

Original Research Article

HSI Journal (2021) Volume 2 (Issue 2): <https://doi.org/10.46829/hsijournal.2021.12.2.2.253-260>Open
Access

Screening for wasting and underweight in children aged 6 - 59 months presenting to the outpatients' clinic of a Tertiary Hospital: a retrospective study

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Received July 2021; Revised August 2021; September 2021

Abstract

Background: Malnutrition is a major underlying factor in under-five mortality and morbidity. Early detection and management are key in preventing the associated complications. However, the nutritional status of children is not frequently assessed at outpatient clinics.

Objective: This study aimed to determine the degree of wasting and underweight and their associated factors in children presenting at the outpatients' department (OPD) of the Tamale Teaching Hospital.

Methods: A 5-month retrospective chart review was conducted at the paediatric OPD of the Tamale Teaching Hospital. Children (6 - 59 months) who presented to the clinic after implementation of Mid-Upper-Arm Circumference (MUAC) measurement during weighing and taking of other vital signs were selected. Data retrieved included the child's age and gender, mother's educational status, marital status and occupation. Weight and MUAC measurements were also recorded from the folders. Descriptive analysis was performed, and univariate associations were determined using cross-tabulation and compared using Chi square tests.

Results: One hundred and ninety-nine children, with a median age of 24 months were included in the study of whom 113 (56.8%) were males. Using the MUAC, 8 (4%) of the children had moderate and severe wasting respectively and 22 (11%) were classified as being at risk of wasting. The weight for age Z scores showed that 31 (16%) and 18 (9.3%) of children were moderately and severely underweight respectively. Younger age ≤ 24 months ($p = 0.01$) and low or no maternal formal education ($p = 0.002$) were factors significantly associated with children being wasted or underweight.

Conclusion: While 4% of the children were classified by their MUAC measurement as being severely wasted, only 3% had a diagnosis of Severe Acute Malnutrition made by the attending doctor. The routine measurement of MUAC could be a useful tool for the early detection of children with severe wasting at the OPD.

Keywords: Paediatric, malnutrition, mid-upper arm circumference, wasting, underweight

INTRODUCTION

Globally, malnutrition contributes significantly to morbidity and mortality with a significant increase in the risk of mortality in children less than five years of age [1,2]. This is through various mechanisms including increased susceptibility to infectious diseases which continue to be major causes of under-five mortality [3,4]. Malnutrition is a contributory factor in more than 50% of child deaths worldwide [1,5,6]. Considering it is important that the nutritional status of children be assessed regularly so that those with faltering growth will be identified early,

and corrective measures put in place to ensure proper growth and development and prevent the untoward effects of undernutrition. Studies in Ghana have shown that undernutrition is widespread yet underdiagnosed [7]. It is also a fact that there exist regional disparities about undernutrition prevalence in Ghana, the Northern region having the highest rates of both stunting and moderate to severe wasting [5]. Demographic and anthropometric measurements like age, weight and height are relied upon to assess the nutritional status of children through the determination of various indices like weight-for-age (WFA), weight-for-height (WFH) and height-for-age based on standard growth charts and tables [8]. In Ghana, nutritional assessment is most often conducted at child welfare clinics where immunization and other preventive

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services are provided to detect children with faltering growth/nutritional status. Despite the importance of child welfare clinic (weighing clinic) attendance in detecting poor growth and development, some studies have shown that parents stop sending their children to these clinics shortly after these children have received the last vaccination at 18 months old, thus reducing the chances of timely detection of faltering growth in these children [7,9]. It is therefore important that anthropometric measurements capable of detecting faltering growth be routinely performed at other points of the health care system like the outpatients' departments (OPD) of health care facilities. Evidence on the ground however shows that a large proportion of these undernourished children presenting to the OPD are not picked up as shown in a study by Antwi [7] in Kumasi, Ghana. The above study [7], by using WFH measurements, showed that of 1182 children assessed 21.2% were wasted, with 4.1% severely wasted and that, of the 251 children who were wasted only 15 (5.9%) were identified by the attending physician to be wasted. The WFH method requires the measurement of children's weight and height and then the use of a standard chart to plot both measurements. This may be cumbersome to do in a busy OPD setting [10] and might be the reason why it is so infrequently done.

