MATERNAL NUTRITIONAL KNOWLEDGE, CHILD FEEDING PRACTICES, AND NUTRITION STATUS IN NJOMBE AND GEITA TANZANIA - ETHNICITY PERSPECTIVE

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN PROJECT MANAGEMENT AND EVALUATION OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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EXTENDED ABSTRACT

Stunting is still one of the major public health issues affecting developing countries, including Tanzania. Despite the effort to achieve child health, more than half of children aged less than five years were stunted. Njombe and Geita are among the regions with a higher prevalence of child stunting in Tanzania. Stunting arises as a result of the cumulative effects of suboptimal Infant and Young Child Feeding Practices (IYCF) practices; poor maternal nutrition knowledge; and poor maternal and child health conditions. There is little information on whether perception of ethnicity had an effect on executing IYCF and maternal knowledge purposely to improve child nutrition status. This study assessed maternal nutritional knowledge, IYCF feeding practices, child nutrition status, and the respective roles of nutrition interventions in regions with high rates of stunting and different ethnicities (Geita and Njombe), Tanzania. A cross-section study was conducted on a sample of 150 mother-child pairs that were randomly selected within regions of high stunting rates (Njombe and Geita) in Tanzania. This study was piloted in the first quarter of 2020.

A structured questionnaire was used for collecting socio-demographic, feeding practices, and anthropometric data. Individual dietary diversity scores were from 24-hourse recall; birth date was calculated from the child's growth card; and standard anthropometric procedures were used to obtain child height and weight. Major ethnic groups from each district were merged to satisfy the statistical power. The ENA for SMART software was used for HAZ, WAZ, and WHZ, and then entered into IBM SPPS Statistics 21 for further analysis. Descriptive and logistic regression models were used to summarize data and explore causes and factors (socio-demographic features and IYCF practice indicators) of child stunting. In the Njombe and Bukombe districts, both had optimal IYCF practices

whereby 46.9% of infants-initiated breast milk within 1 hour after birth; minimum dietary diversity was 11.6%; and only 9.1% of children in Geita had a minimum acceptable diet. Also, the availability of nutrition interventions and their readiness to improve services had a statistically significant effect on optimal IYCF practices and child nutrition status ($p = 0.014$ and 0.048) respectively. About 90.5% of adolescent mothers (15–20 years) had poor nutrition knowledge ($p = 0.005$). In general, major ethnic groups in the Njombe district had the highest rate of increased stunting compared to major ethnic groups in Bukombe district (53.8% vs. 37.6%; $p = 0.5$). Infants aged 0–11.9 months were more stunted than other age groups. The stunting rate of male infants in Njombe district was relatively higher (68%) than female infants (45%). The major ethnic group in Njombe had a mean HAZ of (-1.85) while (-0.91) in the major ethnic group in the Bukombe district. Since the findings showed there was suboptimal IYCF practice and poor maternal nutritional knowledge as determinant factors for child stunting, this highlights the need for initiating and enlarging multicomponent nutrition interventions with vital components for improving nutrition status based on ethnicity perspective.

Keywords: Malnutrition, Stunting, Maternal nutrition knowledge, Infant and Young Child Feeding (IYCF) practices, and Nutrition intervention.

DECLARATION

I, Hassan Tearish**,** Berenge, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

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The above declaration is confirmed

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DEDICATION

This work is dedicated to my daughter "Husniyah", who was born during the period of this study, my parents, my late mother Tiba Hassan Rehani, who laid the foundation of my studies, and my brothers Omary Juma Poli, Aisha Hussein, and my son Hilmi Hassan Tearish for their encouragement during my study period.

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LIST OF ABBREVIATIONS AND ACRONYMS

AAH	Action Against Hunger
ASRP	Accelerating Stunting Reduction Program
ASTUTE	Adressing Stunting Tanzania Early
BF	Breast Feeding
CHW	Community Health Worker
DC	District Council
GNR	Global Nutrition Report
HAZ	Height for Age Z-score (Stunting)
IDDS	Individual Dietary Diversity Score
IMSAM	Intergrated Management of Severe and Aqute Manuntrition
IRIS	Institute of Relations Internationales et Strategigues
IYCP	Infant and Young Child Feeding Practices
MNK	Maternal Nutrition Knowledge
SPSS	Statistical Package for Social Science
TAHEA	Tanzania Home Economic Association
TDHS	Tanzania Demographic Health Survey
TNNS	Tanzania Nationa Nutrition Survey
UNICEF	United Nation Children's Fund
URT	United Republic of Tanzania
VEO	Village Exacutive Officer
WAZ	Weight for Age Z-score (Underweight)
WEO	Ward Exacutive Officer
WHO	World Health Organization
WHZ	Weight for Height Z-score (Wasting)

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Malnutrition remains a global challenge that has a harmful impact on developing countries compared to developed countries (WHO *et al*., 2019). The global nutrition report of 2018 revealed that one in three people are directly impacted by malnutrition. Malnutrition refers to shortages, excesses, or disparities in a person's intake of energy and/or nutrients. Furthermore, malnutrition refers to deprived nutrition, whether that is excess consumption of nutrients (overnutrition), insufficient vitamins or minerals, or poor consumption or absorption of one or more nutrients (undernutrition) (Brossner *et al*., 2005). Nearly, 800 million people worldwide are undernourished (Oenema, 2017). Chronic undernutrition (stunting), indicated by low height-for-age, still affects 149.2 million children, and wasting, which reflects low weight-for-height measures, affects 45.5 million children, which indicates both chronic and acute undernutrition. Underweight, which also reflects low weight-for-age measures, affects 20.5 million children under 5 years of age (GNR, 2021).

Tanzania has one of the highest stunting rates in Sub-Saharan Africa with a rate of 31.8% higher than the average of 30.7% for the African regions UNICEF *et al.* (2020). Recent reports from the 2015 Tanzania Demographics and Health Survey indicate that child undernutrition has declined in Tanzania. While efforts have been made to decrease childhood undernutrition, the numbers of underweight and stunted children have decreased steadily from 1992 to 2015. Although the percentage of children who are underweight or stunted in 2015 is "low" relative to the world average, it is still "high" when measured by WHO standards (WHO, 1995). About 35% of children below five

years of age were stunted; 14% were underweight; and 5% were wasted (NBS and ICF Macro, 2015-16). Undernutrition is more common in rural areas than in urban areas, as is the way people live and believe concerning maternal nutrition practices in such areas (Fotso, 2007; Simeon *et al*., 2015; Horiuchi *et al*., 2018). In addition, concerning urban and rural areas, there are differences between regions in Tanzania where there are criteria for stunting prevalence classification. Six regions have a very high severity of stunting (Rukwa, Njombe, Ruvuma, Iringa, Kagera, and Geita) and all other regions except Dar es Salaam have a medium to high severity prevalence (20–40%) (WHO, 1995). The results of the demographic and health surveys put a lot of focus on regional analysis so that specific regional interventions can be made (URT, 2015).

Nutrition is the most important factor in a child's development; it has a significant impact on a child's growth and development (UNICEF, 2009; URT, 2014). Appropriate nutrition provides the energy and nutrients essential to sustain life and promote physical, social, emotional, and cognitive development (El-Nmer *et al*., 2014). The available bodies of evidence suggest that both maternal knowledge and children's feeding practices in early life affect their health and nutrition, which are major factors in childhood undernutrition, and may continue to shape food attitudes and eating patterns through adulthood (Skafida, 2013; Ickes *et al*., 2015). In Tanzania and other developing countries, however, inadequate maternal knowledge and suboptimal child feeding practices are significant contributors to persistent child undernutrition (Mawa, 2018). These suboptimal infant and young child feeding (IYCF) practices comprise: early initiation of breastfeeding within the first hour after birth; exclusive breastfeeding in the first 6 months of life; continued breastfeeding through age 2; introduction of solid and semisolid foods at age 6 months; and increases in the amount of food and frequency as the child grows older (WHO, 2010; Marriott *et al.*, 2012).

Using the UNICEF conceptual framework (Figure 1.1), we may better understand how undernutrition affects children in developing countries, and we can use it as a guide for analysing the causes of undernutrition and planning solutions (UNICEF, 1998; Stewart *et al*., 2013). The framework explains the relationship between poverty as the root cause of undernutrition, food insecurity, and other underlying and immediate causes of maternal and child undernutrition with its short-term and long-term consequences (Black *et al*., 2008). The framework has three levels of causality: immediate, underlying, and basics, which guide interventions from a multi-sectoral viewpoint. Based on the framework, research focusing on the assessment of maternal nutritional knowledge and feeding practices and how they contribute to the children's nutrition status in regions with different ethnicities was conducted.

1.2 Problem Statement

Maternal nutritional knowledge is essential for child health and nutrition status, with a greater impact on both short-term and long-term consequences (El-nmer *et al*., 2014). Mothers are core drivers of the principle of care required for child growth within 59 months of age (Jemide *et al*., 2016). Mothers' limited nutrition knowledge about food choices, feeding, and health care-seeking practices are among the contributing factors to child undernutrition, particularly stunting (Yue *et al*., 2016). Stunting, which occurs during the first 1000 days of life, is highly damaging (Ickes *et al*., 2015) and affects approximately 149 million children under the age of 60 months worldwide. These children face learning difficulties at school, have little earning capacity as adults and face barriers to community engagement as a result of the consequences of stunting (WHO *et al*., 2019). Stunting in children is a long-term effect of poor nutrition and poor living conditions. It can be prevented by helping women of childbearing age learn more about nutrition and how to eat well, with a focus on interventions during pregnancy and

appropriate infant and young child feeding practices (IYCF), such as eating a variety of foods (WHO and UNICEF, 2017).

According to the recent Tanzania Demographic and Health Survey and Malaria Indicator Survey reports, stunting or being short for age affects 34% of children under the age of five. Njombe and Geita are among the regions with a high child stunting rate, contributing to 49% and 43%, respectively (URT, 2015; URT, 2016).

To a large extent, women and caregivers who lack proper nutrition knowledge are expected to have poor food choices, feeding, and healthcare-seeking practices, which lead to malnourished children (Chege and Kuria, 2017). Studies have reported that mothers with formal education are more likely to have nutrition knowledge and good nutrition practices compared with those who have non-formal education (URT, 2015). Knowledgeable mothers are more likely to have children healthier children and have the ability to identify illnesses and pursue treatment for their children (Abuya *et al*., 2012; WHO, 2014).

Despite having great momentum nationally, there is little progress in tackling chronic undernutrition among children under 5 years of age (AAH and IRIS, 2017). This may show that there is a need for more social and behavioural change in certain areas, especially to improve what mothers know about nutrition and how they feed their children (WHO, 2016). The study examined maternal nutritional knowledge, feeding practices, and the role of multicomponent nutrition interventions in regions with significant rates of child undernutrition particularly stunting.

1.3 Problem Justification

Suboptimal infant and young child feeding (IYCF) practices has a negative impact on child health and nutritional status (Mya *et al*., 2019). Tanzania, like other developing countries, has suboptimal IYCF practices that result from inadequate maternal nutrition knowledge (TDHS, 2015). Inadequate maternal nutrition knowledge limits women's ability to have knowledge and skills that enhance their ability to recognize illness, seek treatment, follow medical instructions, and follow nutritional practices accepted for improving nutritional status (Abuya *et al*., 2012). The rates of stunting, wasting, and underweight children tend to go down as the mother's education level goes up (Kuzma, 2013; Jones *et al.*, 2014; WHO *et al*., 2019). This can also depend on the ethnic makeup of the society.

This study hypothesized the impact of local perceptions and attitudes towards IYCF practices and maternal nutritional knowledge on improving child nutrition status under ethnicity perspectives. In different communities, ethnicity may have a different effect, but it may have a bigger effect on how much mothers know about nutrition and how they feed their children, which has also affected the nutrition status of children (Asemahagn, 2016). Some ethnic practices appear to be unacceptable for health care and practices in our communities, particularly in developing countries, including maternal nutrition knowledge and IYCF practices. Patriarchal gender norms and violence are two of the many ethnic factors that make it hard for mothers to get the health care services their children under 5 need for optimal growth and development. Stakeholders will work to change these factors also, to get a vivid picture of which methods and techniques are significant in improving nutritional status and how they contribute to promoting good health and wellbeing as a key component in sustainable development goals.

1.4 Study objectives

1.4.1 General objective

The purpose of this study was to evaluate maternal nutritional knowledge, infant and young child feeding practices, and their respective roles in nutrition interventions in Tanzanian regions with high rates of stunting and diverse ethnicities (Geita and Njombe).

1.4.2 Specific objectives

The specific objectives were to:

i. Assess feeding practices among children below five years of age in study areas.
ii. Determine the nutritional status of the children less than five years of age in the study areas.
iii. Determine mothers' knowledge of infant and young child feeding practices in the study regions
iv. Mapping nutrition interventions and assessing their impacts on maternal IYCF practice knowledge and child nutrition status.

1.5 Research Questions

i. Are feeding practices for children guided by acceptable infant and young child feeding practices?
ii. What is the current nutrition status of children aged less than five years of age within the Njombe and Geita regions?
iii. What are the levels of mothers' knowledge of infant and young child feeding practices within regions?

iv. How many, and to what extent do multicomponent nutrition interventions impact maternal nutrition knowledge to improve child nutrition status?

1.6 Conceptual Framework

The UNICEF conceptual framework is a useful tool for understanding the determinants of undernutrition and serves as a guide in analysing the causes of undernutrition and planning interventions mainly among children in developing countries (UNICEF, 1998; Stewart *et al.*, 2013). The framework explains the relationship between poverty as a root cause of undernutrition, food insecurity, and other underlying and immediate causes of maternal and child undernutrition with its short-term and long-term consequences (Black *et al.*, 2008; UNICEF, 2015). The framework has three levels of causality: immediate, underlying, and basic. These levels help guide interventions from a multi-sectoral point of view.

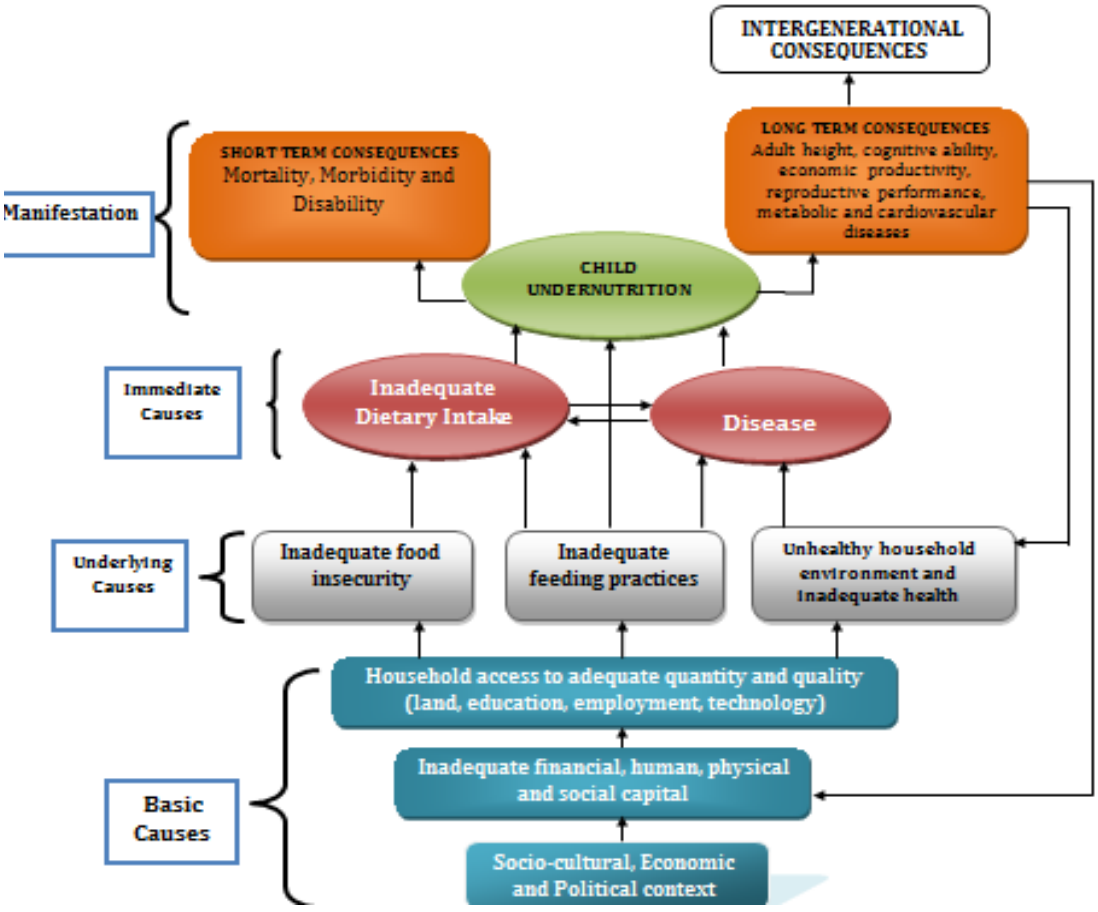

Figure 1.1: UNICEF conceptual model of the determinant of child undernutrition

Source: *Adopted and improved from UNICEF (1990)*

From the general view point of the UNICEF conceptual model of determinants of child undernutrition, the study is guided by some few components (Figure 1.2). Socio-economic and socio-demographic features together with maternal nutritional knowledge are expected to be the basic causes which impact infant and young child feeding practices. The harmful effect of basic causes may influence inadequate infant and young child feeding practices, which are noted as an underlying cause, which have a greater impact on child undernutrition.

