Vol. 17(8) pp. 167-178, August 2023
DOI: 10.5897/AJFS2022.2226
Article Number: 0F2B9DE71113
ISSN: 1996-0794

http://www.academicjournals.org/AJFS

ACADEMIC JOURNALS
expand your knowledge

African Journal of Food Science

Full Length Research Paper

Feeding practices and nutrition status of children aged 0-59 months from Njombe and Geita, Tanzania

Hassan T. Berenge[1]* and Happiness S. Muhimbula[2]

[1]Department of Policy Planning and Management, Sokoine University of Agriculture, P. O. Box 3035, Morogoro, Tanzania.
[2]Department of Food Technology, Nutrition and Consumer Science, Sokoine University of Agriculture, P. O. Box 3006, Morogoro, Tanzania.

Received 8 September, 2022; Accepted 20 February, 2023

This study aimed to assess infant and young child feeding (IYCF) practices, child nutrition status, and their variations within ethnic groups in regions with high prevalence rates of stunting. A cross-sectional 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. Socio-demographic, IYCF practices, and anthropometric data (HAZ, WAZ, and WHZ) were measured and further analysed in IBM SPPS Statistics 21. In general, major ethnic groups in the Njombe district had a higher rate of stunting (53.8% vs. 37.6%; p = 0.5) than major ethnic groups in the Bukombe district. Infants aged 0-11.9 months were more stunted than other age groups. Both had optimal IYCF practices, where 46.9% of infants initiated breast milk within 1 h 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 group in Njombe had a mean HAZ of -1.85, while the major ethnic group in Bukombe had a mean HAZ of -0.91. This indicates the need for initiating and expanding multicomponent nutrition interventions based on ethnic features allied with IYCF practises and child nutrition status improvement.

Key words: Nutrition status, stunting, ethnicity, infant and young child feeding (IYCF) practices, underweighting.

INTRODUCTION

Despite some improvements in infant and young child health, malnutrition continues to be a significant public health issue in Tanzania and other developing nations (Powell et al., 2017). Tanzania was ranked among the nations with the highest intolerable burden of child malnutrition worldwide (Fanzo et al., 2018). Globally, approximately 21.9% of children under five were stunted, and 7.4% were wasted (DIPR, 2020), whereas in Africa, approximately 58.8% of children aged 0-59 months were stunted, and 14% were wasted (WHO et al., 2019). According to the most recent national nutrition survey conducted in Tanzania in 2018, 31.8% of children under the age of five were stunted and 14.6% were underweight. The 2015-2016 Demographic and Health Survey found that 5% of children under the age of five were underweight.

*Corresponding author. E-mail: tearish103@gmail.com. Tel: +255659110266.

UNICEF and other child nutrition and health experts claim that optimum infant and young child feeding (IYCF) has the largest impact on child survival of all established preventive health and nutrition interventions (Demilew et al., 2017; Hashmi et al., 2019). Poor IYCF practises can lead to malnutrition, which affects child survival (Mihretie, 2018). Undernutrition is the leading cause of poor health in children under five (Fanzo et al., 2018). Poor IYCF practises cause malnutrition in 45% of children under 5 worldwide (Asoba et al., 2019). When national policies and programme strategies prioritise early infancy nutrition and IYCF, child undernutrition, morbidity, and mortality can be reduced.

WHO and UNICEF recommend exclusive breastfeeding for the first 6 months, then introducing nutritionally adequate and safe complementary foods while continuing regular on-demand breastfeeding for two years or longer (UNICEF, 2018; WHO, 2021). The IYCF recommends breastfeeding within an hour after birth, exclusive breastfeeding for the first 6 months, introducing semi-solid, solid, and soft foods between 6 and 8 months of age, a minimum dietary diversity, a minimum acceptable diet, vitamin A and iron-rich foods, and also a supplement (Rollins et al., 2016; Powell et al., 2017). Children under the age of five are stunted, wasted, and underweight as a result of malnutrition. However, height/length for age (HAZ) indicates stunting, weight for age (WAZ) indicates underweight, and weight for length and height (WHZ) indicates wasting (WHO and UNICEF, 2021).

