

Prevalence of Poor Nutritional Status and Associated Factors Among Children in Dodoma Region of Tanzania

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ABSTRACT

Background: Undernutrition is a problem of public health significant in developing countries. This study examined the factors associated with stunting in children in Dodoma Region in Tanzania.

Methods: Multistage stratified sampling procedure was used to select respondents. Height and weight were measured and nutritional status of children was determined. Stunting, underweight, and wasting in children were defined using these criteria, which were compared to WHO norms and standards. Logistic regression models were used to establish relationships between stunting and multiple variables.

Results: The overall prevalence of stunting was 33%. Mzula village had the highest prevalence of severely underweight children at 3.6%. There were no significant differences in weight and height among children between villages. Important factors associated with stunting in a univariate logistic regression were mother's education, material used to build house, age of the child and distance to water source. In the multivariate analysis distance to water source and mother's education, maternal education, and child's age were found to independently predict stunting. The univariate logistic regression picked the father's education, age of the mother and distance to water source as main determinants of being underweight.

Conclusion: The current study stresses the importance of implementing region specific and context-relevant treatments to prevent malnutrition in this and other similar contexts in Tanzania.

Keywords

Determinants, Nutrition status, Stunting, Underweight.

Abbreviations

ENA: Emergency Nutrition Assessment, GAM: Global Acute Malnutrition, HAZ: Height for age Z scores, SAM: Severe Acute Malnutrition, SMART: Monitoring and Assessment of Relief and Transitions, SPSS: Statistical Product and Service Solution, TDHS: Tanzania Demographic and Health Survey, TNNS: Tanzania National Nutrition Survey, UNICEF: United Nations International Children's Emergency Fund, WAZ: Weight for age Z scores, WHO: World Health Organization, WHZ: Weight for height Z scores.

Introduction

Undernutrition among children in developing nations is a serious public health concern because it imposes a significant financial burden on already vulnerable families. South Asia and sub-Saharan Africa as a whole had more than half stunted and one-quarter of the global wasted children [1]. The Tanzania National Nutrition Survey (TNNS) using Standardized Monitoring and Assessment of Relief and Transitions (SMART) methodology of 2018 indicates that chronic malnutrition is endemic with 32% of children aged less than five years being stunted and 10% severely stunted [2]. This makes Tanzania to be one of the worst affected countries in the world. Nevertheless, the prevalence of stunting has reduced significantly between 2010 and 2018. In the Mainland, the

recent UNICEF/WHO classification reported the level of stunting to be “very high” (>30%) in 15 regions out of 26. In Zanzibar, the prevalence of stunting was oscillating from 20.4% in Stone Town to 23.8% in Unguja North. About 3.5% of children aged 0-59 months were found to have Global Acute Malnutrition (GAM) and 0.4% suffered from Severe Acute Malnutrition (SAM) (wasting) and the prevalence of underweight was 14.6% [2].

Despite efforts made at global and regional levels to curb undernutrition, the number of children who are stunted, wasted, or underweight remains elevated. Some factors have been discovered in earlier studies that are associated with children's nutritional status. For example, although some research linked the phenomena to low household wealth, maternal education, and the lack of antenatal care follow-up [3], others pointed to family size, child sex, vaccination status, child age, and diarrhoea episode as drivers [4]. Birth order, child's birth weight, breastfeeding, nutritional diversity score, family income, and developmental delay are all characteristics that have been mentioned in certain research [5,6]. Most of these studies are country wide based with little consideration specified to a small region wise approach. This denotes that a small region method to scrutinizing the factors associated with adverse nutritional status of children is underexplored.

This study presents factors associated with stunting and underweight in children aged 24 to 59 months in Dodoma region, in an attempt to duplicate data from other Tanzanian locations. An innovative approach was taken to investigate the correlates of nutritional status by assessing the association between socio-demographic characteristics of households.

Conducting this study serves as a means of comparing the findings of previous studies. It will help to ensure that the prevalence and determinants of malnutrition are consistently understood and to identify any changes or discrepancies in the data.

The results of this study will help to ensure that the prevalence and factors associated with malnutrition are consistently understood and to identify any changes or discrepancies in the data. Also identifying the localized factors associated with undernutrition can guide the development of targeted interventions to address these specific issues in the community. This can help to ensure that limited resources are used effectively to improve child nutrition and wellbeing.

