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# Maternal and Child Characteristics as Protective Factors for Child Nutritional Status in Pangani District, Tanzania

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## Abstract

Undernutrition is attributed to various causes, including characteristics of the mother. Maternal health and height of the mothers have been identified several times in the literature as critical factors influencing child growth. However, the influence of maternal sociodemographic characteristics on undernutrition, especially among those population residing in rural settings has scantily been explored. This paper examined the influence of maternal variables on undernutrition among children under-five years in Pangani District. Data were collected from 340 mothers/caregivers-child pairs using a structured questionnaire, child hospital cards, and anthropometric measurements which were taken from 355 children under-five years of age. Emergency Nutrition Assessment (ENA) for SMART (2011) software was used to generate indices for weight-for-height, height-for-age and weight-for-age. Thereafter, a composite index of anthropometric failure (CIAF) was used to measure undernutrition. Binary logistic regression analysis was used to measure the relationship between a categorical dependent variable and independent variables. The CIAF results indicated that undernutrition is still a health problem in Pangani District whereby male children were more undernourished (22.5%) compared to female children (14.1%). Ten variables were entered for analysis; of the 10 variables subjected to binary logistic analysis, four variables (education of the mother or caretaker, sex of the child, immunization status and marital status) significantly influenced undernutrition. Education of the mother was the strongest predictor of undernutrition of children under- five years ($\beta = 2.333$, Wald = 30.356, OR = 10.309, $p = 0.000$). It is concluded that undernutrition is still a problem in the study area. Education of the mother was found to be among the important factor influencing child undernutrition in Pangani district. It is recommended that the government, through the Ministry of Health, should ensure availability of health services and facilities close to the communities. Provision of quality education to transfer knowledge geared at empowering women to take actions regarding their health and the health of their children is also recommended.

**Key words**: Maternal characteristics, undernutrition, children under-five**,** Tanzania

## 1. Introduction

Undernutrition remains a significant public health problem in many developing countries. According to WHO (2018), 52 million children under-five years of age are wasted; 17 million are severely wasted and 155 million are stunted. Although the Global Nutrition Report of 2017 details the world's progress in reducing number of children under-five years who are chronically or acutely malnourished, the progress is not rapid enough to reduce these forms of malnutrition by 2030 (Development Initiative, 2017). In an effort to achieve this, the United Nations (UN) Sustainable Development Goals (SDGs) included incredible challenges to the world, which comprise an end to hunger and improving nutrition for all people by 2030 (Development Initiative, 2017). Despite the significant steps the world has taken towards achieving the set targets through the inclusion of SDGs targets in national policies and programmes, undernutrition remains a major considerable drawback to the success of the efforts (Akombi *et al.,* 2017). This particularly remains as an alarming public health concern in South Asian countries (Tariq *et al., 2*018) and in sub-Saharan Africa, especially in East and Central Africa (UN, 2015).

Tanzania is among the countries with the highest undernutrition burden in East and Central Africa. In order to overcome this, a number of programmes have been put in place and implemented in order to reduce child undernutrition. Such programmes include infants and young child feeding, sanitation, de-worming, Vitamin A supplementation and health education (MoHSW, 2008). As a way of understanding the progress and outcomes of these efforts, the Tanzania Demographic Health Survey and Malaria Indicator Survey (TDHS-MIS, 2015 - 2016) has been following up changes and reported a significant reduction of undernutrition between 1996 and 2016, that stunting decreased from 48 to 34%, wasting from 7 to 5% and underweight from 24 to 16% (MoHCDGEC *et al.,* 2016). Even with this reduction, the prevalence of undernutrition among children under-five in Tanzania is still disappointingly too high by the World Health organization (WHO) standards of reducing wasting to less than 5% and achieving 40% reduction of stunting by 2025 (FAO and WHO, 2018). In this regard, scholars need to carry out studies that could highlight factors leading to a slow pace in achieving the set standards and suggesting effective measures that policy makers could devise in order to reduce undernutrition and achieve related SDGs.

Several studies carried out on the nutritional status of children under-five suggest that undernutrition is caused by many factors. Whereas some of these studies have tried to focus on the general contributions of the maternal characteristics

(Nyaruhucha *et al.,* 2006; Semali *et al.,* 2015; Safari *et al.,* 2015), many of these studies are area specific and have not fully explored the influence of maternal characteristics in relation to household variables on undernutrition among children under-five years. Additionally, like in many other developing countries, the empirical evidence on the cause of undernutrition is based on periodic demographic data and health surveys (Safari *et al.,* 2015). Consequently, little is understood on how these causes differ at the community level. Moreover, available statistics from TDHS-MIS, 2015 - 2016 have been hardly analysed to see the extent to which maternal characteristics influence undernutrition. Understanding the status of undernutrition and its prevailing determinants is an important stepping-stone to the strategies of overcoming the problem at the district level. Similarly, an accurate understanding of the causes of undernutrition and how they relate to each other is important for designing programmes and interventions aiming at reducing undernutrition at district, regional and national levels. Pangani District is of no exceptional as communities differ in terms of availability of health facilities, cultural backgrounds and economic activities.