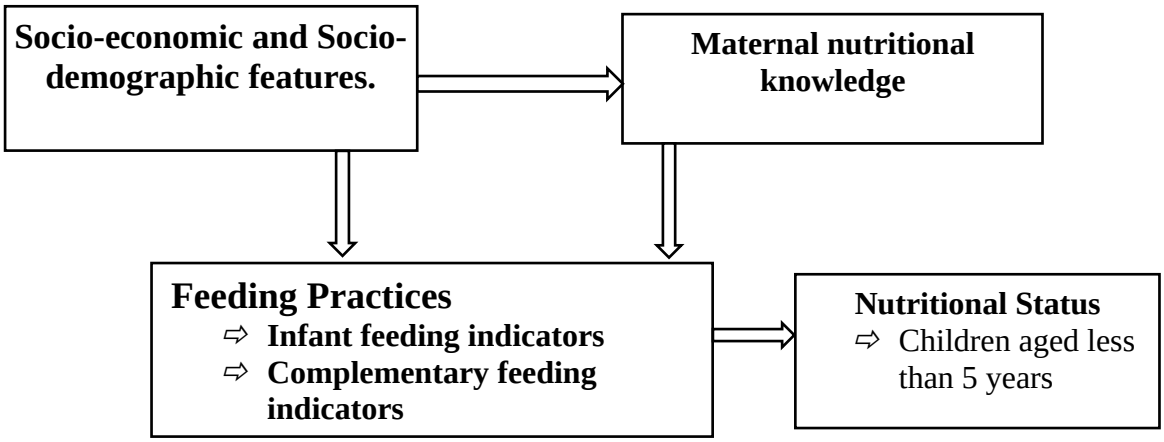

Figure 1.2: Conceptual framework of the study.

1.7 Organizational of the Dissertation

The dissertation is structured to cover three main chapters and has adopted a publishable manuscript format. The first chapter comprises the extended abstract in addition to the general subject matter studied. Chapter two, contract with publishable manuscript one, "Feeding practices and nutrition status of children aged 0–59 months": Practices from regions with a high rate of malnutrition (Geita and Njombe, Tanzania." The manuscript one also covers objectives i and ii and gives answers to questions i and ii. Alike to

Chapter Three, which contains the publishable manuscript titled “The Role of Nutrition Interventions to Maternal Knowledge on Infant and Young Child Feeding Practices: A Mapping Study in Njombe and Geita." Paper two of chapter three covered objectives iii and iv and gave answers to questions iii and iv, respectively. Lastly, chapter four covers the overall conclusions and recommendations.

1.8 Limitation of the Study

The study was conducted during the rainy season, which made data collection difficult since the majority of eligible participants were farmers and were not available at home. An absent eligible respondent was replaced with an existing participant based on the eligibility criteria, which was a woman with a child younger than five years old. This was done so that the required sample size could be met in a timely manner. Some infants and children refused to stand on a body weight scale by themselves. To account for this, researchers calculated the child's body mass by subtracting the mother's weight while holding the child from the mother's weight while standing alone. Due to language barriers, it was difficult to obtain some pertinent information because some respondents spoke only their native tongue and not the national language (Swahili). Therefore, the issue was mitigated with the assistance of community health workers (CHWs) who spoke the local language.

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CHAPTER TWO

Manuscript one

Feeding Practices and Nutrition Status of children aged 0-59 months from Njombe and Geita, Tanzania

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2.0 Abstract

While optimal Infant and Young Child Feeding (IYCF) practices have been revealed to improve child nutrition status, there is slight progress within areas of high stunting rates. Limited studies have examined if ethnic variation in IYCF practices had an impact on improving child health outcomes. This study aimed to assess the IYCF practices, child nutrition status, and their variations within ethnic groups in regions of high prevalence rates of stunting. A cross-sectional study was conducted on a sample of 150 mother-child pairs purposefully selected from high-stunting regions in Tanzania (Njombe and Geita). In addition, two districts (Njombe rural and Bukombe) were chosen at random from each region. Socio-demographic, IYCF practices, and anthropometric data (HAZ, WAZ, and WHZ) were measured. In general, major ethnic groups (Bena and Hehe) in the Njombe district had a higher rate of stunting (53.8% vs. 37.6%; $p = 0.5$) than major ethnic groups (Sukuma and Sumbwa) in Bukombe district. Infants aged 0–11.9 months were more stunted compared to other age groups. Both Njombe and Bukombe districts had optimal IYCF practices whereby 46.9% of infants-initiated breast milk within 1 hour after birth; minimum dietary diversity was 11.6%; and only 9.1% of children in Bukombe district had a minimum acceptable diet. The major ethnic groups (Bena and Hehe) in Njombe district had a mean HAZ of (-1.85) while (-0.91) in the major ethnic group in the Bukombe district. This demonstrates the need to initiate and expand multicomponent nutrition interventions based on ethnicity that could be linked to cultural practises of IYCF and the improvement of child nutrition status.

Keywords: Undernutrition, Maternal Nutrition Knowledge, Nutrition Status, Stunting, Ethnicity, IYCF practices, Underweighting.

2.1 Introduction

Despite some improvements in infant and young child health, undernutrition still remains one of the major public health problems in Tanzania and some other developing countries (Powell *et al*., 2017). Globally, Tanzania was ranked among the countries with a high intolerable burden of child undernutrition (GNR, 2018a). About 21.9% of children aged under-five years globally were stunted and 7.4% were wasted (DIPR., 2020); while about 58.8% of children aged (0-59 months) in Africa were stunted and 14% were wasted (WHO *et al.,* 2019). The most recent Tanzania national nutrition survey of 2018 revealed that 31.8% of children under the age of five were stunted; 14.6% were underweight; and according to the Demographic and Health Survey of 2015-2016, 5% of children under the age of five were wasted.

UNICEF and other child nutrition and health experts confirmed that optimal IYCF has the single greatest potential impact on child survival, compared to all proven preventive health and nutrition interventions (Demilew *et al*., 2017; Hashmi *et al.*, 2019). Also, poor IYCF practices are a serious window for poor nutritional status with a worse influence on child existence (Mihretie, 2018). Undernutrition is the major determinants of poor health among children under the age of five compared to other determinants (GNR, 2018a). Globally, about 45 percent of children under the age of five die due to malnutrition attributed to poor IYCF practices (Asoba *et al.,* 2019). Therefore, reduction of child undernutrition, morbidity and mortality can be reached when nutrition in early infancy and IYCF specifically are highly prioritized in national policies and programme strategies.

WHO/UNICEF and other public health agencies recommend that all infants should be breastfed within 1 hour of delivery and exclusively breastfeed for the first 6 months,

followed by introduction of nutritionally adequate and safe complementary foods while continuing frequent on demand breastfeeding for up to 2 years or beyond (WHO, 2001, WHO and UNICEF, 2014). The recommended IYCF practices comprise breastfeeding within one hour of birth; exclusively breastfeeding within 6 months; introduction of semi-sold; sold and soft foods at 6-8 months of age; minimum dietary diversity; minimum acceptable diet and consumption of vitamin A and iron rich foods (Rollins *et al*., 2016: Powell *et al.,* 2017). It's also including in complementary feeding, (Beyene *et al*., 2015). Stunting, wasting, and being underweight are indicators for undernutrition among children under the age of five. However, stunting is indicated by height/length-for-age (HAZ), underweight is indicated by weight-for-age (WAZ) and wasting as indicated by weight-for-length/height (WHZ) (WHO, 2010).

Despite the considerable progress of the core IYCF practices, there has been little progress, which has impeded the improvement of child nutritional status (WHO *et al.,* 2010; URT, 2015; Fanzo *et al.,* 2018). Njombe and Geita are among the regions in Tanzania with a high rate of chronic undernutrition despite their high food production and food security (URT, 2015; 2018/2019). Notwithstanding the substantial efforts made by the government of Tanzania and other stakeholders to improve the nutritional status of children, the results vary. According to the Tanzania National Nutrition Survey Report (2018/2019), 53.6% of 0–59-month-old children in Njombe are stunted. This is 4.6% more than in 2015, but the situation has gotten better in Geita, where the number of stunted children has gone down from 41% to 38.9%. The major question of this study was based on the assumption that ethnicity perspective had an effect on optimal IYCF practises within regions with a high rate of stunting. The study essentially assessed ethnic differences in breastfeeding and complementary feeding

practises, as well as child nutrition status, in Tanzanian regions with high rates of chronic malnutrition.

2.2 Methodology

2.2.1 Description of study areas

The study was conducted in two districts (Njombe Rural and Bukombe) within regions with a high rate of undernutrition, Njombe and Geita respectively. The Njombe Rural district has a land area of 3448 km^2 and was one of six districts in the Njombe region before it became part of the Iringa region. It is surrounded by Wanging'ombe District to the west, Kilombero District to the west, Makambako Town to the north, and Njombe Town to the south. The temperature ranges from 2°C to 20°C on a higher plateau and 20°C to 30°C on a lower plateau, though the rainfall lies between 1500 and 2800 mm annually and only 371km^2 is agriculturally useful land (URT, 2007; URT, 2016). Bukombe District has 10 842 km^2 and is one of the five districts of the Geita region. The Bukombe district lies between longitudes 31 and 32° East and latitudes 3 and 3.33° South. It shares a border with Urambo district to the south, Kahama district to the east, Kibondo district to the west, and Biharamulo district to the north.

The major ethnic groups found in Njombe District are Bena and Hehe, while in Bukombe District are Sukuma and Sumbwa. The major ethnic groups in the same area had nearly the same ethnicity. Currently, both Njombe and Bukombe districts are within the most nutritionally vulnerable regions in Tanzania, contributing to 53.6% and 38.9% of child stunting, respectively (URT, 2015/16; URT, 2018).

2.2.2 Study design

The cross-sectional study was used to assess the feeding practices and nutritional status of children less than 5 years old. The design was employed because survey methods are typically used to gather data; they are cost-effective, quick to run, and provide occurrence rates of various nutritional aspects. It focuses on studying and drawing implications from existing differences between people, subjects, or phenomena (Bell and Jones, 2015).

2.2.3 The study population

Women and caregivers with children under the age of five in Bukombe and Njombe Rural Districts were included in the study population. There are 20 594 women of reproductive age in Njombe Rural and 51 153 in Bukombe, with a 60% and 86% chance of having a child younger than 5. (URT, 2013). The average number of women with children under the age of five in the study areas was 56 309. The eligible respondents were women/caregivers with children less than five years of age. The eligibility criteria for such women should be at least the same as those who lived in study areas in the past 12 months.

2.2.4 The sample size

The Green (1991) rule of thumb was used to determine the minimum sample size required to identify a statistically significant difference if one truly exists (Burmeister and Aitken, 2012). The Green formula is n = 50 + 8p, where p is the number of predictors for regression. Based on the objectives of this study, 12 predictors were sufficient to answer the key questions. Nevertheless, the sample size is collected as follows:

$$N \geq 50 + 8(12) = 146.$$

To increase the power, 4 additional samples were added with an equal distribution in each district following a calculation. Nevertheless, Bukombe District has a greater population

than Njombe District. Therefore, the sample size was appropriate, with 65 individuals in the Njombe District and 85 individuals in the Bukombe District, for a total of 150 individuals. However, Bukombe District has a higher population compared to Njombe District. So, the sample size was right, with 65 people in the Njombe District and 85 people in the Bukombe District, for a total of 150 people. Other researchers (Sudman, 1976; Bailey, 1994; Mundfrom *et al*., 2005; Beleites *et al*., 2013) agree that a sample size of at least 100 people is needed to do a meaningful analysis in a social science study.

2.2.5 Sampling procedures

In this study, a multi-stage sampling method was used to acquire eligible respondents within the study areas. The two regions (Geita and Njombe) with a high rate of malnutrition were purposefully selected. The same was true for one district from each of the selected regions (Bukombe and Njombe DCs). A list of eligible households in selected villages was made, and if the total number of households in a village was higher than the sample size needed for a certain area, the interval of households visited was found by dividing the total number of households by the sample size needed in that village.

2.2.6 Methods of data collection

A structured questionnaire was used by the researcher to conduct a household survey among those who were eligible to take part in the research and lived in the study areas. Quantitative as well as qualitative criteria were adapted in this study. As a data collection method, a questionnaire was used to collect information from women with children under 5 who resided in study areas. Information on socioeconomic and sociodemographic background, the mother's knowledge of nutrition, feeding practices, and anthropometric measurements is provided in this questionnaire.

2.3 Measurements

2.3.1 Anthropometric measurement

Researchers had to take the children's weight, height, and age into account while determining their nutritional condition. Electronic Seca 874 weighing scales were utilised to determine the child's actual weight. Babies were measured and recorded for their weight while being held by their mothers (a method known as "tared weighing"). Kids were weighed wearing minimal clothing and barefoot to reduce the possibility of inaccuracy. After the baby was placed on the scale and tipped to zero, she was given back to her mother and only her new weight was recorded. Each value was recorded twice, with the differences rounded down to the nearest 0.1 gramme. Additionally, a length board was set up on a hard, level surface and the infant's recumbent length was recorded. While keeping the baby's knees firmly down on the length board, the baby's head was placed against the head stop and the foot stop was lowered to meet the baby's feet. The older children Measurements were recorded to the nearest 0.1 cm. Length was measured in duplicate by the same enumerator to minimise inter-examiner error. The children's exact ages were determined by recording their birth dates from their clinic cards

2.3.2 Dietary assessment

In this case, we used the 24-hour recall diet method, which was based on the food consumed by children aged 6 to 59 months in the previous 24 hours. The mothers or caregivers had to remember and describe all of the food and beverages their children had consumed in the previous 24 hours. Many more questions were posed about how well babies fared when they were introduced to non-breastfeeding fluids and foods as recommended by the World Health Organization (WHO).

2.3.3 Data analysis

The Statistical Package for the Social Sciences, version 21 (IBM Corp., 2011, Armonk, NY) was utilised to analyse quantitative data collected via structured interviews. After the data was entered from the structured questionnaire, it was searched for informality, trends, and outliers. A p-value of 0.05 was used to demonstrate the statistical significance of the association between variables. The transformed data was appropriate for determining the correlation and effects between variables.

2.3.4 Anthropometric data

ENA analysed anthropometric raw data for Standardized Monitoring and Assessment of Relief Transitions (SMART) 2011 to determine. Stunting, underweight and wasting were defined as Z-scores below −2 standard deviations (SD) of median values of the reference data. Additionally, the data from ENA for SMART were entered into IBM SPSS version 21 for extensive analysis.

2.3.5 Descriptive statistics

Descriptive statistics were used for socio-demographic variables to check out the occurrence of features associated with child's nutritional status. The frequency distribution, mean, chi-squared, and standard deviation of the descriptive data were computed and tabulated.

2.3.6 Binary logistic regression

Binary logistic regression analysis was used to determine the relationship and influence between social-demographic features, feeding practices, and child nutrition status (Stunting and Underweight). The statistical model, as well as the applied variables, were specified as follows:

The binary logistic regression model

$$Logit\ (Ti) = log\ (Ti\ /\ 1\text{-}Ti) = h_0 + h_1x_1 + h_2x_2 + h_3x_3 + \ldots\ldots\ldots\ldots\ldots h_kx_k\ldots\ldots\ldots\ldots \quad (1)$$

Whereby;

Logit (Ti) = in odds (event) that is a natural log of the odds of an event (HAZ or WAZ versus Normal) occurring.

Ti = Probability that the event will occur, {Prob (event)}

1-Ti = Probability that the event will not occur, {Prob (no-event)}

h_0 = Constant of the equation

h_1-h_k = Coefficient of the independent variables

k = Number of independent variables

x_1= household size

x_2 = Child sex (female)

x_3 = Child age

x_4 = Child birth weight

x_5 = Child received all Vaccines (Yes)

x_6 = Early initiation of breast milk (Yes)

x_7 = Minimum meal frequency (Yes)

x_8 = Minimum acceptable diet (Yes)

x_9 = Time to the nearest health facility

x_{10} = Maternal nutrition knowledge (knowledgeable)

x_{11} = Maternal formal education (Yes)

2.4 Results

2.4.1 Respondent's socio-demographic characteristics

The sociodemographic features of respondents (n = 150) are presented in Table 2.1. The mothers were aged between 21 and 35 years; the majority were married in both districts and had at least a primary level of education. About 94% had a monthly income of less than 450 000 Tanzania shillings and 2.7% had no income. The majority of respondents (84.7%) participated in agricultural activities, and the rest were either public

servants, micro-entrepreneurs, or domestic helpers. The major ethnic groups in Njombe were 31.3% Bena and 10.7% Hehe, while in Bukombe they were 28% Sukuma and 23% Sumbwa.

