

Severity Extent Of Wasting Among Children Admitted To Therapeutic Feeding Program. A Case Control Study

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Abstract

Introduction: Children with complicated Severe Acute Malnutrition (SAM) admitted to Therapeutic Feeding Center (TFC), and 'uncomplicated' SAM managed in Outpatient Therapeutic Program (OTP).

Objective: This study aims to examine the anthropometric differences between SAM admitted to TFC and OTP.

Methods: A hospital based case control study conducted in the Therapeutic Feeding Program (TFP) of Al-Sadaka General Teaching hospital, Aden, included complicated (cases) and uncomplicated (control) severely wasted 6-60month old children admitted between July 2022 to June 2023. The WHO anthropometric calculator was used to assess every child's weight-for-length/height SD and length/height for ageSD.

Results: A total of 313 cases and 122 controls were admitted, mean age, weight, length/height, and MUAC among the cases were (13.04±7.34 mo., 5.41±1.33 kg, 68.32±7.10 cm, and 10.57±1.36 cm) respectively; while among the controls were (20.05±12.93 mo., 7.05±1.74 kg, 76.89±10.46 cm, and 11.28±1.11 cm) respectively. Severe wasting by WFL/H < - 3SD z- score seen more among the controls; cases vs controls were (37.0% vs 68.9%). However, the other groups of severity of WFL/H z-score were seen with nearly double frequencies among the case vs the controls (35.8% vs 18.8% < - 4SD), (14.7 vs 7.4% < - 5SD). Less than - 6SD was seen much more among the cases vs the controls (8.6% vs 1.6%). Less than - 7 SD among the cases was 1.3% and no children belong to this group in the controls.. The majority of the cases belonged to the age group 6-24 months. **Conclusion:** Children admitted to TFC had severe wasting reaching up to < - 6 and < - 7 SD below the WHO cut-off, WFL/H < - 3SD z-score, and at an early age, with simultaneous presence of severe stunting and low MUAC which denotes high mortality risk.

Introduction

Severe Acute Malnutrition (SAM) among under 5-year-old children is defined by a very low weight-for-length/height, or clinical signs of bilateral pitting oedema,

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or a very low mid-upper arm circumference. Worldwide, SAM affects an estimated 19 million children under 5 years of age and is estimated to account for approximately 400,000 child deaths each year [1]. In Yemen, malnutrition rates are among the highest in the world and according to Unicef, an estimated 2.2 million of children are suffering from acute malnutrition including over 540,000 children suffering from severe acute malnutrition [2].

While requiring nutritional intervention, not all severely malnourished children require hospitalization [1]. Treatment should be provided by means of Therapeutic Feeding Programme (TFP), a facility-based, offering inpatient care “Therapeutic Feeding Center (TFC)” and outpatient care “Outpatient Therapeutic Program (OTP)” services. ‘Complicated’ SAM, i.e., infection or metabolic disturbance, severe oedema or poor appetite; managed in the TFC, whilst children with ‘uncomplicated’ SAM, clinically well, alert and have retained their appetite; usually be managed as outpatients, where suitable services with access to Ready-to-use Therapeutic Food (RUTF) exist [3,4]. However, children who are admitted to TFC can be transferred to OTP when their medical complications, including oedema, are resolving, they have good appetite, and are clinically well and alert [1].

The early detection of severe wasting and edematous malnutrition and outpatient therapy for these conditions using RUTF forms the cornerstone of modern therapy, and only a small percentage of children develop complications requiring inpatient care [1-3].

Our hypothesis is, that children who develop complications and in need of inpatient care have more severe degrees of wasting, below the cut-offs, compared to those admitted to outpatient care. Therefore, this study aims to examine the anthropometric differences between children admitted in the TFC and the OTP with regards to the extent of severity of severe wasting and to measure the frequency of stunting among these children.

Patients and Methods

Patients and setting: this was a hospital based unmatched case control study conducted in the TFP of Al-Sadaka General Teaching hospital, Aden/Yemen, and included complicated (cases) and uncomplicated (control) severely wasted 6-60 month old children admitted to the TFC and the OPT, respectively, over a period of 1 year between July 2022 to June 2023.

