Feedback meetings with supervisors Transport blood samples to the laboratory for analysis Data capturing and analysis
Professional Paediatric Nurse	Draw blood

3.10 Validity and Reliability

3.10.1 Validity

According to Leedy and Ormrod (2010: 99) "validity of measurement instrument is the extent to which the instrument measures what it is intended to measure". The questionnaire was developed based on objectives and relevant literature. Content validity of the questionnaire was reviewed through a panel of nutrition professionals with extensive knowledge, understanding and experience in the field of IYCF. Presentation of the instrument to the Department of Nutrition and School Higher Degree Committee offered another avenue for the scrutiny of the research instrument. Mothers were interviewed using the local language (Tshivenda) to ensure that accurate information is obtained. All the questionnaires were checked at the end of each day, the purpose was to ensure accuracy, quality and completeness.

3.10.2 Reliability

Leedy and Ormrod (2010: 28) define reliability as "consistency with which a measuring instrument yields a certain, consistent result when the entity being measured hasn't changed". The questionnaire was pre-tested before data collection to determine whether the questions were clearly understood by the participants. Test-retest reliability of the questionnaire was done during pre-testing to test consistency in producing same results. Pre-testing of the instrument was done on two occasions to the same participants. The calibration of the weighing scales was done before measurements were taken. Anthropometric measurements were taken twice in one participant to ensure the accuracy of the results as it is recommended by Lee and Nieman (2010: 161). To check for reliability 10% of the questionnaire were randomly selected and mothers were

interviewed again after week of the initial round of data collection. This quality control interview was conducted on different days from the initial interview and by a different interviewer. The quality control data were analysed in the same way as the original data for comparison.

3.11 Pre-test

A pre-test of the questionnaire was conducted before the pilot study. The purpose of pre-testing the questionnaire was to check the understanding, sequence and clarity of the questions. The questionnaire was given to supervisors and other nutritional professionals to check the content and appropriateness. Furthermore, the questionnaire was also presented to the Department of Nutrition and School Higher Degree Committee (SHDC) to check the content and appropriateness. Thereafter, few questions were rephrased to the questionnaire by the researcher and supervisors e.g. question 28 was rephrased “When are you going to stop breastfeeding” to “How long do you intend continuing breastfeeding your child”.

3.12 Piloting

A pilot study is a smaller version of a proposed study conducted a develop and refine the steps in the research process. A pilot study was conducted in Malavuwe clinic, which did not form part of the study sample. A total number of 25 (10%) mother with children aged 0 to 36 months were conveniently selected. The purpose of the pilot study was to identify possible problem throughout the entire research process and to assess whether the study is feasible, realistic and rational from start to finish. The pilot study involved all the different aspects of data collection except biochemical measurements due to financial constraints. The findings of the pilot study were used to rephrase question to the questionnaire and no amendments were made to data collection process e.g. question 47 was rephrased “Do you have knowledge regarding complementary feeding practices” to “were you taught about complementary feeding practices”

3.13 Statistical analysis

The data obtained were cleaned, coded and entered in Microsoft (MS) Excel spreadsheet, then exported to IBM Statistical Package for Social Science version 26 for analysis (SPSS Inc., Chicago, Illinois). Anthropometric measurements were calculated using WHO Anthro version 3.2.2 (WHO, 2011a) and the results were interpreted according to WHO cut-off points (WHO, 2009a). The printed frequencies were used to examined accuracy, consistency and missing values of variables.

Descriptive statistics was performed for all variables in the study, including socio-demographic characteristics, breastfeeding practices, complementary feeding practices and nutritional status. The categorical variables were presented as frequencies (n) with percentage (%) of the total study sample. Continuous variables were presented as mean ± standard deviation (SD) for normally distributed data.

Chi-Square test for the categorical variables was performed. The chi-square test used to discover the relationship between two categorical variables. The null hypothesis was that there is no association between nutritional status and feeding practices. The alternative was that there is an association between nutritional status and feeding practices. To test the two hypothesis, the observations were cross-classified according to the categories of the two variables; forming a contingency table with r-rows and c-columns. Here r and c were the respective numbers of categories for each of the two variables. The test statistic used to make a choice between the two hypotheses was a scaled sum of the squared deviations between the observed and expected (assuming there is no association) frequencies in each of the cells of the contingency table;

$$\mathrm{X}^2 = \frac{\sum (O-E)^2}{E}$$

The summation is over all the cells of the contingency table.

If there was an association between the two variables, the deviations between the observed and expected frequencies was large. Therefore, the null hypothesis was rejected when the values of the test statistic exceed a certain value which is obtained from chi-square tables. Alternatively, statistical analysis gave the p-value values corresponding to the test statistic. The null hypothesis was rejected if the p-value was less than the level of significance (usually 5%).

Logistic regression analysis was performed to explore associations between nutritional status and feeding practices. The Crude Odds Ratio (COR) and Adjusted Odds Ratios (AOR) together with their corresponding 95% confidence intervals was computed and interpreted accordingly. A P-value<0.05 was considered to declare a result as statistically significant in this study. The advantage of logistic regression over chi-square tests was that in logistic regression the effect of one variable on the response is evaluated after adjusting for the effects of other variables in the model.

Logistic regression is applicable when the outcome variable has two possible outcomes. In this study, all the nutritional status variables were dichotomized e.g. the serum ferritin variable was dichotomized as normal/high (1) and low (0). The logistic regression model that predicts the log odds (success versus failure) of the dependent variable expressed as:

$$\log\left(\frac{p}{1-p}\right) = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 \ldots\ldots\ldots + b_kx_k \ldots. \quad (1)$$

Here $x_1, x_2, \ldots, x_k$ are all the independent (feeding practices) variables and $b_0, b_1, \ldots, b_k$ are the parameters of the model and p is the predicted probability of success.

A forward selection method was used to choose feeding practice variables to be included into the model. The method starts with a model without any explanatory variables and sequentially adds the explanatory variables to the model, one at a time. At each step, the explanatory variable with the highest influence on the response is added to the model, provided it has a significant impact. Addition of variables continues until no variable with significant impact can be found from among those not already in the model.

3.14 Institutional approval

The research proposal was presented to the Department of Nutrition and School Higher Degree Committee (SHDC) for recommendation to the University Higher Degree and Ethics Committee. Ethical approval to conduct the study was sought and received from University Higher Degree and Ethical Committee of the University of Venda in March 2019 (PROJECT NO: SHS/19/NUT/01/1503) (Appendix 5). After institutional ethical clearance was obtained, permission to conduct the study was received from the provincial Department of Health (Appendix 6) and Vhembe District Department of Health (Appendix 8). All the approval letters were submitted to the clinic managers to inform them about the study before the start of data collection.

3.15 Ethical considerations

No participants were enrolled in the study until the ethical clearance certificate was obtained from the University of Venda Ethics Committee. The study was conducted according to the principle of research ethics in health sciences guided by the Declaration of Helsinki (2013), good clinical practice and laws of South Africa.

- **Informed consent**

The participants signed informed consent form after adequate oral and written explanation of the study, including possible risks, was provided by the researcher (Appendix1 and 1A). Participants were each provided with information sheet containing the key information of the study (Appendix 2 and 2A). The consent form and information sheet were issued in the local language (Tshivenda). The researcher read the consent form and information sheet to the participants who were unable read to enhance understanding and comprehension. Participants were informed that they were free to withdraw from the study at any stage without any repercussions. Participation in this study was voluntary.

- **Privacy and confidentiality**

The participants were assured that the privacy of their personal information would be maintained and used only for the study. A private or consultation room in the clinic was used during data collection to ensure the privacy and confidentiality of the participants. After data capturing, all the questionnaires were stored in a safe place for a period of the next five years. For data verification and quality control purposes regulatory authorities or members of the Higher Degree and Ethics Committee of the University of Venda might be allowed access to participants data under conditions of strict confidentiality.

- **Anonymity**

The anonymity of participants was ensured by using codes instead of names during data collection. All the participants and clinics were given codes during data collection.

- **Harm and risk**

The researcher offered a guarantee that no participants were put in a harm or risk situation during their participation in the study. To minimise the risk or harm during the drawing of blood, Professional Paediatric Nurse was responsible for drawing blood from the children. Only two attempts to draw blood were made from children. Failure to do so, there was no further attempt to draw blood.

3.16 Conclusion

This chapter outlined the methods used in this study. A cross-sectional study design was used in this study. The target population was all mothers with children aged 0 to 36 months in the Vhembe district and the accessible population was mothers with children aged 0 to 36 months in the Thulamela Municipality. Simple random sampling was used to select three clinics per cluster to make a total of 18 clinics. A total number of 250 mothers and their children were selected using a convenience sampling technique. A structured questionnaire was used to collect data on socio-demographic characteristics, breastfeeding and complementary feeding practices. The Minimum Dietary Diversity (MDD) of children was assessed using 24-hour recall method. Anthropometric measurements including weight, height and MUAC were assessed following the standard procedures described by Lee and Nieman (2010: 161-165). Professional Paediatrics Nurse collected blood sample from children following procedures stipulated on WHO. The blood samples were used to assess vitamin A and iron status of children.

The data obtained were cleaned, coded and entered in Microsoft (MS) Excel spreadsheet, then exported to IBM SPSS version 26 for analysis (SPSS Inc., Chicago, Illinois). Anthropometric measurements were calculated using WHO Anthro version 3.2.2 (WHO, 2011a). Descriptive statistics was performed for all variables in the study, including socio-demographic characteristics, breastfeeding practices, complementary feeding practices and nutritional status. Chi-Square test for the categorical variables was performed. The chi-square test used to discover the relationship between two categorical variables. Logistic regression analysis was performed to explore associations between nutritional status and feeding practices. P value< 0.05 was considered to declare a result as statistically significant in this study.

Ethical approval to conduct the study was sought and received from University Higher Degree and Ethical Committee of the University of Venda in March 2019 (PROJECT NO: SHS/19/NUT/01/1503). Permission to conduct the study was received from the provincial Department of Health and Vhembe District Department of Health. No participants were enrolled in the study until the ethical clearance certificate was obtained from the University of Venda Ethics Committee.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results of the study. The results of this study are presented as follows: Socio-demographic characteristics of mothers and children, breastfeeding practices, complementary feeding practices and nutritional status.

4.2 Socio-demographic characteristics of the study participants

The socio-demographic characteristics of the study participants are summarised in Table 4.1. The study was carried out on 250 children under three years of age and their mothers. Just above half of the children (52.4%) were males and 47.6% were females. About 40.4% of children were aged 0 to 6 months, 28.8% were aged 7 to 12 months, 22% were aged 13 to 24 months while 8.8% were aged 25 to 36 months. The mean (± SD) age of children in months was 10.53 (±8.39 SD).

Almost half of the mothers (49.2%) were aged 20 to 29 years, 35.2% were aged 30 to 39 years while 12.4% were aged 19 years or below. However, only 3.2% of the mothers were aged 40 years or above. The mean (± SD) age of mothers in years was 27.79 (±7.13SD). More than half of mothers (54%) were single, 37.6% were married, 3.6% were living with their partners, 2.8% were separated while 2% were divorced. Very few mothers never attended school (0.4%), 3.2% had attained primary education, 79.6% had attained secondary education while 16.8% had attained tertiary education. Three quarters of mothers (75.2%) were unemployed whereas 24.8% were employed. From those who were employed, 35.5% of mothers were self-employed, 24.2 % were domestic worker, 27.4% were working in retails shops, 11.3% were security guard while 1.6% were health workers.

The main source of income for the households were social grants (76.4%), father/husband (3.6%), mother (17.2%) and parents (2.8%). Less than 20% of households had income of R999 or less per months, 51.6% had income of R1000 to R1999, 22.8% had income of R2000 to R4999, 2.8% had income of R5000 to R9999, 3.6% had income of R10 000 and more.

Table 4.1: Socio-demographic characteristics of the study participants.

Characteristics	Frequency (n=250)	Percentage (%)
Age of child (months)		
0 – 6	101	40.4
7 – 12	72	28.8
13 – 24	55	22.0
25 – 36	22	8.8
Mean ± SD	10.53 ± 8.39	
Gender		
Male	131	52.4
Female	119	47.6
Maternal age (years)		
≤19	31	12.4
20 - 29	123	49.2
30 – 39	88	35.2
≥40	8	3.2
Mean ± SD	27.79 ± 7.133	
Marital status		
Single	135	54.0
Married	94	37.6
Divorced	5	2.0
Living with partner	9	3.6
Separated	7	2.8
Education level		
Never attended	1	0.4
Grade 1 – 4	2	0.8
Grade 5 – 7	6	2.4
Grade 8 – 10	48	19.2
Grade 11 – 12	58	23.2
Passed grade 12	93	37.2
Tertiary	42	16.8
Employment status		
Employed	62	24.8
Unemployed	188	75.2
Type of employment		
Self employed	22	35.5
Health worker	1	1.6
Domestic worker	15	24.2
Security guard	7	11.3
Retail shops	17	27.4
Source of income		
Social grants	191	76.4
Father/Husband	9	3.6
Mothers	43	17.2
Grandparents	7	2.8
Household income per month		
≤ R999	48	19.2
R1000 – R1999	129	51.6
R2000 – R4999	57	22.8
R5000 – R9999	7	2.8
≥ R10000	9	3.6

When mothers were asked about the source of cooking fuel, they indicated that they were using firewood (58.8%), electricity (47.6%) and/or paraffin (4.4%) (Table 4.2).

Table 4.2: Source of fuel for cooking.

Variable	Frequency (n=250)	Percentage (%)
Source of fuel		
Firewood	147	58.8
Electricity	119	47.6
Paraffin	11	4.4

Table 4.3 show that source of drinking water was communal tap water (69.2%), own household tap water (12.8%), borehole water (6.4%), water from dam (6.0%) and water from the river (5.6%).

Table 4.3: Main source of drinking water

Variable	Frequency (n=250)	Percentage (%)
Source of water		
Own tap in the household	32	12.8
Communal tap	173	69.2
River	14	5.6
Dam	15	6.0
Borehole	16	6.4

Table 4.4 shows that 52.4% of households were owning livestock while 47.6% were not owning livestock. From those households with livestock, 68.7% were owning chicken, 20.6% were owning cattle, 5.3% were owning goats, 3.1% were owning pigs while 2.3% were owning sheep. Furthermore, some of the households were owning more than one type of livestock.

Table 4.4: Household ownership of livestock.

Variable	Frequency (n=131)	Percentage (%)
Livestock in the household		
Chicken	90	68.7
Cattle	27	20.6
Sheep	3	2.3
Goat	7	5.3
Pigs	4	3.1

Table 4.5 show the number of people and children per household. More than three quarters (76.8%) of households were four to seven members, 13.6% were three and below members while 9.6% were eight and above members. The mean (± SD) number of household members was 5.22 (±1.637SD).

When mothers were asked about the number of children under five year in a household, 48.8% were having one child, 32.8% were having two children while 18.4% were having three children or more. The mean (± SD) number of children under five years in the household was 1.87 (±1.152SD) (Table 4.5).

Table 4.5: Household size.

