Original Research Article

The Role of Nutrition Interventions and Mother Knowledge on Infant and Young Child Feeding: Mapping Study in Njombe and Geita Regions, Tanzania

Abstract

Children under the age of five are risk of undernutrition 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 optimal nutritional status. The purpose of this study was to examine the roles of nutrition interventions and maternal knowledge regarding , Infant Feeding Practices (IYCF) practices 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 recently ended (within previous 3 months) nutrition interventions. A sample of 150 mothers with were selected purposeful to participate in the study. 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 practices ,, maternal knowledge with nutrition status, and differences between areas with few and many nutrition related interventions. According to the results of this study, mothers' IYCF practices (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 practices and the nutritional status of children at the earliest stages of learning.

Key words: Intervention, Nutrition status, stunting, infant feeding practices, undernutrition

1.0 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 percent of children under the age of five stunted (URT, 2019).

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). The optimal feeding practices can be met through achieving all the all the recommendations.

Poor maternal nutritional knowledge, on the other hand, is one of the drivers of improper Infant and Young Child Feeding (IYCF) practices 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-sensitive programs 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, the study hypothesized the positive impact of nutrition intervention on IYCF practices and child nutrition status.

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 (Doudou et al., 2018). Mapping exercises and evaluation were done to determine whether and to what extent the projects improved maternal knowledge of IYCF practices 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 practices.

It was determined whether and to what extent the projects improved maternal knowledge of IYCF practices 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 presented study aimed to Mapp nutrition interventions in two regions ofGeita and Njombe, Tanzania, with high rates of stunting; and to explore the influence of these nutrition interventions on maternal knowledge, IYCF practices and child nutrition status.

2.0 Methodology

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). About 60 % of study participants, were framers in both regions. The study areas showed to have different ethnicity and while variation in other socio-demographic features was minimal to justify 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).

2.2 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 is comparatively–less time-consuming and inexpensive during the survey, using easy survey procedures and giving occurrence rates of various features (Bell and Jones, 2015).

2.3 Sampling procedure and study4 Study population and sampling procedure

In this study, a multi-stage sampling method was used to obtain 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.

Women or caretakers with children younger than five years old living in rural areas of the Bukombe and Njombe Rural Districts and were part of nutrition-related interventions were selected for study. 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~~).~~

2.4 The 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).

2.5 Methods of data collection

2.6 Data collection and interviews

Maternal and child demographics, anthropometric assessment and mapping of project with pro nutrition interventions were done through face-to-face interviews and physical measurements.

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

A pretested structured questionnaire was administered to eligible 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.

2.6.2 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).

A semi-structure questionnaire was used to obtain data on maternal nutrition knowledge. The questions was developed from FAO guideline for assessing nutrition related knowledge and attitudes, practices (KAP) (Marías & Glasauer, 2014). A total question asked to mothers were 17 including those on early breastfeeding practices, complementary feeding practices and the risk associated with poor feeding practices. For each question correctly answered, 1 point was scored whereas wrong on I dent know answers was scored 0. The average score was adopted for assessing maternal nutrition knowledge. Then the average score was related and measured on the scale for further analysis.

Table 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".

2.6.3 Infant and young child nutrition status (Anthropometric)

Anthropometric measurements were used to assess the nutritional status of children. Weight, and length height were recorded for children using standard procedures (Cogill, 2003). The age of children was recorded from their clinical cards/records. Infant and young childrenchildren's weights were measured using a Seca 874 weighing scales wearing minimal clothing. Infant weight was measured using the "tared weighing" method while held by their mother. Infant recumbent length and height were measured using the UNICEF Portable length board and height measuring system SET- 2 (S0114540) following standard procedures (Cogill, 2003). All anthropometric equipment was calibrated prior to use. Length /height - for- age z- score (LAZ/HAZ), weight- for- age z- score (WAZ) and weight for- length / height z- score (WLZ /WHZ) were calculated using ENA for SMART Software (Software for Emergency Nutrition Assessment) (De Onis, 2006). Stunting, underweight and wasting were defined as z- scores below minus 2 standard deviations (SD) of the median values of the reference data.

2.6.4 Mapping of nutritional related interventions

The SUN-PMT tool was used to identify project-level interventions which have potential to improve maternal nutritional knowledge, IYCF and nutritional status. Three approaches to data collection were employed in the mapping exercise; first, the direct one to one interview with project staffs at the project office. Second, phone interviews with the project staffs (especially if it was impossible to meet the staff in their office). Third, search for supplementary information from the projects websites where this was available. Fourth, read through the documents provided by the project staff where this was available to supplement information collected through interviews. The assessment looked at details as to how the interventions improved maternal nutritional knowledge. 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

2.7 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 ENA 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).

3.0 Results and Discussion

3.1 Results

3.1.1 Socio-economic and demographic characteristics of infants and mothers

The findings from Table 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 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.

3.1.2 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 implementing nutrition interventions. 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) 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 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: 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 behaviours** 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.	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 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

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

The finding from study (Table 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 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*

3.1.4 Nutrition status of children aged 0-59 months

The findings for infant and young child nutritional status was indicated from Table 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 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

		Bukombe district			Njombe district			
Category	**Sub-category**	**N**	**n**	**% [CI 95%]**	**N**	**n**	**% [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.

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

Table 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 7) in Bukombe and Njombe districts.

Table 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

3.2 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.

3.2.1 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 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.

3.2.2 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.

3.2.3 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).

3.2.4 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 5 and 6). Table 3 shows

some positive outcomes, namely an increase of 70% in practice key pro-nutrition behaviors including IYCF, in Njombe district. Despite of this, Table 6 shows a higher prevalence, although not statistically significant, of stunting children in Njombe district, compared with Bukombe district. When observing the association of maternal nutrition knowledge with IYCF practices indicators and child nutrition status, by districts (Table 7). The findings showed that maternal nutrition knowledge had no statistical significantly different with IYCF practices indicators and anthropometric indices (Table 7) in Bukombe and Njombe districts. While, other factors such as seasonal variation in food accessibility; social-economic factors and little availability of animal source foods may have contributed to poor nutrition status, 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. Additionally, maternal nutritional knowledge had a higher average among major ethnic groups in Njombe district than in Bukombe district but stunting within major ethnic groups in Njombe was higher than the child stunted rate within major ethnic groups in Geita. 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. While other factors contributing to suboptimal feeding practices, further investigation on ethnicity and child nutrition are needed.

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).

4.0 Conclusion and Recommendations

4.1 Conclusion

The study estimated the importance 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.

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.

Ethical Approval:

Ethical clearance was obtained from Research Ethics Committees of Sokoine University of Agriculture, Morogoro Tanzania. Additionally, Njombe and Geita regions with District Administration and local leaders gave the permission to conduct the study in their respective areas. The permission to use village health centres for data collection was obtained from District Medical Officers (DMO) of the respective districts.

Consent

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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