2.4.2 Children's characteristics and health information

The results (Table 2.1) show that 56.7% of children aged less than five years are girls, but more than 80% are children aged two years. The majority (86.7%) of children were born at health facilities, and the rest were born at home. About 92.7% were born with a standard birth weight of 2500 gms, and most of the children completed all the recommended vaccines within their eligible age. The majority of children (69.3%) reach the nearest health facilities in less than 30 minutes.

Table 2.1: Demographic and socio-economic characteristics of mother and children (n=150)

Category	Sub-category	Bukombe n=85(%)	Njombe n=65(%)	Total
Marital status	Married	77(90.6)	56(86.2)	133(88.7)
	Divorced/Separated	4(4.7)	2(3.1)	6(4)
	Never Married	4(4.7)	7(10.8)	11(7.3)
Maternal age	Mean (SD)	27.04(5.75)	28.80(6.71)	27.80(6.23)
Level of education	Primary	51(60)	46(70.8)	97(64.7)
	Secondary	17(20)	15(23.1)	32(21.3)
	Technical/Vocational	3(3.5)	0(0.0)	3(2)
	None	14(16.5)	4(6.2)	18(12)
Ethnicity	Bena	0(0.0)	47(72.3)	47(31.3)
	Hehe	0(0.0)	16(24.6)	16(10.7)
	Sukuma	42(49.4)	0(0.0)	42(28)
	Sumbwa	35(41.2)	0(0.0)	35(23.3)
	Other tribes	8(9.4)	2(3.1)	10(6.7)
Occupation	Farmer	68(80)	59(90.8)	127(84.7)
	Domestic help	15(17.6)	2(3.1)	17(11.3)
	Farmer	68(80)	59(90.8)	127(84.7)
	Public servants/SME's/Others	2(2.4)	4(6.2)	6(4.0)
Maternal Income	Less than TZS 450,000	78(91.8)	63(96.9)	141(94)
	TZS 450,001-700,000	5(5.9)	0(0.0)	5(3.3)
	Don't know/remember	2(2.4)	2(3.1)	4(2.7)
Child sex	Boy	40(47.1)	25(38.5)	65(43.3)
	Girl	45(52.9)	40(61.5)	85(56.7)
Child age group	0-5 months	12(14.1)	4(6.2)	16(10.7)
	6-11 months	24(28.2)	13(20.0)	37(24.7)
	12-24 months	44(51.8)	38(58.5)	82(54.7)

	25-59 months	5(5.9)	10(15.4)	15(10.0)
Child birth place	Home	18(21.2)	2(3.1)	20(13.3)
	Health facility	67(78.8)	63(96.9)	130(86.7)
Birth weight	<2.5 kg	3(3.5)	8(12.3)	11(7.3)
	>=2.5 kg	82(96.5)	57(87.7)	139(92.7)
Child vaccination	Completed all vaccines	54(63.5)	53(81.5)	107(71.3)
	Not completed/<9 months	31(36.5)	12(18.5)	43(28.7)
Time to reach the nearest health facility	1-30 minutes	55(64.7)	49(75.4)	104(69.3)
	31-60 minutes	21(24.7)	16(24.6)	37(24.7)
	>61 minutes	9(10.6)	0(0.0)	9(6)

Note: Number in brackets is percentages.

2.4.3 Infant and young child feeding practices variation within the districts

Table 2.2 shows that there are no statistically significant differences between Bukombe and Njombe districts on any of the IYCF practise variables. Conversely, about 55.8% and 37.9% of children in both Bukombe and Njombe districts were breastfed within 1 hour after birth, which was equal to the overall average of 49.3% for both areas. Also, infants aged 20–23.9 months continued breastfeeding, and more than 70% of children under 2 years were appropriately breastfeeding. As per the specific age group, the findings show that infants were exclusively breastfed under six months and continued breastfeeding at 12 months. Furthermore, 60% of infants aged 6–8 months in the Njombe district received solid, semi-solid, or soft foods, whereas only 37.5% in the Bukombe district. Simply, about 15.1% and 8.1% of infants aged 2–23.9 months received minimum dietary diversity, while 60.6% and 47.8% met the standard proportional of receiving solid, semi-solid, or soft foods in Bukombe and Njombe districts, respectively. Results from Table 2.3 also indicate that no infants met the minimum acceptable diet in the Njombe district, while only 9.1% in the Bukombe district. More than half (70%) of children aged 2–63.9 months of age from the study areas received iron-rich or iron-fortified foods.

Table 2.2: WHO-acceptable indicators for determine IYCF practices

Indicator	Definition	Bukombe n(%)	Njombe n(%)	Sig
Early initiation of breastfeeding.	Children born in the previous 24 months and breastfed within 1 hour after birth.	49(55.8)	31(37.9)	0.124
Exclusive BF under 6 months	Infant aged 0-5.9 months who had not consumed only breast milk.	32(100)	24(100)	-
Continued BF at 1 year	Infant aged 12-14.9 months who were received breast milk on previous 1 day.	27(100)	24(100)	-
Introduction of solid, semi-sold or soft foods.	Infant aged 6-8 months who consumed these foods on the previous 1 day.	23(37.5)	23(60)	0.429
Minimum dietary diversity*	Infants aged 6-23.9 months who received 4 or more food groups on previous day.	31(15.1)	25(8.1)	0.210
Minimum meal frequency	Proportional of infants aged 6-23.9 months who received solid, semi-sold or soft foods as per recommended number on 1 day before.	40(60.6)	31(47.8)	0.344
Minimum acceptable diet	Breastfeed infants aged 6-23.9 months who met both minimum dietary diversity and meal frequency.	23(9.1)	0(0)	0.137
Consumption of iron-rich/ iron-fortified food.	Infants aged 6-23.9 months who received iron-rich/ iron fortified food on the previous day.	42(66.7)	37(77.3)	0.396
Continued breastfeeding.	Infants 21-23.9 months of age who were still breastfed.	23(21.4)	21(14.3)	0.694
Age-appropriate breastfeeding	Infants 0-23.9 months of age who were appropriately breastfed.	59(72.2)	42(78.6)	0.532
Predominant breastfeeding under 6 months	Infants aged 0-5.9 months who received breast milk as the predominant foods on the previous day.	21 (5.9)	21 (16.7)	0.334

Note: number in brackets means percentages

*Individual dietary diversity score was used to determine minimum dietary diversity of the infants; the data were developed from 24-hours recall by summing up the number score of food groups consumed by infants within the previous 24hrs. The food groups were ranged from 1–7 as per WHO-recommendation and those who received at least 4 food groups were considered as they met the minimum dietary diversity.

2.4.4 Infants and children's nutrition status

The mean height-for-age (HAZ) z-score, weight-for-age z-score (WAZ), and weight-for-height z-score (WHZ) are presented in Table 2.3. Mean HAZ and WAZ were significantly lower for females than males in both districts. The mean HAZ difference between males and females was significant (p = 0.04) in Njombe Dc and not significant (p = 0.96) in Bukombe. However, the mean WAZ was no significant difference (p = 0.26) in Bukombe and (p = 0.62). The mean WHZ was statistically significantly lower for males compared with females in the Njombe district (p = 0.01). HAZ, WAZ and WHZ were not significantly different between age groups in Bukombe (p = 0.96, p = 0.11, p = 0.49); and Njombe (p = 0.77, p = 0.92, p = 0.17). There was a statistically significant decrease in WAZ, HAZ, and WHZ done by pair-wise comparison from Bukombe to

Njombe districts (p 0.001). The occurrence of underweight was the same in Bukombe and Njombe districts by (11% while p = 0.97). The occurrence of stunting was also higher in Njombe (54%) than in Bukombe districts (38%). Also, the rate was higher in males (68%) compared to females (45%) in Njombe but not statistically significantly (p = 0.07). For infants aged 1-2 years, Njombe had a higher proportion of stunted (55%) than Bukombe (20%), but the difference was not statistically significant. The outcomes were nearly related to regional results from the current report from the Tanzania National Nutrition Survey of 2019.

Table 2.3: Mean WAZ, HAZ, WHZ and frequency of underweight, stunting and wasting between age, sex and districts

		Bukombe Dc				Njombe Rural			
Underweight	N	Normal (%) >-2SD	Underweight (%) <-2SD	Mean z-score WAZ	N	Normal (%) > -2SD	Underweight (%) <-2SD	Mean z-score WAZ	*P-value*
Total	85	89.4	10.6[b]	-0.52 ± 1.21[a]	65	89.2	10.8[b]	0.62 ± 0.31	<0.001[a]; 0.97[b]
Male	40	87.5	12.5	-0.77 ± 1.12	25	88	12	-0.99 ± 0.92	
Female	45	91.1	8.9	-0.40 ± 1.21	40	90	10	0.38 ± 1.13	
p-value			0.59[b]	0.29[c]			0.80[b]	0.62[c]	
0-5 months	12	100	0	0.28 ± 0.63	4	100	0	-0.31 ± 1.25	
6-11 months	24	79.2	20.8	-0.63 ± 1.63	13	84.6	15.4	-0.75 ± 1.16	
12-24 months	44	90.9	9.1	-0.67 ± 1.05	37	89.2	10.8	-0.60 ± 1.20	
25-59 months	5	100	0	-0.51 ± 0.63	10	100	0	0.63 ± 0.41	
p-value			0.19[b]	0.11[d]			0.53[b]	0.92[d]	
Stunting				**HAZ**				**HAZ**	
Total	85	62.4	37.6[b]	-1.07 ± 1.89[a]	65	46.2	53.8[b]	-1.82 ± 1.33	<0.001[a]; 0.05[b]
Male	40	62.5	37.5	-1.06 ± 1.85	25	32	68	-2.16 ± 1.19	
Female	45	62.2	37.8	-1.08 ± 1.92	40	55	45	-1.60 ± 1.39	
p-value			0.98[b]	0.96[c]			0.07[b]	0.04[c]	
0-5 months	12	66.7	33.3	-0.31 ± 1.99	4	25	75	-2.48 ± 1.24	
6-11 months	24	45.8	54.2	-1.29 ± 2.20	13	53.8	46.2	-1.17 ± 0.99	
12-24 months	44	68.2	31.8	-1.21 ± 1.64	38	44.7	55.3	-1.82 ± 1.52	
25-59 months	5	80	20	-0.64 ± 2.04	10	50	50	-1.68 ± 1.04	
p-value			0.24[c]	0.42[e]			0.77[c]	0.77[e]	
Wasting				**WHZ**				**WHZ**	
Total	85	88.2	11.8[b]	0.12 ± 1.46[a]	65	98.5	1.5[b]	0.52 ± 1.12	<0.001[a]; 0.02[b]
Male	40	85	15	-0.02 ± 1.79	25	96	4	0.31 ± 1.12	
Female	45	91.1	8.9	0.28 ± 1.12	40	100	0	0.72 ± 1.12	
p-value			0.38[b]	0.08[c]			0.20[c]	0.01[d]	
0-5 months	12	91.7	8.3	0.81 ± 2.22	4	100	0	1.69 ± 0.90	
6-11 months	24	83.3	16.7	0.23 ± 2.28	13	100	0	0.25 ± 1.29	
12-24 months	44	90.9	9.1	-0.04 ± 1.56	38	97.4	2.6	0.57 ± 1.14	
25-59 months	5	80	20	-0.31 ± 1.57	10	100	0	0.47 ± 0.69	
p-value			0.72[b]	0.49[d]			0.86[b]	0.17[d]	

Note: Underweighting, Stunting and Wasting Z-score values are obtainable as mean ± *SDs* with due regard to WHO, references standard of 2006.

Z-scores were obtained from software (INA for SMART) by entering the data for age, height and weight; WAZ means Weight for Age Z-score; HAZ means Height for Age Z-score and WHZ means Weight for Height Z-score. About <-2SD were identified as Underweighted, Stunted and Wasted while Z >-2SD were considered as Normal.

[a]The differences in mean Z-score were useful by ***Paired sample t test***. [b]The ***Chi squared test*** was used for comparison of significance of proportional of underweight, stunted and wasting in Bukombe and Njombe districts as well as categorical variables among groups. [c]The comparisons of mean differences for continuous variables between two groups were done by using ***Independent sample t test***. The mean differences for continuous between four infant age groups was assessed by using ***One-way analysis of variance***.

2.4.5 Association of IYCF practices and child nutritional status

The results (Appendix 2.1) from Bukombe districts show that the introduction of solid, semi-solid, or soft foods was statistically significant with stunting (X2 = 0.018, p = 0.005), while minimum dietary diversity, minimum acceptable diet, and continuous breastfeeding within (20-24 months of age) also were statistically significant with underweight (X2 = 0.025, p = 0.009; X2 = 0.106, p = 0.043; and X2 = 0.093, p = 0.031) respectively. Appendix 2.2, from the Njombe district, also indicates that there was no significant association between IYCF practice indicators and child nutritional status. According to Table 2.4, there is a statistically significant relationship between stunting and children aged 6–8.9 months who received solid, semi-solid, or soft foods; being underweight and being a child aged 6-23.9 months who received four or more food groups out of seven or not, the minimum acceptable diet; and being a child aged 21-23.9 months who was still breastfeeding. The findings were also linked to other studies with a common group, specifically the Tanzania National Nutrition Survey report from 2018 and the Tanzania Demographic and Health Survey report from 2015.

Table 2.4: Association of infant and young child feeding practices and nutritional status in both Bukombe district and Njombe district

	Underweight				Stunted			
	Underweighted	**Normal**	**X^2**	***Sig***	**Stunted**	**Normal**	***X^2***	***Sig***
Core indicators								
EI (Breast milk),								
Yes	4(10.0)	36(90.0)	0.516	0.753	17(42.5)	23(57.5)	0.217	0.315
No	5(12.2)	36(87.8)			22(53.7)	19(46.3)		
Intr. (solid, semi/soft)								
Yes	1(16.7)	5(83.3)	0.731	0.906	1(16.7)	5(83.3)	0.025	0.013
No	1(14.3)	6(85.7)			6(85.7)	1(14.3)		
Min. (Dietary diversity)								
Yes	5(31.3)	11(68.8)	0.024	0.011	9(56.3)	7(43.8)	0.248	0.344
No	11(9.2)	108(90.8)			52(43.7)	67(52.3)		
Min. (meal frequency)								
Yes	7(22.6)	24(77.4)	0.133	0.140	15(48.4)	16(51.6)	0.358	0.571
No	2(8.0)	23(92.0)			14(56.0)	11(44.0)		
Min. (acceptable diet)								
Yes	2(66.7)	1(33.3)	0.064	0.014	2(66.7)	1(33.3)	0.527	0.596
No	7(13.2)	46(86.8)			27(50.9)	26(49.1)		
Cons. (Iron-rich/ fortified)								
Yes	8(20.5)	31(79.5)	0.188	0.194	20(51.3)	19(48.7)	0.583	0.981
No	1(6.3)	15(93.7)			8(50.0)	8(50.0)		
Optional indicators								
Cont. (BF at 2 years)								
Yes	2(50.0)	2(50.0)	0.080	0.023	2(50.0)	2(50.0)	0.586	0.748
No	1(5.9)	16(94.1)			7(41.2)	10(58.8)		
Age-appr. BF (0-23 months)								
Yes	9(14.8)	52(85.2)	0.212	0.227	31(50.8)	30(49.2)	0.266	0.314
No	1(4.8)	20(95.2)			8(38.1)	13(61.9)		
Predo. BF (<6 months)								
Yes	0(0.0)	2(100.0)	0.823	0.639	-	-	-	-
No	2(10.0)	18(90.0)			-	-		

2.4.6 The determinants of child nutrition status

Generally, the findings from this study (Table 2.5) observed that the overall model of stunting was well predicting the outcome as ($p < 0.001$). The Nagelkerke R2 = (0.288, 0.213) shows that the independent variables entered into the model were able to predict only 28.8% and 21.3% of both stunting and underweight, respectively. Household size, early breast milk initiation, and minimum meal frequency all had a negative effect on the chance of being stunted (=-0.187, -0.464, 0.935; Appendix 2.6), as did child age and early breast milk initiation (=-0.024, -0.680; Appendix 1.5).The rest had positive effects of

being stunted and underweighted, but only maternal nutrition knowledge and feeding practices, especially the minimum acceptable diet, were statistically significant (p = 0.028). This means that the likelihood of children being stunted was 2.5 times higher among mothers with low nutrition knowledge compared to mothers with nutrition knowledge. Also, children without a minimum acceptable diet were 24.3 times more likely to be underweighted compared to children with a minimum acceptable diet.