Variables	Frequency (n=250)	Percentage (%)
Number of people in the household		
Three and below	34	13.6
Four to seven	192	76.8
Eight and above	24	9.6
Mean ± SD	5.22 ± 1.63	
Number of children under five years		
One	122	48.8
Two	82	32.8
Three	18	7.2
Four	17	6.8
Five	7	2.8
Six	4	1.6
Mean ± SD	1.87 ± 1.152	

4.3 Breastfeeding practices

The majority of mothers (96%) initiated breastfeeding within one hour of birth, 3.2% initiated breastfeeding a day after birth, 0.4% initiated breastfeeding a week after birth while 0.4% never initiated breastfeeding. Of all mothers who initiated breastfeeding, 95.2% were assisted by nurses while 4.8% were assisted by the medical doctors (Table 4.6).

Table 4.6: Initiation of breastfeeding.

Variables	Frequency (n=250)	Percentages (%)
Timely initiation of breastfeeding		
Within one hour of birth	240	96.0
A day after birth	8	3.2
Week after birth	2	0.8
Assistance of initiation of BF		
Nurse	237	95.2
Medical Doctor	13	5.6

Mothers were asked if children received any pre-lacteal feeds, 90.8% indicated that children did not receive pre-lacteal feeds while 9.2% indicated that they received pre-lacteal feeds within the first three days of birth. Of those children who received pre-lacteal feeds, 52.2% were given plain water, 26.1% were given glucose water, 17.4% were given gripe water and 4.3% were given tea/infusion (Table 4.7).

Table 4.7: Consumption of pre-lacteal feeds during the first three days after birth.

Variable	Frequency (n=23)	Percentages (%)
Types of pre-lacteal feeds given		
Plain water	12	52.2%
Sugar or glucose water	6	26.1
Gripe water	4	17.4
Tea/ infusion	1	4.3

The majority of mothers (91.6%) had received breastfeeding information while 8.4% did not receive any breastfeeding information. Of those mothers who received breastfeeding information, 91% received information from health care professionals, 6.6% received information from mom-connect, 1.3% received information from mass media while 0.9% received information from parents/parents-in-law (Table 4.8).

Table 4.8: Sources of breastfeeding information.

Variable	Frequency (n=229)	Percentages (%)
Sources of BF Information		
Health care professionals	209	91
Parents/parents in law	2	0.9
Media (Magazine, Radio & TV)	3	1.3
Mom-connect	15	6.6

Table 4.9 show the duration of exclusive breastfeeding. More than two thirds of mothers (68.8%) exclusively breastfed for 2 months or less, 23.6% exclusively breastfed for 3 to 5 months while 7.6% exclusively breastfed up to 6 months.

Table 4.9: Duration of exclusive breastfeeding.

Variable	Frequency (n=250)	Percentages (%)
Duration of EBF		
0 to 2 months	172	68.8
3 to 5 months	59	23.6
6 months	19	7.6

Nearly three quarters of mothers (74%) were still breastfeeding their children at the time of the interview while 26% were no longer breastfeeding (Table 4.10).

Table 4.10: Current breastfeeding status.

Variable	Frequency (n=250)	Percentages (%)
Breastfeeding status		
Still breastfeeding	185	74
Stopped breastfeeding	65	26

Mothers who were still breastfeeding indicated reasons for continuing to breastfeed as follows: breastmilk is the perfect food for the baby (52.4%), breastmilk protects the baby against diseases (40.5%), breastfeeding helps to form bond between mother and baby (5.4%) and breastmilk is free (1.6%) (Table 4.11).

Table 4.11: Reasons for choosing to breastfeed.

Variable	Frequency (n=185)	Percentages (%)
Reasons for choosing BF		
Perfect food for a child	97	52.4
Protect child against diseases	75	40.5
Free	3	1.6
Bonding between mother and child	10	5.4

Of all mothers who were still breastfeeding, 60.5% were breastfeeding on demand, 27% were breastfeeding on their own time while 12.4% were breastfeeding on schedule time (Table 4.12).

Table 4.12: Frequency of breastfeeding per day.

Variables	Frequency (n=185)	Percentages (%)
Breastfeeding frequency		
On-demand	112	60.5
On schedule time	23	12.4
At your own time	50	27.0

The majority of mothers who were still breastfeeding indicated that they offer both breast during each feed, 4.3% indicated that they offer one breast while 3.7% indicated that sometimes they offer both breasts.

Of all mothers who stopped breastfeeding, 32.3% stopped breastfeeding when the child was aged 13 to 19 months, 27.7% stopped when the child was aged 6 to 12 months, 26.2% stopped breastfeeding when a child was aged 2 to 5 months, 10.8% stopped breastfeeding when the child was less than 1 month after birth, while 3.1% stopped breastfeeding when the child was 19 to 24 months (Table 4.13).

Table 4.13: Age of stopping breastfeeding.

Variables	Frequency (n=65)	Percentages (%)
Age of stopping breastfeeding		
Less than 1 month	7	10.8
2 - 5 months	17	26.2
6 - 12 months	18	27.7
13 - 18 months	21	32.3
19 – 24 months	2	3.1

The reasons given by mothers for stopping breastfeeding were going back to school/work (41.5%), medical condition (20%), child refused breast (15.4%), not enough breastmilk (12.3%), another pregnancy (4.6%) while 6.2% indicated that it was the right time to stop breastfeeding (Table 4.14).

Table 4.14: Reasons for stopping breastfeeding.

Variable	Frequency (n=65)	Percentages (%)
Reasons for stopping breastfeeding		
Medical condition	13	20.0
Child refused breast	10	15.4
Going back to school/work	27	41.5
Not enough breastmilk	8	12.3
Another pregnancy	3	4.6
Was the right time to stop breastfeeding	4	6.2

More than half of mothers (52.3%) were influenced to stop breastfeeding by parents or parents' in-laws, 20% were influenced by health professionals, 13.8% were influenced by father/spouse, 9.2% were influenced by relatives while 4.6% were influenced by employer/supervisor (Table 4.15).

Table 4.15: People influenced mothers to stop breastfeeding.

Variable	Frequency (n=65)	Percentages (%)
People influenced mothers to stop BF		
Father/spouse	9	13.8
Parents/parents in-laws	34	52.3
Other relatives	6	9.2
Health professionals	13	20.0
Employer or supervisor	3	4.6

4.3.1 Infant formula milk

About 63.6% of the children received infant formula milk whereas 36.4% did not receive infant formula milk. Of those children who received infant formula milk, almost all infants were introduced to infant formula milk before the age of six months while 5.5% were introduced to infant formula milk at the age of six months and above (Table 4.16).

Table 4.16: Age of introducing infant formula milk.

Variable	Frequency (n=91)	Percentages (%)
Age of introducing infant formula milk		
1 – 4 weeks	41	45.1
5 – 8 weeks	13	14.3
9 – 20 weeks	32	35.2
6 months and above	5	5.5

The main reasons for introducing infant formula milk were mother going back to school or work (64.8%), medical condition (19.8%), insufficient breastmilk (6.6%), baby refused breastmilk (3.3%), advised by family (3.3%) and another pregnancy (2.2%) (Figure 4.1).

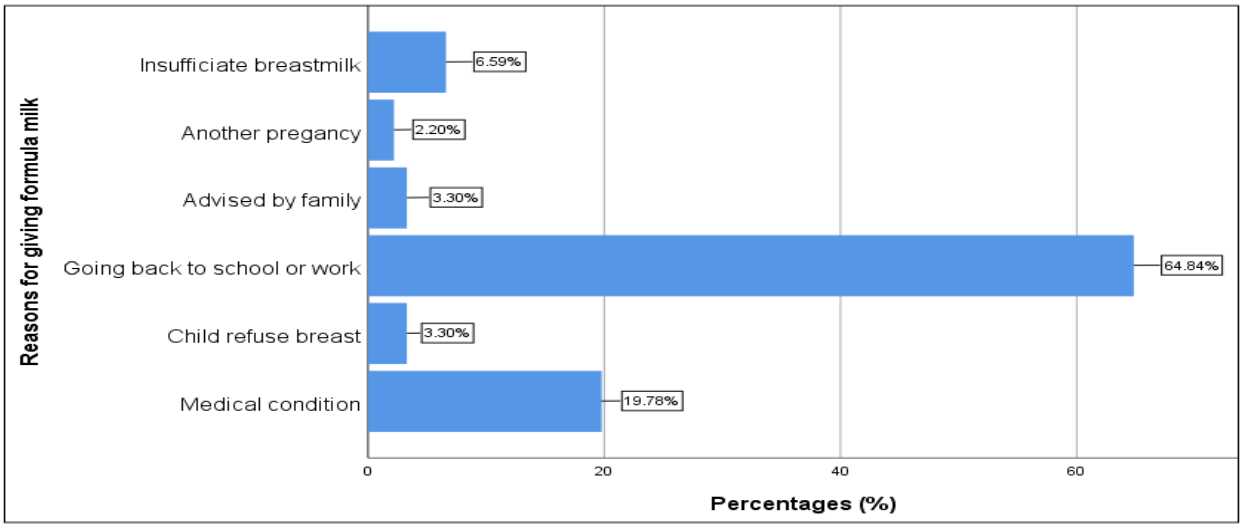

Figure 4.1: Reasons for giving infant formula milk.

Table 4.17 shows the types of infant formula milk given to children. More than half (51.6%) of the children were given Nan, 37.4% were given Lactogen, 9.9% were given Infacare while 1.1% were given Nido.

Table 4.17: Type of infant formula milk given.

Variable	Frequency (n=91)	Percentages (%)
Types of infant formula milk		
Nan	47	51.6
Nido	1	1.1
Lactogen	34	37.4
Infacare	9	9.9

Of all mothers who formula fed their children, 72.5% indicated that health care professionals did not advise them on the type of infant formula milk to use whereas 27.5% indicated that they were advised on the type of infant formula milk to use. Furthermore, 68.1% indicated that they were not taught how to prepare and store infant formula milk while 31.9% indicated that they were taught how to prepare and store infant formula milk. Almost all children (97.8%) were given infant formula milk using bottle with artificial nipple whereas 2.2% were cup fed.

More than three quarter (78%) of mothers were giving the same infant formula milk while 22% of mothers switched infant formula milk. The main problems encountered with the use of infant formula milk were constipation (40%), allergic reaction or intolerance (25%) and diarrhoea (25%) (Table 4.18).

Table 4.18: Reason for changing infant formula milk.

Variable	Frequency (n=20)	Percentages (%)
Problems with infant formula		
An allergic reaction or intolerance	7	35
Constipation	8	40
Diarrhoea	5	25

When mothers were asked the best way to feed three months old child, 81.2% indicated that breastfeeding alone is the best option to feed three months old child while 12.4% indicated that combination of breastfeeding and formula feeding is the best option and 6.4% indicated that formula feeding alone is the best option (Table 4.19).

Table 4.19: The best way to feed three months old child.

Variable	Frequency (n=250)	Percentages (%)
The best way to feed three months old child		
Breastfeeding	203	81.2
Formula feeding	16	6.4
Combination of BF and FF	31	12.4

4.3.2 Water

The majority of children (82.4%) were given water whereas 17.6% were not given water. Of all children who were given water, 20.9% introduced to water at the age of 0 to 2 months, 36.9% introduced at the age of 3 to 4 months, 32% introduced at the age of 5 to 6 months while 10.2% were introduced to water at the age of above 6 months (Table 4.20).

Table 4.20: Age of introducing water.

Variables	Frequency (n=206)	Percentages (%)
Age of introducing water		
0 – 2 months	43	20.9
3 – 4 months	76	36.9
5 - 6 months	66	32.0
Above 6 months	21	10.2

Figure 4.2 show the main reason for giving water to the child was to quench thirst (69.9%), advises from parents or relatives (18.0%), and cooling children temperature (12.1%).

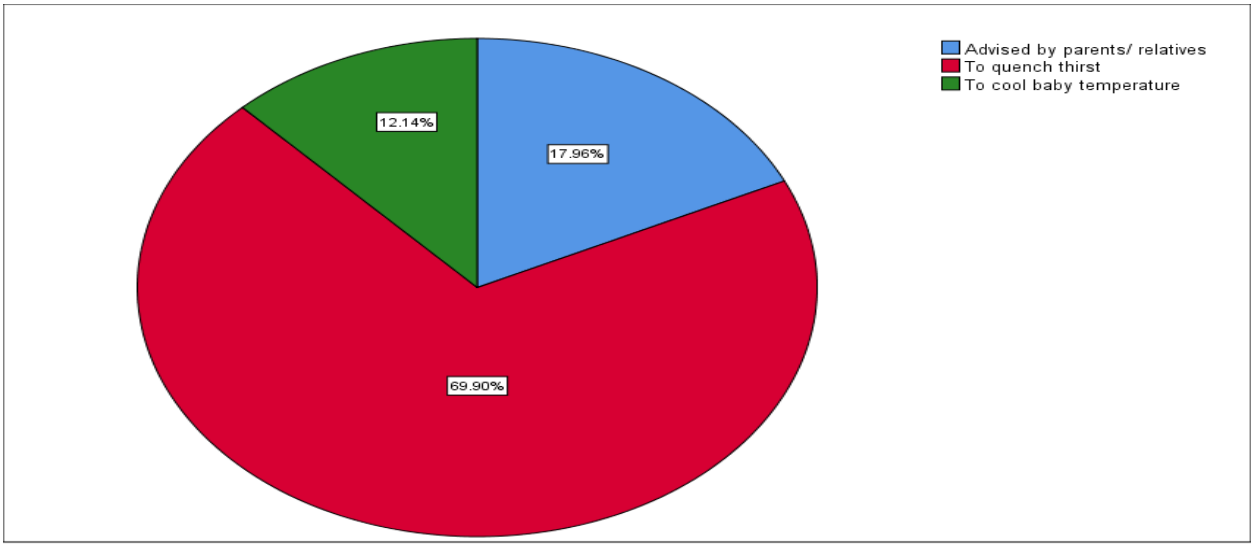

Figure 4.2: Reasons for introducing water

Of all children who were given water, 60.2% of children were given water using bottle with artificial nipple, 35.9% were given using a cup, 1.9% were given using spoon while 1.9% were given using hand (Table 4.21).

Table 4.21: Type of container used to give water.

Variable	Frequency (n=206)	Percentage (%)
Type of container used		
Bottle feeding	124	60.2
Cup feeding	74	35.9
Spoon feeding	4	1.9
Hand	4	1.9

4.4 Complementary feeding practices

At the time of the interview, 73.6% of children were introduced to complementary foods while 26.4% were not introduced to complementary foods. Of those who were introduced to complementary foods, 3.8% were given complementary foods at the age of one month after birth, 19% were given complementary foods at the age of 2 to 3 months, 64.7% were given complementary foods at the age of 4 to 5 months while 12.3% were given complementary foods at the age of six months (Table 4.22).

Table 4.22: Age of introducing complementary foods.

Variable	Frequency (n=184)	Percentages (%)
Age of introducing complementary foods		
1 month	7	3.8
2 – 3 months	35	19.0
4 – 5 months	119	64.7
6 months	23	12.5

When mothers were asked, which food was given to the children as a first food, all mothers indicated that maize meal soft porridge added sugar was given to the child as the first food.

At the time of the interview, 14% of children who were given complementary foods were aged 0 to 6 months, 28.8% were aged 7 to 12 months, 22% were aged 13 to 24 months while 8.8% were aged 25 to 36 months (Table 4.23).

Table 4.23: Children on complementary feeding by age group.