The conceptual framework of this manuscript is informed by empirical literature review, which is based on traditional conceptual framework developed by UNICEF (1990), which was later modified by Victoria *et al*. (1997). The framework mainly explains the causes of undernutrition in view of three variables: intermediate (socioeconomic variables), underlying factors (environmental variables at the household level) and the basic factors, which influence health outcomes. The conceptual framework adapted in this manuscript (Figure 1) illustrates the relationship of child specific characteristics and maternal characteristics that act directly or indirectly through intervening variables to influence child nutrition status. The framework put forward role of these variables that act at a household level to influence nutritional outcomes. It provides a broader understanding of factors impacting on the nutrition status, emphasize the need to look beyond food needs of a population and address other underlying factors that directly or indirectly influence health as explained by UNICEF (2013). The likelihood of a child being undernourished is based on non-maximization of quality child care practices that the child receives which are essential for child health, growth and development. The quality of these child care practices in turn is determined by the sociodemographic characteristics of the mother and household status at which the child is born.

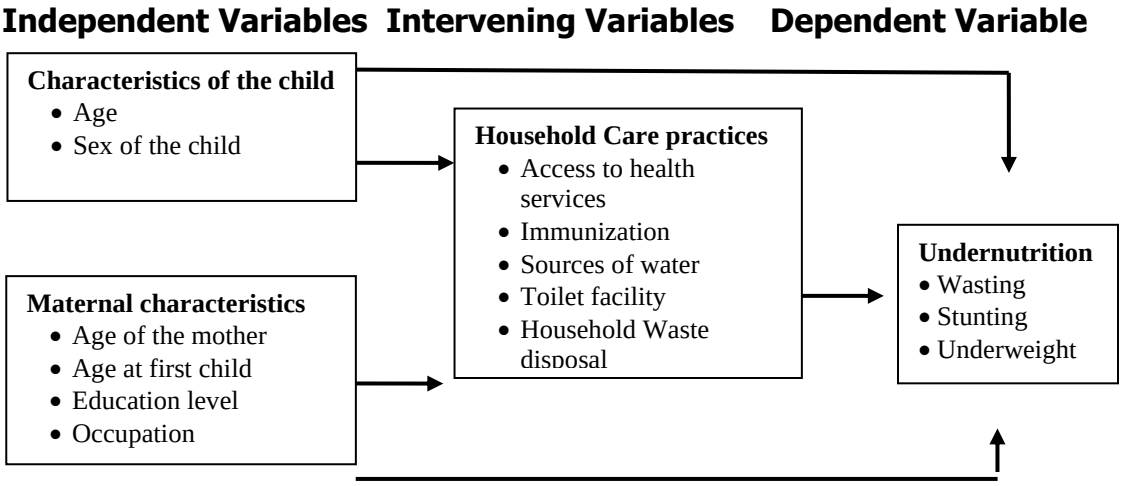


**Figure 1: Relationship between maternal sociodemographic characteristics and undernutrition**

**Source:** Adapted from UNICEF (1990) and Victoria *et al.* (1997)

Based on the review of these variables explained in the conceptual framework, this manuscript aims to see how these characteristics of the mother/caretaker relate to the health outcomes of children under-five years. Specifically, this manuscript (i) determined the sociodemographic characteristics of the mothers with children under-five years, (ii) assessed child care practices by the mothers/caretakers of children under-five years, and (iii) examined the influence of maternal characteristics and community variables on undernutrition among children under-five years in Pangani District.

## 2. Methodology

### 2.1Description of the study district

The study was conducted in Pangani District. The District occupies the smallest area and population of the eight districts of Tanga region. It bordered by Handeni district to the West, the Indian Ocean with the islands of Zanzibar and Pemba to the East, Muheza district to the North and Bagamoyo district of the Coast Region to the South. Administratively, the District is divided into four divisions, 13 wards, 33 villages and 94 hamlets (RS/RHMT, 2013). The district has 22 health facilities, among which are one district hospital, one health centre and 20 dispensaries (RS/RHMT, 2013). The district was selected purposively because it has highest stunting rate among other districts along the coast of Indian Ocean (MoHCDGEC *et al.,* 2016). Choosing this area with highest stunting rate was aimed at understanding the magnitude of undernutrition and its determinants as well as understanding child care practices and socioeconomic well-being in the study area.

## 2.2 Research design

A cross–sectional research design was suitable for this manuscript because it entails the collection of data on a number of cases at single point in time and is suitable for descriptive analysis and determination of relationship among variables (Bailey, 1994; Walliman, 2006). The design allows more than one method to be used at a time in which larger clusters are divided into smaller clusters (Kothari, 2004). Therefore, it was considered that this design was suitable to assess the influence of maternal characteristics on nutritional status of under-five children in Pangani District. The study population involved mother/care takers of children under-five years of age residing in Pangani and those who were willing to participate in the study. All mothers/care takers with children above five years, and those who were not willing to participate in the study and those who were not residing in the study areas were excluded from the study.

## 2.3 Sampling and sample size

Purposive sampling was used to select two divisions, Mwera (representing river side) and Pangani (representing ocean side). Two wards from each division and two villages from each ward were randomly selected, making a total of eight villages. Simple random sampling was then used to select households with children under-five years as a sample. The sample size was determined based on stunting prevalence in Pangani district of 49% (MoHCDGEC *et al.,* 2016) by using Cochran's formula as adopted by Bartlett *et al*. (2001). Based on the above formula, a total of 340 households were used in the study. Where a household had two or more children under-five years all were included in the sample, therefore a total of 355 children were involved in the study.

