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# Prevalence of undernutrition and risk factors of severe undernutrition among children admitted to Bugando Medical Centre in Mwanza, Tanzania

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## Abstract

**Background:** Malnutrition is a major public health problem in developing countries including Tanzania, contributing up to 50 % of under-five mortality. East Africa region was among the three United Nations (UN) subregions with the highest prevalence of stunting in 2011. In resource limited countries, the available little resources in hospitals are likely to be used focusing the primary clinical problem that led to admission of children leaving moderate and mild malnutrition unattended. This work was conducted to determine the prevalence of under-nutrition and risk factors associated with severe malnutrition among undernourished children aged 6–60 months admitted to Bugando Medical Centre (BMC) paediatric wards.

**Method:** This was a hospital-based cross sectional study where by 720 children were screened in order to determine their nutritional status. Data were collected through measurement of weight/length or height, mid upper arm circumference (MUAC) and interpretation was done using Z-score (mild malnutrition  $\leq 1SD$ , moderate malnutrition  $\leq 2SD$  and severe malnutrition  $\leq 3SD$ ). The socio-demographic data were obtained using a questionnaire that was completed by interviewing children's parents/caregiver.

**Results:** Out of 720 screened children, 402 (55.8 %) were undernourished. Severe malnutrition was found in 178 (24.7 %) children and among these 97 (54.5 %) had marasmus. Risk factors associated with severe malnutrition were children with age less than 2 years, lack of vaccination, taking unbalanced diet, low maternal education and single parent, with  $p$ -value ( $<0.001$ ,  $<0.001$ ,  $<0.001$ ,  $0.02$ ,  $<0.001$ ) respectively.

**Conclusion:** This study show a high prevalence of malnutrition in hospitalized children and the majority was marasmic. The risk factors associated with severe malnutrition were described. We recommend improving the screening for undernutrition in all admitted patients so that proper management of this problem can be done concurrently with the primary clinical disease that led to admission.

**Keywords:** Malnutrition, Marasmus, Underfives

**Abbreviations:** BMC, Bugando Medical centre; CI, Confidence interval; EPI, Essential program for immunization; MUAC, Mid-upper arm circumference; OR, Odds ratio; SD, Standard deviation; TB, Tuberculosis; TDHS, Tanzania demographic and Health Survey; UN, United Nations; WHO, World Health Organisation

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## Background

Malnutrition is still a problem in the developing world. Its prevalence among under-fives is 41 % with an estimated 230 million (39 %) children being chronically malnourished [1, 2]. East Africa was among three UN subregions with highest prevalence of stunting among all United Nations subregions in 2011 [3]. In this study it was reported that East Africa was the second UN subregion with a prevalence of 42 % being second to South-central Asia. [3] In resource limited countries, the available little resources in hospitals are likely to be used focusing the primary clinical problem that led to admission of children, leaving moderate and mild malnutrition unattended. Nutritional support and parents counseling are essential aspect of the management of children admitted to hospital. [4]. Although there is a lot of data on the prevalence of malnutrition in the community, data on the prevalence of malnutrition in hospitalized children especially from Africa is scarce. Abrupt weaning and lack of breast feeding contribute to malnutrition in the first year of life, while inadequate intake of protein and calories in the second year of life [5]. In developing countries, malnutrition contributes to more than 50 % of under-five mortality [6–9]. Malnourished survivors are usually left with mental developmental delay, poor school performance and reduced intellectual achievements [2, 6, 10].

According to the Tanzania Health and Demographic Survey (TDHS) of 2010, moderate malnutrition ( $\leq 2SD$ ) was found in 5 % and 1 % of the surveyed children were severely wasted ( $\leq 3SD$ ). In the same survey, the prevalence of moderate and severe malnutrition in Mwanza region were 3.9 % and 1.3 % respectively [11].

In view of these findings, this study was designed to find the prevalence of under-nutrition children admitted in paediatrics wards of Bugando Medical centre. The risk factors of severe undernutrition among admitted children with malnutrition was also investigated. The real prevalence of the hospital setting in this area were not known, and it is expected that children admitted for various illnesses might be suffering from an underlying undernutrition.