The current acceptance of the use of a measurement of the Mid-Upper-Arm Circumference (MUAC) as an independent determinant of wasting which Ghana adopted as part of the Community-based Management of Acute Malnutrition program in 2008 [11] has the potential of facilitating improved detection of wasting at the OPD because of its ease of use even by inexperienced users [12] and good inter-rater reliability. It is for this reason that we introduced the use of this tool at our paediatric OPD to facilitate the early detection of wasting in young children. This is important because studies have shown that up to three-quarters of the children who die from causes related to malnutrition were mildly or moderately malnourished, showing no outward sign of their vulnerability [13], making early detection very important. This study aimed to evaluate wasting and underweight and their associated factors among children aged 6 - 59 months presenting to the paediatric OPD of the Tamale Teaching Hospital. We hypothesised that more children with wasting will be detected by routine MUAC measurements than without this assessment, by the clinicians attending to them at the OPD.

MATERIALS AND METHODS

Study setting

This study was conducted at the paediatric OPD of Tamale Teaching Hospital (TTH). The hospital is in Tamale, the capital city of the Northern Region of Ghana with a bed capacity of 800, of which 90 is for children from 1 month to 12 years. The child health department also runs a daily outpatient clinic supervised by a paediatrician. The catchment area of the hospital has one of the highest prevalences of wasting, underweight and stunting in the country [5].

Study design

A 5 - month retrospective operational study was carried out at the paediatric OPD of TTH. The folders of all children aged 6 – 59 months during the period 1 August 2018 to 31 December 2018 were reviewed regardless of the presenting condition of the child. However, folders of children who had records of oedema in the extremities or ascites, those who were < 6 months or ≥ 60 months or who had incomplete data were excluded from the study. During this period the paediatric department introduced measurement of MUAC for children aged 6-59 months presenting at the OPD at the point where they are weighed and their vital signs were taken. A total of 3,771 children were seen at the OPD during the study period. Out of these, the records of 1,473 children between the ages of 6 months to 59 months were reviewed of which 199 (13.5%) met the inclusion criteria. Sampling was non-randomised with the inclusion of all children with the required data. The most common reasons for exclusion were incomplete data (absence of weight or MUAC measurements). A few children with bilateral itting pedal oedema were excluded.

Data collection procedures

Folders of children who met the inclusion criteria and had recorded MUAC were retrieved from the records section of the hospital. A data extraction form was developed to collect data relating to demography such as age and gender of the child, mother's educational status, marital status and occupation. Information regarding the presenting complaint and diagnosis at the time of presentation was also collected. MUAC and weight measurements of the children were also recorded from the folders. There was no information on the length or height of the child. MUAC was measured (in centimetres, cm) on the child's non-dominant arm using a flexible, inelastic measuring tape manufactured by Secca™. Weight was measured according to standard procedures. Children's MUAC measurements were classified according to the WHO classification in MUAC < 11.5 cm indicated severe acute malnutrition/severe wasting (SAM), 11.5cm to 12.4 cm denoted moderate acute malnutrition and wasting, 12.5 cm to 13.5 cm indicated the risk of acute malnutrition and wasting, and > 13.5 cm denoted the child is well nourished [13].

Statistical analysis

All data were entered into the IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, Version 23.0.). Descriptive statistics of mean, standard deviation, frequencies, and percentages were used to describe the data. Univariate associations were determined using cross-tabulation and compared using Chi square test. All $p < 0.05$ were accepted as statistically significant.