Variable		Children on complementary feeding		
		Yes		No
Age of children	**n=184**	**(%)**	**n=66**	**(%)**
0 – 6 months	35	14.0%	66	26.4
7 – 12 months	72	28.8%	0	0
13 – 24 months	55	22.0%	0	0
25 – 36 months	22	8.8%	0	0
		73.6%		26.4%

Mothers were asked the reasons for introducing complementary foods, 70.1% indicated that child was crying a lot, 11.4% were advised by parents/parents-in-law, 9.2% were advised by health professional, 8.2% insufficient breastmilk while 1.1% believed that it was right time to introduce complementary foods (Table 4.24).

Table 4.24: Reasons for introducing complementary foods.

Variable	Frequency (n=184)	Percentages (%)
Reasons for introducing complementary foods		
Child cries a lot	129	70.1
Insufficient breastmilk	15	8.2
Advised by parents/parents-in-law	21	11.4
Advised by health professionals	17	9.2
It was the right time	2	1.1

Table 4.25 summarised frequency of meals per day. Half of children (50%) received meals three times and more per day, 39.1% received meals two times per day while 10.9% received meal once per day.

Table 4.25: Frequency of meals per day.

Variable	Frequency of meal per day					
	Once per day		Two per day		Three and more per day	
Age of children	**n=184**	**(%)**	**n=184**	**(%)**	**n=184**	**(%)**
0 – 6 months	8	4.3	14	7.6	14	7.6
7 – 12 months	8	4.3	23	12.5	41	22.3
13 – 24 months	2	1.1	27	14.7	25	13.6
25 – 36 months	2	1.1	8	4.3	12	6.5
	20	**10.9**	**72**	**39.1**	**92**	**50.0**

More than half of mothers (57.2%) did not receive complementary feeding information while 42.8% did receive complementary feeding information. Of all mothers who received complementary feeding information, 87.9% received information from health worker, 6.5% received information from parents or parents in law, 4.7% received information from media while 0.9% received information from peers (Table 4.26).

Table 4.26: Sources of complementary feeding information.

Variable	Frequency (n=107)	Percentages (%)
Sources of CF information		
Health worker (Nurse, Dietician/Nutritionist)	94	87.9
Parents/parents in-law	7	6.5
Media (Newspaper, Radio, TV)	5	4.7
Peers (friends, colleagues).	1	0.9

Table 4.27 show the type of complementary feeding information received by mothers. Almost three quarter of mothers (72%) indicated that children should eat variety of foods, 20.6% indicated that children should eat vegetables and fruits daily, 3.7% indicated that children should eat meat, eggs as often as possible while 3.7% indicated that children should start complementary foods at the age of six months.

Table 4.27: Type of complementary feeding information received by mothers.

Variable	Frequency (n=107)	Percentages (%)
Type of CF information received		
Child must eat a variety of foods	77	72
Child must eat vegetables and fruit every day	22	20.6
Child must eat meat, eggs as often as possible	4	3.7
Child must start complementary foods at the age of six months	4	3.7

Table 4.28 provides information on healthy foods to be given to children. Most mothers (69.2%) did not receive information regarding healthy foods to be given to children while 30.4% of mothers received information regarding healthy foods to be given to children. Of all mothers who received information regarding healthy foods to be given to children, 50% indicated that vegetables and fruits are healthy foods for children, 34.2% indicated that fish and eggs are healthy foods for children, 14.5% indicated that soft maize porridge mixed with other food item is healthy food for children while 1.3% of mothers indicated that beans and soya are healthy foods for children.

Table 4.28: Information on healthy foods for the child.

Variables	Frequency (n=76)	Percentages (%)
List of mentioned foods		
Soft maize porridge	11	14.5
Vegetables and fruits	38	50.0
Meat, fish and eggs	26	34.2
Beans and soya	1	1.3

Of all children who were given complementary foods, the highest consumed food groups were grains, roots and tubers at 99.5%, vitamin A-rich fruits and vegetables at 24.9% and flesh foods (meat and animal product) at 23.2%. The least consumed food groups were other fruits and vegetables at 12.4%, eggs at 10.8%, dairy products at 9.7% and legumes and nuts at 5.9% (Table 4.29).

Table 4.29: Food groups consumed by children, based on 24-hour recall.

Variable	Frequency (n=184)	Percentages (%)
Food groups consumed by the child		
Grains, roots and tubers	183	99.5
Legumes and nuts	11	5.9
Dairy products	18	9.7
Flesh foods (Meat and animal products)	43	23.2
Eggs	20	10.8
Vitamin A-rich fruits and vegetables	46	24.9
Other fruits and vegetables	23	12.4

The minimum dietary diversity of complementary food was determined based on the seven food groups which are enumerated in Table 4.30 above. Minimum dietary diversity is referred to as the consumption of four or more of the seven food groups listed. Most children (90.8%) had not attained minimum dietary diversity while 9.2% had attained minimum dietary diversity (Table 4.30).

Table 4.30: Dietary diversity score for complementary feeding.

Variable	Frequency (n=184)	Percentages (%)
Dietary Diversity Score		
<4 food groups	167	90.8
≥4 food groups	17	9.2

Nearly three quarter of children (72%) did not consume any vitamin A-rich foods in the past 24 hours while 28% of children consumed vitamin A-rich foods in the past 24 hours. More than three quarter (77.4%) of children did not consume any iron-rich foods in the past 24 hours while 22.6% consumed iron-rich foods in the past 24 hours (Table 4.31).

Table 4.31: Consumption of vitamin A-rich foods and iron-rich foods.

Variable	Frequency (n=184)	Percentages (%)
Vitamin A-rich foods		
Consumed	52	28.0
Not Consumed	134	72.0
Iron-rich foods		
Consumed	42	22.6
Not consumed	144	77.4

4.5. Nutritional status of children

In this section, results on anthropometric and micronutrients status of children are presented.

4.5.1 Anthropometric status

Anthropometric measurements at birth were obtained from child Road to Health Booklet. The current anthropometric measurement recorded in this study were taken during the interview. Children were measured length, standing height, weight and MUAC. The anthropometric status was presented using weight-for-age, length/height-for-age, weight-for-length/height, BMI-for-age, and MUAC-for-age.

4.5.1.1 Anthropometric status of children at birth.

The mean (± SD) weight-for-age z-score (WAZ) of the total children was -0.29 (±0.863 SD) at birth. Most children (81.2%) were of normal weight-for-age at birth, 16.8% were mild underweight, 0.4% were underweight while 1.6% were at possible growth problem (Table 4.32).

Table 4.32: Weight-for-age

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
<–3SD	Severely underweight	0	0	
–3SD - <–2SD	Underweight	1	0.4	
–2SD - <–1SD	Mild underweight	42	16.8	-0.29 ± 0.863
–1SD - +1SD	Normal WAZ	203	81.2	
>+1SD - ≤+2SD	Possible growth problems	4	1.6	

The mean (± SD) length-for-age z-score of total children was -0.05 (± 0.916 SD) at birth. The majority of children (90%) were of normal length-for-age at birth, 8.8% were mild stunted while 1.2% were stunted (Table 4.33)

Table 4.33: Length-for-age

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
<–3SD	Severely stunted	0	0	
–3SD - <–2SD	Stunted	3	1.2	
–2SD - <–1SD	Mild stunted	22	8.8	-0.05 ± 0.916
–1SD - <+3 SD	Normal length	225	90	
>+3SD	Above normal	0	0	

The mean (± SD) weight-for-length (WLZ) of the total children was -0.53 (±1.139 SD) at birth. About 60% of children were of normal weight-for-height at birth, 24% were mild wasted, 9.6% were wasted while 5.6% were at possible risk of overweight (Table 4.34).

Table 4.34: Weight-for-length

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
<–3SD	Severely wasted	0	0	
–3SD - <–2SD	Wasted	24	9.6	
–2SD - <–1SD	Mild wasted	60	24	-0.53 ± 1.139
–1SD - +1SD	Normal WLZ	152	60	
>+1SD - ≤+2SD	Possible risk of overweight	14	5.6	
>+3SD	Obese	0	0	

The mean (± SD) BMI-for-age for total children was -0.87 (±0.996 SD) at birth. The majority of children (91.6%) were of normal BMI-for-age at birth, 5.6% were wasted while 2.8% were at possible risk for overweight (Table 4.35).

Table 4.35: BMI-for-age.

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
-3SDto<-2SD	Wasted	14	5.6	
-2SDto<-1SD	Normal BMI/A	117	46.8	
-1SDto+1SD	Normal BMI/A	112	44.8	-0.87 ± 0.996
>+1SDto<+2SD	Possible risk of overweight	7	2.8	
+2SDto<+3SD	Overweight	0	0	

4.5.1.2. Anthropometric status of children at time of interview

The mean (± SD) weight-for-age (WAZ) for total children was -0.24 (±0.871 SD) at the time of interview. Nearly three quarter of children (73.2%) were of normal weight-for-age at the time of interview, 16.4% were mild underweight, 16.4% were underweight while 6.8% were facing possible growth problems (Table 4.36).

Table 4.36: Weight-for-age

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
<–3SD	Severely underweight	0	0	
–3SD - <–2SD	Underweight	9	3.6	
–2SD - <–1SD	Mild underweight	41	16.4	-0.24 ± 0.871
–1SD - +1SD	Normal WAZ	183	73.2	
>+1SD - ≤+2SD	Possible growth problems	17	6.8	

The mean (± SD) length/height-for-age (L/HZ) for total children was -0.35 (±1.258 SD) at the time of interview. Two thirds of children (66.8) were of normal length/height-for-age at the time of interview, 23.6% were mild stunted, 9.2% were stunted while 0.4% were severely stunted (Table 4.37).

Table 4.37: Length/height-for-age.

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
<–3SD	Severely stunted	1	0.4	
–3SD - <–2SD	Stunted	23	9.2	-0.35 ± 1.258
–2SD - <–1SD	Mild stunted	59	23.6	
–1SD - <+3 SD	Normal length	167	66.8	

The mean (± SD) weight-for-length/height (WL/HZ) of total children was -0.06 (±1.049 SD) at the time of interview. Nearly two third of children (64.4%) were of normal weight-for-age at the time of interview, 19.2% were mild wasted, 2% were wasted, 13.2% were at possible risk of overweight while 1.2% were overweight (Table 4.38).

Table 4.38: Weight-for-length/height

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
<–3SD	Severely wasted	0	0	
–3SD - <–2SD	Wasted	5	2.0	
–2SD - <–1SD	Mild wasted	48	19.2	
–1SD - +1SD	Normal WHZ	161	64.4	-0.06 ± 1.049
>+1SD - ≤+2SD	Possible risk of overweight	33	13.2	
+2SDto<+3SD	Overweight	3	1.2	
>+3SD	Obese	0	0	

The mean (± SD) BMI-for-age for total children was -0.05 (±1.064 SD) at the time for interview. The majority of children (80%) were of normal BMI-for-age at the time of interview, 16% were at the possible risk of overweight, 2% were wasted while 1.6% were overweight (Table 4.39).

Table 4.39: BMI-for-age.

WHO Z-Score classification	Interpretation	n=250	(%)	Mean ± SD
-3SDto<-2SD	Wasted	6	2.4	
-2SDto<-1SD	Normal BMI/A	46	18.4	
-1SDto+1SD	Normal BMI/A	154	61.6	-0.05 ± 1.064
>+1SDto<+2SD	Possible risk of overweight	40	16.0	
+2SDto<+3SD	Overweight	4	1.6	

The mid-upper arm circumference was measured in 200 children who were three months and above at the time of interview. The mean (± SD) MUAC-for-age was 0.45 (±0.77 SD) at the time of interview. The majority of children (92%) were well-nourished, 6.5% were at risk of acute malnutrition while 1.5% were at risk of moderate acute malnutrition (Table 4.40).

Table 4.40: Mid-Upper Arm Circumference for age.

MUAC Classifications	Interpretation	n=200	(%)	Mean ± SD
<11 cm	Severe Acute Malnutrition	0	0	
11.0cm to 12.5 cm	Moderate Acute Malnutrition	3	1.5	0.45 ± 0.77
12.5cm to 13.5cm	At risk of Acute Malnutrition	13	6.5	
>13 .5 cm	Well-Nourished	184	92.0	

4.5.1.3. The association between infant feeding practices and anthropometric status of children.

The association between infant feeding practices and anthropometric status are summarised in Table 4.41. A higher percentage (37.4%) of children who received water were more likely to be underweight as compared to those who did not receive water (13.6%) (p=0.002). About 38.1% of children who received water before 6 months of age were more likely to be stunted as compared to those who received water at 6 months and above (19.9%) (p=0.001). A few percentages (18.5%) of children who received complementary foods were more likely to be wasted as compared to children who did not receive complementary foods (71.2%) (p=0.003).

Table 4.41: The association between infant feeding practices and anthropometric status of children

Variables	Weight-for-age		df	P-value
Introduction of water	**Underweight N (%)**	**Normal N (%)**		
Yes	77(37.4%)	129(62.6%)	1	0.002
No	6(13.6%)	38(86.4%		
	Height-for-age			
Age of introducing water	**Stunted N (%)**	**Normal N (%)**		
6 months and below	72(38.9%)	113(61.1%)	1	0.001
Above 6 months	11(16.9%)	54(83.1%)		
	Weight-for-height			
Introduction of CF	**Wasted N (%)**	**Normal N (%)**		
Yes	34(18.5%)	150(81.5%)	1	0.003
No	47(71.2%)	19(28.8%)		

*Pearson chi-square test; *Significance at ρ < 0.05;*
CF=Complementary Foods.

4.5.1.4 Association between anthropometric status and feeding practices (Logistic regression)

The association between age of introducing complementary foods and weight-for-age are summarised in table 4.42. Children who were given complementary foods 1 week after birth, the odds of being underweight were 9.00 times as compared to those who were given complementary foods after six months (OR=9.00; 95% CI=1.325 - 61.138). On the other hand, no association between children who were given complementary foods between the age of 2 to 3 months after

birth and being underweight (OR=1.067; 95% CI=0.301 - 3.785). Furthermore, no association was observed between children who were given complementary foods between 4 to 6 months after birth and underweight (OR=0.642; 95% CI=0.211 - 1.948).

Table 4.42. Association between the age of introducing complementary foods and weight-for-age.

Variables		Weight-for-age	
Age of introducing CF	**OR**	**(95% CI)**	**P-value**
1 week after birth	9.000	1.325 - 61.138	0.025
2 to 3 months	1.067	0.301 - 3.785	0.920
4 to 6 months	0.642	0.211 - 1.948	0.433

AOR: Adjusted Odd Ratio, CI=Confidence Interval, Significance at ρ < 0.05. CF= Complementary foods

4.5.2 Micronutrients status.

The blood samples were drawn from 138 children whose mothers gave consent. The blood sample was used to determine the micronutrient status of children. Micronutrients status in this study refers to vitamin A and iron status of the children.

Table 4.43 illustrates vitamin A status of children. Vitamin A status of children was assessed using serum retinol concentration. The mean (± SD) serum retinol concentration was 25.17µg/dl (±6.289 SD). More than half of children (54.3%) had adequate serum retinol (vitamin A) concentration, 23.9% had a normal serum retinol (vitamin A) concentration, 20.3% had marginal serum retinol (vitamin A) status while 1.4% had serum retinol (vitamin A) deficiency.

Table 4.43: Vitamin A status of children.