Some positive developments in the field of child nutrition have occurred despite slow progress in the area of IYCF core practises (WHO and UNICEF, 2021; URT, 2015; Fanzo et al., 2018). Chronic malnutrition is a severe concern in Njombe and Geita despite the government's initiatives to end malnutrition and other efforts to ensure sufficient food supplies and a high degree of food security (URT, 2015, 2018, 2019). The Tanzania National Nutrition Survey Report indicates that 53.6% of Njombe children aged 0-59 months are stunted (2018-2019). This is 4.6% more than in 2015, despite Geita's decline from 41 to 38.9%. This study's primary hypothesis was that ethnicity has an effect on appropriate IYCF practises in places with a high prevalence of stunting. In Tanzanian regions with high chronic malnutrition rates, the study compared breastfeeding, supplementary feeding, and child nutrition.

MATERIALS AND METHODS

Description of study areas

The study was undertaken in two regions with high malnutrition rates (Njombe and Geita) (Njombe Rural and Bukombe). The Njombe Rural district covers 3448 km^2 and was one of six districts in the Njombe region before joining Iringa. It is surrounded by Wanging'ombe, Kilombero, Makambako, and Njombe town. Temperatures range from 2 to 20°C on a higher plateau and 20 to30°C on a lower plateau, although only 371 km^2 is agriculturally suitable ground (URT, 2007, 2016). Geita's Bukombe district has 10,842 km^2. Bukombe is located between 31 and 32° East and 3 and 3.33° South. It borders Urambo, Kahama, Kibondo, and Biharamulo. Bena and Hehe are significant ethnic groups in Njombe, while Sukuma and Sumbwa are in Bukombe. The majority of the population in a certain district shared a similar ethnic background. Njombe and Bukombe districts are within Tanzania's most nutritionally vulnerable regions, with 53.6 and 38.9% of children stunted (URT, 2015, 2016, 2018).

Study design

The cross-sectional study was used to assess the feeding practices and nutritional status of children less than 5 years old. It is 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 (Connelly, 2016). It focuses on studying and drawing implications from existing differences amongst people, subjects, or phenomena (Kothari, 2017).

The study population and target groups

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

The sample size

The Green (1991) rule of thumb determined the minimal sample size needed to detect a statistically significant difference (Dattalo, 2018; Pajula and Tohka, 2016; Walker et al., 2017). The Green formula is n = 50 + 8p, where p is the number of regression predictors in the Green formula. Twelve predictors were enough to address the study's major questions. However, the sample size is:

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

Adding 4 more equally distributed samples increased the power and form a sample size of 150 participants. Thus, 150 people, 65 from Njombe and 85 from Bukombe since Bukombe district exceeds Njombe in population. Researchers agree that at least 100 participants are recommended for a relevant social science analysis (Denscombe, 2017; Ferguson, 2016; Mondragon, 2017; Vasileiou et al., 2018).

Sampling procedures

In this study, a multi-stage sampling method was used to acquire eligible respondents within the study areas. The two districts (Bukombe and Njombe) from the regions with high stunting rates and different ethnic groups were purposefully selected. 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.

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 and qualitative information were used to collect information from women with children under 5 years who resided in the study areas. Information on socioeconomic and sociodemographic background, the mother's knowledge of nutrition, feeding practices, and anthropometric measurements were provided in the questionnaire.

Measurements

Anthropometric measurement

In order to determine a child's nutritional status, the researcher had to measure the child's weight and height and assess their age. The Seca 874 electronic weighing scales were used to measure the weight of a child under the age of five. To begin with, the weights of infants and children who were unable to stand were recorded on the scales. It will also be reset to zero on the weighing scale. In addition, the mother requested that she hold the baby and stand on the scale while the baby is weighed in. The children's exact ages were determined by recording their birth dates on their clinic cards. In addition, the children's height and length were measured while they were lying down using a height-length board with a precision of 0.1 cm.

Dietary assessment

In this case, we used the 24-h recall diet method, which is based on the food consumed by children aged 6 to 59 months in the previous 24 h. The mothers or caregivers had to remember and describe all of the food and beverages their children had consumed in the previous 24 h. 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).

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.

Anthropometric data

ENA analysed anthropometric raw data for Standardized Monitoring and Assessment of Relief Transitions (SMART) 2011 to determine Height for Age Z (HAZ), Weight for Age Z (WAZ), and Weight for Height Z (WHZ) scores under WHO flags. Additionally, the data from ENA for SMART were entered into IBM SPSS version 21 for extensive analysis.

Descriptive statistics

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

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 the following.

The binary logistic regression model:

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

where *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).

RESULTS

Respondent's socio-demographic characteristics

The socio-demographic features of the respondents (n = 150) are presented in Table 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 Tanzanian 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.