RESULTS

One hundred and ninety-nine children aged 6-59 months were included in the study. Most of the children (n=113, 56.8%) were males, aged ≤ 24 months (n= 117, 58.8%). Concerning mothers and caregivers of the children, almost all were married (n = 189, 96.5%) and employed (n = 184, 93.4%). More than half of them (n = 113, 57.5%) had a

senior high school education and above. Table 1 shows the detailed socio-demographic characteristics of the mothers and their children included in the study.

The final diagnosis of patients as recorded in folders

The most common conditions seen at the clinic was malaria (n = 47, 24.6%) followed by upper respiratory tract infections (n = 41, 21.5%), pneumonia (n = 30, 15.7%) and gastroenteritis (n = 16, 8.4%). Six of the patients, representing 3%, had a diagnosis of severe acute malnutrition recorded in their folders as part of their final

diagnosis even though the MUAC measurements classified 4% of children as being severely wasted. Of the children studied 96.3% were diagnosed with one major acute or chronic condition while 3.7% had no major ailment diagnosed.

Anthropometric measurements

Anthropometric measurements of MUAC and weight was obtained from the folders of 199 children. The children had a mean (\pm standard deviation) MUAC of 14.2 \pm 1.5 cm. Based on the WHO classification of nutritional status based on MUAC, an equal proportion (n = 8, 4%) of the children had moderate wasting and severe wasting, yielding a combined wasting prevalence of 8% (Figure 1). Almost 12% (n = 22) of the children were at risk of being malnourished. All 6 of the children with a diagnosis of severe acute malnutrition and severe wasting by the physicians were also identified by MUAC as being severely wasted. Two children identified as severely wasted by MUAC were missed by the clinician. Weight and age values were retrieved for 194 children. The mean WFA Z-score was -1.11. Figure 2 displays the Z-score distribution of the children compared with the WHO reference population for children aged 0 - 59 months. Eighteen of the children representing 9.3% were severely underweight while 31 (16%) of the children were moderately underweight. As shown in Figure 2, the children in this study were generally lagging the WHO reference population.

Univariate associations

The nutritional status of the children was stratified according to socio-demographic characteristics including the child's gender and age in months and the mother's educational status, marital status, type of marriage, religion, and employment status. The comparison was done using Fischer's exact test and the results are presented in Table 3.

Table 1: Socio-demographic characteristics of the children (6 - 59 months)

Variable	Frequency ^a (%)
Female	86 (43.4%)
Male	113 (56.8%)
Mean age (months)	24.1 (15.8)
Median age (25%, 75%)	24 (10, 36)
Age \leq 24 months	117 (58.8%)
Age > 24 months	82 (41.2%)
Marital status of mother/care giver (n = 198)	
Married	189 (96%)
Single/divorced	8 (4%)
Type of marriage (n=189)	
Polygamous	41 (21.7%)
Monogamous	148 (78.3%)
Level of education (n=193)	
No formal education	40 (20.7%)
Low (Primary/JHS)	40 (20.7%)
High (SHS/Tertiary)	113 (57.5%)
Religious status of mother/care giver (n = 199)	
Christianity	46 (23.1%)
Islamic	153 (76.9%)
Employment status (n = 197)	
Unemployed	13 (6.6%)
Employed	184 (93.4%)
Mean number of meals per day (n = 192)	3.45 (0.78)
Median meals per day	3 (1, 4)
\leq 3 meals per day	116 (60.4%)
> 3 meals per day	76 (39.6%)
Snacks per day (n = 155)	
< 2 snacks per day	77 (49.7%)
\geq 2 snacks per day	78 (50.3%)
Was exclusively breastfed (n = 144)	
Yes	125 (84.7%)
No	19 (13.2%)
Start of complementary feeding (n = 178)	
Before 6 months	18 (10%)
6 months or later	160 (90%)

^a Not all frequencies add up to 199 due to missing values.