Serum retinol concentration	Cut-off values	n=138	(%)	Mean ± SD
Vitamin A deficiency	<10 µg/dl	2	1.4	
Marginal vitamin A status	10 – 19.9 µg/dl	28	20.3	25.17 ± 6.289
Adequate status	20 – 29.9 µg/dl	75	54.3	
Normal/ well-nourished status	> 30 µg/dl	33	23.9	

Haemoglobin concentration level was used to assess the prevalence of anaemia among children. The mean (± SD) haemoglobin concentration was 10.98 g/dl (±1.145 SD). About 21% of children had moderate anaemia, 32.6% had mild anaemia while 46.4% had normal haemoglobin concentration (Table 4.44).

Table 4.44: Anaemic status of children.

Haemoglobin concentrations	Cut-off values	n=138	(%)	Mean ± SD
Severe anaemia	<7.0 g/dl	0	0	
Moderate anaemia	7.0–9.9 g/dl	29	21	10.98 ± 1.145
Mild anaemia	10.0–10.9 g/dl	45	32.6	
Normal	≥ 11 g/dL	64	46.4	

Table 4.45 illustrate the prevalence of iron deficiencies among children as determined by the four iron indicators. The mean (± SD) serum iron was 47.33 µg/dL (± 21.97 SD). The majority of children (82.6%) had normal serum iron while 24% had iron depletion. The mean (± SD) serum ferritin was 33.88 *µ*g/l (± 29.33 SD). Majority of children (86.9%) had normal iron stores while 13% had iron deficiency. The mean (± SD) serum transferrin was 2.98 g/L (± 29.33 SD). The majority of children had normal serum transferrin while 2.9% had mild depletion. The mean (± SD) saturation transferrin was 51.48% (± 43.22 SD). About 63% of children had normal saturation transferrin while 37% had low saturation transferrin.

Table 4.45: Iron status of children.

Iron indicators	Cut-off values	n=138	(%)	Mean ± SD
Serum iron				
Depletion	< 60 µg/dL	24	17.4	47.33 ± 21.97
Normal	≥115 µg/dL	114	82.6	
Serum ferritin				
Iron deficiency	< 12 *µ*g/l	18	13.1	33.88 ± 29.33
Normal iron stores	≥ 12 *µ*g/l	120	86.9	
Serum transferrin				
Severe depletion	< 1.0 g/L	0	0	
Mild depletion	1.5 – 2.0 g/L	4	2.9	2.98 ± 29.33
Normal	> 2.0 g/L	134	97.1	
Saturation transferrin				
Low	<15%	51	37.0	51.48 ± 43.22
Normal	10-20 %	87	63.0	

4.5.2.1 Association between micronutrients status and infant feeding practices of children.

The association between infant feeding practices and micronutrients status of children are summarised in Table 4.46. Children who were still breastfeeding were more likely to have normal haemoglobin (73.5%) as compared to those who were no longer breastfeed (61.5%) (p=0.045). Most children (93.4%) who were on infant formula milk were more likely to have normal vitamin A status as compared to children who were not given infant formula milk (84.9%) (p=0.047). One third (33%) of children who were given water were more likely to have anaemia as compared to

those who were not given water (13.6%) (p=0.011). Children who were given water before 6 months were more likely to have anaemia as compared to those who did not receive water (p=0.001). The was a significant relationship between children who received water before the age of 6 months and iron deficiency (serum ferritin) (p=0.04). Children who were introduced to complementary foods were more likely to have anaemia compared to those who were not introduced (p=0.001). There was a significant relationship between children who were not introduced to complementary foods had low saturation (P=0.021).

Table 4.46: The association between infant feeding practices and micronutrients status of children.

Variables	Haemoglobin		df	P-value
Still breastfeeding	**Anaemia N (%)**	**Normal N (%)**		
Yes	49 (26.5%)	136 (73.5%)	1	0.045
No	25 (38.5%)	40 (61.5%)		
	Vitamin A			
Child received infant formula milk	**VAD N (%)**	**Normal N (%)**		
Yes	6(6.6%)	85(93.4%)	1	0.047
No	24(15.1%)	135(84.9%)		
	Haemoglobin			
Introduction of water	**Anaemia N (%)**	**Normal N (%)**		
Yes	68(33.0%)	138(67.0%)	1	0.011
No	38(86.4%)	6(13.6%)		
	Haemoglobin			
Age of introducing water	**Anaemia N (%)**	**Normal N (%)**		
6 months and below	65(35.1%)	120(64.9%)	1	0.001
Above 6 months	9(13.8%)	56(86.2%)		
	Serum Ferritin			
Age of introducing water	**ID N (%)**	**Normal N (%)**		
6 months and below	17(9.2%)	168(90.8%)	1	0.040
Above 6 months	1(1.5%)	64(98.5%)		
	Haemoglobin			
Introduction of CF	**Anaemia N (%)**	**Normal N (%)**		
Yes	65(35.3%	119(64.7%)	1	0.001
No	9(13.6%)	57(86.4%)		
	Saturation			
Introduction of CF	**Low N (%)**	**Normal N (%)**		
Yes	44(23.9%)	140(76.1%)	1	0.021
No	7(10.6%)	59(89.4%)		

*Pearson chi-square test; *Significance at p < 0.05; CF=Complementary Foods*
VAD= Vitamin A Deficiency; ID=Iron Deficiency

The association between age of introducing water and haemoglobin concentration are summarised on Table 4.47. Children who were given water before the age of six months, the odds of having anaemia were about 3 times as compared to those who were given water after six months (OR=3.081; 95% CI=1.005 - 9.441).

Table 4.47: Association between age of introducing water and haemoglobin concentration

Variable		Haemoglobin	
Age of introducing water	**OR**	**(95% CI)**	**P-value**
6 months and below	3.081	1.005 - 9.441	0.049

AOR: Adjusted Odd Ratio, CI=Confidence Interval, Significance at ρ < 0.05.

4.5.2.2 Association between micronutrient and feeding practices (Logistics regression)

Table 4.48 shows results from logistic regression of associations between breastfeeding initiation, infant formula milk and serum ferritin. Children who were initiated on breastfeeding immediately after delivery, the odds of having iron deficiency were 0.11 times as compared to those who were initiated breastfeeding a day after delivery (OR=0.111; 95% CI=0.015 - 0.812). Since the odds ratio is less than 1, it means children who were initiated on breastfeeding immediately after delivery has low chance of having iron deficiency as compared to children who were initiated to breastfeeding a day after delivery. Children who were given infant formula milk, the odds of having iron deficiency were 0.22 times as compared to those who were not given infant formula milk (OR=0.216; 95% CI=0.046 - 1.018).

Table 4.48: Association between breastfeeding initiation, infant formula milk and serum ferritin.

Variables		Serum ferritin	
Breastfeeding initiation	**OR**	**(95% CI)**	**P-value**
Immediately after delivery	0.111	0.015 - 0.812	0.030
Is you baby on infant formula milk			
Yes	0.216	0.046 - 1.018	0.053

AOR: Adjusted Odd Ratio, CI=Confidence Interval, Significance at ρ < 0.05.

4.6 Conclusion

The study was carried out on 250 children aged 0 to 36 months and their mothers. The mean (± SD) age of children in months was 10.53 (8.39). The mean (± SD) age of mothers in years was 27.79 (±7.13SD). More than half of mothers (54%) were single, 37.6% were married, 3.6% were living with their partners, 2.8% were separated while 2% were divorced. More than three quarters of mothers (79.6%) had attained secondary education. Three quarters of mothers (75.2%) were unemployed whereas 24.8% were employed. The main source of income for the households were social grants (76.4%).

Most mothers (96%) initiated breastfeeding within one hour after birth. Exclusive breastfeeding up to six months was practised by only 7.6% of mothers. Nearly three quarters of mothers (74%) were still breastfeeding their children at the time of the interview while 26% were no longer breastfeeding. The main reason for stopping breastfeeding were going back to school/work (41.5%) and medical condition (20%). The majority (87.5%) were complementary feeding before the age of six months. The highest consumed food group during complementary feeding were grains, roots and tubers at 99.5%. Most children (90.8%) had not attained minimum dietary diversity.

The prevalence of stunning, wasting, underweight at birth were 1.2%, 9.6% and 0.4% respectively. The prevalence of stunting, wasting and underweight were 9.2%, 2% and 3.6% respectively. The prevalence of vitamin A among children was 21.7% (<10 µg/dl). The prevalence of anaemia (Hb <11 g/dL), and iron deficiency (serum ferritin < 12 *µ*g/l) amongst children was 53.6% and 13.1% respectively.

About 38.1% of children who received water before six months of age were more likely to be stunted as compared to those who received water at six months and above (19.9%) (p=0.001). Children who were still breastfeeding were more likely to have normal haemoglobin (73.5%) as compared to those who were no longer breastfeed (61.5%) (p=0.45). Children who were given complementary foods one week after birth, the odds of being underweight were 9.00 times as compared to those who were given complementary foods after six months (OR=9.00; 95% CI=1.325 - 61.138). Children who were initiated on breastfeeding immediately after delivery, the odds of having low ferritin were 0.11 times as compared to those who were initiated breastfeeding a day after delivery (OR=0.111; 95% CI=0.015 - 0.812.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

In this chapter, the study results in terms of socio-demographic characteristics, breastfeeding and complementary feeding practices, nutritional status of children, relationship between nutritional status and feeding practices are discussed in the context of the current scientific literature. The limitations of the study were also discussed in terms of the possible impact on the results.

5.2 Limitation of the study

The current study provided findings for feeding practices and nutritional status of children 0 to 36 months in the Thulamela Municipality, but was not representative of children in Limpopo Province as a whole.

The prevalence of HIV/AIDS status was not determined amongst children in the current study. HIV/AIDS infection is associated with weight loss, wasting and an increased risk of infections, these could have influenced the impact of the nutritional status of children (Fanta, 2004; Poda *et al*., 2017). Furthermore, infections are known to affect iron status. In the current study, it was not determined whether the children had Acute and Chronic infections. Inflammatory diseases, certain neoplastic diseases and liver disorders elevate serum ferritin because ferritin is an acute-phase protein (Gibson, 2005: 461).

In the current study, it was not determined whether the children had been de-wormed in the Road to Health Booklet. Children with the parasite lose blood and iron frequently; these could cause anaemia among children (FAO, 1997; Seidelman *et al*., 2016). Furthermore, parasite depends on the host for nutrients and these could contribute to the poor iron status of children.

5.3 Socio-demographic characteristics of study participants

The study was carried out on 250 children aged 0 to 36 months and their mothers. The mean (± SD) age of children in months was 10.53 (8.39). Out of all children, 52.4% were males while 47.6% were female. Gender distribution of children in the current study was similar to statistics reported in the 2016 Census for the Limpopo Province, where 47.2% and 52.8% of children under five years were males and females respectively (Statistics SA, 2016). A similar observation was

made in the study conducted in Limpopo Province by Mushaphi *et al*. (2017) where 49.4% of children under five years were male and 50.6% were female.

In the present study, more than half (54%) of the mothers were not married while 37.6% were married. A similar observation was made in 2016 censes where 55.2% of mothers in Limpopo Province were single while 44.8% were married (Statistics SA, 2016). According to South African Demography and Health Survey (SADHS, 2016), 58.6% of mothers are single while 41.4% were married in South Africa. Phooko-Rabodiba *et al.* (2019) reported that 53.4% of mothers were single while 46.6% were married. The findings of the current study are comparable with the findings of previous studies conducted in Limpopo Province (Statistics SA, 2016; Phooko-Rabodiba *et al*., 2019). On the contrary, Faber *et al*. (2016) reported that 73.4% of mothers were single while 26.6% were married in KwaZulu-Natal Province. Marital status seems to play a role in infant feeding practices. According to Ndkarni (2015), married mothers were more likely to exclusively breastfeed for the recommended period of six months in America. Wanjohi *et al*. (2016) also reported that father support contributed greatly to the optimal infant and young child feeding practices.

The results of this study showed that 42.4% of mothers had attained secondary education. A similar observation was made in the study done in KwaZulu-Natal Province, where 42.4% of mothers had attained secondary education (Faber *et al*., 2016). In the national survey conducted by SADHS (2016) reported that only 49.3% of mothers in South Africa has attained secondary education. Mushaphi *et al*. (2017) reported that 60% of mothers in Limpopo Province had attained secondary education, which is higher than the current study, and SADHS conducted in 2016. Motadi *et al*. (2019) reported a lower percentage (37.5%) of mother in Limpopo Province who had attained secondary education. Previous studies show that mothers with higher education were more likely to accept health education information as compared to mothers with lower educational level in the study conducted (Dubois & Girard, 2003; Kuchenbecker *et al.,* 2017). According to Phooko-Rabodiba *et al.* (2019) the level of education influences the mother's knowledge of feeding practices, which may have significate impact on the nutritional status of the child. Therefore, mothers need to attain formal education as it will contribute significantly to improve feeding practices resulting in better nutritional status of young children. Furthermore, SADHS (2016) reported that number of students who drop out declines sharply from 88% in primary school to 77% in a secondary school in South Africa.

In the present study, three quarters (75.2%) of mothers were unemployed. A similar observation was made in the study done in Cape Town by Budree *et al*. (2017) where 73% of mothers were unemployed at the time of interview. Phooko-Rabodiba *et al*. (2019) reported a much higher percentage (92.2%) of unemployed mothers in Sekhukhune District. The unemployment rate in the current study and previous studies in South Africa (Budree *et al*., 2017; Phooko-Rabodiba *et al*., 2019) was much higher compared to the national unemployment rate of 38% (Stats SA, 2019). The high percentage of unemployment rate in the current study and previous studies may be attributed to the lack of tertiary education among mothers. Thus, resulting in high unemployment rate among mothers that could lead to household food insecurity, which may increase the risk of malnutrition among children due to lack of access to nutritious foods. In South Africa, food insecurity affects one in five households and majority of those households are located mostly in the rural communities (Labadarios, 2007; Govender *et al*., 2017).

In the present study, most of mothers (71.6%) were from households which earn less than R2000. Furthermore, the main source of income for most households were social grants (92.3%). Previous studies were done in Limpopo and KwaZulu-Natal provinces also reported that majority of households rely on social grant for monthly income (Mushaphi *et al*., 2017; Horwood *et al*., 2018). Statistic South Africa (2016) indicated that social grant is the second main income in South Africa as 50% of households receive social grant monthly. Furthermore, about 56% of South African population live in poverty and almost 28% in extreme poverty. These findings are a clear indication that social grant remains a vital safety net, particularly in the poorest province such as Limpopo Province. There is widespread evidence that social grants increase access to food and reduce food insecurity (Waidler & Devereux, 2019). However, social grants may not be sufficient to maintain the predominant household and these may increase the risk of food insecurity.

5.4 Breastfeeding practices

The WHO/UNICEF (2021) recommended that breastfeeding should be initiated within first hour after birth. The result from the current study showed that the majority (96%) of mothers had initiated breastfeeding within an hour after birth, which is in line with WHO/UNICEF (2021) recommendations. Similar trends were observed in the previous studies conducted in Southern Ethiopia (Beyene *et al*., 2016), Eastern Sudan (Hassan *et al*., 2018), Bangladesh (Haider & Saha, 2016), Malawi (Chipojola *et al*., 2020) where initiation of breastfeeding within an hour after birth among mothers were 83.7%, 87.2%, 94% and 95.4% respectively. On the contrary, low rate of breastfeeding initiation within an hour after birth was reported in Ghana (39%) and America (39%)

(Fosu-Brefo & Arthur 2015; Thomson *et al*., 2017). According to Olufunlayo *et al.* (2019), early initiation of breastfeeding within an hour is mostly determined by culture, maternal education and maternity services in low and middle-income countries. More than 90% of mothers in the current study and previous studies (Haider & Saha, 2016; Chipojola *et al.,* 2020) initiated breastfeeding within the recommended time by WHO which indicate very good practices.