Methods and Materials

Study site

The study was conducted in five villages from the semi-arid Dodoma region in Tanzania (Figure 1). Food production in Dodoma is predominantly rain fed. Dodoma region receives rainfall in one season with an average of 350-500 mm rainfall per annum. Dodoma is characterized by a prevalence of highly food-insecure areas. Crops produced include cereals (sorghum, pearl millet and maize), roots/tubers (cassava and sweet potato), legumes (cowpea, pigeon pea, bambara nut, groundnut, chickpea,

green gram and lablab bean), oil crops (sunflower, sesame, groundnuts) and fruits (pawpaw, guava, mango, grape, lemon and dates). There is also widespread collection of edible wild fruits and vegetables. The food system in Dodoma is mainly based on cereals with pearl millet as the preferred staple. Groundnuts are normally mixed in most relishes that are used with the main dish. Edible wild products, particularly vegetables and fruits, are important in local food menus [7]. The Chamwino district imports food crops from other regions during deficit months. These foods include maize, beans and pigeon pea. During deficit months imported food such as maize and pearl millet is sold at a price more than three times its price during the months of plenty. This is because there are no structured local markets in the study villages, only small grain and pulse traders [8]. The villages were selected on basis of geographic representation in that that they spread across the region and included population with varying density in order to account for differences in community structures and access to resources. Also the willingness of the communities to participate in the study was considered in selecting the villages as their cooperation is essential for gathering accurate data.

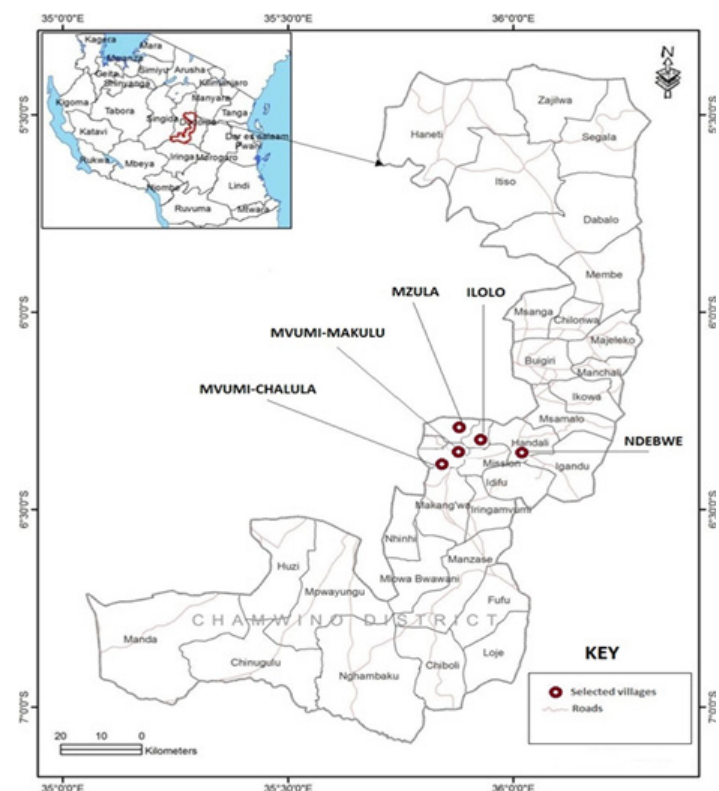


Figure 1: Map of the study villages.

Population, Sampling and Sample Size

The study population comprised all children aged between 6 and 59 months and their mothers/caregivers in the sampled households in the five selected villages. The responsible was the mother/woman or any person responsible for the preparation and serving of food within the household.

Stratified sampling procedure was used to select respondents. First, purposive sampling was used to select Dodoma region as one of the regions with highest prevalence of malnutrition in Tanzania (36.9%) while national prevalence is 32% [9]. Due to homogeneity in the number of households between villages, five villages were selected, namely: Mzula, Ilolo, Ndebwe, Mvumi-Makulu and Chalula. Second and third stages were stratified based on the information obtained from village record offices. The third stage involved selection of households that met the study criteria.