## Methods

### Study design, area and population

This was a hospital-based cross-sectional study conducted at Bugando Medical Centre (BMC) which is one of the four tertiary referral, research and teaching hospitals in Tanzania serving the northwestern part. The pediatric department of BMC is divided into four subunits namely; general pediatric ward, pediatric semi-intensive care unit, neonatal unit and malnutrition unit. The malnutrition unit admits severely malnourished children and in this ward, specialized care and feeding are strictly supervised

by both nurses and doctors. In this study all children admitted in the paediatric department, aged 6 – 60 month, were screened for their nutritional status and those found to be undernourished were included after parents/caretaker signed an informed consent forms. Children with known sickle cell disease, cerebral palsy and congenital heart diseases were excluded from this study.

### Demographic and clinical information

Information regarding the socio-demographic data and past medical history was collected using a pretested structured questionnaire. Feeding history was established if the child was still breast-feeding, ever breastfed or not and the duration of breastfeeding. When complementary feeding was started, types of complementary food, the number of feeds in a day and the amount which was given were documented. Unbalanced diet was considered when one or more of the major groups of food were missing in the diet. The major food groups considered were carbohydrates, proteins, fats, minerals and vitamins and water.

### Clinical work-up

All the admitted children aged 6–60 months with any clinical condition, were screened in order to determine their nutritional status. Anthropometric measurements such as weight for height or length and mid-upper arm circumference (MUAC) were used in order to categorize the degree of malnutrition. Infants under two years of age were weighed using a 25 kg Salter hanging scale (CMS Weighing equipment, High Holborn, London United Kingdom), while those above two years of age were weighed while standing on the Salter digital floor scale (CMS Weighing equipment, High Holborn, London United Kingdom). MUAC of 12.5–13.5 cm were categorized as mild malnutrition, 11.0 to 12.5 cm was regarded as moderate malnutrition and less than 11 cm were considered as severe malnutrition. Children with weight for length/height Z score of  $\leq 1SD$  were categorized as mild malnutrition, while  $\leq 2SD$  was considered moderate malnutrition and severe malnutrition were those from  $\leq 3$ . Convenient serial sampling method was used to enroll all children admitted. Data was entered into the computer using Microsoft Excel 2007, cleaned and analyzed using STATA version 11 (college station, Texas), and thereafter summarized in frequency tables. To determine the risk factors of severe malnutrition in under-nutrition, we performed univariate followed by multivariate logistic regression analysis. Factors with a *p*-value less than 0.1 on univariate logistic regression analysis were subjected to multivariate logistic regression. Factors with *p*-value of less than 0.05 were considered to be statistically significant.

## Results

### Prevalence of under-nutrition

From September 2012 to January 2013, a total of 738 children aged between 6 – 60 months were admitted in pediatric wards at BMC and were all screened for under-nutrition. Among them, 18 were excluded from the study due to cerebral palsy. Of the remaining 720 who were included in the analysis, 402 (55.8 %) children were undernourished. Among 720 participants, 178 (24.7 %) had severe malnutrition and 97 (54.5 %) of them were marasmic. (Fig. 1). Further analysis included only 402 children with malnutrition.

