PREDICTORS OF STUNTING AMONG CHILDREN 6-59 MONTHS OF AGE IN RURAL AREAS OF MASWA DISTRICT, TANZANIA

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Abstract

Adequate nutrition is critical to child health and development. Malnutrition is a common health problem among children throughout the world. However, there has been minimal research particularly in the rural areas of Tanzania. The objective of this study was to examine the nutritional status of the under-five children in rural areas of Maswa district. Data for the study were collected from a total of 472 mother-child pairs using a structured questionnaire. The questionnaire captured information on various socio-economic and demographic factors, feeding practices and anthropometry for children aged 6-59 months. The survey data were analyzed using SPSS for windows version 17.0 whereas nutritional status data were analyzed using ENA for SMART (2011) software. Child nutritional status was assessed based on weight-for-age, weight-for-height and height-for-age. The overall prevalence rate of malnutrition as determined by stunting, wasting and underweight were 43%, 5% and 11%, respectively. Exclusive breastfeeding (EBF) was associated with higher Z- scores ($p<0.05$) for HAZ, WHZ and WAZ compared to scores of non-exclusively breastfed children.

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The social risk factors for stunting were young mothers aged <20 years (Odds Ratio-OR =1.80, p=0.041) and single mothers (OR=1.19, p=0.05). However, reduced risks of stunting was associated with increased level of mother's education (OR=0.67, p=0.0017), increased duration of breastfeeding (OR=0.87, p=0.023) and household food insecurity (OR=0.52, p=0.007). Overall, interventions to address child malnutrition should take into account the socio-economic factors including poverty, food security and education levels of mothers and care givers in a particular local context. This could also require Local Government Authorities to ensure that nutrition interventions are included in the councils' plans and budgets.

Key words: *Child nutritional status, malnutrition, predictors, stunting, Tanzania.*

Introduction

Malnutrition plays a major role in the premature deaths of millions of children in developing countries (Black, Morris and Bryce, 2003). The commonly used indicators of child nutritional status (also referred to as forms of malnutrition) are stunting, wasting and underweight. Stunting or chronic malnutrition is an indicator of long term nutritional deprivation, which develops as a result of sustained poor dietary intake or repeated infections or a combination of both. It has severe, irreversible consequences, beyond the shortness of stature, including physical health and cognitive functioning, which are intergenerational. Wasting or acute malnutrition develops as a result of recent rapid weight loss or a failure to gain weight, and is assessed by low weight-for-height compared to the WHO international growth reference. Underweight, which reflects both stunting and wasting indicates low weight-for-age measurement calculated based on comparing the weight-for-age of a child with the WHO international growth reference (Reinhard and Wijayatne, 2001; WPF, 2015).

Globally, it is estimated that 26% of children under the age of five years are stunted, 8% wasted and 16% underweight. The situation is even more critical in Sub-Saharan Africa where about 40% of the under-five children are stunted, 9% wasted and 21% underweight (UNICEF, 2011). The health and physical consequences of prolonged states of malnourishment among children include delay in their physical growth, reduced intellectual capacity, and susceptibility to diseases (WHO, 2010). Malnutrition prevents children from reaching their full physical and

mental potential. Further, malnutrition predisposes children to morbidity and mortality. Under-nutrition in the aggregate-including fetal growth restriction, stunting, wasting, and deficiencies of vitamin A and zinc along with sub-optimal breastfeeding-was a cause of 3·1 million child deaths annually or 45% of all child deaths in 2011 (Black *et al*., 2013). Generally, children below the age of five constitute a vulnerable segment which suffers the highest rate of morbidity and mortality (Lartey, 2008). Their nutritional vulnerability stems from rapid growth and development which result in an increase in nutrient requirements (Domellof *et al*., 2002; Daelmans and Saadeh, 2003). Child malnutrition, particularly the long term nutrient deprivation (stunting), varies from country to country and even place to place in a given country (TDHS, 2010; Hanf *et al*., 2013).

The burden of stunting in Tanzania is higher than all other African countries except Ethiopia and Democratic Republican of Congo (UNICEF, 2009). The 2010 Tanzania Demographic and Health Survey (THDS) showed that stunting among under-five children in Tanzania stood at 42% whereas wasting and underweight were 5% and 16.1%, respectively. However, apart from the periodic national surveys such as the TDHS, few local studies have been done on the prevalence and risk factors associated with malnutrition in children. The objective of this study was, therefore, to examine the prevalence and factors associated with malnutrition in rural areas using Maswa district as a case. The study contributes to the academic and policy literature on child nutritional status in rural Tanzania by unraveling the predictors of stunting among under-five children in a local context. This information is critical for interventions that aim to reduce the rate of malnutrition in a target population under specific socio-economic contexts.