The total sample size of 660 households was computed using Fisher's formula, with the prevalence of anaemia in rural areas used as a basis for the determination of sample size [10]. In the fourth stage, due to less variation in the number of population sizes between the villages, the obtained sample size was equally divided into five villages, which gave an average of 132 households for each village where simple random sampling method was applied to select the required equal number of households in all the villages. The inclusion criteria to participate in the study were; a rural household with a mother or a caregiver and a child aged 23 to 59 months. Households excluded in the study were those which did not have a mother or caregiver or a child of that age. All the eligible households were listed from the village registry and subjected to Emergency Nutrition Assessment (ENA) for SMART software for randomization. This led to the selection of the 660 households from five villages that participated in the study.

Protocol

Permission to conduct the study was obtained from the Sokoine University of Agriculture and from Chamwino District Commissioner's Office. Household heads and spouses were informed of the purpose, objectives and activities of the study by reading to them the information sheet. The participants were required to sign the consent form or apply a thumb print (in ink), marking their consent to participate in the study.

Social, Economic and Demographic Indicators

In the selected households, an interviewer-administered questionnaire was used to collect demographic and socioeconomic data as well as to assess the knowledge of mothers or caregivers in nutrition and practices. Five nutritionists were taught to conduct anthropometric measurements and interview caregivers in order to assess living conditions and nutrition practices.

In addition, we inquired if the child had suffered any major health issues since birth, and if the mothers were concerned about the child's growth and development. To get a better idea of their economic situation, we noted the type of house they lived in (with a focus on the building materials used), if they owned the house, and how much time they spent fetching water. The use of 'assets' or a 'wealth index' as estimates of expenditure and income has been proposed, particularly in developing nations where it is hard to estimate levels of income.

Anthropometric Measurements

Height and weight were measured and nutritional status of children was determined. The WHO [11] guidelines and standards were used to define stunting, underweight and wasting. All standard methods of taking anthropometric measurements were carried out in accordance with relevant guidelines and regulations accordingly [12,13].

The children's ages were collected from their parents and verified using their clinic cards, if accessible. The height (in cm) and weight (in kg) of children were measured. A SECA electronic bathroom scale was used to measure weight to the closest 0.01 kg (A SECA, Vogel and Haieke, Hamburg, Germany). A stadiometer was used to measure height (Shorr Productions, Perspective Enterprises, and Portage, Missouri, USA). The child was measured while standing without shoes on a horizontal flat plate attached to the base of the stadiometer, with their heels together, stretched upwards to their utmost length.

Data Analysis and Statistical Methods

The data was analyzed using the Statistical Product and Service Solution (SPSS) software version 20 (SPSS Inc., Chicago, IL, USA). The ENA for SMART 2011 (www.nutrisurvey.de/ena2011/) was used to categorize the study children into nutritional status categories by converting anthropometric measurements into z-scores, such as weight for age Z scores (WAZ), height for age Z scores (HAZ), and weight for height Z scores (WHZ). Stunting, underweight, and wasting in children were defined using these criteria, which were compared to WHO norms and standards.

While controlling for other variables, the net effects of each independent variable were evaluated using logistic regression multivariate analysis. For independent factors in the models, the odds ratio was utilized to quantify the risk (increased or decreased) of stunting. When the P value was less than 0.05, significance was evaluated. A logistic model was run. Child stunting was the dependent variable in this model. Stunting (a child's height in relation to his or her age) is a common marker of malnutrition and is seen as a good indicator of poverty, showing insufficient food consumption over time [14]. Stunting is a typical symptom of chronic malnutrition that is linked to environmental and socioeconomic factors [15]. Household size, cultivated land size, gender of the child, age of the child, literacy status of the mother, use of iodized salt, body mass index of the mother, breastfeeding duration, distance to a water source, region of residence, marital status of the mother, age of the mother, and gender of the mother were the independent variables considered in the regression.

Ethical Considerations

Permission to conduct the study was obtained from the Chamwino District Commissioners' Office. Household heads and spouses were informed of the purpose, objectives and activities of the study. The household representatives were required to sign the consent form, marking their consent to participate in the study. For participants who couldn't read the informed consent form, the document was orally presented to

them and they were required to apply a thumb print (in ink) to give their informed consent. All participants of this study gave the informed consent. Ethical clearance was obtained from the Sokoine University of Agriculture Ethics Committee. The SUA Senate Ethical, Research and Publication Committee approved the study. All methods used in this study to measure weight and height and other anthropometrics were carried out in accordance with relevant guidelines and regulations.