Table 2.5: Multivariate analysis of the determinants of child nutritional status

Dependent variables	**Stunted**		**Underweight**	
Independent Variables	***p***	**OR, (95% CI)**	***p***	**OR, (95% CI)**
Household size	0.696	0.83 (0.32-2.13)	0.695	1.27, (0.39-4.12)
Child sex (female)	0.289	2.22 (0.51-9.66)	-	-
Child age	0.857	1.01 (0.89-1.15)	0.776	0.98, (0.83-1.15)
Child birth weight	0.126	2.72 (0.76-9.77)	-	-
Child received all Vaccines (Yes).	0.309	2.39 (0.45-12.78)	-	-
Early initiation of breast milk (Yes).	0.469	0.63 (0.18-2.21)	0462	0.51, (0.08-3.10)
Min. Meal frequency (Yes).	0.200	0.39 (0.09-1.64)	-	-
Min. Acceptable Diet (Yes).	0.577	2.26 (0.13-39.34)	0.028	24.34, (1.41-418.92)
Time to the nearest health facility.	0.577	1.38 (0.45-4.26)	-	-
Maternal nutrition knowledge (Overall).	0.028	2.52 (1.11-5.73)	0.338	1.66, (0.59- 4.67)
Maternal formal education (Yes).	0.237	4.64 (0.36-59.18)	-	-

Note:

Stunting — *Overall Wald statistics = 21.435 (p <0.001); Omnibus Tests of Model Coefficients X^2 = 13.395 (p = 0.268); Hosmer and Lemeshow Test X^2 = 6.617 (p = 0.470), Cox and Snell R^2 =0.216; Nagelkerke R^2 = 0.288*

Underweighting — *Overall Wald statistics = 0.163 (p = 0.686); Omnibus Tests of Model Coefficients X^2 = 7.048 (p = 0.217); Hosmer and Lemeshow Test X^2 = 6.395 (p = 0.495), Cox and Snell R^2 =0.120; Nagelkerke R^2 = 0.213*

2.4.7 Association between maternal nutrition knowledge, nutritional status and IYCFP within different ethnicity

The results (Table 2.6) show maternal nutritional knowledge had a higher average (2.52) among major ethnic groups in Njombe district than in Bukombe district (2.00) with (U = 19.32, p = 0.002). This means that maternal nutrition knowledge among major ethnic groups (Bena/Hehe) was higher than major ethnic groups in Bukombe (Sukuma/Sumbwa). The child stunted rate within major ethnic groups in Njombe was

higher than the child stunted rate within major ethnic groups in Geita by a mean HAZ of (-1.85) and (-0.91), respectively (U = 3.55, p = 0.011).Young children within ethnic groups in the Bukombe district had a greater chance to acquire a minimum acceptable diet as per WHO recommendations compared to those in the Njombe district (mean score = 1.17 and 1.09; p = 0.010).

Table 2.6: Association between maternal nutrition knowledge, nutritional status and IYCFP difference within ethnic groups

Grouping variable / Group	N	Test variable Mean	SD	Stat-value	Significance (*p-value*)
Maternal nutrition knowledge on IYCFP					
Sukuma/Sumbwa	72	2.00	0.964	19.318	0.002[a]
Bena/Hehe	62	2.52	1.004		
Underweight (Weight for Age Z-score)					
Sukuma/Sumbwa	72	-0.48	1.22	0.345	0.474[a]
Bena/Hehe	62	-0.63	1.11		
Stunting (Height for Age Z-score)					
Sukuma/Sumbwa	72	-0.91	1.94	3.545	0.011[a]
Bena/Hehe	62	-1.85	1.33		
IDDS outcomes					
Sukuma/Sumbwa	59	1.17	0.378	6.849	0.010
Bena/Hehe	56	1.09	0.288		

Note: IYCFP = Infant and Young Child Feeding Practices, IDDS = Individual Dietary Diversity Score.

[a]Mann-Whitney U Test was used to observe the significant difference when *p-value* < 0.05

2.5 Discussion

This systematic cross-section study was required to assess the prevalence of IYCF practices indicators as recommended by WHO/UNICEF and nutrition status among children aged less than five years and to recognize aspects related to child nutrition outcomes. The study determines the significant relationship among infants aged 6–8 months who consumed solid, semi-solid or soft foods; infants aged 6–23.9 months who consumed a minimum dietary diversity and a minimum acceptable diet; infants aged

21–23.9 months of age who continued breastfeeding; and being either stunted or underweighted. However, after adjusting for prospective confounders, the analysis indicated the determinants of child nutrition status within regions of high prevalence rates of stunting in Tanzania. Finally, the study showed the variation of child nutrition status in the context of ethnic perspective within major ethnic groups in the Njombe and Bukombe districts.

2.5.1 Child health information

The child health information showed a significant improvement in the prevalence of high-impact health interventions. This indicated that there is community awareness to seek for maternal and child health services and also facilities' readiness to provide services. As reported by UNICEF (2016), the access to suggested routine immunization, vitamin A supplementation, and obtainability of nearest health facilities respond to a better chance of under-five children's survival. This argument was strongly supported by several other studies with similar cohorts in dissimilar study areas (Greenspan *et al.,* 2019; Hambidge and Krebs, 2018; Lassi *et al.*, 2014; Barker *et al.*, 2018; WHO, 2009).

2.5.2 Infant and young child feeding (IYCF) practices

Based on findings from Table 1.3, the prevalence of IYCF practices did not comply with WHO and UNICEF acceptable criteria. About half (51.7%) of children were not breastfed within 1 hour after birth, only 11.6% were at minimum dietary diversity, and about 4.6% were at minimum acceptable diet. Some of the results of this study are almost the same as the latest report from the Tanzania National Nutrition Survey of 2018. In that report, 51.6% of infants in the Njombe and Geita regions didn't start breastfeeding within an hour of birth. On average, infants ate foods from 3.2 food groups, which showed that the

majority (59.8%) had less than optimal minimum dietary diversity, while only 25.2% had a minimum acceptable diet.

Child chronic undernutrition is more prevalent in Njombe and Bukombe districts, which have poor infant and young child feeding practises. More than half of children under the age of two are at risk of diseases related to growth and development and nutritional diseases due to the lack of colostrum and diets essential for protecting the child from contamination (WHO *et al.,* 2010; Rollins *et al.,* 2016; Demilew *et al.,* 2017; WHO, 2020).

2.5.3 Infants and children's nutrition status

The results indicated that there were more children with stunted growth in the Njombe district (54.4%) than in the Bukombe district (37.8%) while the number of underweight and wasted children did not change significantly. This study found that children under the age of 12 months were more stunted than children of other ages, and that stunting was more prevalent among boys than girls. Some of the causes of stunting in infants aged 0–11.9 months may include insufficient prenatal care, non-exclusive breastfeeding, and inadequate complementary feeding practises by age and gender. These results are consistent with numerous other studies from Tanzania and other nations (Ahmed *et al.,* 2016; Chirande *et al.,* 2015; Khamis *et al.,* 2020; Muhimbula *et al*., 2019; Sunguya *et al.,* 2019). (Keino *et al.,* 2014; Seboka *et al.,* 2021; Ziba *et al.,* 2018). Due to the variation in child, maternal, and household socioeconomic characteristics, the nutritional status of children in regions with a high rate of malnutrition was not assessed. Results were highly correlated with current studies assessing chronic malnutrition developments and factors in Tanzania, which similarly highlighted the same threat characteristics (Kejo *et al.,* 2018; Khamis *et al.,* 2020; Mrema *et al.,* 2021;

Sunguya *et al.,* 2019). In addition, the children's suboptimal IYCF practises increase the likelihood that their nutritional health is substandard.

2.5.4 Association of IYCF practices and nutritional status

Overall, the results indicated that IYCF practices were still poor in the study areas. Only 29.7% of the children reach the minimum dietary diversity. This means that 70.3 percent of children under the age of five had a lower chance of eating at least one type of fruit or vegetable, one type of staple food, or one type of animal food. Stunting was found (53.7%) of newborns who were not breastfed within the first hour of life. Children with unaccepted IYCF practices had a higher risk of being undernourished. The findings also are related with other similar studies conducted in different areas (Anin *et al*., 2020; Meshram *et al*., 2019; Mya *et al*., 2019; Karn *et al*., 2019; Saaka *et al.,* 2015). Inadequate IYCF practices not only increase the likelihood of being stunted or wasted, but they are also a risk factor for child mortality (UNICEF, 2011; URT, 2015; Muhimbula *et al*., 2019).

2.5.5 Determinants of child nutrition status

This study found that non-maternal nutritional knowledge was strongly associated with an increased risk of having children with stunted growth ($p = 0.028$). Additionally, the minimum acceptable diet is more likely to affect the nutritional status of the child. Nutritional outcomes are one of the most significant obstacles to child development. In addition, the nutritional knowledge of mothers influences improved feeding practises. Optimal IYCF practises increase the likelihood of survival for children under the age of five. Inadequate nutrition has had a lasting impact on humanity and civilization. The same findings were reported in the most recent Tanzania national nutrition survey reports from

2019 and the Tanzania Demographic and Health Survey from 2015, both of which indicated that the mother's nutritional knowledge and infant and young child feeding practises had an impact on nutritional outcomes. The results are similar to what other studies in different fields have found (Acheampong and Haldeman, 2013; Aguayo *et al*., 2018; Ajieroh, 2009; Chirande *et al*., 2015; Fadare *et al*., 2019; Kebede *et al*., 2020; Keino *et al.,* 2014; Kejo *et al*., 2018; Mbogori and Murimi, 2019; Meshram *et al*., 2019; Rakotomanana *et al*., 2020; Karn *et al*., 2019; Sunguya *et al*., 2019).

2.5.6 The relationship between maternal nutrition knowledge, nutritional status, and IYCF practises varies by ethnicity

This study found that more than half of the IYCF practises of children under five in places with a high rate of chronic malnutrition were not as good as they could be. When ethnicity was taken into account, there was also a statistically significant difference in the variety of diets between the Njombe and Bukombe districts. With similar results in Tanzania (Powell *et al.,* 2017), they found that ethno-nutrition knowledge on IYCF practises is likely to affect the optimal feeding practises accepted by the World Health Organization and, therefore, the nutrition status of children. Other studies (Hamner *et al*., 2021; Gatica-Domínguez *et al*., 2020; Le *et al*., 2019; Robinson *et al*., 2019; Nguyen *et al*., 2016; Veghari, 2015; Jones *et al*., 2015; Rana *et al*., 2014; Sommer *et al*., 2013) revealed that socio-economic disparity; and nutritional services seeking behavior may explain a large amount of difference ethnic dietary diversity pattern and nutrition status. Njombe and Geita are among Tanzania's multiethnic regions with the highest prevalence of malnutrition (URT, 2012; URT, 2016). The nutrition status in ethnic Njombe regions has worsened by 53.8% while it has decreased by 36.7% in ethnic Geita regions (URT, 2018).

2.6 Conclusions and Recommendations

2.6.1 Conclusions

The study assessed the infant and young child feeding practices and child nutrition status effects of ethnicity practices within regions of high rates of chronic malnutrition in Tanzania. The study observed that, despite the accessibility of nutrition-related services; willingness to achieve; and availability of optimal dietary diversity, there were suboptimal infant and young child feeding practices. The majority of under-five children with suboptimal infant and young child feeding practices also had an anthropometric failure for HAZ, WAZ, and WHZ, and their mothers had little or poor knowledge related to accepted IYCF practices. Furthermore, the statistically significant variations of IYCF practices and child nutrition status within ethnic groups highlight the need for further information about community behavior to comply with optimal IYCF practices for improving child nutrition status.

2.6.2 Recommendation

With due respect to the findings and conclusions of this study, the following are recommendations for ensuring sustainable improvement of IYCF practices and child nutrition status based on their community boundaries.

i. Due to suboptimal IYCF practises, the government and non-governmental organisations should launch and expand interventions to promote pasturage and household income generation. As consumption of animal-related foods and other optimal dietary diversity is promoted, this may have a direct impact on IYCF practises, maternal health, and child nutrition status.

ii. Government and non-government organizations should have consistency in improving nutrition knowledge through community and clinical interventions by inspiring and enlarging the services delivered by facility health workers and CHWs. This can promote an improvement of available nutrition services and ethical considerations, which will empower the awareness of communities and their respective ethnic groups to seek for and comply with optimal infant and young child feeding practices for the best child growth.

iii. Furthermore, governments and non-governmental organisations should collaborate to develop and implement strategies and policies that improve the use of optimal IYCF practises indicators and the nutritional status of children.

iv. Since the result showed suboptimal IYCF practices and anthropometric failures with slight augmentation, there is a need for further research to be focused on socio-economic and biological features allied with IYCF practices and child nutrition status.

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Appendix 2.1: Association of infant and young child feeding practices and nutritional status in Bukombe district

Dependent Variable's	Underweighted				Stunted			
	Underweight	Normal	WAZ	WAZ	Stunted	Normal	HAZ	HAZ
Independent Variable's	**n(%)**	**n(%)**	**X^2**	***Sig***	**n(%)**	**n(%)**	***X^2***	***Sig***
Core indicators								
EI (Breast milk),								
Yes	4(4.7)	20(23.5)	0.632	0.937	12(14.1)	17(20)	0.310	0.438
No	3 (3.5)	25(29.4)			12(14.1)	11(12.9)		
Intr. (solid, semi/soft)								
Yes	1 (1.2)	2 (2.4)	0.643	0.673	3(3.5)	0(0.0)	0.018	0.005
No	1 (1.2)	4 (2.4)			0 (0.0)	5(5.9)		
Min. (Dietary diversity)								
Yes	4 (4.7)	7 (8.2)	0.025	0.009	5 (5.9)	6(7.1)	0.418	0.599
No	5 (5.9)	57(67.1)			23(27.1)	39(45.9)		
Min. (meal frequency)								
Yes	5(5.9)	15(17.6)	0.419	0.509	9(10.6)	11(12.9)	0.284	0.353
No	2(2.4)	11(12.9)			8(9.4)	5(5.9)		
Min. (acceptable diet)								
Yes	2(2.4)	1(1.2)	0.106	0.043	2(2.4)	1(1.2)	0.523	0.582
No	5(5.9)	25(29.4)			15(17.6)	15(17.6)		
Cons. (Iron-rich/ fortified)								
Yes	6(7.1)	16(18.8)	0.232	0.228	11(12.9)	11(12.9)	0.459	0.805
No	1(1.2)	10(12.1)			6(7.1)	5(5.9)		
Optional indicators								
Cont. (BF 20-24 months)								
Yes	2(14.3)	1(7.1)	0.093	0.031	1 (7.1)	2 (14.3)	0.725	0.923
No	1(7.1)	10(71.4)			4 (28.6)	7 (50.0)		
Age-appr. BF (0-23 months) n= 54								
Yes	7 (12.9)	32(59.3)	0.281	0.296	19(35.2)	20 (37)	0.234	0.308
No	1 (1.9)	14(25.9)			5 (9.3)	10 (18.5)		
Predo. BF (<6 months) n=								
Yes	0 (0.0)	1 (5.9)	0.882	0.707	0 (0.0)	1(5.9)	0.529	0.331
No	2 (11.8)	14(82.4)			8 (47.1)	8 (47.1)		

Appendix 2.2: Association between infant and young child feeding practices and nutritional status in Njombe district

Dependent Variable's	Underweighted				Stunted			
	Underweight	Normal	WAZ	WAZ	Stunted	Normal	HAZ	HAZ
Independent Variable's	**n(%)**	**n(%)**	**X^2**	***Sig***	**n(%)**	**n(%)**	***X^2***	***Sig***
Core indicators								
EI (Breast milk),								
Yes	0(0.0)	11(16.9)	0.377	0.252	5(7.7)	6(9.2)	0.442	0.597
No	2(3.1)	16(24.6)			10(15.4)	8(12.3)		
Intr. (solid, semi/soft)								
Yes	-	3(4.6)	-	-	1(1.5)	2(3.1)	0.700	0.709
No	-	2(3.1)			1(1.5)	1(1.5)		
Min. (Dietery diversity)								
Yes	1(1.5)	4(6.2)	0.462	0.521	4(6.2)	1(1.5)	0.220	0.211
No	6(9.2)	51(78.5)			29(44.6)	28(43.1)		
Min. (meal frequency)								
Yes	2(3.1)	9(13.8)	0.217	0.122	6(9.2)	5(7.7)	0.579	0.827
No	0(0.0)	12(18.5)			6(9.2)	6(9.2)		
Min. (acceptable diet)								
Yes	-	-	-	-	-	-	-	-
No	2(3.1)	21(32.3)			12(18.5)	11(16.9)		
Cons. (Iron-rich/ fortified)								
Yes	2(3.1)	15(23.1)	0.589	0.421	9(13.8)	8(12.3)	0.500	0.611
No	0(0.0)	5(7.7)			2(3.1)	3(4.6)		
Optional indicators								
Cont. (BF 20-24 months)								
Yes	-	1(14.3)	-	-	1(14.3)	0(0.0)	0.571	0.350
No	-	6(85.7)			3(42.9)	3(42.9)		
Age-appr. BF (0-23 months) n= 54								
Yes	0(0.0)	20(71.4)	0.611	0.443	12(42.9)	10(35.7)	0.600	0.843
No	2(7.1)	6(21.4)			3(10.7)	3(10.7)		
Predo. BF(<6 months) n=								
Yes	-	1(16.7)	-	-	1(16.7)	0(0.0)	0.600	0.361
No	-	5(83.3)			3(50.0)	2(33.3)		