Materials and Methods

Study area and design

A cross-sectional study was undertaken in Maswa district in 2014 in Simiyu region in north western Tanzania. The district is situated approximately 135 km from Shinyanga town, its former regional headquarters and 94 km from Bariadi town the current regional headquarters. The district is located at latitude 3° 25' 00" S and longitude 34° 20' 00" E, and about 1310 m above the mean sea level. It has a population of 344,125 people of whom 176,723 (51.3%) are females and 167,402 (48.7%) are males with the average household size of 6.5 (URT, 2013). The

population is mainly constituted of the Sukuma ethnic group but at the center, settlements include a multi-ethnic population. The study involved areas typical of rural setting which included nine villages in Mwagala division. The rural population in the area mainly depends on subsistence farming and livestock keeping.

Sampling and sample size estimation

In calculating the sample size, the national average of 16% for weight-for-age which is also a composite index of height-for-age and weight-for-height was used in a formula by Fisher *et al*. (1991) ($n = Z^2 pq/d^2$) Where

n = sample size

Z = 1.96, value for standard normal deviate at 95% confidence level

p = 0.16, prevalence of underweight in Tanzania based on weight-for-age Z score

q = 1-0.16, population without the characteristics being measured

d = 0.05, degree required for accuracy

Further, 15% of the estimated sample was added for any dropout of the study subjects. The calculated sample was multiplied by 2 to correct for the design effect.

Data collection methods and instruments

A total of 472 mother-child (age 6-59 months) pairs were involved in the study. Simple random sampling technique was employed to select households with the under-five children within the selected villages. In the event that a household was found to have no child of the target age, the household was replaced by another nearby household also chosen at random. A household questionnaire was prepared to collect various information regarding subjects. The questionnaire was pre-tested on a non-sample population having similar socio-economic background. The questionnaire included potential determinants for poor anthropometric status, including child age and sex, birth order, feeding practices, maternal characteristics, household size, household economic status and food security. Whenever possible, the interviews were conducted in Kiswahili. But in incidences where respondents were not fluent in Kiswahili, a bilingual enumerator was identified to translate from the local language to Kiswahili. Anthropometric data were obtained from 472 children. Weight was measured on an electronic SECA weighing scale

(SECA Vogel and Halke, Haamburg, Germany). Height was measured with a portable Harpenden stadiometer (Holtain Ltd, London, UK) with a capacity of measuring up to 25kg. The weighing scales were calibrated with known weights and set to zero before each use. Weight was recorded to the nearest 0.1 kilogram.

Data processing and statistical analysis

Because nutrition has a strong effect on children's growth, their nutritional status can be assessed from their height (or length) and weight relative to their age. Height-for-age and weight-for-age Z scores are measures of how a child's height and weight compared with a well-nourished reference population of the same age. Thus, nutritional status of children was assessed using the 2006 WHO growth standards. Accordingly, stunting, wasting and underweight were defined as height-for-age, weight-for-height and weight-for- age of 2SD or more below the corresponding median of the reference population, respectively. Age, education background and parity level of mothers were used as predictors of child nutritional status. Index for household assets was developed as a proxy for the social-economic status of the households, and was also used as predictor of nutritional status. Possession of a radio, television, bicycle, motorcycle and/or car was used to compute index for household economic status. Based on this, three categories were set: those without any of these possessions (low), those with only one (medium) and those owning two to five of the items (high).

Most of the variables in the questionnaire were analyzed for descriptive statistics such as frequency distribution and cross tabulation using Statistical Package for Social Sciences (SPSS) version 17. Anthropometric data were entered and analyzed using ENA for SMART (2011) software to compute for z-scores for stunting, wasting and underweight. Means were compared using analysis of variance (ANOVA). Binary Logistic Regression Analysis was used to identify the socio-economic and demographic factors that are significantly associated with a cumulative indicator of growth retardation (height-for-age). The odds ratio, which is determined from the logistic regression coefficients indicating increased or decreased chance of malnutrition given a set level of the independent variables while controlling for the effects of the other variables in the model. Estimates of odds greater than 1.0 indicate that the risk of malnutrition is greater than that for the reference category. Estimates less than 1.0 indicate that the risk of malnutrition is less

than that for the reference category. In addition, t-test was used to assess the effect of exclusive breast feeding on height-for-age, weight-for-height and weight-for-age. Statistical significance was set at $p < 0.05$.