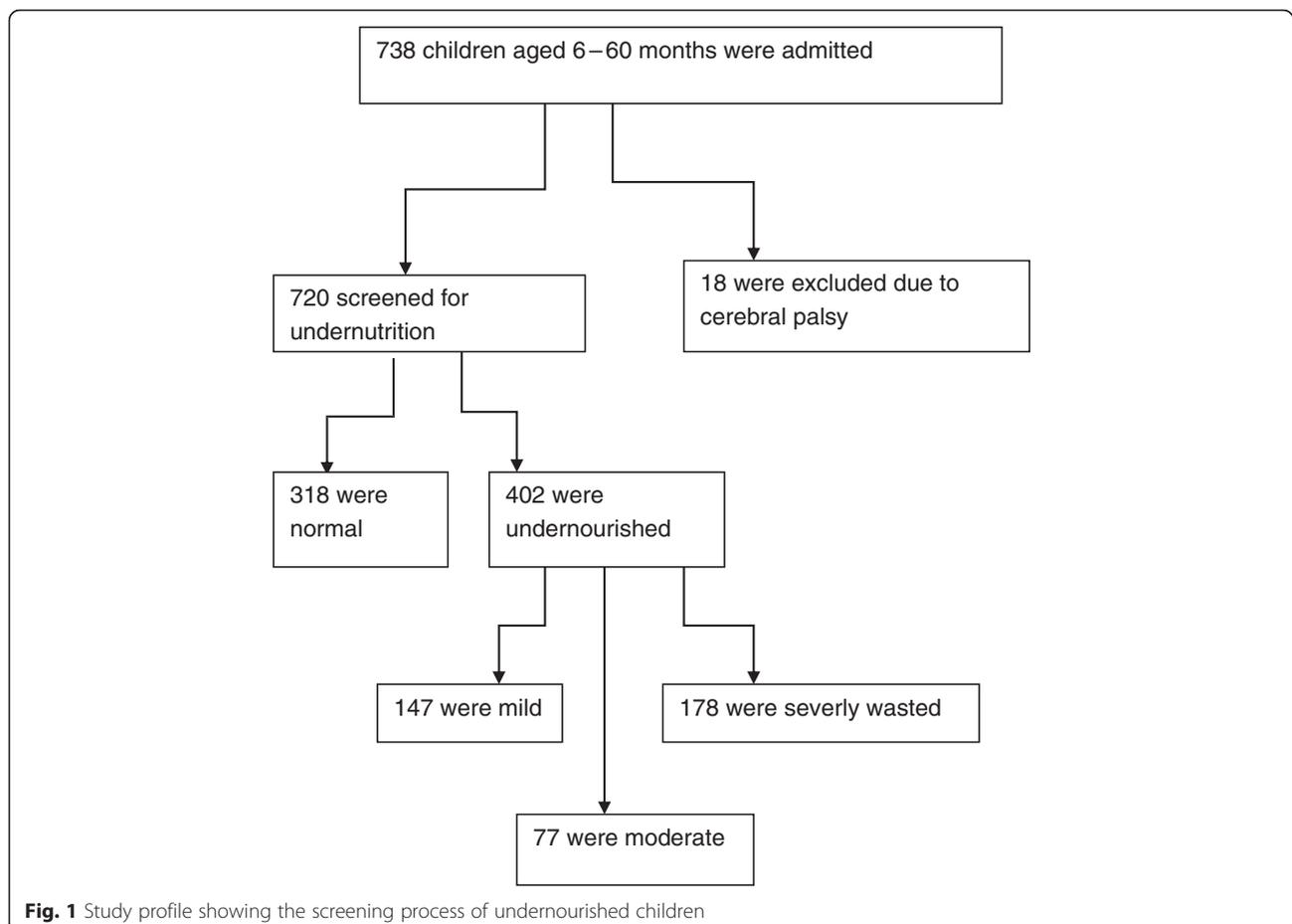
### Social demographic characteristics

Most of the children were residing in Mwanza region, (352, 87.6 %), male children were 229 (57 %) and those aged 13 – 24 months were 147 (36.6 %). The majority, 358 (89.1 %) completed vaccination as per WHO expanded programme on immunization (EPI) schedule and a large group of children, 267 (66.4 %), were weaned less than six months (Table 1).

### Risk factors for severe malnutrition among undernourished children

In univariate logistic regression analysis, age group 6–12 months and 13–24 months were both significantly associated with severe malnutrition ( $p < 0.001$ ) compared to children aged more than 2 years. Other factors that were significantly associated with severe malnutrition on univariate analysis were eating unbalanced diet (OR = 7.1; 95%CI = 2.7 – 18.4;  $p < 0.001$ ), incomplete or lack of vaccination (OR = 3.4; 95 % CI = 1.7 – 6.8;  $p < 0.001$ ) and children with a single parent (OR = 3.9; 95 % CI = 2.3 – 6.6;  $p < 0.001$ ). When these factors (type of diet, vaccination status and parenthood) were subjected to multivariate logistic regression analysis, they all remained significantly associated with severe malnutrition (OR = 3.9, 95 % CI = 1.5 – 10.6,  $p = 0.007$ ; OR = 2.1, 95 % CI = 1.1 – 4.5,  $p = 0.042$ ; OR = 3.4, 95 % CI = 1.9 – 5.9,  $p < 0.001$ ) respectively (see Table 2). Also age group 6–12 months and 13–24 months remained statistically significant in multivariate logistic regression ( $p < 0.001$  and 0.001 respectively)