Appendix 2.3: The determinants of child nutritional status (stunting) in Bukombe district (regression analysis)

Factors/Determinants	B	Std. Err.	Wald	Df	Sig.	Exp (B)	95% CI	
							Lower	Upper
Household size	0.459	0.657	0.489	1	0.485	1.583	0.437	5.734
Child sex (female)	-1.106	1.229	0.810	1	0.368	0.331	0.030	3.677
Child age	0.112	0.110	1.019	1	0.313	1.118	0.900	1.388
Child birth weight	2.157	1.357	2.525	1	0.112	8.644	0.605	123.604
Child received all Vaccines (Yes).	-0.527	1.400	0.142	1	0.707	0.590	0.038	9.181
Early initiation of breast milk (Yes).	-0.327	1.110	0.087	1	0.768	0.721	0.082	6.347
Min. Meal frequency (Yes).	-0.650	1.021	0.405	1	0.524	0.522	0.071	3.863
Min. Acceptable Diet (Yes).	1.324	1.748	0.573	1	0.449	3.757	0.122	115.551
Time to the nearest health facility.	-0.041	0.810	0.003	1	0.959	0.960	0.196	4.696
Maternal nutrition knowledge (Overall).	1.071	0.798	1.803	1	0.179	2.919	0.611	13.943
Maternal formal education (Yes).	1.643	1.526	1.160	1	0.282	5.171	0.260	102.874
Constant.	-13.025	6.264	4.323	1	0.038	<0.001		

Appendix 2.4: Selected determinants of child nutritional status (Stunting) in Njombe district (regression analysis)

Factors/ Determinants	B	Std. Err.	Wald	Df	Sig.	Exp(B)	95% CI	
							Lower	Upper
Household size	-2.799	3.687	0.576	1	0.448	0.061	<0.001	83.761
Child sex (female)	6.517	3.490	3.487	1	0.062	676.615	0.724	632 319.499
Child age	-0.206	0.245	0.711	1	0.399	0.814	0.504	1.314
Child birth weight	-1.292	2.056	0.395	1	0.530	0.275	0.005	15.431
Child received all Vaccines (Yes).	3.931	3.099	1.609	1	0.205	50.953	0.117	22151.145
Early initiation of breast milk (Yes).	-1.076	3.039	0.125	1	0.723	0.341	0.001	131.783
Min. Meal frequency (Yes).	-2.830	3.518	0.647	1	0.421	0.059	<0.001	58.268
Min. Acceptable Diet (Yes).	1.324	1.748	0.573	1	0.449	3.757	0.122	115.551
Time to the nearest health facility.	4.311	3.948	1.192	1	0.275	74.503	0.032	171 027.903
Maternal nutrition knowledge (Overall).	2.619	1.684	2.417	1	0.120	13.720	0.505	372.435
Maternal formal education (Yes).	18.302	40192.977	<0.001	1	1.000	88 774 572.054	0.000	18.302
Constant.	-22.911	40192.978	<0.001	1	1.000	<0.001		

Appendix 2.5: Selected determinants of child nutritional status (underweight) in Bukombe district and Njombe district (regression analysis)

Factors/Determinants	B	Std. Err.	Wald	Df	Sig.	Exp(B)	95% CI	
							Lower	Upper
Household size	0.236	0.602	0.153	1	0.695	1.266	0.389	4.120
Child age	-0.024	0.083	0.081	1	0.776	0.977	0.831	1.148
Early initiation of breast milk (Yes).	-0.680	0.924	0.542	1	0.462	0.507	0.083	3.097
Min. Acceptable Diet (Yes).	3.192	1.452	4.835	1	0.028	24.342	1.414	418.920
Maternal nutrition knowledge (Overall).	0.506	0.528	0.919	1	0.338	1.659	0.589	4.674
Constant.	-1.906	2.496	0.583	1	0.445	0.149		

Appendix 2.6: The determinants/ or factors for child nutritional status (stunted)

Factors/Determinants	B	Std. Err.	Wald	Df	Sig.	Exp(B)	95% CI	
							Lower	Upper
Household size	-0.187	0.480	0.152	1	0.696	0.829	0.323	2.125
Child sex (female)	0.796	0.751	1.124	1	0.289	2.217	0.509	9.656
Child age	0.012	0.065	0.033	1	0.857	1.012	0.891	1.148
Child birth weight	1.000	0.653	2.343	1	0.126	2.717	0.756	9.771
Child received all Vaccines (Yes).	0.870	0.856	1.033	1	0.309	2.387	0.446	12.780
Early initiation of breast milk (Yes).	-0.464	0.641	0.525	1	0.469	0.629	0.179	2.209
Min. Meal frequency (Yes).	-.935	.729	1.646	1	0.200	0.393	0.094	1.638
Min. Acceptable Diet (Yes).	0.814	1.458	0.311	1	0.577	2.257	.129	39.338
Time to the nearest health facility.	0.321	0.576	0.311	1	0.577	1.379	0.446	4.264
Maternal nutrition knowledge (Overall).	0.924	0.420	4.844	1	0.028	2.518	1.106	5.733
Maternal formal education (Yes).	1.535	1.299	1.396	1	0.237	4.639	0.364	59.179

CHAPTER THREE

Manuscript two

The Role of Nutrition Interventions to Maternal Knowledge on Infant and Young Child Feeding Practices: Mapping Study in Njombe and Geita Regions

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3.0 Abstract

Children under the age of five are especially susceptible to malnutrition, particularly in developing countries. It was discovered that mothers' nutrition knowledge was one of the most influential factors in determining whether or not children under the age of five had an acceptable nutritional status. The purpose of this study was to examine the impact of nutrition interventions on maternal knowledge of IYCF practises and child nutrition status in regions with high rates of stunting. This was a cross-sectional study conducted in the Tanzanian regions of Njombe and Geita from a community-based perspective and examining current and eventually nutrition interventions. Women and their children younger than five years old were chosen purposively to participate in the study. The Chi-square test (p 0.05) was used to compare IYCF practises, maternal knowledge, nutrition status, and differences between areas with few and many interventions. According to the results of this study, mothers' IYCF practises (p = 0.014) and their children's nutritional status (p = 0.048) improved significantly when nutrition interventions were easily accessible and readily usable. P = 0.005 revealed that 90.5% of teenage mothers (15–20 years old) had inadequate nutrition knowledge. Approximately 68 percent [49.7-86.3] of stunted infants in the Njombe district were male, and there were few interventions in place, whereas the Bukombe district had a stunted infant rate of 38.9 percent. Multicomponent nutrition interventions in regions with high chronic malnutrition should initiate and strengthen programmes to improve IYCF practises and the nutritional status of children at the earliest stages of learning.

Key words: Intervention, Nutrition status, stunting, infant and Young child feeding (IYCF) practices, maternal nutritional knowledge, undernutrition.

3.1 Introduction

Child undernutrition remains a global health problem with the goal that no country is harmless (GNR, 2018a). Undernutrition has destructive effects commonly in developing countries compared to developed countries (WHO *et al.,* 2019). Tanzania is one of the countries with a high rate of undernutrition, with approximately 31.8% of children under the age of five stunted (URT, 2019). Poor maternal nutritional knowledge, on the other hand, is one of the drivers of improper infant and young child feeding (IYCF) practises that lead to child malnutrition (Mbogori and Murimi, 2019; Mistry *et al*., 2019). The regions with the high prevalence rate of chronic malnutrition in Tanzania had poor maternal nutrition knowledge which made them unacceptable IYCF practices (CW and UNICEF, 2015). Findings from other cohort studies observed that inadequate IYCF practices, maternal education, poor care, diseases, poor access to health services, and socio-economic status are among the major causes of undernutrition (Abubakar *et al.,* 2012; Mussa, 2014; Ramokolo *et al.,* 2017; Muhimbula *et al.,* 2019; Fadare *et al.,* 2019). Maternal nutrition knowledge is likely to affect child feeding practices which both influence the nutrition status of children aged (0-56) months of age (El-nmer *et al.,* 2014; URT, 2015; Jemide *et al.,* 2016).

Government and non-governmental organizations are now focusing on the role of nutritional-related activities that will raise healthier maternal and children's nutrition status (URT, 2012; UNICEF, 2015; Fanzo *et al*., 2018). According to the Tanzania Health and Demographic Survey (TDHS-MIS) of 2015/2016, various efforts have been made to reduce child malnutrition since 1992, when about 50% of children aged under five years were stunted compared to 31.8% in the current report. Furthermore, the Global Nutrition Report of 2018 revealed that Tanzania was among the countries with a high unacceptable burden of child malnutrition and its progress is currently simply not good enough. From

that general point of view, this study hypothesized the role of nutrition interventions with specific components of maternal nutrition knowledge on IYCF practices.

This study uses the Scaled-Up Nutrition Project Monitoring Tool (SUN-PMT) for mapping and assessing current nutritional interventions in order to determine their effect on maternal nutrition knowledge. It was determined whether and to what extent the projects improved maternal knowledge of IYCF practises and the nutritional status of children under five; whether or not the projects had an impact on the intervention area and wider environment; and whether or not the project objectives were appropriate for improving maternal nutritional knowledge and IYCF practises. These were the criteria used in the assessment. Nutritional projects confirmed that baseline and end-line data were obtained from the TDHS-MIS report of 2015/2016 and the Tanzania National Nutrition Survey report of 2014/15, while household data from the study survey and current publishable nutritional project reports were both guided tools to capture their outcome. Based on this lack of evidence, the study's hypothesis was to investigate whether nutrition interventions can improve maternal nutrition knowledge and thus, the nutritional status of children in high-malnutrition regions.

3.2 Methodology

3.2.1 Description of study areas

The assessment and mapping of nutrition interventions were concentrated on the regions with a high rate of malnutrition. The regions and their respective districts were selected purposively based on the high prevalence rate of malnutrition. Njombe and Geita are among the mostly nutritional vulnerable regions in Tanzania with 49% and 41% rates of chronic malnutrition, respectively (URT, 2015). However, the study areas have different socio-economic and demographic features. Their difference will help to identify some

other determinants of child nutrition status. Furthermore, the study areas showed to have different ethnicity and other socio-demographic features which were vital in the justification of the outcomes. The household survey was conducted in two representative districts such as Njombe Rural and Bukombe with coverage areas of 3448 km^2 and 10 842 km^2 respectively (URT, 2007; URT, 2016).

3.2.1.1 Study design

A cross-section study was adopted for assessment of the effort made by nutrition interventions on infant and young child feeding practices and the nutrition status of children less than 5 years of age. For the large extent and nature of this study, the cross-section seems comparatively less time-consuming and inexpensive during the survey, using easy survey procedures and giving occurrence rates of various features (Bell and Jones, 2015).

3.2.1.2 The study population

The people who were part of the study were women or caretakers with children younger than five years old who lived in some rural areas of the Bukombe and Njombe Rural Districts and were getting nutrition-related help. Some of the nutrition project officers who work in the study areas and regional or district nutrition officers were also part of the study. There are 20 594 women of childbearing age in Njombe Rural and 51 153 in Bukombe. There is a 60% chance that a woman in Njombe Rural and an 86% chance that a woman in Bukombe will have a child under the age of five (URT, 2013). In study areas, the average age of women with children younger than five years old is 56 309.

3.2.1.2 The target groups

The qualified respondents were women/caregivers with children of less than five years of age, the nutritional project officers responsible for representing the project or having say over the project, and regional and district nutrition officers. Experience and exposure related to nutritional issues, including IYCF practices, nutritional knowledge, and project information, were among the essential criteria for the target group. However, the worthiness criteria for household survey respondents was that women had better be at least as good as those who had lived in study areas since the initiation of some interventions.

3.2.1.4 Sample size

Accordingly, the Green formula was used to select the most statistically significant samples of household surveys possible. The number of predictors, p, determines the value of the constant n. Although the sample size is corrected as follows, it is expected that the number of predictors in this study will not exceed 12, based on the objectives and key questions.

In this case, N 50 + 8(12) = 146.

A minimum sample size of 20 percell is sufficient for social science studies, according to Simonsohn *et al*. (2011), while the same authors presented at a conference suggested using a sample size of N > 50. (Simmons *et al*., 2013). The sample has grown to 150 after an additional four people were recruited and distributed equally among the two districts. The population size of Njombe District and Bukombe District dictated that the sample size was 65 and 85, respectively. In addition, other scientists believe that a sample size of

100 respondents or more is sufficient for statistically significant analysis (Sudman, 1976; Bailey, 1994; Mundfrom *et al*., 2005; Beleites *et al*., 2013).

3.2.1.5 Methods of data collection

Household surveys, clinical surveys, and project premises offices were used to collect quantitative and qualitative data. Mapping exercises and evaluation of either process or outcome evaluation of nutrition related projects were done through face-to-face interviews with nutrition officers or/and project staff, phone interviews, and exploration for further existing information from the project website.

3.2.1.6 Child's health and mother's socio-economic and demographic features

A pretested structured questionnaire was administered to eligible respondents (mothers with children aged under 5 years) as a useful tool for recording quantitative information such as: mother's age, marital status, education, occupation, and maternal nutritional knowledge; child's age, sex, delivery place, and birth weight; and health or/and nutritional services availability and willingness assessment. Qualitative data was collected through Key Informant Interviews (KII) by Regional and District Nutrition Officers. KIIs' were guided by checklist items.

3.2.1.7 Maternal knowledge on infant and young child feeding (IYCF) practices (Average score measurement)

WHO recommends IYCF indicators as the assessment guideline for acquiring suitable feeding practices information based on children's age groups (Aguayo *et al.*, 2018). Indicators are early initiation of breastfeeding (BF) within 1 hour after birth; exclusive BF without any other foods or drinks under 6 months; continued BF at age of 12-14.9 months; introduction of solid, semi-solid or soft foods at 6-8 months; minimum dietary

diversity, meal frequency and acceptable diet at 6-23.9 months; and consumption of iron-rich/ iron-fortified food at age of 6-23.9 months (Menon, Bamezai, Subandoro, Ayoya and Aguayo, 2015). Individual dietary diversity score data, on the other hand, was transformed from a 24-hour recall assessment tool designed for complementary feeding practices (UNICEF, 2011).

The average score was adopted for assessing maternal nutrition knowledge. The right answers from questions related to breastfeeding and complementary feeding indicators were coded as one, which means' knowledgeable ', and incorrect answers were coded as zero, which means' no knowledge. Then the average score was related and measured on the scale for further analysis.

Table 3.1: Average Score measurement scale

Code	Very Poor Knowledge (1)	Poor Knowledge (2)	Fair Knowledge (3)	Good Knowledge (4)	Excellent Knowledge (5)
Average Score (AS) value	0.00 – 1.80	1.81 – 2.60	2.61 – 3.40	3.41 – 4.20	4.21 – 5.00

Example of coding adopted on this study: AS ≤ 3.00 = 0 which means “No/Poor knowledge, while AS ≥ 3.10 means “Knowledgeable”.

3.2.1.8 Infant and young child nutrition status (Anthropometric)

The data was obtained by recording the child's age from their clinical cards/records, as well as the child's height and weight. The anthropometric tools (electronic weighing scale (Seca 874) and UNICEF moveable body height and length measure) were tested and then adjusted to obtain data entered into ENA for SMART software. Moreover, the unladen weighing method was used while the mother had to stand on a weighing scale with her child, who was not able to stand alone. Stunting was measured by low height for age z-score (HAZ), underweighting for low weight for age (WAZ), and wasting was

measured by low weight for height (WHZ). Due to WHO flags, z-scores less than negative 2 standard deviation of the median value of the mentioned data (HAZ, WAZ, and WHZ) were defined as stunted, underweighted, and wasted (WHO, 2014).

3.2.1.9 Mapping of nutritional related interventions

The Scaled-Up Nutrition Project Monitoring Tool (SUN-PMT) was used to identify and justify the extent of nutritional interventions for improving maternal nutritional knowledge and hence child nutritional status. The study showed the implementing agents of nutrition activities by detailing what, who, when, where, how, and to what extent they were done. The assessment subjected many to interventions with maternal nutritional knowledge. However, the comparison of child nutritional status before (baseline data) and after (based on the status of existing interventions) by their association with maternal nutritional knowledge and IYCF practices was done to have outcome information (FANRPAN, 2017). The outcome data were obtained from Tanzania Demographic Health Survey and Malaria Indicator Survey report of 2015, Tanzania National Nutrition Survey report of 2019, publishable and existing evaluation project reports as well as data and information from the Regional nutrition officer, District nutrition officer, or authorized Project officer.