## 2.4 Data collection

Variables including weight, height, birth weight, age and sex of children were taken during home visits. Length of the children less than 24 months was measured in a recumbent position to the nearest 0.1 cm using a wooden base and a movable head piece. Height of children above 24 months was measured in a standing position to the nearest 0.1 cm using a vertical board with a detachable sliding piece (Assaf *et al.,* 2015). A household survey questionnaire which consisted of both open ended and close ended questions was used to obtain information on children. Four FGDs, one from each ward comprising 8 participants, were conducted in order to understand the depth of the qualitative information on care practices, access to community services and health related factors. Bryman (2004) and Barbour (2011) suggest that 6 to 12 participants are enough for effective participation and good quality data in FGDs for the reasons that if

participants are too many some of them may just remain silent, and if they are too few, they may not be able to discuss difficult topics effectively.

### 2.5 Data analysis

Emergency Nutrition Assessment (ENA) for SMART was used to generate measurement indices of height-for-age, weight-for-age, and weight-for-height. The indices generated were compared with standard reference values for WHO growth standard (2006) to obtain Z-scores[1]. In order to consider all undernourished children at a single point, this manuscript adopted an aggregate composite index of anthropometry failure (CIAF) as proposed by Svedberg (2000) later modified by Nandy *et al*. (2005). Binary logistic regression model was employed to determine the relationship between the dependent categorical variable and explanatory independent variables. Analysis of the results from the model focused on interpretation of β-coefficients for measuring the directions of the relationship; p-values for testing significance of the relationship, and odds ratios (EXP (B) values) for predicting the number of times various predictor variables have chances to occur relative to one another regarding the relationship between variables as explained in Pallant (2007) and undernutrition of children under-five years. The binary logistic regression model used is shown in the following equation.

$\text{Log}\ (P_i/1\text{-}P_i) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \ldots + \beta_{10}X_{10} + e$..... Equation

Where: $\text{Log}\ (P_i/1\text{-}P_i)$ = is the natural logarithm of the status of a child being malnourished (Undernutrition) or not, Pi = Probability of the $i^{th}$ child being malnourished

$1\text{-}P_i$ = probability of the $i^{th}$ child not being malnourished measure by CIAF

$\beta_0$ = Constant (Y- interception)

$\beta_1 - \beta_{15}$ = Logarithm of regression coefficient of independent (predictors) variables:

$X_1$= age of the mother/caretaker (years)

$X_2$ = Marital status of the mother/caretaker (1 = married; 0 = otherwise)

$X_3$ = Education of the mother/caretaker (years of schooling)

$X_4$ = Occupation of the mother/caretaker (1 = engaged with work outside home; 0 = otherwise)

$X_5$ = Access to nearby health facility (1 = Yes; 0 = No)

$X_6$ = Sex of the child (1 = Male; 0 = Female)

[2] Z-score of -2 standard deviations is the most commonly adopted cut-off point for all nutrition indicators (Zewdie and Abebaw, 2013). In this study, a child with Z-scores below -2 SD in respective nutritional status indicator was considered malnourished i.e. stunted, wasted or underweight (WHO, 2006).

$X_7$ = Child Immunization status (1 = fully immunized; 0 = partially immunized)
$X_8$ = If child was sick or admitted two weeks before survey (1 = Yes; 0 = No)
$X_9$ = If a child received Vitamin A supplement (1 =Yes; 0 = No)
$X_{10}$ = If a child received de worming tablets (1 = Yes; 0 = No)

## 3. Results and Discussion

### 3.1 Demographic characteristics of the mothers

A total of 340 mothers/care takers and child pairs were studied, consisting of 355 children under-five years because some of the mothers had more than one child under-five years. The sociodemographic characteristics of the mothers are summarized in Table 1. The findings revealed that the minimum and maximum ages of the mothers ranged between 18 and 48 years with the mean age of 28.48 years. Nearly half of the mothers (48.5%) were in the age group which ranged from 25 to 34 years, suggesting that a greater proportion of the mothers were at their active reproductive age, while 30.6% were young mothers with the age range from 14 to 24 years.

In analysing mothers' age at the time of delivering the first child, more than half (57.2 %) of the mothers had their first child at the age range from 15 to 18 years, indicating a high rate of early childbearing in Pangani District. Similar findings have also been reported by UNFPA (2013) that Tanzania is among the countries with highest adolescent pregnancy rate, with an estimated of 23% of girls between 15 and 19 years compared to the global adolescent pregnancy estimate of 19%. Early childbearing is reported to place girls at high health risks, and they are likely to die in childbirth (UNFPA, 2013).

Premature childbearing in Pangani District could be attributed to the culture of most coastal areas in which a girl is married soon after puberty. This may imply that the community in the study area violates a number of local and international legal instruments which define a child as a person below 18 years as explained in Nyange *et al*. (2016). Infants born to a mother below 18 years are likely to be undernourished due to nutrient competition between mother and unborn child. Thus, this manuscript may emphasize the value of delaying child bearing in the study population in order to adhere to the rights of the girl child but also reduce the chances of increasing undernutrition among children under-five years. The findings on occupation of the mothers show that the biggest proportion of the mothers (43.2%) were engaged in small businesses such as food vendors, selling vegetables and fruits, while 30.9% of the mothers were involved in fishing activities. Further analysis shows that 20% of the mothers were engaged in

agricultural activities with only 5.9% being employed in different sectors. Although the results indicate diverse income generating activities among the mothers, but the types of activities performed by the majority of the mothers provided an opportunity for the mothers to be with a child while working. Women's economic statuses in the household are likely to increase status power and may likely to reinforce their preference in spending their earnings on health and nutrition of their families.