In univariate logistic regression analysis, children of parents with primary education was significantly associated



**Table 1** Social demographic characteristics of 402 undernourished children admitted at bugando medical centre

Characteristics	Number (N = 402)	Percentage (100 %)
Child age (Month)		
6 - 12	128	31.8
13 - 24	147	36.6
≥ 25	127	31.6
Child Sex		
Male	229	57.0
Female	173	43.0
Vaccination of the child		
Complete	358	89.1
Incomplete	41	10.2
None	3	0.7
Age of weaning(month)		
< 6	267	66.4
≥ 6	135	33.6
Caretaker education		
Non-formal	83	20.6
Primary	266	66.2
Secondary	36	9.0
College/university	17	4.2
Parents Occupation		
Peasant	237	58.9
Employed	49	12.2
Business	116	28.9
Parental Marital status		
Single	53	13.2
Married	318	79.1
Divorced	24	6.0
Widowed	7	1.7
Family Size		
< 6	294	73.1
≥ 6	108	26.9

with severe malnutrition compared to those of parents with college or university education (OR = 4.3; 95 % CI = 1.2 - 15.4;  $P = 0.02$ ). However, this factor was not statistically significant in multivariate logistic regression analysis as shown in (Table 2).

## Discussion

The overall prevalence of undernutrition in our hospital was high. The prevalence is higher than 34 % which was found among hospitalized paediatrics patients in South Africa [12]. The prevalence is higher than the community prevalence of malnutrition in Tanzania (TDHS). This could be explained by the fact that this

study was done in the referral hospital which is the only hospital in Tanzania's lake zone with the malnutrition unit. Nearly a quarter of the participants had severe malnutrition. This is closely similar to the community studies done in Malawi and Sudan where their prevalence were 22 % and 27.3 % respectively [13, 14]. Among the children with severe malnutrition, slightly over half of them had marasmus, similarly to the study done in Kenya where 57.6 % had marasmus [15]. We did not find a higher proportion of children with kwashiorkor, probably due to the fact that majority of the participants live in close proximity to lake Victoria where they can easily access protein containing foods like fish though affordability may limit its access. Previous studies done in other parts of Africa where common food is maize, yams and banana with limited access to protein rich food reported the prevalence of kwashiorkor ranging from 35 % to 86 % [5, 15–18].

Furthermore, these studies were done in children aged less than 2 years who require higher calories for metabolism and growth. Malnutrition also significantly lowers immunological responses and hence a higher possibility of having a vicious circle between malnutrition and recurrent infections. Our finding that an association exists between lower age and malnutrition is further supported by previous studies done in Sudan, Nigeria and Bangladesh [13, 17, 19].

Having a single parent was strongly associated with severe malnutrition in both univariate and multivariate logistic regression analysis. This finding is similar to results from studies done in Botswana and Congo where the chances of malnutrition were decreasing when both parents were living together [20, 21]. Single parents may be struggling to earn more income in order to sustain their children.

Children who were fed on unbalanced diet had a higher chance of developing malnutrition since they are more likely to live in a low social economic environment with limited access to nutritious food. Food for majority of children is still a challenge; these children are not getting enough food not only in case of amount but also poor in quality so they are prone to all types of malnutrition. A Study done in Congo observed that majority of under-fives especially in rural areas were not taking balanced diet [21].