Inclusion criteria: Children 06 – 60 months old with severe wasting either by WFL/H < -3SD z- score or mid upper arm circumference (MUAC) < 11.5 cm who admitted to the TFC with complications (cases) and to the OTP without complication (controls) [5].

Exclusion criteria: Children beyond the age range, having edema, history of perinatal insult (birth asphyxia/trauma/intraventricular hemorrhage (IVH)/kernicterus etc.), history of neonatal intensive care unit (NICU) admissions in the neonatal period, evolving central nervous system disease, gross malformation or secondary malnutrition were excluded.

Data collection: The following data of the first day of admission for all severely wasted children retrieved retrospectively from TFC and OTP registries, in a pre-structured data sheet: Age in months (mo.), gender, weight in kilogram (kg) length/height in centimeters (cm), and MUAC in cm. The WHO anthropometric calculator, age and sex specific, was used to assess every child’s weight-for-length/height (WFL/H) SD z-scores and length/height for age (L/HFA) SD z- scores [6]. A L/HFA Z score < -3 SD units from the median of the reference population was considered as severe stunting and the

calculated Z scores for the WFL/H and L/HFA were recorded. The study children were divided into groups based on age in months and weight for length/height SDz score as per WHO anthropometric calculator.

The statistical analyses were carried with SPSS software (Statistical Package for the Social Sciences, version 24). Numerical data were described as mean $\pm$ SD. Frequency tables with percentages were used for categorical variables. A *p*-value < 0.05 is considered statistically significant.

Ethical consideration

Ethical consideration and approval were obtained from the management office of Al-Sadaka General Teaching Hospital/Aden to obtain TFC and OTP SAM registries for the purpose of conducting this study. The objectives of the study were justified and the information collected was kept totally confidential. In addition, patient identifiers were not included; therefore, no ethical harm was inflicted on the patients.

Results

A total of 313 complicated severely wasted children (cases) were admitted to the TFC, boys (48.9%) and girls (51.1%). Uncomplicated severely wasted children (controls) admitted to the OTP were 122, among them boys (41.8%) and girls (58.2%).

Mean age, weight, length/height, and MUAC among the cases were (13.04 $\pm$ 7.34 mo., 5.41 $\pm$ 1.33kg, 68.32 $\pm$ 7.10 cm, and 10.57 $\pm$ 1.36 cm) respectively; while the mean age, weight, length/height, and MUAC among the controls were (20.05 $\pm$ 12.93 mo., 7.05 $\pm$ 1.74 kg, 76.89 $\pm$ 10.46 cm, and MUAC 11.28 $\pm$ 1.11 cm) respectively. P value <0.001 presented in Table 1.

Table 1. Mean $\pm$ SD of age, weight, length/height, and MUAC among study population

Variable	Cases (No. 313)		Controls (No. 122)		p-value ^s
	Mean	Std. Deviation	Mean	Std. Deviation	
Age (months)	13.04	7.34	20.05	12.93	< 0.001
Weight (kg)	5.41	1.33	7.05	1.74	< 0.001
Length\Height (cm)	68.32	7.1	76.89	10.46	< 0.001
MUAC (cm)	10.57	1.36	11.28	1.11	< 0.001