Results and Discussion

Socio-demographic characteristics of mothers

The socio-demographic characteristics of mothers are presented in Table 1. The majority of respondents (60.6%) were in the middle age (20-35 years). Nine in every ten women received antenatal care in their recent pregnancy. The surveyed area is culturally a patrilineal society. A large proportion of the household heads (64.2%) was, therefore, male headed. Most women (87.1%) were married, and had attained primary education (77.5%). This shows that the respondents came from diverse socio-demographic backgrounds and could therefore be considered as representatives of the different socio-economic groups in the study area.

Table 1: Social-demographic characteristics of mothers (n=472)

Characteristic	Frequency	Percent
Age at a most recent birth (years)		
< 20	23	4.9
20 - 35	286	60.6
> 35	163	34.5
Received antenatal care in recent pregnancy		
Yes	225	91.1
No	22	8.9
Sex of the household head		
Male	303	64.2
Female	169	35.8
Marital status		
Never married	8	1.7
Married/in union	411	87.1
Divorced/separated/widowed	53	11.2
Education level		
Never attended school	95	20.1
Primary	366	77.5
Secondary	6	1.3
College	5	1.1
Household size		
<6	205	43.4
6 above	267	56.6

Prevalence of malnutrition

The findings of the anthropometric status are drawn from 472 children (48.1% boys, 51.9% girls; mean age 31.1±14.3) who were involved in the study. The mean Z- score for height-for-age was -1.68 (95% CI -3.72, 0.36), and for weight-for-height was 0.38 (95% CI -2.25, 1.49) while that for weight-for-age was -0.67 (95% CI -2.01, 0.67). The proportions of stunted, wasted and underweight children were 43% (46% boys, 40% girls), 5% (4.2% boys, 5.9 girls) and 11.1% (11.1% boys, 11% girls), respectively. The mean Z-score difference was significant for stunting only (p<0.05). In comparison to the TDHS data, the proportions of stunting and wasting in the present study are similar to the national averages of 42% and 5%, respectively (URT, 2010). The rate of underweight, however, is slightly lower than 16% at the national level. Overall, the three forms of malnutrition are above the WHO acceptable levels of <20% for stunting, <5% for wasting and <10% for underweight (WHO, 1995). This means that child malnutrition still remains a major public health problem in the study area, and may have important implications for the health care sector.

Factors associated with poor anthropometric status

In this study, breast feeding practice was used as a proximal factor. The findings show that twenty three percent of mothers initiated breastfeeding one hour after delivery. A large majority of them (77%), initiated breastfeeding 24 hours post-delivery. The majority of women (95%) gave colostrum to infants. All children were breastfed, but exclusive breastfeeding was reported by 21.6% of mothers, and that did not exceed three months. This could suggest that a large majority of mothers are generally not aware about the importance of breast feeding. According to WHO (2003), exclusive breastfeeding (EBF) is a practice of feeding only breast milk (including expressed breast milk) and no other liquids or solids with the exception of drops or syrups consisting of vitamins, mineral supplements or medicine In this study, EBF was associated with higher Z- scores (p<0.01) for HAZ, WHZ and WAZ compared to scores of non- exclusively breastfed children (Table 2). The World Health Organization recommends EBF for the first six months of life based on evidence of the importance of good nutrition in the early months of life and the role it has in achieving good health. Additionally, duration of breastfeeding influenced

child nutritional status. Breastfeeding for 2 years and beyond reduced chances of stunting by 13% (Table 3). Previous research elsewhere shows that non-exclusive breastfeeding in infants aged 0–5months results in more than two-fold increased risks of dying from diarrhea or pneumonia (Ahmad *et al.*, 2000). Overall, sub-optimal breastfeeding results in an increased risk for mortality in the first 2 years of life (Black *et al*., 2013). Although evidence of the life-saving benefits of exclusive breast-feeding up to 6 months of age is compelling, only 30% of children <6 months of age in sub-Saharan Africa (UNICEF, 2005), 36% in low income countries (WHO, 2009) and 50% in Tanzania are exclusively breast-fed (URT, 2010).