**Table 1: Sociodemographic characteristics of the mothers (n = 340)**

| Variable | n | % |
|---|---|---|
| **Age of the Mothers (Yrs)** | | |
| 14 – 24 | 104 | 30.6 |
| 25 - 34 | 165 | 48.5 |
| 35 – 44 | 70 | 20.6 |
| 45+ | 01 | 0.3 |
| **Age of the Mothers at First Child** | | |
| Below 14 | 133 | 37.5 |
| 15 – 18 | 203 | 57.2 |
| 19 – 30 | 04 | 1.1 |
| **Marital Status** | | |
| Single | 42 | 12.4 |
| Married | 213 | 62.6 |
| Divorced/Separated | 46 | 13.5 |
| Cohabitating | 33 | 9.7 |
| Widow | 06 | 1.8 |
| **Education level** | | |
| Not attended school | 61 | 12.9 |
| Primary education | 223 | 62.8 |
| Secondary education | 54 | 15.3 |
| Post-Secondary Education | 04 | 1.1 |
| **Occupation** | | |
| Employment | 20 | 5.9 |
| Agriculture | 68 | 20 |
| Fishing | 105 | 30.9 |
| Business | 147 | 43.2 |

Note: n=number of respondents, %=percentage

### 3.2 Level of undernutrition among children under-five years

Out of 355 total of children under-five years, 47.9% were male and 52.9% were female (Table 2). The results for anthropometric analysis of children under-five years indicated the prevalence of stunting, underweight and wasting among children under-five years was 27.9, 13.8 and 5.1% respectively. Stunting is still recognized as a health problem; it was found to be higher (27.9%) than the acceptable WHO standard level of 20%. Similarly, the level of wasting surpassed the national and acceptable level of 5% (MoHCDGEC *et al.,* 2016).

**Table 2: Anthropometric analysis of children under-five years (n=355)**

| Age groups | Normal | | Stunted | | Wasted | | Underweight | | Overweight | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in months) | n | % | N | % | n | % | n | % | n | % | n | % |
| 1 - 6 | 06 | 1.7 | 4 | 1.1 | 1 | 0.3 | 3 | 0.8 | 5 | 1.4 | **19** | 5.4 |
| 7 – 12 | 11 | 3.1 | 3 | 0.8 | 3 | 0.8 | 4 | 1.1 | 6 | 1.7 | **27** | 7.6 |
| **13 – 24** | 42 | 11.8 | 26 | **7.3** | 3 | 0.8 | 12 | **3.4** | 13 | 3.7 | **99** | 27.0 |
| **25 – 36** | 71 | 20 | 57 | **16.2** | 12 | **3.4** | 28 | **7.9** | 07 | 1.9 | **174** | 49.9 |
| 37 – 48 | 23 | 6.5 | 9 | 2.5 | 0 | 0 | 2 | 0.6 | 0 | 0 | **35** | 9.9 |
| 49 – 60 | 04 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **04** | 1.1 |
| **Sex of a child** | | | | | | | | | | | | |
| Male | 93 | 26.2 | 47 | 13.2 | 11 | 3.1 | 19 | 5.3 | | | 170 | 47.9 |
| Female | 96 | 27.0 | 52 | **14.6** | 7 | **1.9** | 30 | **8.4** | | | 185 | 52.1 |

Note: n = number of respondents, % = per cent

Further analysis was performed to measure the level of undernutrition based on CIAF, which permits disaggregation of undernutrition into six sub-groups as explained by Nandy *et al.* (2005). The CIAF results (Table 3) show a high prevalence of undernutrition (36.6%) in comparison with three other anthropometric indicators (stunting, underweight and wasting). Analysis of CIAF based on sex of a child indicated that more male children were undernourished compared to female children. This is contrary to what has been reported by Gibson (2005) that female children are often deprived of resources due to socio-cultural settings which favour male children in child care practices.

The relationship between sex of a child and nutritional status has been reported as favourable for male children, with discriminatory breastfeeding and supplementary practice for female children. Infant girls are breastfed less frequently, for short duration, and over short periods than boys. However, this is contradictory to what Wagstaff *et al*. (2003) and Chirwa and Ngalawa (2008) have reported that boys are generally prone to malnutrition than girls. This contradiction may suggest that

the influence of child sex over undernutrition is area specific and therefore any generalization of the findings from one area to another is unjust.

**Table 3: Status of under-nutrition of children under-five years based on CIAF (n = 355)**

| Variables | n | % |
|---|---|---|
| **No Failure** | | |
| Male | 88 | 24.7 |
| Female | 137 | 38.6 |
| **CIAF (Wasting + Stunting + Underweight)** | | |
| Male | 80 | 22.5 |
| Female | 50 | 14.1 |
| **Total** | **355** | **100** |

Note: n = number of respondents, % = per cent

The present manuscript shows a lower CIAF (36.6%) than the national level of 45.9% as reported by Gupta (2017), but indicates that large number of undernourished children is incorporated in the CIAF analysis as compared to anthropometric analysis. These findings, therefore, propose that using CIAF to assess nutritional status is more appropriate because CIAF offers a comprehensive measurement of undernutrition among children under-five. This is in line with a study done by Shits *et al*. (2012) which ascertained that, despite certain conceptual limitations, CIAF gives a near complete picture of undernutrition and helps prioritize undernourished children.

### 3.3 Child health care practices

Analysis of child care practices for this manuscript focuses on immunization status, incidences of illness and care for children during illness. The findings in Figure 2 show that the majority of children (71.8%) were fully immunized while 28.1% were partially immunized. Further analysis indicated that 62.8 % of children above 2 years of aged had received all the basic vaccinations required for their age. Additional analysis indicated that vitamin A supplementation for children aged 6 to 12 months was 69%, and de worming for children aged between 12 and 59 months was 64.2%.