Children's characteristics and health information

The findings (Table 1) indicate that 56.7% of children younger than five years are female, whereas more than 80% are infants. The majority of children (86.7%) were born in health care facilities, while the remainder were born at home. Approximately 92.7% of babies were born with a typical birth weight of 2500 g, and the majority of children received all recommended vaccinations by the age of eligibility. The majority of mothers and their children (69.3%) arrive at the nearest health facilities within 30 min or less.

Infant and young child feeding practices variation within the districts

The IYCF practise indicators did not differ significantly

Table 1. Demographic and socio-economic characteristics of mother and children (n=150).

Category	Sub-category	Bukombe Dc n=85	Njombe Dc 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 min	55 (64.7)	49 (75.4)	104 (69.3)
	31-60	21 (24.7)	16 (24.6)	37 (24.7)
	>61	9 (10.6)	0 (0.0)	9 (6)

Number in brackets is percentages.
Source: Authors

across the districts of Bukombe and Njombe as shown in Table 2. In contrast, approximately 55.8 and 37.9% of children in the districts of Bukombe and Njombe were breastfed within 1 h of delivery, which was equivalent to the nationwide average of 49.3% for both locations. In addition, infants aged 20-23.9 months continued nursing, and more than 70% of children under 2 years were nursed appropriately. According to the age category, infants under six months were exclusively breastfed and continued breastfeeding until 12 months. In addition, 60%

Table 2. WHO-acceptable indicators for determine IYCF practices.

Indicator	Definition	Bukombe Dc	Njombe Dc	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

*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-h recall by summing up the number score of food groups consumed by infants within the previous 24 h. 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.
Source: Authors

of 6-8 month-old infants in the Njombe district ate solid, semi-solid, or soft foods, compared to only 37.5% in the Bukombe district. In the districts of Bukombe and Njombe, 15.1 and 8.1% of infants aged 2-23.9 months experienced minimal dietary diversity, while 60.6 and 47.8% satisfied the threshold proportional to consuming solid, semi-solid, or soft meals.

According to Table 2, no infants in the Njombe district had an appropriate diet, whereas only 9.1% of infants in the Bukombe district did. More than half (70%) of 2-63.9-month-old children in the study areas consumed iron-rich or iron-fortified meals.

Infants and children's nutrition status

Table 3 displays the mean height-for-age z-score (HAZ), weight-for-age z-score (WAZ), and weight-for-height z-score (WHZ). In both districts, the mean HAZ and WAZ were considerably lower for girls than for males. In Njombe district, the mean HAZ difference between males and females was statistically significant ($p = 0.04$) but not in Bukombe ($p = 0.96$). In contrast, the mean WAZ in Bukombe and ($p = 0.62$) showed no significant difference ($p = 0.26$). In the Njombe district, the mean WHZ was statistically substantially lower for males than for females ($p = 0.04$). HAZ, WAZ, and WHZ did not differ significantly among age groups in Bukombe ($p = 0.96$, $p = 0.11$, $p = 0.49$) or Njombe ($p = 0.77$, $p = 0.92$, $p = 0.17$). When comparing the districts of Bukombe and Njombe, there was a statistically significant drop in WAZ, HAZ, and WHZ ($p = 0.001$). The incidence of underweight was identical in the districts of Bukombe and Njombe (11%, $p = 0.97$). The incidence of stunting was significantly greater in the districts of Njombe (54%) than in those of Bukombe (38%). When comparing the districts of Bukombe and Njombe, there was a statistically significant drop in WAZ, HAZ, and WHZ ($p = 0.001$).

The incidence of underweight was identical in the districts of Bukombe and Njombe (11%, $p = 0.97$). The incidence of stunting was significantly greater in the districts of Njombe (54%) than in those of Bukombe (38%). In addition, the rate was higher among males (68%) than females (45%) in Njombe, but this difference was not statistically significant ($p = 0.07$). Njombe had a greater proportion of stunted new-borns (55% versus 20%) than Bukombe, although the difference was not statistically significant. The conclusions were roughly comparable to regional findings from the 2019 Tanzania National Nutrition Survey report.

Association of IYCF practices and child nutritional status

Stunting is associated with children aged 6-8.9 months who received solid, semi-solid, or soft foods; being underweight is associated with being a

Table 3. Mean WAZ, HAZ, WHZ and frequency of underweight, stunting and wasting between age, sex and districts.