^aIndependent sample t test

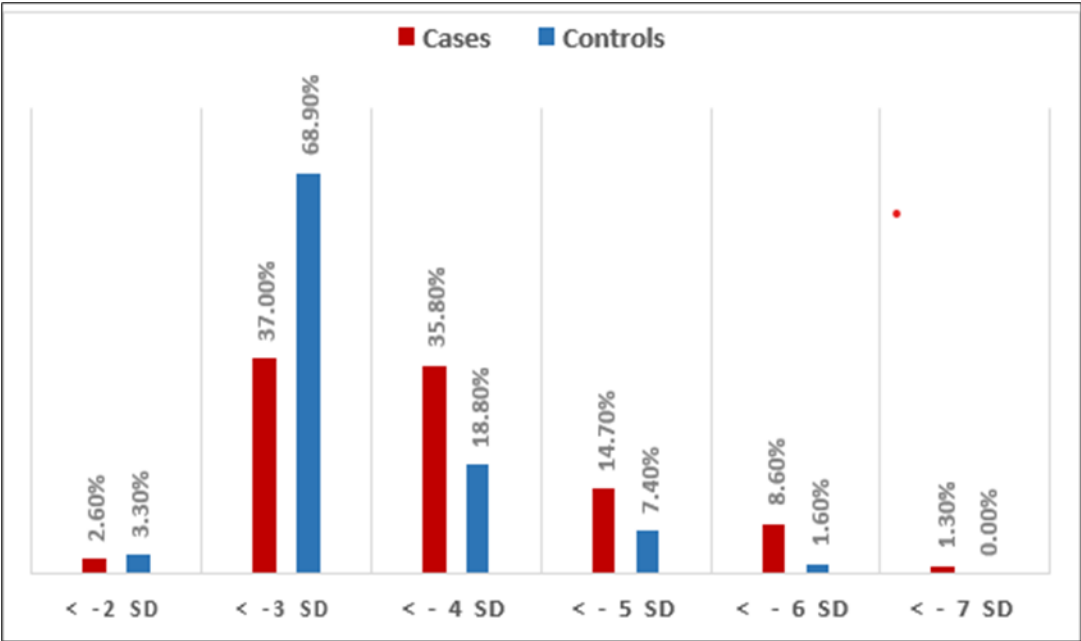


Figure 1. Distribution of study population according to the severity of wasting by weight for length/height SD below the – 2 SD (WHO Z Score reference).

Figure 1 shows that severe wasting by WFL/H < - 3SD z-score group of severity seen more among the control; cases vs controls were (37.0% vs 68.9%). However, the other groups of severity of WFL/H z-score below the cut off of – 3SD z-score seen more among the cases compared to the controls with nearly double frequencies as follow: (35.8% vs 18.8% < - 4SD), (14.7 vs 7.4% < - 5SD). Less than – 6SD group of severity was seen much more among the cases vs the controls (8.6% vs 1.6%). Less than – 7 SD among the cases was 1.3% and no children belong to this group in the controls. Those study children with < - 2 SD (moderate wasting by WFL/H) were admitted for severe wasting by MUAC criterion of < 11.5 cm.

Table 2 shows that out of the total complicated severely wasted children admitted by WFL/H < -3 SD, 59.1% belong to 6-12 mo. age group and children aged 6-24 months represented 93.3%.

Only 4.2% of children belong the age group 25-60 mo. Among the controls, the proportion of children from the three age groups were nearly similar, with 6-12 mo., 13-24 mo, and 25-60 mo. represented 34.4%, 35.2%, and 27.1% respectively. Severe stunting was found among 41.9% of the

Table 2. Distribution of study population by weight for length/height < -3 SD, length/height for age < -3 SD, and MUAC < 11.5 cm based on age group

Age group (month)	Cases, No. = 313			Controls, No. =122		
	WFL/H	L/HFA	MUAC	WFL/H	L/HFA	MUAC
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
6-12	185 (59.1)	79 (25.2)	144 (46.0)	42 (34.4)	8 (6.6)	30 (24.6)
13-24	107 (34.2)	44 (14.1)	64 (20.4)	43 (35.2)	6 (4.9)	16 (13.1)
25-60	13 (4.2)	8 (2.6)	4 (1.3)	33 (27.1)	6 (4.9)	14 (11.5)
Total	305 (97.5)	131 (41.9)	212 (67.7)	118	20 (16.4)	60 (49.2)

cases and nearly all belong to the age group 6-24 mo. while severe stunting was seen among 16.4% of the controls and nearly similar proportion in the three age groups. MUAC < 11.5 cm among the cases was 46.0%, 20.4%, and 1.3% in the three age groups respectively, while among the controls was 24.6%, 13.1%, and 11.5% in the three age groups respectively. A statistically significant age group difference between the cases and the controls, p -value is < 0.001.

Discussion

In the present case control study, complicated severely wasted children admitted to inpatient care were younger, had significantly low mean weight, height, and MUAC compared to uncomplicated severely wasted children admitted to outpatient care.