The immunization status reported in this manuscript is lower than the immunization coverage reported by MoHCDGEC (2018) that Vitamin A supplementation and deworming were 78% and 79% respectively. The low status observed in this manuscript may be due to the fact that data collected are based

on household surveys which include those children who may not be attending health facilities regularly. This is contrary to the MoHCDGEC (2018) report which is hospital-based and therefore includes all children who receive hospital services frequently including the possibility of receiving Vitamin A supplementation and de-worming. This manuscript may suggest the use of household survey data in reporting health status of children under-five in order to get the actual health situation rather depending on hospital visits which may not include those who do not have access to health services.

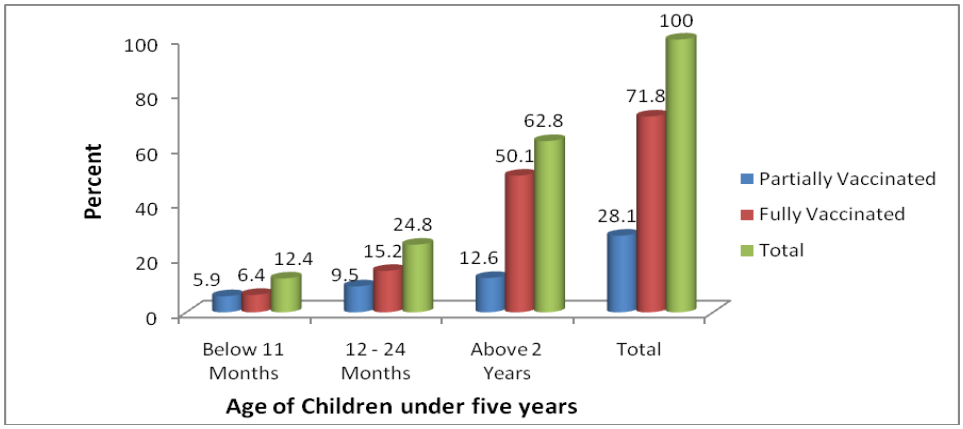


**Figure 2: Immunization status for children under-five years (n = 355)**

Health status of children shows that 47% of children under-five had suffered an illness two weeks prior to the study while 53% had not been sick. Of these, 21.7% suffered from diarrhoea; 19.7% suffered from fever; 9.6% were vomiting; 7.9% suffered from abdominal pain and 8.5% had other illnesses including respiratory infections and coughing. It was found that the majority of the respondents (72.4%) sought health care facilities for their sick children while 15.5% bought drugs from local drug stores, and 5.9% relied on self-medication. When asked how they fed their children during illness, the greatest proportion of the respondents (46.8%) forced them to eat, while 28.8% increased solid and soft foods; 20.3% gave them small amounts of food more frequently and 4.5% stopped solid food and continued breast feeding. Results from focus group discussions (FGD) reported mixed responses when asked what they gave to their children when they had diarrhoea, for example, participants reported that:

"…. *we reduce breast feeding and give the children more water with little salt and sugar because if we continue breastfeeding them the problem of diarrhoea increases…"* (FGD Participants, Mwera Village, 4th November, 2016).

Similarly, the participants also agreed that:

"…. *We usually feed our children more frequently and small amounts with more water and other fluids such as fruit juice whenever they are available …"* (FGD participants, Tungamaa Village, 6th November, 2016).

This result portrays minimum knowledge and information about care practices for children during illness in the study area. According to the adapted UNICEF conceptual framework, child care practice is among the immediate factors influencing undernutrition among children under-five years. Similarly, Raamji (2009) explained care practices including all actions and behaviors by the mothers or care taker related to feeding children, hygiene practices, home health practices and food preparation. Findings from FGDs indicate that there was lack of proper knowledge and information on child care during illness which might endanger the health of children eventually increasing chances of undernutrition.

### 3.4 Proximate variables related to undernutrition

This manuscript assessed household characteristics including access to health services, water availability, toilet facilities and sanitation, which may directly or indirectly intervene the child health status. The results (Table 4) show that the majority (89.3%) had access to health facilities while 10.3% had no access to nearby health facilities. Among these respondents, 32.1% had access to the District hospital; 31.5% had access to village health posts; 14.4% had access to dispensaries and 11.8% had access to health centres. When asked if they were satisfied with the available services at the health centres, 35.6% of the respondents said that they were not satisfied. Participants in an FGD at Bweni village said:

"…. *We have to pay for MCH cards in order to register for MCH clinic. Luckily, we had money to pay but those who didn't have money opted for not attending clinic …"*(FGD participants, Bweni Village, 8th November, 2016).

Although the district has an adequate number of health facilities including the district hospital, health centres and dispensaries (RS/RHMT, 2013), but these findings may suggest that the availability of health services may not guarantee the accessibility and quality of services to the community. This challenge has also been mentioned by Neke *et al.* (2018) that the availability of medicines, medical supplies, and equipment continue to affect the provision of quality services in many areas in Tanzania. While child care is one of the key components of the National Package for Essential Reproductive and Child Health Interventions (NPERCHI) which focus on improving the quality of live for women and children, not all components of services are of good quality and provided to the scale. This

is very much in agreement with the adapted UNICEF conceptual framework which shows that if access to health services is limited, the vulnerability to undernutrition among children under-five increases.