3.2.1.10 Data processing and analysis

The Statistical Package for Social Science (IBM SPSS 21) was used to enter raw data from structured and tested questionnaires. Despite the fact that anthropometric data were initially entered into software known as Emergency Nutrition Assessment (ENA) for Standardized Monitoring and Assessment of Relief Transitions (SMART) 2011, HAZ, WAZ, and WHZ were transformed from INA for SMART software to IBM SPSS Statistics 21 for data cleaning and further analysis under WHO flags. A p-value of less or

equal to 0.05 was considered a statistically significant difference between variables. Socio-economic and demographic features variables, IYCF, and child nutrition status indicators were both descriptively computed. Continuous data were tested and presented as mean and standard deviation; categorical data were computed and presented as Pearson Chi-square significance value; and anthropometric data (HAZ, WAZ and WHZ) were also presented as the proportion of events that occurred with a 95% confidence interval (% [CI 95%]). The WHO standards classify stunted, underweight, and wasting when a z-score value is smaller than a negative 2 standard deviation of the median values of height for age, weight for age, and weight for height, respectively.

Therefore, $CI = P \pm Z * (P\ (1-P)/n)^{0.5}$

Where by p= sample proportion, Z = value from standard normal distribution of 95% N = Sample size and n = number of positive cases.

Lastly, mapping activity was additionally done through the Scaled-Up Nutrition Project Monitoring Tool (SUN-PMT) for appraisals and justifications of the effort made by nutritional interventions on the role of maternal nutritional knowledge in child nutritional status (Gertler *et al*., 2016).

3.3 Results and Discussion

3.3.1 Results

3.3.1.1 Socio-economic and demographic characteristics of infants and mothers

The findings from Table 3.2 indicated that more than half (56.7%) of the children were females. The majority of children were an average of 23.96 months of age and had an average body weight of 3.21 kg. Almost 86% of the children completed the vaccination per the recommended age timeframe. About 88.7% of respondents were married or living together with their male partners, while only 7.3% were never married or living together

with their male partners, and the rest were divorced or separated. The majority of respondents (88.7%) had a primary level of education and 81.3% of respondents had a 21-35-year-old age group. About 84.7% of respondents were farmers. The majority (86.7%) were delivered at health facilities, where about 69.3% used less than 30 minutes to reach the nearest health facility.

Table 3.2: Socio-economic and demographic characteristics of infants and mothers

Category	Sub-category	Bukombe district n=85	Njombe district n=65	Total
Infant gender	Male	40(47.1)	25(38.5)	65(43.3)
	Female	45(52.9)	40(61.5)	85(56.7)
Infant age (months)	Mean (SD)	21.35(13.76)	27.37(13.85)	23.96(14.08)
Infant birth weight (kg)	Mean (SD)	3.24(0.42)	3.17(0.48)	3.21(0.45)
Infant vaccination status	Completed	42(49.4)	44(67.7)	86(57.3)
	Not completed	4(4.7)	1(1.5)	5(3.3)
	< 18 months	39(45.9)	20(30.8)	59(39.3)
Mother's marital status	Married	77(90.6)	56(86.2)	133(88.7)
	Divorced/Separated	4(4.7)	2(3.1)	6(4)
	Never Married	4(4.7)	7(10.8)	11(7.3)
Maternal age group	15-20 years	15(17.6)	7(10.8)	22(14.7)
	21-35 years	68(80.0)	54(83.1)	122(81.3)
	36-49 years	2(2.4)	4(6.2)	6(4.0)
Maternal education	Primary	51(60)	46(70.8)	97(64.7)
	Secondary	17(20)	15(23.1)	32(21.3)
	Technical/Vocational	3(3.5)	0(0.0)	3(2)
	None	14(16.5)	4(6.2)	18(12)
Maternal occupation	Farmer	68(80)	59(90.8)	127(84.7)
	Domestic help	15(17.6)	2(3.1)	17(11.3)
	Public servant &Others	2(2.4)	4(6.2)	6(4.0)
Maternal delivered place	Health facility	67(78.8)	63(96.9)	130(86.7)
	Home delivery	18(21.2)	2(3.1)	20(13.3)
Time to reach the nearest health facility	1-30 minutes	55(64.7)	49(75.4)	104(69.3)
	31-60 minutes	21(24.7)	16(24.6)	37(24.7)
	>61 minutes	9(10.6)	0(0.0)	9(6)

Note: Number in bracket is percentages, Continuous data being presented by Mean (SD) while SD means Standard Deviation.

3.3.1.2 Mapping of existing nutrition interventions in Njombe and Geita regions

The study showed the implementing agents of nutrition activities by detailing out what, who, when, where, how, and to what extent they were done. The assessment was based on interventions with maternal nutritional knowledge together with IYCF practices components. This study observed only two multicomponent nutrition interventions (ASRP-Tubadilishe Project and Kizazi kipya Project) with an average coverage area of 66.7% in Njombe. But, only ASRP had a component of maternal knowledge on IYCF practices. Also, findings from this study observed that more than half (52.3%) of respondents had low knowledge related to IYCF practices (Table 5). The result showed that the ASRP role could not be enough to reach its own target of 75% being impacted with acceptable IYCF practices. However, an increase in the stunting rate from 44% to 53.6% (Table 3.3) of children under five years demonstrates the need for increasing effort for maternal nutrition knowledge for the betterment of child nutrition status.

Findings from (Table 3.4) observed four multicomponent nutrition interventions with maternal nutritional knowledge out of five executed in Geita. The projects in the Geita region (ASTUTE, Mtoto Mwerevu, USAID Boresha Afya, and Kizazi Kipya) had an optimistic effect on the community with the reason that they may have contributed to the decrease in proportion of stunting level by 7.1% while in the Njombe region it increased by 9.5% from 2015 to 2020 (URT, 2015; URT, 2018).

Table 3.3: Mapping and evaluation of nutrition projects in Njombe* district *as per 31 January 2020 (qualitative information)

Project Title	Implementing Organization	Covered Area(s)	Project Objectives	Outcome Evaluation done
Accelerating Stunting Reduction Program (ASRP) *(Tubadilishe Project)* **(2013-2020)**	Consortium of Doctors with Africa-(CUAMM) and Tanzania Home Economics Association (TAHEA)	The whole part of Njombe region.	To **reduce the prevalence of stunting** among children under five years from **44% in 2015 (TDHS) to 35% in 2020** (i.e. 3.4% average annual reduction rate), ***Recent survey stunting rate is 53.6 (2018/2019 TNNS)***	1. Increased proportion of pregnant women and mothers/caregivers of children under two years old who **practice key pro-nutrition behaviors** including IYCF, Health, WASH, and CCD (From 5% in 2014 to 75% in 2020) 2. Increased availability of **diverse nutrient-rich foods** at the household level in Njombe Regions (Mean household dietary diversity score, from 6 in 2013 to 10 in 2020) from year 1 to year 3. 3. Increased coverage of integrated management of severe acute malnutrition (IMSAM) for less than 5 children and improvement of overall SAM services governance. (Outcome two for Y4&Y5). 4. Strengthening the health system to prevent and respond to violence, abuse, neglect, and exploitation of children in the council
Kizazi Kipya Project	Community Concern of Orphans and Development Association (COCODA) and PACT.	Njombe Town Council and Njombe District Council.	1. To enable orphans and vulnerable children age 0-18 years together with adolescents aged 18-19 years to access complete HIV-related services and other essentials for improved health, nutrition, education, protection, livelihoods, and psychosocial well-being.	***No evaluation report available during the period of data collection.***

Table 3.4: Mapping and evaluation of nutrition projects in Bukombe district as per 31 January 2020

Project Title	Implementing Organization	Covered Area(s)	Project Objectives	Outcome Evaluation done
Addressing Stunting in Tanzania Early (ASTUTE). *(Mtoto Mwerevu)* (2016-2020)	IMA WORLD HEALTH	17 wards in Geita Region	1. To **reduce stunting to children with under five age**. 2. Consolidation a multi - sectoral reply to nutrition. 3. Ornamental best care practices for infant, young child and maternal nutrition; water, sanitation and hygiene; an early childhood development. 4. Increasing the knowledge of pregnant women, caregivers, household and community decision makers.	1. From 2016 to 2019 there was decrease about 7.1% level of stunting from 46% to 38.9%.
Mtoto mwerevu **July 2018 – Feb 2020**	Mwangaza SBCO for Bukombe Dc only.	Geita region	1. Community groups formulation and educate them on nutritional knowledge. 2. Capacity building on maternal, infant and young child nutrition practices; sanitation and hygiene; supplementary foods; child care and growth; and gender issues.	1. There is a clearly understand of nutritional related knowledge in the community. 2. Only 83% of the project's target was reached by an intervention (75% out of 90%). The intervention was targeted at three community groups in each ward. 3. There was slight participation of male in the project activities, though gender norms and gender discrimination.
USAID Boresha Afya	JHPIEGO	17 wards in Geita such as	1. Maternal, Infant and Young Child Nutrition. 2. Growth Monitoring. 3. Management of acute malnutrition.	1. For the integration of acute malnutrition, the project trained 34 health workers for implementation. 2. Two hospitals in the region deliver services for the treatment of acute malnutrition. 3. Training of nutrition-related knowledge to health workers and CHW toward facilities and communities' levels.
Kizazi Kipya	NELICO	Geita Dc	1. Nutrition counseling to mother and child. 2. Referral and linkage to malnourished children.	1. *Services delivery through community health worker by 00% from baseline to date.
Red Cross	RED CROSS Society	Mbogwe Dc	1. ***Not available during surveyed period***	1. Provided support of Ready to use therapeutic food to child with under five of age in the District.

Note: *Outcome data for Kizazi Kipya Project was not found from NELICO

3.3.1.3 Maternal nutritional knowledge (MNK) variation between age groups and within Njombe and Bukombe district

The finding from study (Table 3.5) showed that about 90.5% of adolescent mothers aged 14 to 20 years had lower maternal nutritional knowledge compared to those mothers aged 21 to 49 years who had 59% prevalence rate of poor or lower nutritional knowledge, though their difference was statistically significant (p= 0.005). The variation of maternal nutritional knowledge within the districts of respondent had statistical meaningful (p= 0.014) with prevalence rate of 72% and 52% of mothers with poor or lower nutritional knowledge in Bukombe and Njombe districts respectively.

The variation observed on maternal nutritional knowledge within districts also showed the level and effort made by existing nutritional interventions with the elements of maternal nutritional knowledge together with IYCF practices. Despite the large numbers of nutrition intervention (ASTUTE, Mtoto mwerevu, USAID Boresha Afya etc.) in Bukombe district, mothers with reproductive age still had little knowledge related to child nutrition compared with mothers in Njombe district.

***Table 3.5: Maternal nutritional knowledge (MNK) variation between age groups and within* Bukombe and Njombe districts**

Category	Sub-category	Maternal nutritional knowledge		X^2	*p-value*
		Poor/ lower	Good/ higher		
Mother's age group	14- 20 years	19 (90.5)	2 (9.5)	7.747	0.005
	21- 49 years	76 (58.9)	53 (41.1)		
District of respondent	Bukombe	61 (71.8)	24 (28.2)	6.005	0.014
	Njombe	34 (52.3)	31 (47.7)		

Note: *Number in bracket is percentages*

3.3.1.4 Nutrition status of children aged 0-59 months

The findings for infant and young child nutritional status was indicated from Table 3.6 where by stunting was significantly different between Bukombe and Njombe districts ($p = 0.048$). In Njombe district, 68% of male infants and young children were more stunted than female (45%). Related studies indicated that the infants and young children lived in rural areas and those who are male were more impacted with stunting (Keino *et al*., 2014). Njombe district has large proportional average of stunted infants between 0-11.9 months of age. The other results presented by age categories report that infant between 0-11.9 months were harmful impacted with stunting than other age groups (Ali *et al.*, 2017; Muhimbula *et al.,* 2019). The proportion of stunting in all male infants and young children in Njombe district were between 49.7% and 86.3% (95% C.I). 12.5% and 15.0% of Male infants and young children in Bukombe district were underweighted and wasting, respectively. Bukombe and Njombe districts had statistical significantly different for wasted infants and young children ($p = 0.017$). Also, there was no statistical significantly different of nutrition status for infants and young children between sex and age groups. The findings highlighted a high frequency of infants and young children with low HAZ measurement in Njombe district; less frequency of WAZ and WHZ measurement in both Bukombe and Njombe districts which were nearly correlated to recent national data, whereas 38.9% and 53.6% of infants and young children were stunted in Bukombe and Njombe districts respectively (URT, 2018).

***Table 3.6: Prevalence of stunting, underweighting and wasting in children with under five years of age by sex and age group in* Bukombe and Njombe districts**

Category	Sub-category	Bukombe district N	Bukombe district n	Bukombe district % [CI 95%]	Njombe district N	Njombe district n	Njombe district % [CI 95%]	*p-value*
Stunting								
Child sex	male	40	15[a]	37.5 [22.5-52.5]	25	17[a]	68.0 [49.7-86.3]	0.048[a]
	female	45	17	37.8 [23.6-52.0]	40	18	45.0 [29.6-60.4]	
		p-value		0.979[b]	*p-value*		0.070[c]	
Child age	0-5.9 months	12	4	33.3 [6.6-60.0]	4	3	75.0 [34.6-115.4]	0.242[b]
	6-11.9 months	24	13	54.2 [34.3-74.1]	13	6	46.1 [19.0-73.2]	0.772[c]
	12-23.9 months	44	14	31.8 [18.0-45.6]	38	21	55.2 [39.4-71.0]	
	24-59.9 months	5	1	20.0 [-15.0-55.1]	10	5	50.0 [19.0-81.0]	
Underweighting								
Child sex	male	40	5	12.5 [2.3-22.7]	25	3	12.0 [-0.7-24.7]	0.972[a]
	female	45	4	8.9 [0.6-17.2]	40	4	10.0 [0.7-19.3]	
		p-value		0.589[b]	*p-value*		0.800[c]	
Child age	0-5.9 months	12	0	-	4	0	-	0.189[b]
	6-11.9 months	24	5	20.8 [4.6-37.0]	13	2	15.4 [-4.2-35.0]	0.531[c]
	12-23.9 months	44	4	9.1 [0.6-17.6]	38	5	13.2 [2.5-23.9]	
	24-59.9 months	5	0	-	10	0	-	
Wasting								
Child sex	male	40	6	15.0 [4.9-26.1]	25	1	4.0 [-3.7-11.7]	0.017[a]
	female	45	4	8.9 [0.6-17.2]	40	0	-	

Note: [a]Chi square test was used for finding significant difference between Bukombe and Njombe districts; [b,c]Chi square test was used for finding significant difference between sex and age groups in Bukombe and Njombe districts respectively. P-value ≤ 0.5 was considered as statistical significance.

3.3.1.5 Association of maternal nutrition knowledge on IYCF practices and nutrition status

Table 3.7 highlighted that mother within regions of high-rate malnutrition had poor knowledge related to child nutrition. About 85.7% of adolescent mothers had little nutritional knowledge. There was statistical significantly difference between mother with or without nutritional knowledge and mother's age group in Bukombe district (p = 0.010), in addition (p = 0.005) significant difference of maternal nutritional in Bukombe and Njombe districts. The findings showed that maternal nutrition knowledge had no statistical significantly different with IYCF practices indicators (p = 0.751 and 0.655) and stunting, underweighting and wasting (p = 0.058, 0.116 and 0.186; Table 3.7) in Bukombe and Njombe districts.

Table 3.7: Association of maternal nutrition knowledge among mothers' age group, IYCF practices and child nutritional status

		Maternal nutritional knowledge (MNK)				
		Bukombe district		Njombe district		
Category	**Sub category**	**Poor/ Lower**	**Good/ Higher**	**Poor/ Lower**	**Good/ Higher**	**Total *(p-value)***
Mothers' age group	15-20 years	14(100.0)	0(0.0)	5(71.4)	2(28.6)	0.005
	21-49 years	47(66.2)	24(33.8)	29(50.0)	29(50.0)	
	p-value		0.010		0.284	
Child feeding Practices						
Early initiation of breastfeeding	disqualified	15(28.8)	8(15.4)	9(31.0)	9(31.0)	0.715
	qualified	21(40.4)	8(15.4)	4(13.8)	7(24.1)	
	p-value		0.577		0.474	
Min. dietary diversity	disqualified	45(61.6)	17(23.3)	30(48.4)	27(43.5)	0.655
	qualified	8(11.0)	3(4.1)	3(4.8)	2(3.2)	
	p-value		0.992		0.752	
Child nutritional status						
Stunting	stunted	26(35.6)	6(7.1)	22(33.8)	13(20.0)	0.054
	normal	35(41.2)	18(21.2)	12(18.5)	18(27.7)	
	p-value		0.131		0.066	
Underweight	underweighted	7(8.2)	2(2.4)	6(9.2)	1(1.5)	0.116
	normal	54(63.2)	22(25.9)	28(43.1)	30(46.2)	
	p-value		0.672		0.061	
Wasting	wasted	8(9.4)	2(2.4)	1(1.5)	0(0.0)	0.186
	normal	53(81.5)	22(25.9)	33(50.8)	31(47.7)	
	p-value		0.538		0.336	

Note: Number in bracket is percentages

3.3.2 Discussion

This study assesses the role of nutritional interventions scheduled maternal knowledge on IYCF practices within the regions of high rate of undernutrition and identify the number of projects available, their coverage areas together with their outcomes (either process or final outcomes). Mothers' IYCF practices knowledge is the fundamental principle for mothers to improve and comply with acceptable IYCF practices. Improved maternal knowledge on IYCF practices was assumed as main for reduced if not eliminated child (0-59 months) undernutrition within the regions of high rate of malnutrition.