Parameter	Bukombe Dc				Njombe Rural				*P-value*
	N	Normal (%) (≤2SD)	Underweight (%) (<-2SD)	Mean z-score (WAZ)	N	Normal (%) >-2SD	Underweight (%) (≤2SD)	Mean z-score (WAZ)	
Underweight									
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]	

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*.
Source: Authors

Table 4. Association of infant and young child feeding practices and nutritional status in both Bukombe district and Njombe district.

Core indicators	Underweight				Stunted			
	Underweighted	Normal	X^2	*Sig*	Stunted	Normal	X^2	*Sig*
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)			-	-		

Source: Authors

child aged 6-23 months who received four or more food groups out of seven or not, the minimum acceptable diet; and being a child aged 2-23 months who was still breastfeeding (Table 4). 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.

The determinants of child nutrition status

According to the findings of this study (Table 5), the overall model of stunting accurately predicted the outcome ($p < 0.001$). The Nagelkerke R^2 = (0.288, 0.213) indicates that the independent factors included in the model could only predict 28.8 and 21.3%, respectively, of stunting and underweight. The likelihood of being stunted was negatively affected by household size, early breast milk initiation, and minimum meal frequency (-0.187, -0.464, 0.935), as well as by child age and early breast milk initiation (-0.024, -0.680). However, only maternal nutrition knowledge and feeding behaviours, particularly a minimum permissible diet, were statistically significant ($p = 0.028$).

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

The results (Table 6) show maternal nutritional knowledge had a higher average (2.52) among major ethnic groups

Table 5. Multivariate analysis of the determinants of child nutritional status.

Dependent variable	Stunted		Underweight	
Independent variable	***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)	-	-

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.
Source: Authors

Table 6. Association between maternal nutrition knowledge, nutritional status and IYCFP difference within ethnic groups.

Grouping variable	N	Test variable		Stat- value	Significance (*p-value*)
Group		**Mean**	**SD**		
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		

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.
Source: Authors

in Njombe district than in Bukombe district (2.00), with U = 19.32 and p = 0.002. This means that maternal nutrition knowledge among major ethnic groups (Bena and Hehe) was higher than among major ethnic groups in Bukombe (Sukuma and 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 scores = 1.17 and 1.09; p = 0.010).

DISCUSSION

The purpose of this systematic cross-sectional study was to analyse the prevalence of IYCF practises indicators as suggested by WHO/UNICEF and nutrition status among

children less than five years old, as well as to identify factors related to child nutrition outcomes. The study examines the relationship between infants aged 6-8 months who consumed solid, semi-solid, or soft foods, infants aged 6-23.9 months who consumed a minimum of dietary diversity and an acceptable diet, infants aged 21-23.9 months who continued breastfeeding, and stunting or underweight status. However, after correcting for potential confounding variables, the study revealed the drivers of child nutrition status in Tanzanian regions with a high prevalence of stunting. In conclusion, the study revealed variations in the nutritional status of children in the Njombe and Bukombe areas among the various ethnic groups.

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 out maternal and child health services and also facilities' readiness to provide those services. According to WHO and UNICEF (2021), access to recommended routine immunization, vitamin A supplementation, and proximity to health facilities all contribute to a better chance of survival for children under the age of five. This argument was strongly supported by several other studies with similar cohorts in dissimilar study areas (Greenspan et al., 2019; Hambidge and Krebs, 2018; Chan et al., 2020; Barker et al., 2018; WHO, 2016).

Infant and young child feeding (IYCF) practices

Based on findings from Table 2, the prevalence of IYCF practises did not comply with WHO and UNICEF's acceptable criteria. About half (51.7%) of children were not breastfed within 1 h after birth; only 11.6% had minimum dietary diversity; and about 4.6% had a 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 did not 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 (Rollins et al., 2016; Demilew et al., 2017; UNICEF, 2020).

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; Sunguya et al., 2019; 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. The 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.

Association of IYCF practices and nutritional status

Overall, the results indicated that IYCF practises were still poor in the study areas. Only 29.7% of the children reach the minimum dietary diversity. This means that 70.3% 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 in 53.7% of newborns who were not breastfed within the first hour of life. Children with unaccepted IYCF practises had a higher risk of being undernourished. The findings are also related to other similar studies conducted in different areas (Anin et al., 2020; Meshram et al., 2019; Mya et al., 2019; Karn et al., 2019; Donkor et al., 2021). Inadequate IYCF practises not only increase the likelihood of being stunted or wasted, but they are also a risk factor for child mortality (URT, 2018; Derso et al., 2017).