The main source of household water supply was water taps (45.3%) and water wells in the residence and public areas (36.8%), while only 17.9% depended on other sources including rain water and seasonal ponds. Although the findings indicated that the majority of the respondents depended on public taps, but the availability of water from the public tap was unreliable. This was also mentioned in a FGD that:

*"…. We have pipe water, but it's just a name; you can stay for a week without getting a single drop from the pipe…. then we have to go back to the well water which is too salty and unsafe…"* (FGD participants, Bweni Village, 8th November, 2016).

**Table 4: Households' access to community health services (n = 340)**

| Variables | n | % |
|---|---|---|
| **Access to nearby Health Facility** | | |
| District Hospital | 109 | 32.1 |
| Health Centre | 40 | 11.8 |
| Dispensary | 49 | 14.4 |
| Village Health Posts | 107 | 31.5 |
| No nearby health facility | 35 | 10.3 |
| **Source of Water** | | |
| Public Piped water | 154 | 45.3 |
| Public well | 125 | 36.8 |
| Other sources | 61 | 17.9 |
| **Type of Toilet Facility** | | |
| Bush or No Toilet Facility | 36 | 10.6 |
| Pit Latrine | 217 | 63.8 |
| Flush Toilet | 87 | 25.6 |
| **Household waste disposal** | | |
| Public Dump | 66 | 19.4 |
| Household Damp | 230 | 67.6 |
| No proper place for waste disposal | 44 | 12.9 |

Note: n=number of respondents, %=percentage

When asked if they were treating water to make it safe for drinking, the majority (60.3%) of the respondents said that they were treating it and mentioned that they were doing so by boiling (29.4%), filtration (5.6%), use of chloride or water guard (1.8%) and other methods (2.1%). However, some people in the research areas were not treating water; in a FGD mothers said:
*"… No need to treat water; it is safe to drink it since we get it from a deep well…"* (FGD participants, Tungamaa Village, 8th November, 2016). In another FGD, participants said *"…. if you drink boiled water you get diarrhoea*…" (FGD, Langoni village 7th November, 2016).

Large outbreaks of acute watery diarrhoea and death usually affected most vulnerable groups in the research areas. Children were particularly affected by lack of access to safe water, and poor sanitations made them vulnerable to diarrhoea diseases. With limited access to safe water, no proper information on water treatment and lack of proper waste disposal place may promote water-borne diseases. This finding suggests that outbreaks of diseases and illnesses associated with shortage of water and unhygienic environment are likely to occur in the study communities thereby affecting vulnerable groups, including children under-five years. UNICEF (2010) cautions that poor sanitation and hygiene have many other serious repercussions which are health related problems caused by poor hygiene and consumption of contaminated water. Wagstaff *et al.* (2003) shares a similar concern that places for defecation, hand washing after using toilet and before touching any food, and safe drinking water influence occurrence of diarrhoea and other infectious diseases.

### 3.5 Maternal characteristics and child care practices influencing undernutrition among children under-five years

Binary logistic regression was used to single out specific maternal characteristics and care practices that have influence on undernutrition of children under-five years, which was measured based on the level of CIAF. In order to ensure the credibility of the results, multi-collinearity analysis was performed. The term refers to a relationship among independent variables in multiple regressions. It exists when some pairs of independent variables are highly correlated i.e. $r \geq 0.9$ (Pallant, 2007). The findings indicated a Hosmer and Lameshow Goodness of fit result of 14.458 ($p = 0.071$) which is larger than 0.05 indicating that the overall model well predicted the outcome because Hosmer and Lameshow test Chi-square was not significant (Pallant, 2007; Field, 2013). The amount of variation in the variables gave a Cox and Snell R Square of 0.356 and a Nagelkerke of R Square of 0.488 meaning that 33.9 to 48.8% of the variance in the dependent variable was

explained by the variables entered in the model. The Omnibus Chi-square was significant (p = 0.000) indicating that the overall model predicted the outcome well (Pallant, 2007; Field, 2013).

Analysis of the findings based on interpretation of; a ß-coefficient with a positive or negative sign indicates the direction of the relationship between dependent and independent variables; either ß increases (positive sign) or decreases (negative sign) the likelihood of the problem of malnutrition to occur. Wald test measures the magnitude of the problem and p-value is for testing the significance of influence of the predictors. A greater Wald statistic implies that the independent predictor variable associated with it has a higher contribution to the occurrence of the outcome variable.

The results of the binary logistic regression in Table 5 reveal that, among the ten (10) variables entered for analysis, four variables were found to be important determinants of undernutrition in the study area. Education of the mother was the strongest predictor of undernutrition; the Wald statistic was 30.356, demonstrating that education of the mother contributed significantly to predicting the chances of the child being undernourished. The findings indicated further that the odds ratio for education of the mother was 10.309, implying that not having basic education for the mothers increased the chances of children being undernourished by about than 10 times. Based on the adapted UNICEF conceptual framework, household characteristics can exacerbate the problem of undernutrition through immediate factors such as education of the mother. Numerous studies have associated undernutrition with low parental educations, particularly mother's education. For example, Gwatkin *et al*. (2000) found that the prevalence of malnutrition is lower among children of educated mothers. Similarly, Safari *et al*. (2015) reported that, in Tanzania, stunting level declines with increase in education status of the mothers. The findings from this manuscript indicate that maternal education is among the important demographic determinants influencing undernutrition in the study area. Mother's education has a large positive influence on the nutrition status of the children (Dancer and Rammohan, 2009). At the household level, greater education for mothers contributes to acquisition of new skills, beliefs, and choices about sound health and nutritional practices that directly influence the proximate determinants of child health.