3.3.2.1 Socio-economic and demographic characteristics of infants and mothers

The findings were much closed with TDHS-MIS report of 2015/2016 here indicated that majority of children were born with acceptable birth place and weight, also almost more than half of respondents had primary level of education which may also have an impact to maternal nutritional knowledge hence child nutrition status. Based on the results (Table 3.2), most mothers (86.7%) gave birth at health facilities, and 69.3% of them got there in less than 30 minutes. This means that the study areas had ready-to-use health services, including services related to nutrition for mothers and babies, which are important for improving the health and nutrition of children.

3.3.2.2 Mapping of existing nutrition interventions in Bukombe and Njombe districts

In spite of the effort made for improving nutrition outcomes there was little sensitive focus on civilizing maternal knowledge on infant and young child feeding practices as essential elements needed to pick up nutrition status. Other studies indicated that there is a need of amplification together with improves of nutrition specific and highly responsive nutrition action such as maternal knowledge and IYCF practices so as to sustain the outcome (Deborah *et al*., 2014; IRS, 2017; Turner *et al*., 2018; Msuya, 2019; Worldbank, 2015; CW and UNICEF 2015). This was due to fact that mother with poor nutritional knowledge had underprivileged implementation of infant and young child feeding practices led to deprived child nutrition status (Acheampong and Haldeman, 2013; Asoba *et al*., 2019; El-nmer *et al*., 2014; Mosimah, 2015; WHO *et al*., 2019). Results from (Table 2, 3 and 4) also recognized the contribution of clinical services (PNC and ANC) which offer the essential opportunities of maternal nutrition knowledge transformation for better achievement of child nutrition status. However, the study observed little effort done within Njombe regions with small numbers of nutritional related interventions together with their coverage areas compared to Geita region.

3.3.2.3 Maternal nutritional knowledge (MNK) variation between age groups and within Bukombe and Njombe districts

The study revealed that mothers of reproductive age within regions of high prevalence rates of stunting still had little knowledge related to IYCF practices and child nutrition status. Also, there was little experience and skills in child nutrition-related knowledge for adolescent mothers compared to adults. The variation between age groups indicates the perception of the need to expand health services and nutrition-related knowledge at the earliest age. Adolescents are among the vulnerable groups that deserve special treatment in obtaining sexual and reproductive health services (SRHS), particularly knowledge and services related to maternal and infant nutrition (Chilinda *et al*., 2014). Lower sexual and reproductive health services (SRHS) together with poor maternal nutritional knowledge of adolescent girls are among the determinants of unwanted pregnancy, which leads to the high risk of inaccuracy in caring for the infant's health within the first 1000 days of life. Other studies have argued that mothers with limited access to SRHS have poor knowledge of IYCF practices, hence unacceptable child nutritional status (Sedgh *et al*., 2015; Niyeha *et al*., 2018).

3.3.2.4 Nutrition status of children aged 0-59 months

The study observed a significant reduction in stunting prevalence among under-5 children in Bukombe resulted from recommended IYCF practices due to nutrition interventions which rely on an improvement in maternal nutritional knowledge (Table 4 and 6). The inability of nutrition-related interventions to improve maternal nutrition knowledge contributed to an increase in stunting among children under the age of five in the Njombe districts (Tables 3 and 6). However, other factors that may contribute to impacting child nutrition status are seasonal accessibility and consumption of some essential nutrients; social-economic and demographic features; and little availability of animal-related

proteins. Other researchers revealed that optimal child nutrition status is largely dependent on how well mothers/caregivers have knowledge of IYCF practices (Abubakar *et al*., 2012; Kaminski and Gilbert, 2016; Mistry *et al*., 2019; Msuya, 2019; Rakotomanana *et al*., 2020).

3.3.2.5 Association of maternal nutrition knowledge on IYCF practices and nutrition status

This study showed that mothers who didn't know much about nutrition were more likely to engage in unacceptable IYCF practises and give their children bad nutrition. Mothers may not always know how important variety and balance are in a child's diet or how much and what kinds of food kids need to grow and be healthy. Since a mother's main job for the first five years of her child's life is to take care of him or her, it's important to know what to eat, especially when there aren't many resources for food and health. The findings seem similar to studies with the same group (Agize *et al*., 2017; El-nmer *et al*., 2014; Saaka, 2014; URT, 2015; WHO, 2018).

3.4 Conclusion and Recommendations

3.4.1 Conclusion

The study indicated the role of nutrition interventions on maternal knowledge of IYCF practices with an impact on child nutritional status within regions of high malnutrition rates in Tanzania. There were some initiatives made to improve child nutritional status within the most vulnerable regions, but the efforts were not good enough. Analysis from this study observed little effort guided by a small number of multicomponent nutrition interventions to attain nutrition status through maternal nutritional knowledge in Njombe. Still, there was poor maternal nutrition knowledge, but their variations reflected the numbers and readiness of nutrition projects to achieve IYCF practices together with acceptable child nutritional status. From the study view point, areas with less effort had a

worse increase in stunting rate from 44% to 54%, while areas with greater effort and readiness had a significant decrease in stunting rate by 7% for the period of 2015-2020. Also, infants aged 0–11.9 months were more stunted than other age groups, and this emphasizes the need to observe maternal health and nutritional status while pregnant.

3.4.2 Recommendations

As per findings from this study and conclusion the followings are suggestions for improving maternal nutritional knowledge on IYCF practices for healthier child nutritional status.

(i) Knowledge related to IYCF practices should expand and strengthen intentionally that the community, particularly women need a better understanding of what, when, how, and why to feed themselves and their infants to comply with WHO guidelines. This can be taken into consideration by all stakeholders such as government authorities, and non-government organizations.

(ii) The study observed that the prevalence of stunted children was very high for mothers with poor nutrition knowledge and had the worst effect on adolescent girls (15–20 years). This therefore speculates that the needs of governments and non-government organizations to initiate and strengthen the programs of nutrition knowledge to the earliest stages of learning may be at primary or secondary levels of education. There is probably a chance that some infants were born stunted, and this also may direct future program interventions to focus mainly on maternal health and child nutritional status.

(iii) Mutual efforts from public entities and donors are needed to address, expand the coverage, and strengthen multi-component nutrition initiatives to improve their efficiency, effectiveness, impact, and sustainability on maternal nutrition knowledge.

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CHAPTER FOUR

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary of Major Findings

Below is a summary of the study's major findings in a consecutive order as per presented manuscripts.

4.1.1 Ethnic feeding practices and nutrition status of children aged (0–59 months) from regions of high rate of chronic malnutrition (Geita and Njombe), Tanzania

Objective one was about assessing infant and young child feeding practices, while objective two aimed to determine the nutrition status of children aged less than five years. From a general point of view, this study showed that the IYCF practices and child nutrition status in the area still don't meet the standards set by WHO and UNICEF for the best growth and development of children. Only 37.9% of children aged less than five in the Njombe district were breastfed within one hour after their birth, while in the Bukombe district it was 55.8%. The minimum dietary diversity was also at a suboptimal level where only 8.1% and 15.1% of children aged 6 to 23.9 months in Njombe and Bukombe districts, respectively, received at least four food groups. In the Njombe district, no child aged 6-23.9 months had a minimum acceptable diet, while only 9.1 percent of children had a minimum acceptable diet. The suboptimal IYCF practices resulted in a high prevalence rate of child malnutrition of about 53.8% and 37.6% ($p = 0.05$) of under-five children being stunted, though (10.8% and 10.6% $p = 0.97$) were underweight in Njombe and Bukombe districts, respectively. Njombe district had 68% of stunted male children and 60.6% of the infants aged 0–11.9% were also stunted.

Moreover, about 53.7% of infants who didn't breastfeed within one hour after their birth; about 56% and 50.9% of children aged 6–23.9 months with suboptimal minimum meal frequency and minimum acceptable diet, respectively, were also stunted. There was a statistically significant difference between children who had a minimum acceptable diet and were underweight ($p = 0.011$) and those who did not have a minimum acceptable diet and were underweight ($p = 0.014$). The selected variables (household size, child sex, child age, child birth weight, child completed vaccines, early initiation of breast milk, minimum meal frequency, minimum acceptable diet, time to reach the nearest health facility, MNK, and mothers' formal education) in the regression model were able to predict only 28.8% and 21.3% for both stunting and underweight. Also, the study revealed that the likelihood of children being stunted was 2.5 times higher among mothers with low or poor nutritional knowledge compared to mothers with nutrition knowledge. The infants with a low rank of minimum acceptable diet were 24.3 times more likely to be underweighted compared to infants with a minimum acceptable diet.

From the speculation of major ethnic groups in Njombe district (Hehe/Bena) and in Bukombe district (Sumbwa/Sukuma), the study showed significant differences in maternal nutrition knowledge ($p = 0.002$), stunting ($p = 0.011$) and IDDS level ($p = 0.010$). Furthermore, the results showed that children from major tribes in Njombe district were more stunted and were under the line of minimum dietary diversity compared to major tribes in Bukombe district.

4.1.2 The role of nutrition interventions to maternal knowledge on infant and young child feeding practices: Mapping study in Njombe and Bukombe districts

The third objective of the study is aimed at determining mothers' knowledge of infant and young child feeding practices and their variation within regions. Objective four involves mapping nutrition interventions and assessing their contributions to maternal knowledge of IYCF practice and child nutrition status. The results of the study show that regions with little effort or a low number of nutrition-related interventions had a high prevalence rate (52.3%) of mothers with poor knowledge of IYCF practices and worse, increased from 44% to 53.6% of children with chronic malnutrition. Njombe had only two multi-component interventions (ASRP – Tubadilishe project and Kizazi Kipya project) with a coverage area of 66.7% per region, but only one ASRP had components of nutritional knowledge and IYCF practices. The results observed that four nutrition interventions (ASTUTE, Mtoto Mwerevu, USAID Boresha Afya, and Kizazi Kipya) contained maternal nutrition knowledge and IYCF practices out of five implemented in Geita. The interventions in the Geita region had an optimistic effect on the community due to the fact that they may have contributed to the reduction amount of stunting level by 7.1%, while in the Njombe region it was cumulative by 9.5% from 2015 to 2020.

The results further show that nutrition knowledge was still poor and adolescent mothers aged 14 to 20 years are the most vulnerable group, whereas the majority (90.5%) had lower nutrition knowledge compared to 58.9% of unknowledgeable mothers aged 21 to 49 years. There was a statistically significant difference ($p = 0.005$) in the level of knowledge between teen mothers and adults of mothers (71.8%) in Bukombe had lower or poor knowledge related to IYCF practices, while Njombe district had 52.3% with a 0.005 probability value.

Even though the number of male infants who were too short for their age in Njombe was between 49.7% and 86.3% with a 95% confidence interval. The study also observed that mothers with poor nutrition knowledge had optimal IYCF practices, whereas 61.6% in Bukombe district and 48.4% in Njombe district said their children didn’t meet the minimum dietary diversity. Similarly, poor maternal nutrition knowledge results in a possibility of having stunted children since 35.6% out of 7.1% of mothers with poor knowledge had their children had lower height for age z-score in Bukombe district while Njombe district had 33.8% out of 20%.

4.2 Conclusions

Despite the significant progress toward improving child nutrition status through the availability of nutrition-related services, willingness to achieve, and availability of accepted dietetic varieties, IYCF practices fell short of WHO guidelines of infants weren’t breastfed within one hour after birth and didn’t receive the minimum acceptable diet as among the key indicators for the best child growth development. The study’s findings can be concluded that there is lower nutrition-related knowledge than suboptimal IYCF practices, which differ within the regions of high stunting rates and in their major ethnic groups. This means that inadequate child feeding practices are an underlying cause of child undernutrition, which results from inadequate maternal nutritional knowledge. Male infants and those children under one year of age were more stunted than female infants and other age groups.

Ultimately, adolescent mothers were found to be defenseless due to their failure to comply with optimal IYCF practices. Hence, the plausibility of having stunted children emerged. The nutrition interventions don't do enough to reduce child death, illness, disability, and other problems with long-term effects, such as metabolic and

cardiovascular diseases caused by poor nutrition. Variations in the availability and readiness of nutrition interventions within high stunting rate regions support the level of effort made to improve child nutrition status. From this study, sentiment effortless region (Njombe) ratified by the small number of available nutrition interventions and their coverage areas, resulted in a worsening of the stunting rate from 44% to 54%, while multiple interventions with large footprints in the Geita region declined the stunting rate by 7% for the period of 2015-2020 respectively.

4.3 Recommendations

Therefore, based on study findings and conclusions it is recommended that;

i. In order to increase the knowledge and awareness of mothers and caregivers with children aged under five years to comply with optimal IYCF practices, the government and non-government organizations should initiate and strengthen the existing interventions related to nutrition knowledge improvement. This may help mothers to better understand and recognize accepted dietary intake, identify illnesses allied with food deficiencies or suboptimal feeding practices, seek treatment, and follow medical advice.

ii. There is a need for government and non-government organizations to enhance and formulate participatory approaches in which the community will have the chance to participate and contribute to improving and affording some foods with critical dietary diversities for better child growth development. This can be achievable by having interventions that endorse pasturage and gainful activities for the community with limited access to animal-source foods like fish, eggs, meat, milk, and milk products.

iii. Since there was an advantageous impact on the region with a large coverage area of nutrition interventions, there is a need to adapt randomization designs that

allow a large coverage area of nutritional interventions. The randomized phase-in and rotation designs will provide the opportunity to make important progress towards reaching knowledge and services related to improving child malnutrition within a large coverage area.

4.4 Area for Further Study

Generally, the study has observed that mothers' nutritional related knowledge and attitudes had a worse effect on the optimal IYCF practices than the high stunted rate. Therefore, there is a need for further research to be focused on other possible determinants for child undernutrition within regions of high stunting rates. Further study should be conducted since the sample size was not large enough to identify the minimum impact anticipated. Adolescent mothers were found to have had slight experience of optimal infant and young child feeding practices with limited knowledge of nutrition issues. This highlights the need for further investigations into the specific age group and bioethics components.

APPENDICES

Appendix 1: Participant Consent Form

Introduction and Consent

Hello! My name is …… from Sokoine University of Agriculture (SUA). Thanks for taking your time to speak with me. I collaborate with SUA to conduct research on Child feeding practices, maternal nutritional knowledge and nutritional status of under five children. I would like to ask you some questions about your experience and knowledge about child feeding practices and nutritional status based on people perception and ethnical aspect. Your participation will not harm you physically or in anyways. Purposely, information will be used for partial fulfillment of requirements for degree of Master of Art in Project Management and Evaluation. I will use the tablet and/or hardcopy questionnaire to record your responses, also an interview usually takes about 30 to 45 minutes and no any payments made for your participation. All of the answers you give will be confidential and will not be shared with anyone other than members of our research team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time. In case you need more information about the survey, you may contact Dr. Happiness Muhimbula (0757 550879) and Dr. Goodluck Massawe (0754 929360).

Do you have any questions? ..... / Can I begin interview now? .....

(If respondent agree start to interview (Qn1), if not end the interview)

Signature of Interviewer…… date……

Signature of Interviewee…… ...……. date ……

Appendix 2: Study Questionnaire

Inclusion criteria: Please select women with under five child(ren).