Determinants of child nutrition status

Non-maternal nutritional information was significantly associated with an increased chance of having children with stunted growth, according to this study ($p = 0.028$). In addition, the minimally acceptable diet is more likely to impact the child's nutritional status. One of the major challenges to child development is nutritional status.

Moreover, mothers' nutritional knowledge impacts improved feeding practises. Children under the age of five have a greater chance of surviving if IYCF practises are optimal. Humanity and civilization have been adversely affected by inadequate nourishment. In the most current Tanzania national nutrition survey reports from 2019 and the Tanzania Demographic and Health Survey from 2015, it was shown that the mother's nutritional knowledge and newborn and young child feeding practises influenced nutritional outcomes. The findings are comparable to those of other studies in many domains (Agize et al., 2017; Campbell et al., 2018; Fadare et al., 2019; Kebede et al., 2020; Mtongwa et al., 2021; Kejo et al., 2018; Lappan et al., 2020; Mbogori and Murimi, 2019; Meshram et al., 2019; Mishu et al., 2020; Rakotomanana et al., 2020; Karn et al., 2019).

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 about 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-Domnguez et al., 2020; Le et al., 2019; Robinson et al., 2019; Nguyen et al., 2016; Veghari and Vakili, 2016; Jones et al., 2015; Rana et al., 2018; Rashid et al., 2018) revealed that socio-economic disparity and nutritional services seeking behaviour may explain a large amount of difference in ethnicity and nutrition status. Njombe and Geita are among Tanzania's multi-ethnic regions with the highest prevalence of malnutrition (URT, 2012, 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).

Conclusion

A lack of proper feeding practices among young children was observed despite the availability of nutrition services and a diet rich in different foods. The majority of mothers with HAZ, WAZ, and WHZ anthropometric failures was not IYCF-competent and hence was not providing adequate nutrition to their infants and children. Ethnic groups will be able to choose and implement the healthiest and most successful infant and young child feeding practises when ethical concerns are addressed and community health worker (CHW) clinics are improved. More socioeconomic and biological study of IYCF and child nutrition is needed. Since there is a variation in IYCF practises and child nutrition status among ethnic groups, there is a need for more information about what works.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Agize A, Jara D, Dejenu G (2017). Level of Knowledge and Practice of Mothers on Minimum Dietary Diversity Practices and Associated Factors for 6-23-Month-Old Children in Adea Woreda, Oromia, Ethiopia. BioMed Research International 2017(7204562):1-9.

Ahmed MM, Hokororo A, Kidenya BR, Kabyemera R, Kamugisha E (2016). Prevalence of undernutrition and risk factors of severe undernutrition among children admitted to Bugando Medical Centre in Mwanza, Tanzania. BMC Nutrition 2(1):1-6.

Anin SK, Saaka M, Fischer F, Kraemer A (2020). Association between infant and young child feeding (Iycf) indicators and the nutritional status of children (6-23 months) in Northern Ghana. Nutrients 12(9):1-18.

Asoba GN, Sumbele IUN, Anchang-Kimbi JK, Metuge S, Teh RN (2019). Influence of infant feeding practices on the occurrence of malnutrition, malaria and anaemia in children ≤5 years in the Mount Cameroon area: A cross sectional study. PloS one 14(7):1-17.

Barker M, Dombrowski SU, Colbourn T, Fall CH, Kriznik NM, Lawrence WT, Stephenson J (2018). Intervention strategies to improve nutrition and health behaviours before conception. The Lancet 391(10132):1853-1864.

Campbell RK, Aguayo VM, Kang Y, Dzed L, Joshi V, Waid J, Gupta SD, Haselow N, West KP (2018). Infant and young child feeding practices and nutritional status in Bhutan. Maternal and Child Nutrition 14(4):e12762

Chan G, Storey JD, Das MK, Sacks E, Johri M, Kabakian-Khasholian T, Portela A (2020). Global research priorities for social, behavioural and community engagement interventions for maternal, newborn and child health. Health Research Policy and Systems 18(97):1-12.

Chirande L, Charwe D, Mbwana H, Victor R, Kimboka S, Issaka AI, Baines SK, Dibley MJ, Agho KE (2015). Determinants of stunting and severe stunting among under-fives in Tanzania: Evidence from the 2010 cross-sectional household survey. BMC Pediatrics 15(1):1-13.