Results

Socio and Demographic Characteristics of Households and Children

In the participating households, 54.8% and 45.2% of fathers and mothers had completed primary education while 18.2% and 38.3% of fathers and mothers did not attend any schooling respectively. Other key demographic information of the households and respondents is indicated in Table 1. Concerning the child participants, 51.8% were females and 48.2% were male. The mean age of children was 33.8 months. Other characteristics of the child population are given in Table 2.

Nutrition Status of Children

Global standards were used to define undernutrition. For children who had a Z score below -2 SD were defined to be stunted as indicated in the WHO standards [15]. The general prevalence of stunting in was 33%. Mzula and Ndebwe villages had the uppermost frequency of underweight at 13.8% and 13.4%, respectively. Mzula village had the most occurrence of severely underweight children at 3.6%. There were no substantial alterations in weight and height amongst children between villages. The prevalence of stunting and severe stunting was highest in Ndebwe at 29% and 8.9%, respectively.

Table 1: Demographic characteristics of participants.

Socio-demographic variables	N (N=660)	Percentage
Mothers' Educational Level		
No schooling	256	38.8
Primary not completed	47	7.1
Primary completed	298	45.2
Secondary and above	59	8.9
Fathers' Educational Level		
No schooling	120	18.2
Primary not completed	76	11.5
Primary completed	362	54.8
Secondary and above	102	15.5
Mothers' Occupational level		
Skilled	26	4
Unskilled	614	93
No occupation	20	3
Fathers' Occupational level		
Skilled	79	12
Unskilled 365 (85.7)	574	87
No occupation 1 (0.2)	7	1
Marital Status		
Married	489	74.1
Single	20	3

Divorced	72	10.9
Widowed	57	8.7
Cohabiting	22	3.3
Total number of mothers pregnancies		
1	107	16.2
2	121	18.4
3	273	41.3
4	51	7.7
5	23	3.5
6 and more	85	12.9
House Ownership		
Yes	582	88.2
No	78	11.8
Material used to build house		
Mud/ mud bricks	503	76.2
Burnt bricks	23	3.5
Cement	46	7
Iron sheets	53	8
Other materials	9	1.3
Distance to water source		
≤ 30 minutes walk	236	35.8
30-60 minutes walk	99	15
≥ 60 minutes walk	325	49.2

Factors Associated with Stunting

Important factors associated with stunting in a univariate logistic regression were the mother's education (OR: 2.52 (95% CI: 1.51–3.74); $p = 0.021$), material used to build a house (OR: 2.44 (95% CI: 1.18–2.36); $p = 0.041$), age of the child (OR: 0.91 (95% CI: 0.88–0.93); $p = 0.01$) and distance to water source (OR: 0.23 (95% CI: 0.08–0.52); $p = 0.001$). In the multivariate analysis distance to water source and mother's education, maternal education, and child's age were found to independently predict stunting.

Table 2: Characteristics of study children.

Characteristics	N (N=660)	Percentage
Mean Age in months	325	33.8
Boys	223	48.2
Girls	318	51.8
Incomplete immunization	342	2.1
Low birth weight	14	4.8
Mother alive	32	98
Father alive	647	96.8
Mean Maternal age	639	29.4
Mean Paternal age 34.6	194	34.6

Factors Associated with Underweight

The univariate logistic regression picked the father's education (OR: 1.82 (95% CI: 1.08–2.76); $p = 0.024$), age of the mother (OR: 0.89 (95% CI: 0.93–0.98); $p = 0.004$) and distance to a water source (OR: 0.93(95% CI: 0.94–0.97); $p = 0.02$ as main determining factors of being underweight.