ADMINISTRATION

Questionnaire # …… ☐☐☐ Date of interview ☐☐☐☐☐☐☐☐

Region 1= Geita, 2= Njombe ☐ District Code 1= Bukombe 2= Njombe Rural

District ☐ Enumeration Area ☐☐☐☐☐ Household Number ☐☐☐☐

Household ID ……. ☐☐-☐☐☐☐☐☐-☐☐☐☐ - WOMAN

Type of Settlement (1=Semi-urban, 2=Rural) ☐☐

Enumerator Code ☐☐ Supervisor Code ☐☐ Verifier Code ☐☐

Interviewer Visits *Record date of visit.*

Visit 1 DAY ☐☐ MONTH ☐☐ YEAR ☐☐

Visit 2 DAY ☐☐ MONTH ☐☐ YEAR ☐☐

Result of Visit *Record result code.* ☐☐

1 - Completed
2 - Eligible respondent not at home
3 - Entire household absent for extended period
4 - Postponed
5 - Refused
6 - Other (specify): _____

Eligibility Name of woman/caregiver having child <5 years: _____

Start Time: HOUR ☐☐ MINUTE ☐☐

Note: Some of the questions were adopted from TDHS

Section 1: Socio-Economic and Socio-Demographic Data

No	Questions and filters	Codes	Response
1	Are you one among beneficiaries of any nutrition interventions currently available here or interventions ended within previous 3 months? *(Read list of projects/interventions from mapping sheet).*	1- Yes 2- No *If answer is 2 (No) end the interview*	
2	In what month and year were you born? *(If respondent does not remember month and/or year, enter "I don't know" (99))*	Record month Record year	
3	How old were you at your last birthday? *(Compare and correct 2 and/or 3 if inconsistent)*	Age in completed years 99 - Don't know	
4	Has you (Name) attend the school? *(If the answer is "YES" ask qn# 4a if "NO" skip to qn# 5.)*	1- Yes 2- No	
4a	How many years did you spend for schooling?	Write answer in complete years.	
4b	What is the highest level of school (name) has attended?	1- Pre-primary 2- Primary 3- Secondary 4- Technical/vocational 5- College/University 6- Others	
5	What is your marital status?	1- Married/living together 2- Divorced/separated 3- Widowed 4- Never (married/living together)	
6	What is your ethnic group? (tribe)	1- Bena 2- Hehe 3- Sukuma 4- Sumbwa 5- Other (specify)	

7	What is your religion?	1- Muslim 2- Christian 3- Others	
8	What is your occupation?	1- Public Servant 2- Farmers 3- Pastoralist 4- Private sector employee 5- SME's	
9	How many member(s) of household do you have?	Record number	
10	How many meals does your family eat per day?	Record number.	
10a	In the last 15 days, did you or your child(ren) in your household eat less than [NUMBER] meals per day?	1- Yes 2- No	
10b	How often did this happen in the last 15 days?	1- Rarely (once/twice) 2- Sometimes (3-5 times) 3- Often (more than 5) 99- Don't know	
10c	Which members of your household ate less than [NUMBER] meals per day (ate the least amount of food)? *Multiple responses are required, if any (maximum of 3 responses).*	1- Women/ Mother 2- Female children 3- Male children 4- All ate an equal amount 98- Other (specify) 99- Don't know	
11	Did you do any kind of work for cash or in-kind payment in the last 6 months?	1- Yes 2- No	
11a	What is the main type of work you did to earn cash or in-kind payment in the last 6 months? *Multiple responses are required, if any (don't read answers).*	1- Agriculture 2- Fishing 3- Skilled labour 4- Casual labour 5- Handcrafts 6- Motorcycle renting 7- Petty trade 8- Business 98- Others (specify)	
12	What is the total income of your household per month?	1- Less than 200,000TZS 2- TZS (200,001-	

		450,000) 3- TZS (450,001-700,000) 4- TZS (700,001-1,500,000) 5- Greater than 1,500,000)	
12a	What is your total income (Individually)? *(Ask for maternal income)*	6- Less than 200,000TZS 7- TZS (200,001-450,000) 8- TZS (450,001-700,000) 9- TZS (700,001-1,500,000) 10- Greater than 1,500,000)	☐
13	Does this household own any livestock, herds, other farm animals, or poultry?	1- Yes 2- No	☐
14	Does any member of this household own any agricultural land?	1- Yes 2- No	☐
14a	*Check 15. If answer is "Yes" (1):* Has this household cultivated any crops in the last 12 months?	1- Yes 2- No	☐
15	What is the main source of drinking water for members of your household?	1- Piped water 2- Protected well 3- Unprotected well 4- Rain water 5- Spring water 6- Lake / Liver water 98- Other (specify)	☐
16	How much time does it usually take you to reach the nearest health facility to seek for child and/ or lactation mother's nutritional services?	Record MINUTES Record HOURS	☐ ☐
16a	If you were to go to the nearest health facility to seek for child and/or lactation mother's nutritional services, how would you usually go there?	1- Car 2- Motorbike 3- Public transport 4- Animal/ animal cart 5- Walking 6- Bicycle 98- Other (specify)	☐ _____

Section 2: Infant and Young Child Feeding Practice (IYCFP)

(Now I would like to ask you about your experience on Infant and Young Child Feeding Practices (IYCFP).

No	Questions and filters	Codes	Response
17	Have you ever given birth?	1- Yes 2- No	☐
18	How old were you when you had your first child?	1- Yes 2- No	☐
19	How old were you when you had your first child?	*Enter age at first pregnancy (in years)* 99- Don't know	☐
20	What is the name of your last child? *(Write a single name)*	*Record most recently child with age(<5yrs)*	☐
20a	How old is (Name) have?	*Enter age of your last child (in months)* 99 - Don't know	☐
21	Where did you get the delivery services of (Name)/or your last child?	1- Home delivery 2- Dispensary 3- Health center 4- Hospital 5- Private health facility 6- NGO/FBO clinic 98- Other (specify)	☐ _____
22	Did you breastfeed your child after its birth?	1- Yes 2- No	☐
22a	How long after your child's birth did you start breastfeeding your child? *If less than 1 hour, record "00" hours. If less than 24 hours, record hours; otherwise, record days.*	Record number of hours Record number of days	☐ ☐
22b	What was the primary reason that you did not breastfeed your child?	1- Not enough flow of milk 2- Not enough milk 3- Child was unable to suck 98- Other (specify)	☐ _____

23	What are the primary foods consumed by your child(ren) (Name)?	1- Breastfeeding only 2- Breastfeeding + soft drink 3- Breastfeeding + soft drink + semi-sold 4- BF+ soft drink+ semi-sold+ sold foods 5- Soft foods+ semi-sold+ sold foods 98- Other (specify)	
24	How often, are you feeding your child (Name) per day?	1- One times/day 2- Two times/day 3- Three times/day 4- Four times/day 5- Five – Eight times/day 98- Other (specify) 99- Don't know	☐ _____
25	In your household, there are any difficult on acquiring foods to your child (Name)?	1- Yes 2- No *skip 26* 99- Don't know	☐
26	What makes it difficult for getting child foods/nutritional needs? *(Multiple answers are possible).*	1- Low income 2- Unavailability of food required 3- No enough time to prepare 4- Large number of family members 98- Other (specify) 99- Don't know	☐ _____

QN#27- Eligibility criteria: Ask and fill the tables for women/caregivers with children aged 9-

59months.

24-HOURS RECALL FOR INDIVIDUAL DIETARY ASSESSMENT

Now I would like to ask you about your knowledge and experience on the issue related to the types of foods and the way you prepare that foods for your child with age less than 5 years.

MEALS OF THE DAY	NAME OF FOOD	FOOD DESCRIPTION	PREPARATION INGREDIENT
BREAKFAST (Morning) (Time :.....)			
SNAKS (Mid-Morning) (Time :…..…)			
LUNCH (Afternoon) (Time :…...)			
DINNER (Time:..…)			
OTHER(S) (Time :…….)			

Section 3: Maternal Nutritional Knowledge

Now I would like to ask you about your knowledge and experience on the issue related to the nutrition of under-five child (ren).

No	Questions and filters	Codes	Response
28	It is good to put the baby on the breast within one hour after birth.	1- Yes 2- No 99-Don't know	☐
29	In the first six months, the infant needs water and/or other drinks in addition to breast milk.	1- Yes 2- No 99-Don't know	☐
30	How long is it required that women breastfeed their children?	1- Less than 6 months 2- 6 – 11.9 months 3- 12 – 23.9 months 4- 24 months and above 99- Don't know	☐
31	What is the most important thing a mother can do to produce sufficient breast milk? *(Read the answers)*	1- Frequently BF (day & night) 2- Eat 2 additional meals + variety foods daily 3- Believe herself 4- Kangaroo care 5- Both 1 & 2 are correct 99-Don't know	☐
32	A pregnant women can continue breastfeeding	1- Yes 2- No 99-Don't know	☐
33	When a mother is HIV-positive, there are ways to decrease HIV transmission to the baby?	1- Yes 2- No 99-Don't know	☐
33a	What can a mother required to do after facing the difficult on feeding breast milk?	1- Seek for professional help 2- Go to witch doctor 3- Go to village leader 4- Go to traditional midwife 5- Feeding other foods 99-Don't know	☐
34	At what age should babies start eating food in additional to breast milk?	1- At three months 2- At four months 3- At five months 4- At six months 98- Other (specify) 99- Don't know	☐ _____
35	At what months, a mother should begin to add foods in addition to breast milk?	1- 3 months 2- 6 months 3- 4 months 99- Don't know	☐

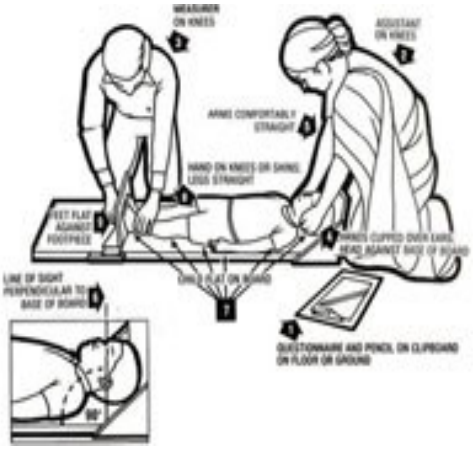
36	Is it true or not true that mother or caregiver should actively encourage the baby to eat all the food given?	1- Yes 2- No 99- Don't know	
37	Is it necessary that young children have their own plates while they are eating?	1- Yes 2- No 99- Don't know	☐
38	Do carrots, mangoes, papaya, and green leafy vegetables contain vitamin A?	1- Yes 2- No 99- Don't know	☐
39	At least, how many year(s) does young children should be breastfed?	1- Five years 2- One year 3- Two years 99- Don't know	☐
40	A young child who is losing weight during illness and not regaining weight after illness needs urgent medical attention?	1- Yes 2- No 99- Don't know	☐
41	Do you know about child malnutrition?	1- Yes 2- No *skip 42* 99- Don't know	☐
41a	*Check if the answer question 1 is "YES" then ask this question below* Do you know the danger signs of malnutrition to your child?	1- Yes 2- No 99- Don't know	☐
42	What are danger signs of child malnutrition? *Multiple answers are possible (Tick all the answer in a box). Probe until the respondent is quit.*	1- Lack of appetite/interest in food or drink. 2- Tiredness and irritability. 3- Inability to concentrate. 4- Always feeling cold. 5- Loss of fat, muscle mass, and body tissue. 6- Longer healing time for wounds. 7- Higher risk of getting sick and taking longer to heal. 8- Hair becomes dry and sparse, falling out easily 98- Other (specify). 99- Don't know	☐ ☐ ☐ ☐ ☐ ☐ ☐ _____

Section 4: Child Nutritional Status

Steps for measuring anthropometric data (Height and weight), age

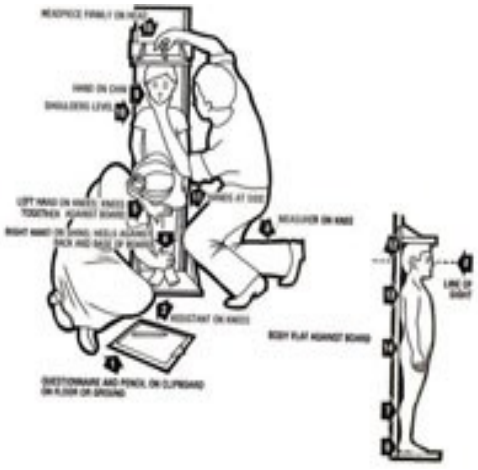
Child aged less than 2 years (< 23.9 months)

1- Both assistant and measurer are on their knees (arrows 2 and 3).
2- The assistant holds the child's head with both hands and makes sure that the head touches the base of the board (arrow 4).
3- The assistant's arms should be comfortably straight (arrow 5).
4- The line of sight of the child should be perpendicular to the base of the board (looking straight upwards) (arrow 6).
5- The child should lie flat on the board (arrow 7).
6- The measurer should place their hands on the child's knees or shins (arrow 8).
7- The child's foot should be flat against the foot piece (arrow 9).
8- Read the length from the tape attached to the board.
9- Record the measurement on the questionnaire (arrow 1).



Child aged 24 – 59 months

1- Both the assistant and measurer should be on their knees (arrows 2 and 3).
2- The right hand of the assistant should be on the shins of the child against the base of the board (arrow 4).
3- The left hand of the assistant should be on the knees of the child to keep them close to the board (arrow 5).
4- The heel, the calf, buttocks, shoulder and occipital prominence (prominent area on the back of the head) should be flat against the board (arrows 6, 7, 14, 13 and 12).
5- The child should be looking straight ahead (arrow 8).
6- The hands of the child should be by their side (arrow 11).
7- The measurer's left hand should be on the child's chin (arrow 9).
8- The child's shoulders should be levelled (arrow 10).
9- The head piece should be placed firmly on the child's head (arrow 15).
10- The measurement should be recorded on the questionnaire (arrow 1).



43 Infant/ child height *Record Child height (cm)* _____

44 Infant/ child weight

1- If infants /children are unable to stand.
   i. Request mother to stand on the

weighing scale.

ii. Record the weight (W1) then refresh weighing scale to zero. W1= _____

iii. Request mother to hold the baby and stand on weighing scale.

iv. Record the weight (W2) and find the difference in weight (W2-W1). W2 – W1 = _____

2- If Infant/children are able to stand on the weighing scale, record their weight.

_____

Appendix 3: Individual dietary diversity score sheet (assessment tool for IYCF practices).

QN	Food group	Example	1- Yes 0- No
1	Cereals	Corn/maize, rice, wheat, sorghum, millet or any other grains/foods made from these (eg. Porridge, bread, noodles or other grain products)+Ugali, nshima or other locally available grains	
2	Vitamin a rich vegetable and tubers	Pumpkin, carrots, squash, or sweet potatoes that are orange inside + Other locally available vitamin-A rich vegetables (red sweet pepper)	
3	White tubers and roots	White potatoes, white yams, white cassava, or other foods made from roots.	
4	Dark green leafy vegetables and other vegetables	Dark green/leafy vegetables, including wild ones + locally available vitamin-A rich leaves such as cassava leaves, spinach, amaranth etc. Other vegetables (e.g. tomato, onion, eggplant), including wild vegetables	
5	Vitamin a rich fruits and other fruits	Ripe mangoes, cantaloupe, apricots (fresh or dried), ripe papaya, dried peaches + other locally available vitamin-A rich fruits. Other fruits, including wild fruits	
6	Organ meat (iron-rich) and Flesh meat	Liver, kidney, heart or other organ meats or blood-based foods; and Beef, pork, lamb, goat, rabbit, wild game, chicken, duck or other birds.	
7	Eggs	Chicken, duck, guinea hen or any other egg	
8	Fish	Fresh or dried fish or shellfish	
9	Legumes, nuts and seeds	Beans, peas, lentils, nuts, seeds or foods made from these.	
10	Milk and milk products	Milk, cheese, yogurt or other milk products	
11	Oils, fats and red palm products	Oil, fats or butter added to food or used for cooking; and Red palm oil, palm nut or palm nut pulp sauce	
12	Sweets	Sugar, honey, sweetened soda or sugary foods such as chocolates, candies, cookies and cakes	
13	Spices, condiments, beverages Beverages	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages or local examples	

Appendix 4: Scaled UP Nutrition – Project Monitoring Tools (SUN – PMT)

MAPPING AND EVALUATION OF NUTRITION INTERVENTIONS ON MATERNAL NUTRITIONAL KNOWLEDGE (MNK) AND INFANT AND YOUNG CHILD FEEDING PRACTICES (IYCFP) IN THE GEITA AND NJOMBE REGIONS.

				Check if project had IYCF practices and MNK components	
Project Title	**Implementing Organization**	**Area Covered**	**Objectives**	**IYCF practices 1- Yes 2- No**	**MNK 1- Yes 2- No**
Eg. Service Availability and Readiness Assessment **(SARA- Project)** (May – July 2020)	Ifakara Health Institute (IHI)	Morogoro region	1- Assess health care services available, key human and infrastructure resources in facility. 2- If facility is able to deliver services with respect to available resources.	**2**	**2**

Regional/ District Nutrition Officers and Authority project personnel are eligible to respond the questions here under. *(Assessment for each mentioned intervention)*

1. What are the contribution made by project on improving child nutrition status through IYCF practices and maternal nutrition knowledge (compare results and objectives)?
   ……
   ……
   …….....
2. Do this intervention had effect to the intended community and for what extent?
   ……
   ……
   ……
3. There is any possibility for maintain the positive effects of this interventions after ended of internal support? *(Probe how)*
   ……
   ……
4. Does project objectives suitable to the problems (suboptimal IYCF practices; Poor MNK; and undernutrition), and to the physical and policy environment within Njombe/Geita?
   ……
   ……
   ……