WHO/UNICEF (2021) recommended that infants should be exclusively breastfed for the first six months after birth. Victoria *et al*. (2016) indicated that exclusive breastfeeding for the first six months is the most effective preventive intervention for reducing child morbidity and mortality. Despite the evidence on the benefits of exclusive breastfeeding, only 7.6% of children in the current study were exclusively breastfed up to six months. The exclusive breastfeeding rate in the current study is much lower than the national rate of exclusive breastfeeding of 32% in 2016 as shown in South African Demographic and Health Survey (SADHS, 2016). In the study conducted in the same district by Mushaphi *et al*. (2017) indicated that none of the children were exclusively breastfed for six months. In South African, it seems as if mixed feeding and early introduction of complementary foods or fluids is a norm (Doherty *et al*., 2012; Budree *et al*., 2016; Mushaphi *et al*., 2017). Lack of maternal self-efficacy, returning to work or school, poor experiences of breastfeeding and perceptions of insufficient milk are the most common barriers to exclusive breastfeeding for the first six months (Doherty *et al*., 2012; Du Plessis, 2013; Rollins *et al*., 2016).

WHO/UNICEF (2021) recommended that mothers should continue breastfeeding up to two years even beyond. In the current study, most (74%) of mother were still breastfeeding their children while 26% were no longer breastfeeding their children. A similar finding was reported in the study conducted in Italy by Carletti *et al*. (2017) where 73% of mothers were still breastfeeding their children at the time of study. In the longitudinal study conducted in South Africa revealed that 58% of mothers were still breastfeeding their children at the age of 12 months (Budree *et al*., 2016). On the contrary, a cohort study conducted earlier in South Africa, reported lower rate 14.4% of mothers who were still breastfeeding between the age 6 to 24 months compared to the current study (Doherty *et al*., 2014). In the study conducted in urban and rural KwaZulu-Natal Province reported that 31% of mothers had stopped breastfeeding before 24 weeks (Faber *et al*., 2016). Breastfeeding infant for two years or beyond is associated with greater linear growth and protect child health, decrease the child's risk of morbidity and mortality (Victoria *et al*., 2016).

In the current study, most mothers indicated that returning to school/work, influence by the family members and insufficient milk as the main reason for introducing complementary foods or fluids. A similar observation was made in the study done in KwaZulu-Natal by Horwood *et al*. (2018) where several factors such as going back to work or school, and HIV status were associated with early breastfeeding cessation. Poor breastfeeding rate could be due to the fact that when infants are given water and complementary foods at an early stage they are likely to stop breastfeeding which will lead to early cessation of breastfeeding because of nipple confusion if given on artificial teat or the child is full from other foods/fluid and end up less interested in the breast (Kavitha *et al*., 2014). Furthermore, at this stage, the infant's gastrointestinal and neurodevelopmental systems and the kidneys still immature to handle the solid food and water. Provision of breastfeeding support from health workers, community health workers, peer supporters and others in the family or community have consistently been associated with improved feeding practices (Tylleskar *et al*., 2011; Shifraw *et al*., 2015; Rollins *et al*., 2016).

5.5 Complementary feeding practices

The WHO/UNICEF (2021) recommended that complementary foods should be introduced at six months of age to ensure that the child obtains all the required nutrients. The results in the study shown that majority of children were introduced to complementary foods or fluids before the age of six months. Previous studies conducted in South Africa made similar observation where majority of infants were introduced to complementary foods before the recommended period of six months (Cape *et al*., 2007; Mushaphi *et al*., 2008; Goosen *et al*., 2014; Kavitha *et al*., 2014; Seonandan & McKerrow, 2016; Ntila *et al*., 2017). The inappropriate age of introduction of complementary feeding is significantly associated with hampering optimal growth and development of the child (Mitchodigni *et al*., 2018). In addition, early introduction of solids increases the risk of diarrheal disease, food allergies, and probably increases the rate of being overweight in infancy and childhood (Kramer & Kakuma, 2012).

In South Africa, complementary feeding practices are largely inadequate in nutrients quality and being comprises of mainly starches that are low in nutrients that are very important for growth and development (Cape *et al*., 2007; Goosen *et al*., 2014; Mushaphi *et al*., 2015; Faber *et al*., 2016; Seonandan & McKerrow, 2016; Ntila *et al*., 2017; Rothman *et al*., 2018; Sayed & Schönfeldt, 2020). In the current study, most children were given soft maize meal porridge only without any other foods item added. Complementary foods made with white maize as the main or sole solid ingredient, such as soft maize porridge is generally adequate in energy, fibre, and B-vitamins, but

deficient in protein and minerals such as iron, calcium, and zinc despite being fortified with minerals and vitamins (Faber *et al*., 2020). This could be attributed to the fact that maize-meal is the staple food in South Africa, hence majority of infants are fed maize-meal soft porridge as observed in the previous and current studies. Poverty, poor food choices, limited food availability coupled with lack of knowledge about the importance of food groups' diversity for the health and growth of young children may limit the inclusion of micronutrient-rich foods in the diets of children (Mitchodigni *et al*., 2018). Many people particularly those in lower-income settings of rural villages of Africa have limited access to diets that meet their daily macro and micronutrients requirements (Mitchodigni *et al*., 2018).

The WHO (2010a) recommended that children must consume a minimum of 4 out of 7 food groups every day to attain minimum dietary diversity. Furthermore, the consumption of 4 food groups ensures that a child obtains the required amounts of micronutrients and macronutrients that are essential for growth and development. However, in the current study only 9.2% of children had attained minimum dietary diversity. This means that the majority of children in the current study were fed monotonous diets, which were based mainly on starchy foods and liquid, such as soft porridge, water and tea with less consumption of fruits and vegetables. A similar observation was made in the study conducted in Lebowakgomo, where children were fed monotonous diets, which is based mainly on starchy and sugary foods, such as soft porridge, sugar, concentrated juice, and tea (Ntila *et al*., 2017). In the current study, white maize meal was the main ingredient in almost all meals given to children during breakfast, lunch, and supper. Consumption of monotonous diet based on starchy food with limited consumption of vitamin and mineral-rich food is likely to increase the risk of micronutrient deficiency in children (Kavitha *et al*., 2014; Ntila *et al*., 2017; Mitchodigni *et al*., 2018).

According to Tegegne *et al*. (2017), improving the quantity and quality of meal is among the most effective strategies to improve overall health and nutritional status of children. The WHO recommends that breastfed children between age 6 to 8 months old should be fed meal 2 times per day, those between 8 to 23 months should be fed 2 to 3 times per day while the non-breastfed ones should be fed 4 time per day (WHO, 2008; WHO, 2010a). However, in the current study the minimum meal frequency is low as per WHO recommendations as 27.2% of children aged 7 to 24 months were given two meals per day. On the other hand, 6.5% of children aged 7 to 24 months were given one meal per day. Du Plessis *et al*. (2016) reported that 71% of children aged 6 to 23 months in the South Africa communities were fed 2 to 3 to three times per or more per

day. In the study conducted in KwaZulu-Natal Midlands by Seonandan and McKerrow (2016) reported that 50% of children 6 to 24 months olds received three meals a day. In the study conducted in Ga-Rankuwa by MacIntyre *et al.* (2005) reported that children from eight weeks or younger were fed 2 to 3 time per day, although WHO recommended that from 6 to 8 months children should be fed two time per day. Children who do not receive meal frequency as recommended by WHO after six months of age are more likely to be stunted, despite they have optimum breastfeeding (Black *et al*., 2008).

5.6 Anthropometric status of children

The anthropometric status of children will be discussed based on the following indicators; weight-for-age, weight-for-height, height-for-age and BMI-for-age.

5.6.1. Weight-for-age

In the current study, the prevalence of underweight was 3.6% of children. These results show that underweight is of low public health concern as the prevalence was less than 10% (WHO, 2015). The previous study conducted in Limpopo Province, show that 8.2% of children were underweight (Mushaphi *et al*., 2015). In 2005, 11% of children aged 1 to 3 years were underweight (NFCS-FB, 2005). In 2012, SANHANES-1 reported 6.1% of children aged 1 to 3 years were underweight (SANHANES-1, 2012). In the national survey done by SADHS, shows that 5.8% of children were underweight (SADHS, 2016). It is important to note that prevalence of underweight it seems as if it is improving when compared to previous national survey.

The prevalence of underweight in the current study could be attributed to the high percentages of mixed feeding, low exclusive breastfeeding rate and poor dietary diversity score which has been shown by the study participants in the current study. Apart from poverty, monotonous diet and poor feeding practices are directly linked to undernutrition during childhood (Cape *et al*., 2007; Goosen *et al*., 2014; Ntila *et al*., 2017). More than one third (37.4%) of children who received water before six months were more likely to be underweight as compared to those who received water at six months and above (P=0.002). Short-term adverse effects of undernutrition include recurring illness, weakness, delayed physical and mental development, irritability, poor appetite, low weight for age while the long-term adverse effects are short height for age, poor learning ability, poor performance at school and poor general health (Olodu *et al*., 2019).

5.6.2 Weight-for-length/height

In the current study, the prevalence of wasting was 2% amongst children. A similar trend was observed in the previous survey conducted in South Africa, where 2.9% of children were reported to be wasted (SANHANES-1, 2012). However, the national survey conducted in South Africa show that 3% of children under five years were wasted, which higher compared to the finding in the current study (SADHS, 2016). The findings in the current and previous survey in South Africa show that wasting is of low public health concern as prevalence of wasting was less than 5% (WHO, 2015). Wasting amongst children has significant effects on levels of educational attainment, acute growth faltering, reduced physical capacity and poor resistance to infections and diseases in children less than five years of age (Ene-Obong *et al.,* 2012; Briend *et al*., 2015). Wasting and childhood morbidity have a synergistic relationship, in such a way that illness can suppress appetite precipitating undernutrition while nutritional deficiencies increase the susceptibility of children to infectious diseases (Mgongo *et al*., 2017).

The findings of the current study revealed that children who received solid, semi-solid or soft foods were more likely to be wasted indicating disparities in nutrition status among children. This finding is coherent with some studies conducted in sub-Saharan Africa, where children who received only solid, semi-solid or soft foods as complementary food were more likely to be wasted (Saaka *et al*., 2015; Udoh & Amodu 2016; Macharia *et al*., 2019). Poor calorie intake has emerged as a significant risk factor for child malnutrition in the current study. Children who are likely to be wasted are those who are weaned only on the maize meal porridge (Semba, 2016). Poor nutritional status of children has been associated with inadequacy of complementary food in term of quality, quantity and frequency of meals (Udoh & Amodu, 2016). Furthermore, children from the food insecure households are more likely to be malnourished. Several studies have found a similar association between household food insecurity and malnutrition among children (Ajao *et al*., 2010; Wong *et al*., 2014).

5.6.3. Height/length-for-age

Although most children in the current study had a normal growth pattern in terms of length/height-for-age, 9.2% of children were stunted while 0.4 were severely stunted. In this study, the results showed that the severity of the stunting prevalence (9.2%) was low when compared to WHO thresholds (with a low prevalence of stunting being <20%) (WHO, 2015). The findings from surveys show that 15.4% and 27% of South African children were stunted, which is higher compared to findings of the current study (SANHANES-1, 2012; SADHS, 2016). A study

conducted in Peri-Urban community of South African by Rothman *et al*. (2018) shows that 28.5% of children were stunted, which is higher than SANHANES-1 survey, SADHS survey as well as in the current study. Kekana *et al*. (2020) reported that 32.3% of children in Limpopo Province were stunted which is much higher when compared with results of the current study.

In the current study, more than one third (38.1%) of children who received water before six months were more likely to be stunted as compared to those who received water at six months and above (p=0.001). On the contrary, a study conducted in Northern Senegal by Gupta *et al*. (2007) reported that there was no significant association between wasting or stunting and introduction of water before three months (p=0.097). A systematic review by Kakuma and Kramer (2004) suggest that early introduction of water has little impact on child growth, but clear negative impact on the child health including the incidence of diarrhoea. Stunting reflects chronic malnutrition which is due to long-term starvation or shortage of food or repeated illness (Agedew & Chane, 2015). Children who are stunted are more likely to carry this burden for their entire lives and meeting their full physical and intellectual potential may be a challenge (Keeley *et al.,* 2019). Children who are stunted are more likely to suffer from infections such as diarrhoea, pneumonia, measles and cardiovascular diseases later in adulthood (Nahar *et al*., 2020).

5.6.4. BMI-for-age

In the current, prevalence of overweight was interpreted according to BMI-for-age. Majority (80%) of children had normal BMI-for-age, 16% were at the possible risk of overweight while 1.6% were overweight. The prevalence of overweight among children in the current study was lower than reported in South African National Health and Nutrition Examination Survey (2012) (17.5%) and South African Demographic Health Survey (SADHS, 2016) (13.3%). The prevalence of overweight in the current study was lower compared to 20.9% found in the study conducted in Peri-urban communities of South Africa (Rothman *et al*., 2018). Otitoola *et al*. (2020) reported that high prevalence of overweight observed in South Africa are caused by consumption of diets that are rich in starch and fats. Childhood overweight has been associated with higher chances of adulthood obesity and premature death and disability (Danguah *et al*., 2020). Most of the children in the current study were eating foods which was comprised of starchy and which provide energy only.

5.7 Micronutrients status of children

5.7.1 Vitamin A deficiency

In the current study, 21.7% of children were vitamin A deficient. The prevalence of vitamin A deficiency amongst children in the current study is much lower when compared with previous national surveys done in South African. Previous findings of the national surveys conducted in South Africa show that 33%, 63.6% and 43% of children aged 1 to 9 years in 1994, aged 6 to 72 months in 2005 and aged 2 to 5 years in 2012 were vitamin A deficient respectively (SAVACG, 1995; NFCS-FB, 2005; SANHANES-1, 2012). In the study conducted in Limpopo Province by Mushaphi *et al*. (2015) results shows that 7.7% of children under five years were vitamin A deficient. Vitamin A deficiency is associated with mild to severe systemic effects on innate and acquired mechanism of host resistance to infection and growth, increased burden of infectious morbidity (Bailey *et al*., 2015). However, the results of the current study still warrant an immediate action since the prevalence is higher than 20% which is regarded as a severe public health concern by WHO (2011d).

South Africa vitamin A supplementation coverage remains very low. According to DHIS (2009), Mpumalanga Province had lowest the vitamin A supplementation coverage (30%) followed by Limpopo Province (32%), Northern Cape Province (32%) and North-West Province 33%. However, vitamin A supplementation coverage was not determined in the current study. In the current study, children were also fed only maize meal soft porridge without any introduction of micronutrients rich food. This could be the contributing factor on the high prevalence of vitamin A deficiency despite the implementation of vitamin A supplementation programme. On the other hand, Vhembe District is rich fruit and vegetables, which are rich in most micronutrients. Moreover, even though Vhembe district is rich of vitamin A rich fruits and vegetables, very few children were given these foods as they are mainly feed diet that lack variety. Low dietary intake of vitamin A-rich food, rapid growth and repeated infections are the major causes of vitamin A deficiency especially in early childhood (Gibson, 2005: 478).