Connelly LM (2016). Cross-sectional survey research. Medsurg Nursing 25(5):369.

Dattalo P (2018). Determining sample size using fast and slow thinking. Journal of Social Service Research 44(2):180-190.

Demilew YM, Tafere TE, Abitew DB (2017). Infant and young child feeding practice among mothers with 0 - 24 months old children in Slum areas of Bahir Dar City. International Breastfeeding Journal 12(26):1-9.

Denscombe M (2017). EBOOK*: The good research guide: For small-scale social research projects*. McGraw-Hill Education (UK). 396pp.

Derso T, Tariku A, Biks GA, Wassie MM (2017). Stunting, wasting and associated factors among children aged 6-24 months in Dabat health and demographic surveillance system site: A community based cross-sectional study in Ethiopia. BMC Pediatrics 17(1):1-9.

Development Initiatives Poverty Research Limited (DIPR) (2020). 2020 Global Nutrition Report: Action on equity to end malnutrition. Bristol, UK 168 p.

Donkor WE, Adu-Afarwuah S, Wegmüller R, Bentil H, Petry N, Rohner F, Wirth JP (2021). Complementary feeding indicators in relation to micronutrient status of Ghanaian children aged 6-23 months: Results from a national survey. Life 11(9):1-17.

Fadare O, Amare M, Mavrotas G, Akerele D, Ogunniyi A (2019).