It was observed that WFL/H < - 3SD z-score group of severity seen more among the control; cases vs controls were (37.0% vs 68.9%). However, comparing the other groups of severity (< -4SD, < -5SD, and < -6SD z-scores), it was found that the proportion of these groups of severity among the cases were nearly more than twice the proportion in the controls. In addition, there were no children in control group with WFL/H < -7SD z-score. A similar hospital based case control study was done in Rajasthan, India showed that < -3SD z-score among the cases vs the controls was (26.0% vs 32.0%), < -4SD cases vs controls was (27.0% vs 28.0%), and the proportion of < -5SD and < -6SD group of severity was high among the cases vs the controls. No children among the controls belong to the groups < -7SD and < -8SD [7]. These findings support the evidence that children with SAM who develop complications have severe deterioration of nutritional anthropometric indices compared to those admitted to outpatient care [8].

In our TFP, the majority of children admitted for severe wasting by WFL/H < -3SD z-score criterion, not by MUAC criterion, and nearly similar proportion was found in the TFC and OTP (97.5%) and (96.7%) respectively. Similar finding was seen in a multicounty study done in India where the proportion of total children diagnosed as SAM by WFL/H z-score were significantly high (84.5%), compared to MUAC criterion [9].

MUAC < 11.5 cm was simultaneously found among (67.7%) of the cases that were identified as severe wasting by WFL/H, compared to (49.2%) among the controls. However, only (2.6%) and (3.3%) of children were admitted for severe wasting by only MUAC < 11.5 cm criterion in the cases and controls, respectively. If < 11.5 cm MUAC is used as a stand alone criterion in our TFP, then a large number of severely wasted children will remain undetected. MUAC becomes an essential tool, as it is a quick, easy and cheap method to identify acutely malnourished children in low-income, high-prevalence or emergency settings where resources may be limited. In addition, MUAC is primarily used to produce rapid prevalence estimates, and for community screening via Community-based Management of Acute Malnutrition (CMAM). Moreover, global evidence suggests that MUAC identifies children who are at a higher risk of mortality and require immediate care [10]. However, in spite of MUAC's higher functionality as an alternative in areas of scarce resources or as mortality predictor, its diagnostic value continues to be debated [11].

Significant proportion of cases were also stunted compared to the controls (41.9% vs 16.4%) and the majority of the cases were 6-24 mo. age group compared to the control (39.3% vs 11.5%).

The proportion of stunting among our cases was higher than the proportion among complicated SAM found in a hospital based studies done in Egypt and Western Kenya, 23.2% and 23.0%, respectively [12,13], and is much higher than stunting among 6-24 month old children in a study included

hospitalized children in Nepal (4.7%) [14]. In the Yemeni context, malnutrition in this age group mostly related to improper complementary feeding practice. According to SMART surveys conducted in 2021, only one in 10 children aged 6-23 months in Yemen receives an adequate diet in the complementary feeding period, with only 12% receiving a minimum acceptable diet. High levels of poverty, spiraling food prices, poor access to services, and the constraints on the daily lives of women, such as movement restriction and challenges accessing financial services, all present challenges to following recommended complementary feeding practices. A lack of knowledge on age-appropriate behaviours and a lack of interaction with children during meals have also been highlighted as barriers to appropriate practice [14].

Limitation

This is a hospital based study done in a single TFP for one year. Our hospital is the only reference hospital in Aden, receiving complicated SAM patient from whole of Aden and the neighboring governorates, which might not be the case for other TFPs in the neighboring governorates.

Conclusion and Recommendation

Children admitted to TFC had severe anthropometric deterioration at a younger age, evident not only by severe wasting of all grades that may be reaching up to $< -6, 7$ SD as per WHO SD z score classification, but also chronic malnutrition which carries a high mortality risk, indicated by simultaneous presence of severe stunting and low MUAC. We recommend strengthening the active case finding of acute malnutrition in the community by assessing WFL/H criterion in addition to MUAC measurement for early detection and management of acute malnutrition. In addition, we recommend other TFPs in the neighboring governorates to conduct similar study to guide our policy makers for best practice with an overall aim to prevent undernutrition.

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Declarations

Ethical consideration and approval

were obtained from the management office of Al-Sadaka General Teaching Hospital/Aden to obtain TFC and OTP SAM registries for the purpose of conducting this study. The objectives of the study were justified and the information collected was kept totally confidential. In addition, patient identifiers were not included; therefore, no ethical harm was inflicted on the patients.

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