Table 2: Final diagnosis of patients

Final diagnosis	Frequency ^a (%)
Severe acute malnutrition	6 (3.1%)
Malaria	47 (24.6%)
Upper respiratory tract infection	41 (21.5%)
Pneumonia	30 (15.7%)
Gastroenteritis	16 (8.4%)
Impetigo and other dermatological conditions	13 (6.8%)
Congenital defects	7 (3.7%)
Healthy infant/child	7 (3.7%)
Neurological disorders	6 (3.1%)
Urinary tract infection	4 (2.1%)
Sepsis	4 (2.1%)
Sickle cell anaemia	2 (1.0%)
Others	8 (4.2%)

^a Frequencies do not add up to 199 due to missing entries

There was a significant association between the age of the children and the prevalence of wasting. The children who were aged ≤ 24 months had a significantly higher prevalence of wasting compared to their counterparts older than 24 months (87.5% versus 12.5%, $p = 0.010$). The prevalence of wasting (low MUAC) was significantly

higher among children of mothers with a low level of education or no formal education ($n = 12$, 80%) compared to children of mothers with a high level of education ($n = 3$, 20%) ($p = 0.002$). The prevalence of underweight (low WFA Z-Score) was significantly higher in females compared to male children (57.1% versus 42.9%, $p = 0.015$); in mothers with a low level of education compared to those with high educational level (59.6% versus 40.4%, $p = 0.004$); and in children of mothers that were employed compared to those unemployed (100% versus 0%, $p = 0.022$) (Table 4).

Table 3: Univariate association between socio-demographic characteristics and the prevalence of malnutrition based on MUAC classification (6 - 59 months)

Variable	Wasted (%) ^a		p value
	No (n= 180)	Yes (n=16)	
Age			
≤ 24 months	100 (55.6)	14 (87.5)	0.010
> 24 months	80 (44.4)	2 (12.5)	
Gender			
Male	104 (57.8)	8 (50)	0.364
Female	76 (42.2)	8 (50)	
Marital status			
Married	171 (95)	16 (100)	0.457
Single/divorced	9 (5)	0	
Type of marriage			
Monogamy	135 (78.9)	12 (75)	0.460
Polygamy	36 (21.1)	4 (25)	
Religion status			
Christianity	43 (23.9)	2(12.5)	0.242
Islamic	137 (76.1)	14(87.5)	
Employment status			
Unemployed	12 (6.7)	1 (6.7)	0.735
Employed	167 (93.3)	14 (93.3)	
Level of education			
Low/No formal education	68 (38.6)	12(80.0%)	0.002
High	108 (61.4)	3 (20.0)	
Number of meals per day			
≤ 3 meals/day	103 (59.2)	10 (66.7)	0.391
> 3 meals/day	71 (40.8)	5 (33.3)	
Snacks per day			
< 2 snacks/day	67 (47.9)	8 (66.7)	0.171
≥ 2 snacks/day	73(52.1%)	4 (33.3)	
Was exclusively breastfed			
Yes	112 (86.2)	10 (90.9)	0.547
No	18 (13.8)	1 (9.1)	
Time of initiating complementary feeding (n = 181)			
Before 6 months	17 (10.5)	0	0.228
6 months or later	145 (89.5)	14(100)	

^a Frequencies don't add up to 199 due to invalid weight values.

Table 4: Univariate association between socio-demographic characteristics and the prevalence of malnutrition based on weight-for-age (6 - 59 months)