Mother's nutrition-related knowledge and child nutrition outcomes: Empirical evidence from Nigeria. PLoS ONE 14(2):1-17.
Fanzo J, Hawkes C, Udomkesmalee E, Afshin A, Allemandi L, Assery O, Baker P, Battersby J, Bhutta Z, Chen K, Corvalan C (2018). Shining a light to spur action on nutrition. Global Nutrition Report, Japan 165 p.
Ferguson CJ (2016). An effect size primer: a guide for clinicians and researchers. Psychological Association 40(5):532-538.
Gatica-Domínguez G, Mesenburg MA, Barros AJD, Victora CG (2020). Ethnic inequalities in child stunting and feeding practices: Results from surveys in thirteen countries from Latin America. International Journal for Equity in Health 19(1):1-13.
Greenspan JA, Chebet JJ, Mpembeni R, Mosha I, Mpunga M, Winch PJ, McMahon SA (2019). Men's roles in care seeking for maternal and newborn health: A qualitative study applying the three delays model to male involvement in Morogoro Region, Tanzania. BMC Pregnancy and Childbirth 19(1):1-12.
Hambidge KM, Krebs NF (2018). Strategies for optimizing maternal nutrition to promote infant development. Reproductive Health 15(1):93-99.
Hamner HC, Beauregard JL, Li R, Nelson JM, Perrine CG (2021). Meeting breastfeeding intentions differ by race/ethnicity, infant and toddler feeding practices study-2. Maternal and Child Nutrition 17(2):1-10.
Hashmi AH, Nyein PB, Pilaseng K, Paw MK, Darakamon MC, Min AM, Charunwatthana P (2019). Feeding practices and risk factors for chronic infant undernutrition among refugees and migrants along the Thailand- Myanmar border : a mixed-methods study. BMC Public Health 19(1):1-16.
Jones KM, Power ML, Queenan JT, Schulkin J (2015). Racial and ethnic disparities in breastfeeding. Breastfeeding Medicine 10(4):186-196.
Karn S, Adhikari DP, Paudyal N, Aryal B, Adhikari RK, Steffen MM (2019). Child Undernutrition and Feeding Practices in Nepal: Trends, Inequities, and Determinants. DHS Further Analysis Reports No. 122. Rockville, Maryland, USA 84 p.
Kebede DT, Bekalo DB, Mekuriaw DM (2020). Multivariate analysis of correlates of children nutritional status in Harar region, Ethiopia. International Journal of Scientific Reports 6(3):101-110.
Kejo D, Mosha TC, Petrucka P, Martin H, Kimanya ME (2018). Prevalence and predictors of undernutrition among underfive children in Arusha District, Tanzania. Food Science and Nutrition 6(8):2264-2272.
Khamis AG, Mwanri AW, Kreppel K, Kwesigabo G (2020). The burden and correlates of childhood undernutrition in Tanzania according to composite index of anthropometric failure. BMC Nutrition 6(1):1-13.
Kothari C (2017). Research methodology methods and techniques by CR Kothari. Published by New Age International (P) Ltd., Publishers 398 p.
Lappan SN, Harman T, Pavela G, Hendricks PS (2022). Relationship Between Food Security Status in a Caregiver's Family of Origin and Current Feeding Practices Among Low-Income, Single, Female Primary Caregivers. Family and Community Health 45(4):257-266.
Le TT, Le TTD, Do NK, Nadezhda VS, Andrej MG, Nguyen TTT, Duong TAD (2019). Ethnic variations in nutritional status among preschool children in northern Vietnam: A cross-sectional study. International Journal of Environmental Research and Public Health 16(21):1-11.
Mbogori T, Murimi M (2019). Effects of a nutrition education intervention on maternal nutrition knowledge, dietary intake and nutritional status among food insecure households in Kenya. International Journal Of Community Medicine and Public Health 6(5):1831-1837.
Meshram II, Mallikharjun RK, Balakrishna N, Harikumar R, Arlappa N, Sreeramakrishna K, Laxmaiah A (2019). Infant and young child feeding practices, sociodemographic factors and their association with nutritional status of children aged <3 years in India: Findings of the National Nutrition Monitoring Bureau Survey 2011-2012. Public Health Nutrition 22(1):104-114.
Mihretie Y (2018). Maternal knowledge on complementary feeding practice and nutritional status of children 6-23 Month in Jigjiga Town. Global Journal of Nutrition and Food Science 1(1):1-12.
Mishu AA, Chowdhury S, Bipasha MS, Raisa TS, Zayed NM (2020). Maternal nutritional status as determinants of child malnutrition under age 5 in Bangladesh: a multivariate approach. International Journal of Management 11(8):1-9.
Mondragon B, Guarneros GT, Jimenez TA (2017). Ethical evaluation of mental health social research: Agreement between researchers and ethics committees. Journal of Empirical Research on Human Research Ethics 12(3):161-168.
Mrema JD, Elisaria E, Mwanri AW, Nyaruhucha CM (2021). Prevalence and Determinants of Undernutrition among 6- To 59-Months-Old Children in Lowland and Highland Areas in Kilosa District, Tanzania: A cross-sectional study. Journal of Nutrition and Metabolism 202:9.
Mtongwa RH, Festo C, Elisaria E (2021). A comparative analysis of determinants of low birth weight and stunting among under five children of adolescent and non-adolescent mothers using 2015/16 Tanzania Demographic and Health Survey (TDHS). BMC Nutrition 7(1):1-10.
Mya KS, Kyaw AT, Tun T (2019). Feeding practices and nutritional status of children age 6-23 months in Myanmar: A secondary analysis of the 2015-16 Demographic and Health Survey. PLoS ONE 14(1):1-13.
Nguyen TT, Nguyen PH, Hajeebhoy N, Nguyen HV, Frongillo EA (2016). Infant and young child feeding practices differ by ethnicity of Vietnamese mothers. BMC Pregnancy and Childbirth 16(1):1-9.
Pajula J, Tohka J (2016). How many is enough? Effect of sample size in inter-subject correlation analysis of fMRI. Computational intelligence and neuroscience 2016:1-1.
Powell B, Bezner Kerr R, Young SL, Johns T (2017). The determinants of dietary diversity and nutrition: Ethnonutrition knowledge of local people in the East Usambara Mountains, Tanzania. Journal of Ethnobiology and Ethnomedicine 13(1):1-12.
Rakotomanana H, Hildebrand D, Gates GE, Thomas DG, Fawbush F, Stoecker BJ (2020). Maternal knowledge, attitudes, and practices of complementary feeding and child undernutrition in the Vakinankaratra Region of Madagascar: A mixed-methods study. Current Developments in Nutrition 4(11):1-11.
Rana MM, Van HN, Ngoc TN (2018). Effectiveness of a community-based infant and young child feeding support group programme among ethnic minorities in Vietnam. Field Exchange 58:71-74.
Rashid V, Engberink MF, Van Eijsden M, Nicolaou M, Dekker LH, Verhoeff AP, Weijs PJ (2018). Ethnicity and socioeconomic status are related to dietary patterns at age 5 in the Amsterdam born children and their development (ABCD) cohort. BMC Public Health 18(115):1-10.
Robinson K, Fial A, Hanson L (2019). Racism, bias, and discrimination as modifiable barriers to breastfeeding for African American Women: A scoping review of the literature. Journal of Midwifery and Women's Health 64(6):734-742.
Rollins NC, Bhandari N, Hajeebhoy N, Horton S, Lutter CK, Martines JC, Victora CG (2016). Why invest, and what it will take to improve breastfeeding practices?. The Lancet Breastfeeding Series Group 387(10017):491-504.
Seboka BT, Hailegebreal S, Yehualashet DE, Demeke AD (2021). Tracking progress in anthropometric failure among under-five children in Ethiopia : a geospatial and multilevel analysis. Archives of Public Health 79(103):1-17.
Sunguya BF, Zhu S, Mpembeni R, Huang J (2019). Trends in prevalence and determinants of stunting in Tanzania : an analysis of Tanzania demographic health surveys (1991-2016). Nutrition Journal 18(1):1-13.
UNICEF (2018). Breastfeeding; A Mother's Gift for Every Child. United Nations Children's Fund (UNICEF), Nutrition Section, Programme Division, New York, NY 10017, USA 20 p.
UNICEF (2020). Nutrition, for Every Child: UNICEF Nutrition Strategy 2020–2030. United Nations Children's Fund (UNICEF). UNICEF, New York, NY 10017, USA 110 p.
United Republic of Tanzania (URT) (2007). National Sample Census of Agriculture *2002/2003.* Regional Report: Iringa Region. National Bureau of Statistics, Ministry of agriculture and Food Security, Ministry of Water and Livestock Development, Ministry of Cooperatives and Marketing, Presidents Office, Regional Administration and Local Government, Ministry of Finance and Economic. Zanzibar 344 p.
United Republic of Tanzania (URT) (2012). Basic demographic and