**Table 5: Maternal characteristics and care practices influencing undernutrition of children under-five years (n = 340)**

| Variables | Coefficient (B) | S.E. | Wald | Sig. | Exp(B) |
|---|---|---|---|---|---|
| Age of the mother | -0.190 | 0.306 | 0.385 | 0.535 | 0.827 |
| Marital status of mother | 0.961 | 0.330 | **8.495** | **0.004** | 2.615 |
| Education of the mother | **2.333** | 0.423 | **30.356** | 0.**000** | 10.309 |
| Occupation of the mother | -0.086 | 0.674 | 0.016 | 0.898 | 0.917 |
| Access to nearby health facility | 0.709 | 0.493 | 2.067 | 0.151 | 2.031 |
| Access to safe water | -0.102 | 0.372 | 0.075 | 0.785 | 0.903 |
| Sex of the child | 0.989 | 0.301 | **10.796** | **0.001** | 2.688 |
| Child immunization status | **1.681** | 0.595 | **7.983** | **0.005** | 5.372 |
| Vitamin A supplementation | 0.046 | 0.641 | 0.005 | 0.942 | 1.048 |
| De worming tablets | 0.282 | 0.404 | 0.488 | 0.485 | 1.326 |

Model fitting information: Omnibus Tests of Model Coefficients (Chi-square = 139.065; sig. = 0.000), Hosmer and Lameshow test = 14.458 (p = 0.071), Cox and Snell $R^2$ = 0.337, Nagelkerke $R^2$ = 0.462.

Children immunization status was another strangest predictor (p = 0.005) of undernutrition; it recorded an odds ratio of 5.372, implying that children who were not fully immunized were 5.372 times more likely to be undernourished than those children who were fully immunized.

Immunization status is among the important child care practices which had significant influence on nutritional status among children under-five years old. Non-immunized children are at higher risks of increasing or reoccurrence of illnesses; as a result, they end up being undernourished compared to fully immunized children. Undernutrition and incidence of illness have synergistic relationship that illness can suppress appetite, leading to nutrition deficiency which ends up with vulnerability to diseases and a vicious circle of undernutrition among children under-five years.

## 4. Conclusions and Recommendations

Although Tanzania has initiated a number of programmes and initiatives, undernutrition among under-five children is still unbridled in the study area. Stunting and wasting were above the WHO standards. Even when undernutrition was measured using CIAF, it was higher than regional levels. The use of CIAF provides a comprehensive picture of the level of undernutrition which is not seen in the individual anthropometric analysis.

Some maternal variables such as education of the mother, influence significantly undernutrition among children under-five years. Children from mothers who have basic education are less likely to be undernourished than their counterparts. Therefore, health interventions explicitly targeted at educating mothers are likely to reduce undernutrition.

The immunization status is an important child care practice and the strongest predictor of child undernutrition. When a child receives all essential immunization based on the age, the chances of becoming undernourished are minimal.

**References**


Akombi, B. J., Agho, E.K., Hall, J.J., Merom, D., Astell-Butt, T., Renzaho, A. M. (2017). Stunting and severe stunting among children under-5 years in Nigeria: A multilevel analysis*. BCM Paediatric* 17: 15.

Assaf, S., Kothari, M.T. and Pullum, T. (2015). *An Assessment of the Quality of DHS Anthropometric Data, 2005-2014.* DHS Methodological Reports No. 16. Rockville, Maryland, ICF International, USA: ICF International.

Bailey, D. K. (1994). *Methods of Social Research.* The Free Press Collier Macmillan Publisher. London. 478pp.

Barbour, R. (Ed.) (2011). *Doing Focus Groups*. Sage Publications Ltd, Los Angelos, London, New Delhi, Singapore, and Washington DC. 174 pp.

Bartlett, J. E., Kotrlik, J. W. and Higgins, C. C. (2001). Organizational Research: Determining Appropriate Sample Size in Survey Research. *Information Technology, Learning, and Performance Journal* 19 (1): 43-50.

Bryman, A. (2004). *Social Research Methods* (Second Edition). Oxford University Press, Oxford. 592pp.

Dancer, D and Rammohan, A. (2009). Maternal Autonomy and child nutrition*;* Evidence from rural Nepal, *Indian Growth and Development Review 2* (1):18-38.

Chirwa, E.W. and Ngalawa, H.P.E., (2008). Determinants of Child Nutrition in Malawi, *South African Journal of Economics* 76 (4): 628-640.

Development Initiatives (2017). Global Nutrition report 2017: Nourishing the SDGs, Bristol, UK: Development Initiatives.

FAO and WHO (2018). Strengthening Nutrition Action. A resource guide for countries based on the policy recommendation of the second international conference on malnutrition. (ICN2). United Nations. Accessed on 17th October, 2018.

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics*, 4th Edition, SAGE Publication Limited, 55 City Road, London. 952pp.

Gibson, R.S. (2005). Principles of Nutritional Assessment. 2nd Edition. Oxford University Press, New York.

Gupta, G. Sharma, A. K. Choudhary, T. S. (2017). Assessment of undernutrition among children below 5, using Composite Index of Anthropometric Failure (CIAF). *Indian Journal of Community Health* 29 (1): 108 - 13.

Gwatakin, D.R. Rutstein, S., Johnson, K., Pande, R.P. and Wagstaff, A. (2000). Socioeconomic Difference in Health, Nutrition and Population, HNP Poverty Thematic Group of the World Bank.

Kothari, C.R. (2004). *Research methodology, methods and techniques*. New Age International (P) Limited Publishers; New Delhi. 401pp.