Variable	Malnourished ^a		p value
	No (n= 150)	Yes (n=49)	
Age			
≤ 24 months	81 (55.1)	33 (67.3)	0.090
> 24 months	66 (44.9)	16 (32.7)	
Gender			
Male	91 (61.9)	21 (42.9)	0.015
Female	56 (38.1)	28 (57.1)	
Marital status			
Married	138 (93.9)	49 (100)	0.070
Single/divorced	9 (6.1)	0	
Type of marriage			
Monogamy	109 (79)	38 (77.6)	0.490
Polygamy	29 (21)	11(22.4)	
Religion status			
Christianity	39(26.5)	6 (12.2)	0.027
Islamic	108 (73.5)	43 (87.8)	
Employment status			
Unemployed	13(8.9)	0	0.022
Employed	133 (91.1)	48.0 (100)	
Level of education			
Low/No formal education	52 (36.1)	28 (59.6)	0.004
High	92 (63.9)	19 (40.4)	
Number of meals per day			
≤ 3 meals/day	83 (58)	30 (65.2)	0.246
> 3 meals/day	60 (42)	16 (34.8)	
Snacks per day			
< 2 snacks/day	54 (46.6)	21 (58.3)	0.148
≥ 2 snacks/day	62 (53.4)	15 (41.7)	
Was exclusively breastfed (n = 146)			
Yes	94 (87)	28 (84.8)	0.472
No	14 (13)	5 (15.2)	
Time of initiating complementary feeding (n =181)			
Before 6 months	14 (10.6)	3 (6.8)	0.342
6 months or later	118 (89.4)	41 (93.2)	

^a Frequencies do not add up to 199 due to invalid weight values.

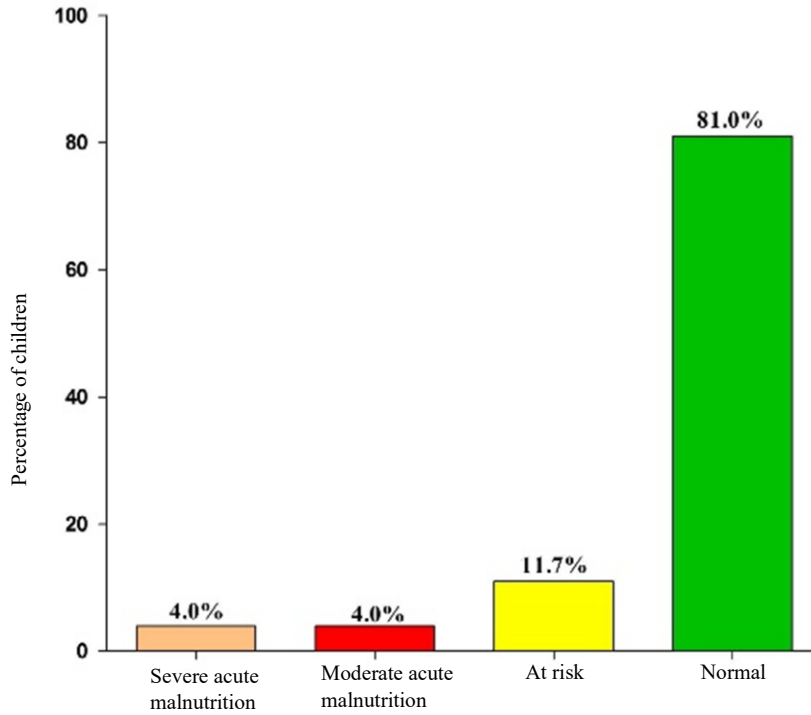


Figure 1: Classification of nutritional status of children (6-59 months) using MUAC