5.7.2 Iron deficiency status

In the current study, more than half (53.6%) of children were anaemic. South African Demography Health Survey (2016) reported that 61% of children aged 1-9 years were anaemic, which is higher compared to finding in the current study. In the study conducted in Limpopo Province reported a higher prevalence of 75% of children who were anaemic as compared to the current study (Heckman *et al*., 2010). Contrary, the prevalence of anaemia in the current study was higher when

compared to SANHANES-1 (2012) survey, NFCS-FB, (2005) survey and the SAVACG (1995) survey where 10.7%, 28.9% and 21.4% of children were anaemic respectively. In the current study, no iron-rich foods were introduced during complementary feeding and children had low dietary diversity score. This high prevalence of anaemia in the current study, might be because children often consume foods with low iron content and in which the bioavailability of iron is poor. The prevalence of anaemia in the current study is of severe public health significance as it is well above the 40% WHO threshold (WHO, 2011b).

Low iron concentration is normally associated with low dietary intake of food rich in these micronutrients (Camaschella, 2015). Even though South Africa had legislated fortification of flour and maize to reduce micronutrients malnutrition, food introduced during childhood includes small amounts of food rich in iron with a high content of substances such as phytates, oxalates, tannins and fibre that interfere with iron absorption (Mitchodigni *et al*., 2018). Many low-income households in rural areas of South Africa are highly dependent for survival on social grants (old age pension and child support grants) and this makes it difficult for them to purchase food which could meet their daily requirements of nutrients because of the high cost of foods especially the protein-rich food (Motadi *et al.,* 2015). Insufficient consumption of iron leads to physical work capacity and growth retardation and alterations in the neurological function being compromised (Hotz & Brown, 2004; Roganović & Starinac, 2018). Most studies have found associations between iron-deficiency anaemia and poor cognitive and motor development and behavioural problems (Bailey *et al*., 2015; Rothman *et al*., 2018).

The findings of the current study revealed that children who were still breastfeeding were more likely to have normal haemoglobin as compared to those who were no longer breastfeeding. This finding is coherent with the study conducted in Nepal where continuing breastfeeding was associated with normal haemoglobin level among children under two years (Chindyo *et al*., 2016). Although the concentration of iron in breastmilk is relative low, but it is highly bioavailable (Ziegler, 2011; Friel *et al*., 2018). Similarly, the study conducted in Nablus revealed the significate relationship between continue breastfeeding and haemoglobin concentration level (Salah *et al*., 2018). According to Marques *et al*. (2016), mothers with poor haemoglobin status during the breastfeeding process are more likely to influence the haemoglobin status of children especially in the first six months of life. Similarly, a study conducted in rural Kenya found that duration of breastfeeding was a positive predictor for haemoglobin status of young children (Uyoga *et al*.,

2017). This finding suggests that mothers should provide infants with an adequate source of iron after six months of exclusive breastfeeding, which would help prevent anaemia.

Infant feeding practices such as poor complementary feeding practices is considered as the main cause of malnutrition among children under five years (Mitchodigni *et al*., 2018). The results in the current study shows that children who were introduced to complementary feeding before the age of six months were likely to have anaemia as compared to those who were not yet introduced to complementary feeding (p=0.001). These findings are coherent with the study conducted in Cambodia by Reinbott *et al*. (2016) where introduction of complementary foods was associated with low level of haemoglobin. On contrary, the study conducted in Nablus found no relationship between the introduction of complementary foods and haemoglobin concentration level amongst infant and young children (Salah *et al*., 2018). The study further revealed that the majority of children did not consume iron-rich foods in the past 24 hours. According to Mitchodigni *et al*. (2018) consumption of foods with limited micronutrient is associated with increased risk of micronutrient deficiency.

5.7.3 Iron Deficiency

Iron deficiency as indicated by low serum ferritin (12µg/dl) and serum transferrin (<2.0 g/L) were present in 13% and 2.9% of children respectively. The majority of children (82.6%) had normal values for serum iron while 86.9% had normal iron stores. In addition, almost all (97.1%) of children had normal values for serum transferrin while 63% had normal saturation transferrin. The prevalence of iron deficiency (serum ferritin < 12µg/dl) was higher when compared to NFCS-FB, (2005) survey and the SANHANES-1, (2012) survey where 7.8% and 8.1% of children under five years were iron deficient. The current findings were even lower than Motadi *et al*. (2015) who reported that 7.2% and 28.1% of children were iron deficient. Iron deficiency during childhood is the form of nutritional deficiency that results from negative iron balance caused by insufficient dietary intake, absorption, and utilisation of iron, increased requirements of iron during growth, blood loss due to infections from parasites such as malaria, soil-transmitted helminth infestations and schistosomiasis (Fançony *et al*., 2020).

Baumgartner *et al.* (2013) reported that low ferritin levels in children are by iron deficiency and diet that lack iron. In addition, inflammation and infections increases ferritin levels and they are also known as inflammatory marker together with CRP. The prevalence found in the current study of iron deficiency suggested that the serum concentrations of ferritin closely reflect the pool of

iron stores. Lower iron status among children in the current study maybe due to dietary factors and parasites even though the parasite was not determined (Ngui *et al*., 2012). Moreover, the most important one in the dietary factors might have been the low intake of iron-rich food in diet and the phytates, oxalates, tannins and fibre content found in legumes and vegetables consumed by the population which might have impeded absorption of iron (Akodu *et al*., 2016). Furthermore, in the current study in was found that children were consuming monotonous diet based on starchy with limited micronutrients. These children are at more risk of iron deficiency because of increased requirements during their rapid growth (Akodu *et al*., 2016). Even though South Africa has implemented food fortification (2003) in the past 10 years, the deficiency of iron still exists in most rural areas among children less than five years of age.

5.8 Conclusion

In this chapter, study results on socio-demographic characteristics of the participants, breastfeeding practices, complementary feeding practices and nutritional status of children were discussed. Furthermore, relationship between nutritional status of children and feeding practices were discussed as well. The study results were discussed in the context of the current scientific literature. The limitations of the study were also discussed in terms of the possible impact on the results.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6. Introduction

This chapter presents conclusions and recommendations made in terms of the results obtained.

6.1 Conclusion

The socio-demographic characteristics of the current study was comparable to that in other studies done in developing or rural area. More than half of children (52.4%) were males while 47.6% were females. The mean (± SD) age of children in months was 10.53 (±8.39 SD). The mean (± SD) age of mothers in years was 27.79 (±7.13SD). Majority of mothers (79.6%) had attained secondary education, 16.8% had tertiary education, 3.2% had attained primary education while few never attended school. Mothers who attained secondary and higher education are more likely to accept health education information. Three quarter of mothers were unemployed and relied on social grants with an income of R1000 to R1999 per months. Considering the low household income observed in this study may pose a risk for the low food security, particularly in rapid recent increases in South African food prices. The results of this study revealed that the majority of households had access to tap water while few still rely in water from river or dam. The results show that most households were using both firewood and electricity as the main source of cooking fuel. Just above half of households had livestock, which could get money if they sell. Therefore, money can be used to buy foods to ensure household food security.

Breastfeeding from birth up to two years even beyond have a range of health benefits to the child. In South Africa, National Department of Health has adopted different policies, and programmes aimed to promote and support breastfeeding practices among mothers. The results from the study shown that most of mothers initiated breastfeeding within an hour after birth while exclusively breastfeeding for the first six months was rarely practised. At the time of the study, the majority of mothers were still breastfeeding while few mothers were no longer breastfeeding. The reasons for stopping breastfeeding was mainly going back to school/work, medical condition, and the child refusing the breast. Appropriate complementary feeding practices play vital role to determine short-term and long-term effects on the children. Most of the children were introduced to complementary fluids or foods earlier than six months as recommended by WHO/UNICEF. The most frequently reported reasons for giving complementary fluids or foods to children was to

quench thirst, advises from parents or relatives, and cooling children temperature. Children who receive complementary foods before six months are increasingly at high risk of diarrhoea diseases or gastrointestinal infection and food allergies. Most of the children had not attained minimum dietary diversity while only few attained dietary diversity. Most of the children did not consume any vitamin A-rich foods and iron-rich foods in the past 24 hours at the time of interview.

The results of this study show that infant feeding practices such as giving water, the introduction of complementary feeding were associated with anthropometric status such as underweight, wasting and stunting ($p<0.05$).

The results indicate that the majority of children had normal anthropometric status at birth and during the time of interview, while few children were underweight, wasted, stunted and overweight respectively. The severity of underweight, wasting and stunting among children in the current study was low when compared to WHO global threshold.

Although South Africa implemented vitamin A supplementation programme, food fortification to reduce micronutrients malnutrition, vitamin A, anaemia, iron deficiency still exists among children under five years. The results of this study show that more than three quarter (78.2%) of children had a normal serum retinol concentration while 21.7% were vitamin A deficiency. Nearly half of children (46.4%) had normal haemoglobin concentration while 53.6% were anaemic. Most children had normal serum iron, serum ferritin, serum transferrin, saturation transferrin while few were iron deficiency.

The results of this study show that infant feeding practices such as stopping breastfeeding, giving water, the introduction of complementary foods were associated with micronutrients status such as low haemoglobin, vitamin A, iron deficiency ($p<0.05$).

6.2 Recommendations

- The study revealed that the majority of mothers were unemployed and relied on social grants. Therefore, it is recommended that mothers should be encouraged to initiate poverty alleviation projects, which will assist them to generate income. Moreover, the researcher can organise with the University of Venda School of Business Management to assist them with training which will help them to establish fundable business. Mothers could also be linked with the South Africa government small business development such Small Enterprise Development Agency (Seda) for the support of these initiatives with funding and training provision.

- In the current study, most mothers initiated breastfeeding within an hour of birth while exclusively breastfeeding up to six months was rarely practiced. Furthermore, most children were introduced to complementary feeding earlier than recommended time, children were also fed with cereal based diet which lack variety. Therefore, it is recommended that nutrition intervention studies be conducted focusing on improving infant feeding practices through nutrition education. In addition, nutrition education should also include demonstration on how to prepare meals and feed their children using local foods.

- This was a quantitative study and was limited in exploring details of feeding practices. Therefore, it is recommended that further research should be done focusing on qualitative study to get insight on different factors behind poor infant and young child feeding practices observed in the current study. This will help to develop and implement better strategy towards the improvement of the infant and young child feeding practices.

- Health professionals should promote the use of mass media and mom-connect as the platforms that may be utilised more optimally to disseminate information on infant and young child feeding practices to young mothers. Although not all households have internet access, the majority has a radio, television set, or cellular phone.

- De-worming status and infections status amongst children were not determined in the current study. Therefore, it is recommended that further study of this nature should take de-worming status, infections status of children into consideration, since parasite and infections influences micronutrients status significantly.

- Micronutrients deficiency such as vitamin A, anaemia and iron deficiency were observed in the current study. Therefore, it is recommended Nutrition professionals should plan and do campaigns to intensify public awareness of micronutrients and dietary diversity especially in rural communities. Furthermore, this information can also be disseminate using mom-connect and other media platforms.

- The current study was conducted in Thulamela Municipality only, therefore it recommended that same type of study should be conducted in the other part of South African Provinces urban and rural.

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APPENDIX 1

CONSENT TO PARTICIPATE IN RESEARCH

Statement of Agreement to Participants in the Research Study:

I hereby confirm that I have been informed by the researcher, Mugware Anzani about the nature, conduct, benefits and risks of this study – Research Ethics Clearance Number.

I have also received, read and understood the above written information (*Participant letter of information*) regarding the study.

I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initial and diagnosis will be anonymously processed into a study report.

In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.

I may, at any stage, without prejudice, withdraw my consent and participation in the study.

I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

I understand that significant new findings developed during the course of the research which may relate to my participation will be made available to me.

Full Name of Participant Date Time Signature

I,……. ……. ……... ……..……

I, Mugware Anzani herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Full Name of the Researcher

..... Date..... Signature.....

Full Name of Witness (If applicable)

..... Date..... Signature.....

Full Names of Legal Guardian (If applicable)

..... Date..... Signature.....

APPENDIX 1A

THENDELANO YA UVHA TSHIPIDA TSHA THODULUSO

Tshitetemende tsha thendelano uvha tshipida tsha thoduluso iyi:

Ndi khou tenda uri mutodulusi vho mugware vho bviseala khagala nga vhuvha, matshimbidzhele, mbuelo, na hombo ya thoduluso iyi.

Ndo vhala bambiri ya zwidodombedzwa zwothe zwono kwama thoduludo iyi nda zwipfesesa.

Ndo vhudzwa uri zwidodombedzwa zwanga zwido dzumbetshedzwa musi itiwa muvhigo

Ndi cou tenda uri zwothe zwine nda do fhindula zwido shumiwa nga khomphuyutha nga mutodolusi.

Ndi khou zwidivha uri ndinga di bvisa kha thoduluso iyi tshifhinga tshinwe na tshinwe.

Ndo fhiwa tshifhinga tsha u vhudzisa ndisathu di dzhenisa kha thoduluso iyi. Ndi khou di dzhenisa kha thoduluso iyi nga lutamo lwanga.

Ndi cou pfesesa uri nga murahu ha thoduluso iyi mvelele kana phindulo ndinga kona u dzhi fhiwa nda dzi vhala na nne.

Madzina nga vhudalo Datumu Tshifhinga Tshaino

Nne,……. …….. …….. ……

Nne, Mugware Anzani khou tenda uri ndo vhudza mme ngaha vhuvha, matshimbidzele, na khombo ya thoduluso iyi.

Madzina a mutodulusi

.....Datumu .....Tshaino.....

Madzina a thanzi

.....Datumu.....Tshaino.....

Madzina a muthogomeli wa nwana

.....Datumu.....Tshaino .....

APPENDIX 2

LETTER OF INFORMATION

Title of the research study: Nutritional status and feeding practices of children aged 0 to 36 months in Thulamela Municipality, Limpopo Province.

Principal investigators/ researcher : Mugware Anzani

Co-investigator Supervisor : Dr LF Mushaphi

: Mr SA Motadi

Brief introduction and the purpose of the Study

The primary aim of this study is investigate nutritional status and feeding practices of children aged 0 to 36 months in Thulamela Municipality.

Outline of the procedures

The study will be conducted in clinics in Thulamela Municipality. Mothers with children aged 0 to 36 months who agree and sign the consent form will be included in this study. The researcher will interview mothers with children aged 0 to 36 months on breastfeeding and complementary feeding practices using a questionnaire. Anthropometric and biochemical measurements will be taken for children.

Risks or discomforts to the participants

Blood of 5ml will be drawn from children to assess micronutrients status (Vitamin A and Iron). A Professional Paediatric Nurse will be responsible for drawing the blood from children, this will help to minimise the risks.

Benefits

There are no immediate benefits for the participants in this study. However, it is hoped that this study will have a beneficial effect on improving nutritional status and feeding practices of children aged 0 to 36 months. The results of this study will be published as a dissertation and manuscript in a peer-reviewed accredited journal.