Discussion

The results of the current study show that Dodoma region has high prevalence of stunting and being underweight. The high prevalence

of stunting indicated is a bit higher than the national prevalence of 31% [9]. Factors associated with child nutritional status for the study sample included mother's education level. Maternal education is recognized as a key determinant of child health and nutrition. Numerous studies have suggested a strong association between a mother's educational level and the nutritional status of her children. Maternal education is associated with child nutrition through various pathways, including maternal knowledge, attitudes, socioeconomic status, and access to resources. The impact of maternal education can be attributed to a number of factors, the most important of which is its impact on economic means (higher educated mothers have better economic activities and more money) or, more directly, its impact on childrearing practices, as mothers with more education have been observed to provide optimal care for their children. Regardless of the source of this influence, our findings highlight the need of investing in the education of girls and mothers as a means of improving child wellbeing in underdeveloped nations. The evidence from existing literature indicates a strong association of maternal education level on child nutrition status. Higher maternal education is associated with improved child feeding practices, higher household socioeconomic status, and enhanced health literacy, all of which contribute to better nutritional outcomes for children. However, it is important to note that the relationship between maternal education and child nutrition is complex and associated by various contextual factors. Therefore, targeted interventions aimed at improving maternal education, empowerment, and access to resources are crucial for addressing disparities in child nutrition based on maternal education level [16-20].

Children from households that were more than sixty minutes walking distance from a source of water were more likely to be stunted than children from households that were less than thirty minutes walking distance. This could be linked to an unfavourable health environment produced by a lack of clean water and sanitation, which can increase the risk of infectious diseases and indirectly lead to malnutrition. Longer walking distances to water sources limit the quality of care and frequency of feeding due to a lack of time for care and food preparation, as the majority of time is spent gathering water for household and other purposes [21-23]. According to reports, when water sources are positioned far away from dwellings, infectious diseases and other harmful consequences of insufficient water supply are enhanced [24].

The results of this study provide compelling evidence of a significant association between proximity to water sources and a reduced likelihood of childhood stunting. These findings are consistent with the broader literature on the critical role of water access in shaping child health outcomes, particularly in low- and middle-income countries where the burden of stunting is disproportionately high. The implications of these results warrant careful consideration and have important implications for public health interventions and policies aimed at addressing childhood malnutrition and stunting.

Improved water access has long been recognized as a crucial

factor in preventing waterborne diseases and improving overall hygiene, particularly in resource-constrained settings. The availability of clean water facilitates proper sanitation practices, including handwashing and food preparation, which are essential for reducing the incidence of diarrheal diseases and other infections that contribute to poor nutritional status in children [25]. Additionally, proximity to water sources may enable households to maintain better hygiene and sanitation facilities, which are integral to preventing environmental enteropathy and recurrent infections that can hinder a child's growth [26]. Furthermore, access to water is closely linked to dietary diversity and food security, both of which are critical factors associated with child nutritional status. Living closer to water sources may enhance the ability of households to engage in agricultural activities, access diverse food sources, and maintain adequate food hygiene practices, all of which have a direct impact on children's nutritional intake [27]. Moreover, improved water availability may contribute to increased breastfeeding rates and the preparation of safe and nutritious complementary foods, which are essential for promoting optimal growth and development in early childhood.

While the findings of this study underscore the potential benefits of proximity to water sources in reducing childhood stunting, it is important to acknowledge the multifactorial nature of stunting and the complex interplay of social, economic, and environmental determinants. Therefore, interventions aimed at addressing stunting should adopt a comprehensive approach that considers not only water access but also nutrition, healthcare, sanitation, and education.

This study enriches the body of knowledge about the relationship between social, economic, and demographic factors and children's nutritional status in various situations. However, because this study is cross-sectional, we cannot draw any conclusions about causation.

Conclusion

The study discovered substantial rates of nutritional deficit, and that these deficiencies were linked to maternal, individual, and household factors. Maternal education, on the other hand, was found to be the most constant risk factor, stressing the need to invest in women's education as a means of improving child wellbeing. It plays a critical role in shaping child nutrition status. Policies and programs aimed at improving maternal education, enhancing household socioeconomic status, and promoting health literacy are essential for addressing child malnutrition and improving overall child health outcomes. The current study also stresses the importance of implementing context-relevant treatments to prevent malnutrition in this and other similar contexts in Tanzania.

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Ethics Approval and Consent to Participate

Permission to conduct the study was obtained from the Sokoine University of Agriculture and from Chamwino District Commissioner's Office. Household heads and spouses were informed of the purpose, objectives and activities of the study by reading to them the information sheet. The participants were required to sign the consent form or apply a thumb print (in ink), marking their consent to participate in the study. All standard methods of taking anthropometric measurements and other parameters were carried out in accordance with relevant guidelines and regulations accordingly.

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