Table 2: Average scores for Height- for- Age (HAZ), Weight- for-Height (WHZ) and Weight- for- Age (WAZ) for exclusively breastfed and non- exclusively breastfed children

	Exclusively breastfed children			Non- exclusively children				
	N	Mean	SD	N	Mean	SD	*t*-value	p-value
HAZ	102	0.32	0.18	370	0.26	0.2	2.91	0.004
WHZ	102	-1.65	1.14	370	-2.03	1.4	2.83	0.005
WAZ	102	-0.49	0.34	370	-0.61	0.37	3.09	0.002

Other factors associated with long-term nutritional deprivation (stunting) were also identified. Older children (≥24 months) were 42% more likely to be stunted than younger children (OR = 1.42, $p = 0.03$) as observed in earlier studies (e.g. Yimer, 2000; Demissie and Worku, 2013). The low risk of malnutrition in young children is most likely due to the protective effect of breastfeeding. High rate of malnutrition at older age could be linked to inappropriate food supplementation during the weaning period and beyond. There was a significant relationship between sex of a child and malnutrition. Girls were less likely to be malnourished than boys (OR= 0.75, $p = 0.023$). Similar findings have also been reported elsewhere (e.g. Ssewanyana, 2003; Wamani *et al*., 2005; Kabubo-Mariara *et al*., 2008). The cause of this discrepancy is, however, not well established. It is believed that boys are more influenced by environmental stress than the girls (Nguyen and Kam, 2008), including possible sex preference by mothers or care givers (Teshome *et al*., 2009).

Whereas the social risk factors for stunting were young mothers aged <20 years (Odds Ratio) OR = 1.80, p = 0.041 and single mothers (OR=1.19, p = 0.05), increased level of education was associated with reduced risk of stunting (OR= 0.67, p = 0.0017). The higher chances (19%) of stunting among children born to younger mothers particularly those below 20 years is an indication that mothers in this age group are not ready to take care of their children. Mothers who gave last birth in their middle age group (20-35 years) had more healthier children than mothers who gave birth during adolescence (<20 years) and women with higher age (>35 years), which reinforces the importance of reducing early and teenage pregnancies. Children born to mothers aged 35 years or above are also more likely to be malnourished because mothers in this particular age group have high chances of giving birth to babies with low birth weights (Shrimpton *et al*., 2001). The observation that children from single mothers had higher odds for stunting is probably associated with the low quality of care given to the child. This could imply that parents who live together are more likely to meet basic needs and the welfare of the child than single parents.

It was further revealed that poor child growth is attributable to a range of factors closely linked to the overall living standards and the ability of the household to meet the basic needs (De Onis *et al*., 2000). Consequently, limited resources, as shown by poor household asset index, implies short supply of the basic needs to the child such as access to food and health care. Similarly, lack of knowledge regarding the nutritional needs of children may lead mothers and caregivers to withhold the needed food, even when it is available (Yimer, 2000). For this reason, parental education especially maternal education requires due emphasis. However, income does not always directly contribute to improving the nutritional well-being of children.

In this study, mother's education was a strong predictor of child nutritional status. Having secondary education reduced odds of being stunted among children by 33%. Indeed, various studies have reported the likelihood of substantially reducing child malnutrition with increased mother's education (e.g. Madise *et al*., 1999; Semba *et al*., 2008), as this is linked to her own health and the responsibility to take care of the child.

Table 3: Results of Binary Logistic Regression Analysis for stunting (dependent variable) against various socio-demographic variables (independent variables)