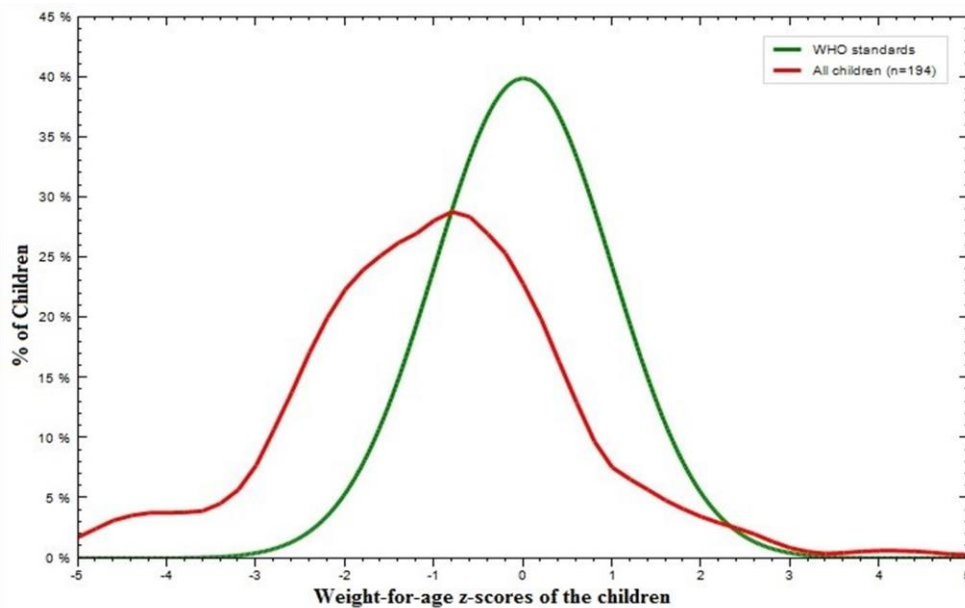


Figure 2: Weight-for-age Z scores compared to the WHO reference population for children aged 0-59 months

DISCUSSION

Undernutrition is a serious problem in the Northern region of Ghana with higher rates of both severe and moderate wasting and underweight children compared to most other regions in the country [5,14]. Eight per cent of the children in this study were either moderately or severely wasted which is comparable to the 9% overall wasting for under 5 years children in the Northern region reported by the 2017/2018 Ghana Multiple Indicator Cluster Survey (MICS) [5]. The proportion of children who were severely wasted however was higher in our study than for the MICS 2017/2018 and another community-based study conducted in northern Ghana by Saaka et al. [14]. The greater likelihood of children with various chronic and acute ailments presenting to the hospital as opposed to being found in the community setting may be responsible for this difference. Only 3.7% ($n = 7$) of patients did not have any acute or chronic medical condition.

The proportion of severely wasted children was similar to a study in Kumasi which showed that 4.1% of children attending the OPD were severely wasted. The proportions of combined moderate and severe wasting were however lower in this study compared to the study in Kumasi [7] and the community-based study by Saaka et al. [14] among children from Northern Ghana. Even though the measure of wasting used in this study varied from the weight for height measurements used in Kumasi, other studies have shown comparable sensitivity and specificity of these two methods (MUAC vs WFH Z score) in detecting wasting with a very similar prevalence of SAM when either method is used [10,13]. With the high levels of moderate and severe wasting among these children and those of previous studies from the region, it is not surprising that the Northern region of Ghana has one of the highest under-five mortality rates in Ghana [5] as malnutrition has a potentiating effect on mortality in children. To achieve a sustained reduction in under-five mortality rates and to subsequently meet the targets for health set in the sustainable development goals [15], malnutrition in all its forms must be tackled. In univariate analysis, younger age (< 24 months) ($p = 0.012$) and maternal level of education ($p = 0.002$) were significantly related to the level of wasting in the children studied, with the proportion of children with wasting being more in children below 24 months and children born to mothers with a low level of or no formal education. These findings are consistent with the findings of the 2017/2018 Ghana MICS [5].

The WHO and UNICEF recommend early initiation and exclusive breastfeeding for the first 6 months, the introduction of complementary feeding progressively thereafter while continuing breastfeeding up to a minimum of 2 years [16-18]. It was found in the current study that most of the patients were exclusively breastfed and started complementary feeding after 6 months but the frequency of meals in many instances (Table 1) did not meet standard infant feeding recommendations [16]. Although the quantity and quality of the complementary feeds could not be explored in this study, recent community-based surveys