Ministry of Health and Social Welfare (MoHSW) (2008). The National Road Map Strategic Plan to Accelerate Reduction of Maternal, New-born and Child Deaths in Tanzania 2008–2015, Sharpened One Plan; Ministry of Health and Social Welfare: Dar es Salaam, Tanzania.

Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC), Ministry of Health (MOH), National Bureau of Statistics (NBS), Office of Chief Government Statistician (OCGS), and ICF. 2016. *Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16*. Dar es Salaam, Tanzania: MOHCDGEC, MOH, NBS, OCGS, and ICF. 630pp

Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC) (2018). Vitamin A, De-worming, and Acute Malnutrition Screening During Child Health and Nutrition Month: National Report – June 2018, Unpublished Report. 45pp

Nandy, S. Irving, M. Gordon, D, Subramanian, S.V. and Smith, G.D. (2005). Poverty, child under-nutrition and morbidity: New evidence from India. *Bullet of World Health Organization;* 83: 210 - 216.

Neke, N. M., Gadau, G. and Wasem, J. (2018). Policy makers' perspective on the provision of maternal health services via mobile health clinics in Tanzania. Findings from key informant interviews. PLoS ONE 13(9): e0203588. https://doi.org/10.1371/journal. (Accessed on 20th November, 2018).

Nyange, T.M., Sikira, A.N., Macha, J.L.G. (2016). Gender Based Violence and Legal Aid Services Interventions among Rural Women in Morogoro Rural and Kongwa District, Tanzania. *International Journal of Asian Social Sciences* 6 (8): 446 – 461.

Nyaruhucha, C.N. M., Mamiro, P.S., Kerengi, A.S. and Shayo, N.B. (2006). Nutritional status of under-five children in pastoral community in Simanjiro District, Tanzania. *Tanzania Health Research Bulletin* 8(1): 32 – 36.

Pallant, J. (2007). SPSS Survival Manual: A Step-by-step guide to data analysis using SPSS for windows 3rd Edition. Open university Press. Berkshire. 335pp.

Raamji, R.S. (2009). Impact of infant and young child feeding and caring practices on nutritional status and health. *Indian Journal of Medical Research* 130 (5): 624-6.

Regional Secretariat/Regional Health Management Team (RS/RHMT) (2013). *Annual Plan 2012–2013*. RS/RHMT, Tanga Region. 65pp.

Safari, G. J., Masanyiwa, S.Z. and Lwelamira, E. J. (2015). Prevalence and factors associated with malnutrition in Nzega district, Rural Tanzania. *Current Research Journal of Social Science* 7(3): 94 – 100

Semali, I.A., Tengia-Kessy, A., Mmbaga, E.J. and Leyna, G. (2018). Prevalence and determinants of stunting in under-five children in central Tanzania: Remaining threats to achieving Millennium Development Goal 4. *BMC Public Health* 15: 1153.

Shits, S., Taraphdar, P., Mukhopadhyah, D.K., Sinbababu, A., Bisuasi, A.B. (2012). Assessment of nutritional status by composite index for anthropometric failure: a study among children in Bankura, West Bengal. India Journal of Public Health: 54 (4): 305 – 7.

Tariq, J., Sajjad, A., Zakar, M. Z. and Fischer, F. (2018). Association with undernutrition in children under the age of two years: Secondary Data

Analysis Based on Pakistan Demographic and Health Survey 2012 – 2013. *Nutrients*, 10 (6): 676.

United Nations Children's Fund (UNICEF) (1990). Strategy for Improved Nutrition of Children and Women in Developing Countries, A UNICEF policy review, New York, UNICEF. 38pp

United Nations Children's Fund (UNICEF). (2010). *Technical Note: Age-adjustment of Child Anthropometry Estimates*. New York: UNICEF.

United Nations Children's Fund (UNICEF). (2013). Improving Child Nutrition: The achievable imperative for global progress. New York. United Nations Publication; 132 p.

United Nations Population Fund (UNFPA) (2013). Adolescent Pregnancy: A review of the Evidence. New York: UNFPA http://www.unfpa.org/sites/default/files/pub -. Accessed on 20th October, 2018.

United Nations (UN) (2015). The Millennium Development Goals Report; United Nations: New York, NY, USA.

Victora, C.G, Adair, L. Fall, C. Hallal, P.C, Martorell, R. and Ritcher, L. (2008). Maternal and Child Undernutrition Study Group. Maternal and Child Undernutrition: consequences for adult health and human capital. *Lancet* 371: 340-357.

Victora, C.G., Adair, L., Fall, C., Hallal, P.C., Martorell, R. and Ritcher, L. (1997). Maternal and Child Undernutrition Study Group. Maternal and Child Undernutrition: consequences for adult health and human capital. *Lancet* 371: 340-357.

Walliman, N. (2006). *Social research methods*. SAGE Publications; London. 224 pp.

Wagstaff, A., van Doorslaer, E., Watanabe, N. (2003). Decomposing the causes of health sector inequalities, with application malnutrition inequalities in Vietnam. *Journal of Econometrics* 112: 219 -227.

World Health Organization (WHO) (2006). WHO child growth standards based on length/height, weight and age. Multicentre growth reference study group. *Acta Paediatric, Supplement,* 2006 (450): 76 – 85.

WHO (2018). Facts Sheet. Available at [www.who.int/new-room/fact-sheet/detail/malnutrition.] Accessed on 11th October, 2018.

Zewdie, T. and Abebaw, D. (2013). Determinants of child malnutrition: Empirical Evidence from Komoloha District of Eastern Hararghe Zone, Ethiopia. *Quarterly Journal of International Agriculture* 52(4): 357 - 372