Under-fives, when vaccinated, have reduced chances of acquiring infections like pulmonary TB, diarrheal disease, measles and severe pneumonia, all of which are clinical conditions that can lead to malnutrition. Findings in this study showed that children who were not vaccinated or had incomplete vaccination had higher chances of having severe malnutrition in both univariate and multivariate analysis which is supported by results from a Ugandan study [22]. It should also be noted that, the lack of vaccination may be related to lack of care,

**Table 2** Risk factors for severe malnutrition among undernourished children admitted at Bugando Medical Centre

Risk factors	Malnutrition		Unadjusted		Adjusted	
	Severe (N = 178) n(%)	Mild and moderate (N = 224) n (%)	OR[95 % CI]	P - value	OR[95 % CI]	P - value
<b>Age</b>						
≥ 25	32 (25.2)	95 (74.8)	1			
13-24	78 (53.1)	69 (46.9)	3.4(2.0–5.6)	<0.001	2.7 (1.5–4.6)	<0.001
6-12	68 (53.1)	60 (46.9)	3.4(2.0–5.7)	<0.001	2.5 (1.4–4.5)	0.001
<b>Vaccination</b>						
Yes	147 (41.1)	211 (58.9)	1			
No/incomplete	31 (70.5)	13 (29.5)	3.4(1.7–6.8)	<0.001	2.1(1.1–4.5)	0.042
<b>Early-weaning</b>						
No	61 (45.2)	74 (54.8)	1			
Yes	117 (43.8)	150 (56.2)	0.9(0.6–1.4)	0.795	-	-
<b>Balanced diet</b>						
Yes	5 (11.6)	38 (88.4)	1			
No	173 (48.2)	186 (51.8)	7.1(2.7–18.4)	<0.001	3.9(1.5–10.6)	0.007
<b>Parent education</b>						
College/University	3 (17.6)	14 (82.4)	1		1.0(0.2–4.6)	
Secondary	11 (30.6)	25 (69.4)	2.1(0.5–8.6)	0.32	2.4(0.6–9.2)	0.990
Primary	128 (48.1)	138 (51.9)	4.3(1.2–15.4)	0.02	2.0(0.5–8.4)	0.193
Non formal	36 (43.4)	47 (56.6)	3.6(0.9–13.4)	0.06		0.297
<b>Family Income (month)</b>						
≥ 50, 000 (Tsh*)	53 (39.8)	80 (60.2)	1			
< 50,000 (Tsh*)	125 (46.5)	144 (53.5)	1.3(0.9 -1.9)	0.209	-	-
<b>Single Parent</b>						
No	119 (37.4)	199 (62.6)	1			<0.001
Yes	59 (70.2)	25 (29.8)	3.9(2.3–6.6)	<0.001	3.4(1.9–5.9)	

\*Tsh is Tanzanian shillings

families with major problems in education, lower social economic status and single parents, all of which may lead to undernutrition. Previous studies had shown that women who didn't attend school and ones with primary level of education had a higher chance of their children being malnourished compared to educated mothers who have a higher tendency of health seeking behavior [14, 19, 21]. Similar to previous studies, we did not find any association between severe malnutrition and either sex of the child, parents' occupation, family income or family size [13, 20, 21, 23].

## Conclusions

High prevalence of undernutrition was observed in our setting and the majority of severely malnourished children were marasmic. Children with single parents, who were fed on unbalanced diet, unvaccinated or who were partially vaccinated and those whose parents had lower level of education were more likely to be severely malnourished. We recommend routine screening for malnutrition to be done in every child who attends the

hospital and nutritional counseling be done to their parents in order to prevent their children from severe malnutrition.

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## Availability of data and materials

Important data for this paper are contained in the manuscript. Individual patients' data are not shared in this work due to ethical reasons. Authors did not include data sharing clearance during the ethical approval.

## Authors' contributions

MHA, EK, AH and RK designed the study. MHA, AH and RK carried out data collection. MHA, EK, AH, BRK and RK were involved in data analysis and interpretation of results. All authors were fully involved in writing the manuscript and all have approved the final manuscript for submission.

**Competing interests**

All authors declare that they have no competing interests.

**Consent for publication**

Not applicable.

**Ethics and consent to participate**

Permission to conduct the study was sought from the Catholic University of Health and Allied Sciences (CUHAS) and BMC joint ethics committee. An informed consent form was signed by parents/care takers before conducting the study. All children with malnutrition were treated according to WHO malnutrition treatment guideline. Permission to publish the paper was also obtained from the CUHAS/BMC joint ethics committee.

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