conducted in Ghana have reported that 1 in every 4 children below 2 years in the Northern region receives the minimum acceptable diet for their age [5,14]. It is a positive sign that the rates of exclusive breastfeeding in our cohort were high but the children may not be receiving the right diversity of complementary feeds. This may partly explain the high rates of wasting and underweight documented in the current study. To mitigate the high levels of undernutrition in this age group, it will be appropriate to adhere to the WHO recommendations on infant and young child feeding [16,19]. Respiratory tract infections, malaria and gastroenteritis (Table 2) were the most common conditions for which the children were managed during the study period. Each of these conditions could trigger malnutrition as children are less likely to feed/be fed appropriately during episodes of acute illness [20]. Diarrheal diseases are especially common during the periods when complementary feeding is initiated due to the use of unwholesome water in the preparation of feeds or poor hygienic practices of the caregivers. Caregiver/maternal education on good hygienic practices during preparation and feeding of the children and on the importance of timely vaccination will go a long way to reducing the burden of diarrheal and lower respiratory tract infections which remain major contributors to the death of children under the age of five years [3,21].

It was found in this study that good nutritional status in the children was associated with a higher educational status of the mother (MUAC measurement, $p = 0.012$ and WFA Z score, $p = 0.010$) which is similar to findings from previous studies [5,14]. Several studies on the impact of maternal educational level on the health of their children have shown positive relationships with children of mothers with higher education having lower mortality and better health indicators likely due to improvement of mother's earning potential, greater involvement with the decision-making process, better healthcare-seeking behaviour like utilization of Antenatal Natal Care services and delivery at hospitals and greater patronage of vaccination services [19,22-26]. It is therefore important to promote girl-child education and encourage the education of females to higher levels.

It is noteworthy in this study that, even though 4% of children fulfilled the criteria for SAM or wasting by their MUAC measurement, only 3% were noted in their folders to be severely wasted. Severely wasted children presenting to the OPD must be identified because the management of such children who fulfil the criteria for Severe Acute Malnutrition (SAM) is quite different from that of children without severe wasting [27]. For instance, children with severe wasting are not routinely given intravenous fluids except when they are in shock. Also, dehydration in these children is managed with a special solution, Rehydration Solution for the Malnourished (RESOMAL) rather than ordinary Oral Rehydration Salt (ORS). It is therefore very important that any doctor (or other medical personnel) attending to a child should be able to identify the child with severe wasting to enable the institution of appropriate management protocols meant for children with SAM. The routine measurement of MUAC in the OPD will enable

these children to be identified. The study had limitations. The retrospective nature of the design in which data was extracted from medical records limited the scope of relevant variables that could be included in the analysis. Data on relevant variables such as dietary intake of the children and immunization status were not included in the medical records. The measurement of MUAC was not also observed and values were only retrieved from patient records. The height was not also routinely measured, making it impossible for us to compute WFH Z scores in our analysis. There is thus a potential bias relating to the excluded records. In addition, the anthropometric measurements were also done by different healthcare providers that had varying knowledge, skills and experience in conducting anthropometric measurements.

Conclusion

While 4% of children were classified by their Mid-Upper Arm Circumference Measurement as being severely wasted (thus fulfilling the criteria for Severe Acute Malnutrition), only 3% of the children had a diagnosis of Severe Acute Malnutrition made by the attending doctor. The routine measurement of MUAC could be a useful tool for the early detection of children with severe wasting at the OPD. Important determinants of wasting were being younger than 24 months of age and the low level of formal education of the mother.

DECLARATIONS

Ethical considerations

This study was reviewed and approved by the ethical review committee of the Tamale Teaching Hospital with approval number THERC/ 20/06/19/08.

Consent to publish

Both authors agreed to the content of the final paper.

Funding

None

Competing Interests

No potential conflict of interest was reported by the authors.

Author contributions

AA conceived the study, contributed to data collection, cleaning, analysis and writing and revision of the manuscript. RCY contributed to the study design, data collection and writing of the manuscript. SAO and SMPK contributed to the study design, data collection and cleaning and contributed to the drafting of the manuscript. VM contributed to study design, data collection and analysis. He also contributed to and revised the final manuscript.

Acknowledgements

The authors are grateful to Dr Amadu Munira, Dr Nathaniel Ofori, Dr Anita Owusu and Mr Nafei Hussein for their support with the data collection.

Availability of data

Data is available upon request to the corresponding author.

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