Reason why the participants may be Withdrawn from the study

Participation in this study is voluntary, and refusal to participate will involve no penalty or loss of benefit to which the subject is otherwise entitled. Participants may stop participating at any time without penalty or loss of benefits to which participants are otherwise entitled to.

Remuneration

The will be no compensation for participation in this study. Participation is voluntary.

Cost of the Study

The participant will not incur any cost to be included in the study.

Confidentiality

All the information that we will collect about you during the course of the research will be kept strictly confidential. Participants will be interviewed in private or in a consultation room to ensure privacy and confidentiality. No name will be used or recorded on the questionnaire, codes will be used instead of names.

Research-related injury

There will be no compensation for research-related injury. However, the researcher will account for medical cost.

Persons to contact in the event of any problems or queries

Please contact the researcher on 0798091977, my supervisor Dr LF Mushaphi on 0824447326 or the University Research Ethics Committee Secretariat on 015 962 9058. Complaints can be reported to the Director: Research and Innovation, Prof GE Ekosse on 015 962 8313 or Georges Ivo.Ekosse@univen.ac.za.

APPENDIX 2A

Linwalo la zwododombedzwa

Thoho ya thoduluso: Mutakalo wa pfusi na kulisele kwa vhana ubva kha nwedzi wa bebiwa u swikela kha minwedzi ya fumiraru rathi kha Thulamela Municipality, Limpopo Province.

Mutodolusi : Vho Mugware A

Vhathusa mutodolusi : Vho dokotela Mushaphi LF

: Vho Motodi SA

Mvela tswinga na tshivhangalwelwa tsha thoduluso.

Tshipikwa tshihulwane ndi thodisiso ya mutakalo wa pfusi kha vhana ubva kha nwedzi vhare wa u bebiwa u swikela kha minwedzi ya fumiraru rathi kha Thulamela Municipality, Limpopo Province.

Ndila dzine dzado thevhelwa musi hu kho itiwa thoduluso iyi.

Thoduluso ido itwa kha dzi kiliniki dza Thulamela Municipality. Vho mme vhare na vhana ubva kha nwedzi wa u bebiwa u swikkela kha minwedzi ya fumiraru rathi vhane vhado saina thendelano vha dovha tshipida tsha thoduluso iyi. Mutodulusi u do vhudzisa vho mme ngaha u mamisa na na zwiliwa zwine vho mme vhafha vhana. Mielo na malofha zwido dzhiwa kha vhana u itela u tola mutakalo.

Khombo kha tholuduso

Vhana vhado dzhiwa malofha u itela u toliwa pfusi mbili dzi tevhelaho (Vitamin A and Iron). Nese was phorofishinala ndi ene ane ado dzhia malofha aya kha vhana u itela u fhungudza khombo.

Mbuelo

Ahuna mbuelo ene vho mme na vhana vhado wana ngauvha tshipida tsha thoduluso iyi. Fhedzi iyi thodoloso ido dovha hafhu u thusedza kha u fhata ndivho ya mutakalo wa pfusi na kulisele kwa vhudi kwa vhana vhatuku. Mvelelo dza hayi thoduluso dzi do andadzwa nga mabambiri u itela uri nyi na nyi a kone udzi swikelela.

Mbuno dza u di bvisa kha thoduluso.

U vha tshipida tsha thoduluso iyi ndo tou nanaga, ahuna ndatiso arali vha takaleli uvha tshipida tsha thoduluso iyi. Arali vhono nanga uvha tshipida tsha thoduluso iyi fhedziha nga murahu vha tama u di bvisa zwitendelwa husina ndatiso nga ngomu.

Magavhelo

Ahuna magavhelo ane ado fhiwa vho mme uri vhavhe tshipida tsha thoduluso iyi. Vho mme vhadovha tshipida nga funa.

U badelwa uvha tsipida

Vho mme avhanga badelwi uvha tshipida tsha thoduluso iyi

Tsireledzo ya phindulo dza vho mme.

Zwothe zwine vho mme vhado fhindula zwido tsireledziwa uri zwisi punde. Vho mme vhado vhudzisiwa vha fhethu ho tsireledzeho. Ahuna dzina kana zwidodombedzwa zwado nwaliwa fhasi, mutodulusi udo shumisa khoudu u itela utsireledza zwidodombedzwa zwa vho mme na vhana.

U huvhala vha tshipida tsha thoduluso

Ahuna magavhelo arali vhanga huvhala vha tshipida tsha thoduluso iyi. Fhedzi mutodulusi u tea u dzhia vhudifhinduleli.

Zwidodombedzwa arali vhana mbudziso

Vhanga kwama mutodulusi vho Mugware kha nambara dza lutingo hadzi 0798091977, na mueletshedzi wavho vho dokotela Mushaphi kha 0824447326 kana yunivesithi ya venda kha 015 962 9058. Mbilaelo vhanga kona u dzi vhiga vha muhulwane wa tshitoduluso vho phorofesa GE Ekosse kha nambara dzi tevhehelaho 015 962 8313 kana kha ivo.ekose@univen.ac.za

APPENDIX 3

QUESTIONNAIRE

Topic: Nutritional status and feeding practices of children aged 0 to 36 months in Thulamela Municipality, Limpopo Province.

Instruction: fill in the spaces provided and give one answer.

Participant code

Date of interview: DD_____MM_____YYYY_____

Name of interviewer: _____

SECTION A: Socio-demographic information

1. Date of birth (child): DD_____MM_____YYYY_____

2. Date of birth (mother: DD_____MM_____YYYY_____

3. Gender of child

1	Male	
2	Female	

4. Marital status

1	Single	
2	Married	
3	Divorced	
4	Co-habiting	
5	Separated	
6	Widowed	

5. Highest education level of the mother

1	Never attended	
2	Grade 1 – 4	
3	Grade 5 – 7	
4	Grade 8 – 10	
5	Grade 11 – 12	
6	Passed grade 12	
7	Tertiary	

6. What is your employment status?

1	Employed	
2	Unemployed	

7. If employed, type of employment

1	Self employed	
2	Teacher	
3	Health worker	
4	Domestic worker	
5	Other (specify);	

8. Monthly income of the family/household

1	Less than R500	
2	R1000 – R2000	
3	R2000 – R5000	
4	R6000 – R10000	
5	R10000 above	

9. Fuel for cooking

1	Electricity	
2	Paraffin	
3	Firewood	
4	Other, (specify);	

10. Main source of drinking water

1	Own tap in house	
2	Communal tap	
3	River/Dam	
4	Borehole/Well	
5	Other (specify);	

11. Livestock in the household

1	Chicken	
2	Cattle	
3	Sheep	
4	Goat	
5	Other (specify);	

12. Number of household members

1	One	
2	Two	
3	Three	
4	Four	
5	Other (specify);	

13. Number of children under the age of five years

1	One	
2	Two	
3	Three	
4	Four	
5	Other (specify);	

SECTION B: Breastfeeding practices

14. How long after birth did you first put the child to the breast?

1	Immediately after delivery	
2	A day after birth	
3	Week after birth	
4	Other (specify);	

15. Who helped you to initiate breastfeeding?

1	Nurse	
2	Doctor	
3	Dietitian/Nutritionist	
4	Other (specify);	

16. During the first three days after delivery, was child given anything to drink other than breast milk?

1	Yes	
2	No	

If yes, please answer question number 17

17. What was child given to drink?

1	Plain water	
2	Sugar or glucose water	
3	Gripe water	
4	Tea/ infusion	
5	Honey	
6	Other (specify);	

18. Where you taught about breastfeeding?

1	Yes	
2	No	

19. If yes, who taught you?

1	Health worker	
2	Close relatives (parents, grandparents, spouse and sibling)	
3	Media (Newspaper, magazine, radio, and TV	
4	Peers (friends, colleagues and fellow mothers	
5	Momconnect	
6	Other (specify);	

20. Are you still breastfeeding?

1	Yes	
2	No	

If no to question 20 above, please answer question 21 – 23 below.

If yes to question 20 above, please answer question 24 – 28 below.

21. How old was your baby when you stop breastfeeding?

1	Less than 1 months	
2	2 – 5 months	
3	6 – 12 months	
4	12 – 24 months	
5	<24 months	
6	Other (specify);	

22. Why did you stop breastfeeding?

1	Medical condition	
2	The baby refused breast	
3	Going back to school/work	
4	Not enough Breastmilk	
5	Previous experience/bad experience	
6	Other (specify);	

23. Did any of the following people wanted you to stop breastfeeding?

1	Baby's father	
2	Parents/parents in law	
3	Another relative	
4	Health professional	
5	Employer or supervisor	
6	Other (specify);	

24. Why did you choose to breastfeeding.

1	Perfect food for child	
2	Protect child against diseases	
3	Free	
4	Bonding between mother and child	
5	Other (specify);	

25. How often do you breastfeed your child per day?

1	Once per day	
2	Twice per	
3	Trice per day	
4	Four-time per day	
5	Five-time per day and more	

26. How do you breastfeed?

1	On demand	
2	On schedule time	
3	At your own time	
4	Other (specify);	

27 Do you offer both breasts at every feed?

1	Yes	
2	No	
3	Sometimes	

28. How long do you intend continuing breastfeeding your child?

1	Less than 4 months	
2	Between 4 – 6 months	
3	Between 6 – 12 months	
4	Longer than 12 months	
5	Two years and beyond	

29. Is your baby on infant formula milk?

1	Yes	
2	No	

If yes to question 29 above, please answer question 30 – 37 below.

30. What type of infant formula milk are you giving your child?

1	Nan	
2	Nido	
3	Lactogen	
4	Other (specify);	

31. When did you start giving infant formula milk?

1	1 – 2 weeks	
2	3 – 4 weeks	
3	2 – 5 months	
4	<6 months	
5	Other (specify);	

32. Reasons for giving infant formula?

1	Medical condition	
2	Baby refuse breast	
3	Going back to school or work	
4	Advised by family	
5	Other (specify);	

33. Did you discuss your choice of the formula with a health professional?

1	Yes	
2	No	

34. Did a health professional tell you how to prepare formula and store prepared formula?

1	Yes	
2	No	

35. How do you give infant formula?

1	Bottle feeding	
2	Cup feeding	
3	Spoon feeding	
4	Other (specify);	

36. Did you ever switch formula because your baby had a problem with the formula you were using?

1	Yes	
2	No	

37. What type of problem did your baby have with formula?

1	An allergic reaction or intolerance	
2	Constipation	
3	Diarrhea	
4	Vomiting	
5	Other (specify);	

39. Do you give your child water?

1	Yes	
2	No	

If yes to question 39 above, please answer 40 – 42 below.

40. When did you start giving your baby water?

1	0 – 2 months	
2	3 – 4 months	
3	5 – 6 months	
4	above 6 months	

41. Indicate the reason for giving water

1	Advised by parents/ relatives	
2	To quench thirst	
3	To cool baby temperature	
4	Other, specify:	

42. How do you give water to your child?

1	Bottle feeding	
2	Cup feeding	
3	Spoon feeding	
4	Other (specify);	

43. How do you feed your baby?

1	Breast milk alone	
2	Infant formula alone	
3	Breast milk, infant formula, and food	
4	Infant formula and food	
5	Breast milk and water	
6	Breast milk, water, and food	

44. Which of the following statements is closest to your opinion? The best way to feed 3 months old baby is?

1	Breastfeeding	
2	A mix of both breast and formula feeding	
3	Formula	
4	Breastfeeding and formula are equally good ways to feed a baby	

SECTION C: Complementary feeding practices

45. Do you give your child complementary foods?

1	Yes	
2	No	

If yes to question 45 above, please answer question 46 below

46. When did you start introducing complementary foods?

1	1 week after birth	
2	2 to 3 months	
3	4 to 6 months	
4	Above 6 months	

47. Where you taught about complementary feeding practices?

1	Yes	
2	No	

If yes to question 47 above, please answer question 50 – 51 below.

50. Who taught you about complementary feeding?

1	Health worker	
2	Close relatives (parents, grandparents, spouse and sibling)	
3	Media (Newspaper, magazine, radio, and TV	
4	Peers (friends, colleagues and fellow mothers	
5	Mom connect	
6	Other (specify);	

51. What were you taught about complementary feeding?

……
……

52. What was the first food given to the child?

……
……

53. Which type of food do you usually give the child?

……
……

54. What was the reason for giving complementary foods?

1	Baby cries a lot	
2	Insufficient production of breast milk	
3	Advise of relatives	
4	Advise of Health worker	
5	Other (specify);	

55. Where you taught which foods are good for your baby?

1	Yes	
2	No	

If yes to question 55 above, please answer the question 56 below

56. If yes, mention those foods

……
……

57. Dietary diversity questionnaire.

Instruction: Please describe the foods (meals and snacks) that child ate yesterday during the day and night, whether at home or outside the home.

Breakfast	Snack	Lunch	Snack	Dinner	Snack

APPENDIX 4

RECORD SHEET

SECTION D

Participant code

I. Name of interviewer: _____

2. Date of data collection: DD_____MM_____YYYY_____

3. Child's date of birth: DD_____MM_____YYYY_____

4. Child gender

1	Male	
2	Female	

5. Birth weight (kg):_____

6. Birth length (cm):_____

7. Child weight:

First (kg):	Second (kg):	Average (kg):

8. Child length/height:

First (cm):	Second (cm):	Average (cm):

9. Child MUAC:

First (cm):	Second (cm):	Average (cm):

10. Was blood sample successfully collected?

	Blood collection status	
1	Yes	
2	No	

11. If no, what was the reason?

……

……

12. Type of blood

Type of blood	**Blood values**					
Plasma retinol (µg/dL)						
Serum Iron (µmol/L)						
Serum Ferritin (µg/L)						
Serum transferrin						
Transferrin (% saturation)						
Hemoglobin						

APPENDIX 3A

SIITARI LA DZI MBUDZISO

Thoho ya thoduloso**:** Mutakalo wa pfusi na kulisele kwa vhana ubva kha nwedzi wa bebiwa u swikela kha minwedzi ya fumiraru rathi kha Thulamela Municipality, Limpopo Province.

Ndaela: Avha fhe phindulo kha magake.