socio-economic profile, Tanzania Zanzibar 245 p.
United Republic of Tanzania (URT) (2013). 2012 Population and Housing Census, Population Distribution by Administrative Areas, NBS&CGS.
United Republic of Tanzania (URT) (2015). Tanzania Demographic Health Survey and Malaria Indicator Survey 2015-2016. Ministry of Health, Community Development, Gender, Elderly and Children Dar es Salaam, Ministry of Health Zanzibar, National Bureau of Statistics Dar es Salaam, Office of Chief Government Statistician Zanzibar, ICF Rockville, Maryland USA 24 p.
United Republic of Tanzania (URT) (2016). Njombe District Council Socio-Economic Profile. National Bureau of Statistics, Dar es Salaam 155 p.
United Republic of Tanzania (URT) (2018). Tanzania National Nutrition Survey 2018. Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) [Tanzania Mainland], Ministry of Health (MoH) [Zanzibar], Tanzania Food and Nutrition Centre (TFNC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS) [Zanzibar] and UNICEF. Dares Salaam, Tanzania 144 p.
Vasileiou K, Barnett J, Thorpe S, Young T (2018). Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. BMC Medical Research Methodology 18(148):1-18.
Veghari G, Vakili M (2016). Trend of Stunting, Overweight and Obesity among Children Under Five Years in a Rural Area in Northern Iran, 1998-2013: Results of three cross-sectional studies. Archives of Iranian Medicine 19(6):397-402.
Walker R, Huxley L, Juttner M, Burmeister E, Scott J, Aitken LM (2017). A pilot randomized controlled trial using prophylactic dressings to minimize sacral pressure injuries in high-risk hospitalized patients. Clinical Nursing Research 26(4):484-503.
World Health Organization (WHO) (2016). Interagency list of medical devices for essential interventions for reproductive, maternal, newborn and child health. World Health Organization, Geneva 176 p.
World Health Organization (WHO) (2018). Global Nutrition Report: Shining a light to spur action on nutrition. [https://doi.org/h ttp://dx.doi.org/10.2499/9780896295643] site visited on 20/6/2021.
World Health Organization (WHO) (2021). Infant and Young Child Feeding. World Health Organization. Available at: [https://www.who.int/news-room/fact-sheets/detail/infant-and-young-child-feeding] site visited on 15/02/2023
WHO, UNICEF (2021). Indicators for assessing infant and young child feeding practices: definitions and measurement methods. World Health Organization and the United Nations Children's Fund (UNICEF). Geneva 122 p.
WHO/UNICEF/ WB (2019). Levels and Trends in Child Malnutrition. World Bank Group, Washington DC. 16 p.
Ziba M, Kalimbira AA, Kalumikiza Z (2018). Estimated burden of aggregate anthropometric failure among Malawian children Estimated burden of aggregate anthropometric failure among Malawian children. South African Journal of Clinical Nutrition 31(2):20-23.