Independent Variable	Response	*β*	S.E	Wald-Statistic	*P*-Value	Odds ratio Exp(*β*)
Age of child (months)	< 24 (Ref.)					
	24 and above	0.35	0.161	4.73	0.030	1.42
Sex of child	Male (Ref)					
	Female	-0.29	0.128	5.17	0.023	0.75
Age of mother (Years)	< 20 (Ref.)					
	20- 35	0.06	0.036	2.78	0.096	1.06
	> 35	0.59	0.289	4.16	0.041	1.80
Marital status	Married/living (Ref)					
	Single/widowed/divorced	0.17	0.087	3.84	0.050	1.19
Educational mother	None or primary (Ref)					
	Secondary and above	-0.40	0.168	5.67	0.017	0.67
Household asset index	Low (Ref.)					
	Medium	-0.38	0.184	4.25	0.039	0.68
	High	-0.84	0.378	5.17	0.026	0.43
Household food security	Food insecure (Ref.)					
	Food secure	-0.65	0.241	7.30	0.007	0.52
Household size	< 6.5 (Ref)					
	6.5 and above	0.19	0.097	3.84	0.050	1.21
Parity	1-2 (Ref)					
	3+	0.37	0.181	4.16	0.041	1.45
Birth order	1-2 (Ref.)					
	3+	0.27	0.116	5.41	0.020	1.31
Number of antenatal visits	1-3 (Ref.)					
	4+	-0.24	0.114	4.41	0.036	0.79
Duration of breastfeeding (months)	0-17 (Ref.)					
	18-23	-0.10	0.048	4.41	0.036	0.90
	24+	-0.14	0.062	5.17	0.023	0.87
Child had a diarrhea episode 2 weeks preceding survey	Yes (Ref.)					
	No	-0.07	0.046	2.37	0.124	0.93
Child had acute respiratory infections two weeks before survey	Yes (Ref.)					
	No	-0.04	0.032	1.52	0.217	0.96

Ref. = Reference category; Nagelkerke $R^2 = 0.56$

It is has been argued that poor feeding practices are associated with poor knowledge or lack of information among mothers or care givers (Majamanda *et al*., 2014). In this study, antenatal visits reduced odds of stunting (OR = 0.79, p = 0.036), which might have resulted from mothers' access to information on child health including nutritional and feeding practices. In addition to imparting knowledge on the best child caring practices, there is need for the government to give support particularly, to the poorest segment mothers. The report on public expenditure review of the nutrition sector for mainland Tanzania found that councils do not have earmarked fund for implementing nutrition interventions (URT, 2014). This means that the goal of reducing child mortality as clearly articulated in the MDGs and other national targets maybe difficult to achieve. Experience from Ghana, for example, shows that access to knowledge of exclusive breast feeding does not necessarily increase exclusive breast-feeding rates. Results of the interventions study among Ghanaian mothers indicated 100% increase in exclusive-breast-feeding rates among mothers that received exclusive-breastfeeding support compared to the control group that only received health education information without breast-feeding support (Aidam *et al*., 2005). Thus, increasing funds to key nutrition interventions is critical for a change and improved nutritional status of children.

The findings further show that high parity (5+) and birth order (3+) increases chances for being stunted by 45% and 31%, respectively. In the literature, prevalence of stunting has been found to increase with birth order (Rayhan and Hayat, 2006; Kabubo-Mariara *et al.*, 2008). The possible explanation for this could be that parents give less attention to older children when they give birth to a new child who needs more attention and care. In Ghana, Nti and Lartey (2007) reported that older infants and young children were not often given the care and attention they needed, including selection of nutritious foods and the encouragement needed to eat foods in sufficient amounts to meet their energy and nutrient requirements. Partly because of the high poverty levels in most rural households, these findings imply that parents need to understand the importance of and be encouraged to use family planning methods so as to have a limited number of children they can adequately care for.

The results also show that household food insecurity was associated with increased odds for stunting (OR= 0.52, p = 0.007). The concept of food insecurity entails lack of regular access to

sufficient, safe and nutritious food needed for healthy living (FAO, 2011). In this study, food insecurity was assessed by establishing the number of months for which households experienced food shortage. These findings mirror those by Akanbiemu (2014) who found food insecurity to be the most recurrent predictor of under-five malnutrition in both the rural and urban areas in Nigeria.

Conclusion and recommendations

The prevalence of child malnutrition among the under-five children is unacceptably high. This calls for concerted efforts and interventions to address the many risk factors of malnutrition as revealed in this and previous studies. Improving health education for mothers regarding child nutrition and access to health care, family planning interventions, and improving food household security are indeed the major policy concerns that could help to address the situation. Similarly, there is a need for the Local Government Authorities to ensure that nutrition interventions are included in the Councils annual plans and budgets so as to address the factors that could otherwise not be tackled by individual households and, thus, contribute towards improving the wellbeing of children in their areas of jurisdiction. Overall, interventions to address child malnutrition should take into account the socio-economic factors including poverty, food security and education service in a particular local context.

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