Khoudu

Duvha la vhudzisa: Duvha_____nwedzi_____nwaha_____

Dzina la muvhudzisi: _____

Tshipida tsha u thoma (A): Zwidodombedzwa zwa mme na nwana

1. Mabebo a nwana: Duvha_____nwedzi_____nwaha_____

2. Mabebo a mme: Duvha_____nwedzi_____nwaha_____

3. Mbeu ya nwana

1	Mutukana	
2	Musidzana	

4. Tshiimo tsha mbingano

1	Thingo maliwa	
2	Ro malana wa mulayo	
3	Ro talana wa mulayo	
4	Ri dzula rothe	
5	Rofhambana	
6	Tshilikadzi	

5. Pfunzo ya nthesa ya mme

1	Athingo dzena tshikolo	
2	Murole wa u thoma uya kha wa vhuna	
3	Murole wa vhutanu ya kha sumbe	
4	Murole wa vhumalo uya kha fumi	
5	Murole wavhu fumithihi uya kha fumimbili	
6	Phasa murole wa fumimbili	

7	Uya magudidzini a ntha	

6. Vhaya shuma?

1	Ndia shuma	
2	Athi shumi	

7. Vha shuma ngafhi?

1	Ndi tou dishuma	
2	Mudededzi	
3	Shuma kha mutakalo	
4	Shuma mudini	
5	Vhanwe vha shuma ngafhi	

8. Vha wana vhugai nga nwedzi

1	Fhasi ha R500	
2	R1000 – R2000	
3	R2000 – R5000	
4	R6000 – R10000	
5	Ntha ha R10000	

9. Vha shumisa mini bika?

1	Mudagasi	
2	Pharafini	
3	Khuni	
4	Zwinwe	

10. Tshiko tsha madi

1	Bommbi nduni	
2	Bommbi ya shango	
3	Mulamboni/ damuni	
4	Tshisimani	
5	Hunwe	

11. Vho fuwa mini hayani

1	Khuhu	
2	Kholomo	
3	Nngu	
4	Mbudzi	
5	Zwinwe	

12. Vha dzula vha vhangana hayani

1	Muthihi	
2	Vhavhili	
3	Vhararu	
4	Vhana	
5	Ntha ha vhana	

13. Vhana vhare fhasi ha minwaha mitanu ndi vhanaga hayani

1	Muthihi	
2	Vhavhili	
3	Vhararu	
4	Vhana	
5	Ntha ha vhana	

Tshipida tsha vhuvhili (B): U mamisa

14. Vho thoma lini u mamisa?

1	Ndi tshi tou fhedza u beba	
2	Duvha nga murahu hau beba	
3	Vhege nga murahu hau beba	
4		

15. Vha thusiwa nga nnyi u thoma u mamisa

1	Nese	
2	Dokotela	
3	Mudivhi nga kulele	
4	Munwevho	

16 Nga murahu ha maduvha mararu vha tshifhedza u beba vho nwana zwiludi zwa unwa?

1	Ee	
2	Hai	

Arali vho tenda a vha fhindule kha 17

17. Vho mufha mini

1	Madi	
2	Madi na swigiri	
3	Madi a girepi	
4	Tie	
5	Mutoli	
6	Zwinwe	

18. Vho funziwa ngau mamisa?

1	Ee	
2	Hai	

19. Vho tenda, vho funziwa nga nnyi?

1	Nga vhamutakalo	
2	Mashaka a tsini	
3	Nga andadza mafhungo	
4	Nga vhashumisani	
5	Momconnect	
6	Zwinwe	

20. Vha khadi mamisa?

1	Ee	
2	Hai	

Arali vha sitsha mamisa avha fhindule mbudziso ya 21 uya kha 23

Arali vha tshikhadi mamisa avha fhindule mbudziso ya 24 ya kha 28.

21. Vho litsha u mamisa nwana ana minwaha mingana?

1	Asathu fara nwaha	
2	Minwedzi mivhili uya kha mitanu	
3	Nwedzi ya rathi uya kha fumbili	
4	Nwaha uya kha minwaha mivhili	
5	Ono fhira minwaha mivhili	

22. Ndi ngani vho litsha u mamamisa?

1	Nga lwala	
2	Nwana a cou hana damu	
3	Humela tshikoloni kana mushumoni	
4	Mukando u mutuku	
5	Nga zwithu zwisi zwavhudi zwobvelelaho murahu	
6	Zwinwe vho	

23. Afho huna vhathu vha tshi khou toda vhatshi litsha u mamisa?

1	Khotsia nwana	
2	Vho mazwale	
3	Nga mashaka	
4	Vha mutakalo	
5	Vha hulwane mushumoni	
6	Vhanwe vho	

24.Ndi ngani vho nang u mamisa.

1	Zwiliwa zwa pfusi	
2	Tsireledza kh malwadze	
3	Nga uri mukando a urengisiwi	
4	Vhusaka vhukati ha nwana na mubebi	
5	Zwinwe vho	

25. Vha mamisa lungana nga duvha?

1	Luthihi	
2	Luvhili	
3	Luraru	
4	Luna	
5	Lutanu uya ntha	

26. Vha mamisa hani?

1	Nga thodea	
2	Ng tshifhinga	
3	Nga tshifhinga tshavho	
4	zwinwevho	

27 Vha mamisa nga madamu othe?

1	Ee	
2	Hai	
3	Tshinwe tshifhinga	

28. Vhado mamisa u swikela lini?

1	U swikela minwedzi	
2	Vhukati ha minwedzi mina u swikela khaya rathi	
3	Vhukati haya rathi na fumbili	
4	Ufhira fumbili	
5	U swikela minwaha mivhili nau fhirisa	

29. Vha a mamisa nwana mafhi a tshikhuwa?

1	Ee	
2	Hai	

Vho tenda kha mbudziso ya 29, avha fhindule ubva kha 30 u swika kha 37.

30.Vha mamisa afhio mafhi?

1	Nan	
2	Nido	
3	Lactogen	
4	Manwe	

31. Vho thoma lini ufha mafhi

1	Vhege yo thoma na ya vhuvhili	
2	Vhege ya vhuraru na ya vhuna	
3	Nwedzi wa vhuvhili na ya vhutanu	
4	Unovha na minwedzi ya vhurathi	
5	Minwedzi mingana	

32. Ndi ngani vho fha nwana mafhi?

1	Ndia vhaisala	
2	Nwana u cou hana damu	
3	Cou humela mushumoni na tshikoloni	
4	Tutuwedziwa nga muta	
5	Dzinwe mbuno	

33. Vho wana ngeletshedzo ngaha mafhi khavha mutakalo?

1	Ee	
2	Hai	

34. Vho eletshedziwa ngaha u ita mafhi na u avhulunga?

1	Ee	
2	hai	

35. Vha mufha mafhi nga mini?

1	Nga bedelo	
2	Nga khaphu	
3	Nga lebula	
4	Inwe ndila	

36. Vhono shandukisa mafhi nga uri nwana una ha mufari zwavhudi?

1	Ee	
2	Hai	

37. Nwana onovha na thaidzo ifhio nga mafhi

1	U thothoniwa na aledzhi	
2	Pateliwa	
3	U shela	
4	U tanzha	
5	Zwinwevho	

39. Vha fha madi nwana?

1	Ee	
2	Hai	

Arali vho fha nwana madi vha fhindule mudziso ya 40 u swikela kha 42 afho fhasi.

40. Vho thoma lini u mufha madi

1	Nwedzi mivhili	
2	Nwedzi miraru uya kha mina	
3	Nwedzi mitanu uya kha rathi	
4	Nwedzi ya ntha ha rathi	

41. Ndi ngani vho fha nwana madi

1	Tsivhudziwa nga muta	
2	Nwana ana dora	
3	Nwana na cou mufhiso	
4	Zwinwe vho	

42. Vha fhisahani nwana madi?

1	Bedelo	
2	Khaphu	
3	Lebula	
4	Inwe ndila	

43. Vhafha nwana mini zwa ula?

1	Mukando fhedzi	
2	Mafhi fhedzi	
3	Mukando na mafhi fhedzi	
4	Mafhi na zwiliwa	
5	Mukando na madi	
6	Mukando, madi and zwiliwa	

44. Ndi dzifhio ndila dza ufha nwana zwiliwa dza khwine

1	U mamisa	
2	Zwothe u mamisa na mafhi	
3	Mafhi fhedzi	
4	Mukando na mafhi zwothe	

Tshipida tsha vhuraru (C): Zwiliwa zwa nwana

45. Vhaya fha nwana zwiliwa?

1	Ee	
2	Hai	

Arali vho fha nwana zwiliwa avha fhindule mbudziso ya 46 afho fhasi.

46. Vho thoma lin ufha nwana zwiliwa?

1	Ana vhege	
2	Nwedzi mivhili uya kha miraru	
3	Nwedzi mina uya khaya rathi	
4	Ntha ha minwedzi ya rathi	

47. Vho funzwa nga ufha nwana zwiliwa?

1	Ee	
2	Hai	

Arali vho funziwa avha fhindule mudziso ya 50 na 51 fho fhasi.

50. Vho funziwa nga nnyi?

1	Vhamutakalo	
2	Mashaka	
3	Nga vha andadza mafhungu	
4	Khonani na vhashumisani	
5	Mom connect	
6	Vhanwe vho	

51. Vho funziwa mini nga ha ufha zwiliwa?

……
……

52. Vho thoma ufha nwana zwiliwa de?

……
……

53. Ndi zwifhio zwiliwa zwine vha dzulela ufha nwana?

……
……

54. Ndi ngani vho thoma ufha nwana zwiliwa?

1	Nwana a khou lila	
2	Mukando wovha u mutuku	
3	Thuthuwedzo ya mashaka	
4	Thuthuwedzo ya vhamutakalo	
5	Dzinwe mbuno	

55. Vho funziwa uri zwiliwa zwavhudi zwa nwana ndi zwifhio?

1	Ee	
2	Hai	

Aril vho funziwa avha fhindule mbudziso ya 56 afho fhasi

56. Vho funziwa, ndi zwifhio zwiliwa zwavhudi zwa nwana?

……
……

57. Mbudziso ngaha zwiliwa zwofhambana zwe nwana ala.

Ndaela: ndi zwifhio zwiliwa zwe nwana ala ubva nga matsheloni u swikela nga madekwana mulovha, hungavha hayani kana nnda ha hayani.

Zwa matsheloni	Zwi sinike	Zwa masiari	Zwi sineke	Zwa madekwana	Zwi sineke

APPENDIX 4A

Siitari la u rekhoda

Tshipida tsha vhuna (D)

Khoudu

I. Dzina na muvhudisi: _____

2. Duvha la thodoloso: duvha_____nwedzi_____nwaha_____

3. Mabebo a nwana: duvha_____nwedzi_____nwaha_____

4. Mbeu ya nwana

1	Mutukana	
2	Musidzana	

5. Tshileme tsha mabebo (kg): _____

6. Vhulapfu ha mabebo (cm): _____

7. Tshileme:

Tsha u thoma (kg):	Thavhuvhili (kg):	Tsha vhukati (kg):

8. Vhulapfu:

Ha uthoma (cm):	Ha vhuvhili (cm):	Ha vhukati (cm):

9. Muelo kha tshishasha:

Wa u thoma (cm):	Wa vhuvhili (cm):	Wa vhukati (cm):

10. Nwana o dzhiwa malofha?

1	Ee	
2	Hai	

11. Arali nwana asongo dzhiwa ndi ngani?

……

……

12. Malofho ndia u tola pfusi ifhio?

Malofha a u tola pfusi	**Tshikalo tsha pfusi**					
Plasma retinol (µg/dL)						
Serum Iron (µmol/L)						
Serum Ferritin (µg/L)						
Serum transferrin						
Transferrin (% saturation)						
Hemoglobin						

APPENDIX 5

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Mr A Mugware

Student No:
11611087

PROJECT TITLE: **Nutritional status and feeding practices of children under three years in Thulamela Municipality, Limpopo Province.**

PROJECT NO: **SHS/19/NUT/01/1503**

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr LF Mushaphi	University of Venda	Supervisor
Mr SA Motadi	University of Venda	Co - Supervisor
Mr A Mugware	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: March 2019
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: .....
Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse

UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2019 -03- 25
Private Bag X5050
Thohoyandou 0950

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950λ LIMPOPO PROVINCEλ SOUTH AFRICA
TELEPHONE (015) 962 8504/8313 **FAX** (015) 962 9060
"A quality driven financially sustainable, rural-based Comprehensive University"

APPENDIX 6

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH

Ref: LP_201904_006
Enquiries: Stander SS
Tel: 015 293 6650
Email: research.limpopo@gmail.com

MUGWARE A
University of Venda
Private Bag x 5050
Thohoyandou
0950

Greetings,

RE: NUTRITIONAL STATUS AND FEEDING PRACTICES OF CHILDREN UNDER THREE YEARS IN THULAMELA MUNICIPALITY, LIMPOPO PROVINCE

Permission to conduct the above mentioned study is hereby granted.

1. 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, or incur any cost on the Department.
   - 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 1 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

02/05/2019
Date

Private Bag X9302 Polokwane
Fidel Castro Ruz House, 18 College Street, Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.

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APPENDIX 7

The Department of Health
Private Bag X5006
Thohoyandou
0950.

RE: Application for permission to conduct research in Thulamela municipality clinics

Dear Sir / Madam

My name is Mugware Anzani (student number: 11611087). A registered Masters in Public Nutrition with University of Venda (UNIVEN) – Department of Nutrition in the school of health sciences. I wish to conduct research project titled: "Nutritional status and feeding practices of children under three years in Thulamela Municipality, Limpopo Province". I therefore request your office to grant me permission to conduct a research project in Thulamela municipality clinics. I have provided you with an approval letter which I received from the UNIVEN Research Ethics Committee (Human) and an approval letter from the Provincial Department of Health.

My study Supervisors are Dr. LF Mushaphi and Mr SA Motadi. Upon completion of the study, I will provide the Department of Health with a bound copy of the full research report. If you require any further information, please do not hesitate to contact me on 015 962 8617, cell 079 8091 977 / 0798226364 and anzanimugware@gmail.com, Thank you for your time and consideration in this matter.

Yours Sincerely

Anzani Mugware

29/05/2019

APPENDIX 8

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OFHEALTH
VHEMBE DISTRICT

Ref: S5/6
Enq: Muvari MME
Date: 29 May 2019

Dear Sir/Madam..ANZANI MUGWARE

Permission to conduct a research on the
"..NUTRITIONAL STATUS AND FEEDING PRACTICES..".

1. The above matter refers.

2. Your letter received on the 29 May 2019 requesting for permission to conduct an investigation is hereby acknowledged.

3. The District has no objection to your request.

4. Permission is therefore granted for the study to be conducted within Vhembe District. You are expected to submit the results to the District.

5. You are however advised to make the necessary arrangements with the facilities concerned.

Wishing you success in your endeavors.

..... 29.05.2019
CHIEF DIRECTOR: DISTRICT HEALTH DATE

Private Bag X5009 THOHOYANDOU 0950
OLD parliamentary Building Tel (015) 962 1000 (Health) (015) 962 4958 (Social Dev) Fax (015) 962 2274/4623
Old Parliamentary Building Tel: (015) 962 1848, (015) 962 1852, (015) 962 1754, (015) 962 1001/2/3/4/5/6 Fax (015) 962 2373, (015) 962 227

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APPENDIX 9

Balote Projects (Pty) Ltd

Cell no: 084 255 2164 **Email:** matlou.moloto@gmail.com
P O Box 1106, Faunapark, 0787
Reg No: 2017/113184/07
Tax Ref: 9299915224

EDITING CERTIFICATE- DISSERTATION

18 July 2021

TO WHOM IT MAY CONCERN

This serves as confirmation that I Matlou Moloto have edited the proposal of Mr Mugware Anzani entitled "**NUTRITIONAL STATUS AND FEEDING PRACTICES OF CHILDREN AGED 0 TO 36 MONTHS IN THULAMELA MUNICIPALITY, LIMPOPO PROVINCE"** to be submitted for the qualification Master of Science in Public Nutrition at the University of Venda.

I therefore, declare that the document is to my knowledge devoid of language errors that may deprive the said persons' work from being accepted for the qualification.

I am contactable at the above contact details should you have queries.

Matlou Moloto (Miss)

Editor's Information: MPhil Second Language Studies (Stellenbosch) BEd Language Methodology (University of Limpopo) BA Languages (University of Limpopo) Higher Education Diploma (University of Limpopo) member of the Professional Editors Group (PEG)

Open Rubric