ORIGINAL ARTICLE

Frequency and Associated Factors of Severe Acute Malnutrition in Children Aged 6 to 59 Months in District Qambar Shahdadkot, Sindh

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Abstract

Background: Acute malnutrition is a serious public health problem reaching to epidemic proportions in certain regions of the world. It has been reported that children with severe malnutrition have weakened immunity and are prone to developmental delays, with a higher mortality risk from common childhood illnesses such as diarrhea, pneumonia and malaria.

Objective: To determine the frequency and associated factors of severe acute malnutrition in children aged 6-59 months at District Headquarter Hospital, Qambar Shahdadkot, Sindh.

Methods: A cross-sectional study was conducted from November 2021 to February 2023 among children aged 6-59 months at District Headquarter Hospital, District Qamber Shahdadkot, Sindh, Pakistan. Data were collected by means of interviews using the study questionnaire. Height was measured using a height board (Stadio Meter), weight was measured using SECA digital weighting scale while mid upper arm circumference was measured using MUAC tape. Data were analyzed by SPSS version 20. Crude and adjusted odd ratios with 95% confidence interval were computed using binary logistic regression to determine the association of socio-demographic characteristics with the nutritional status of children.

Results: The study results showed that the mean age of study children was 26.58±14.54 months, 101 (50.5%) of them were less than 2 years old, 109 (54.5%) were male, 149 (74.5%) were exclusively breastfed for 6 months, only 19 (9.5%) of them started weaning between the age of 4 to 6 months and 147 (73.5%) were completely immunized. Moreover, 26 (13.0%) of them had severe acute malnutrition. On the multivariable model, only child age was found to be significantly associated with the nutritional status of children (aOR: 4.07, 95% CI 1.14-14.48, p=0.030).

Conclusion: Among the study sample, 13% of children had severe acute malnutrition. Moreover, among the socio-demographic characteristics studied, only the age of child was found to be significantly associated with the nutritional status of a child.

Keywords: *Prevalence, severe acute malnutrition, anthropometry, risk factors, children.*

INTRODUCTION

According to the World Health Organization, severe acute malnutrition (SAM) in children aged 6-59 months is defined by "a very low weight-for-height/weight-for-length *i.e.* < -3 standard deviations, or clinical signs of bilateral pitting edema, or a very low mid-upper arm circumference (MUAC) *i.e.* < 115 mm" [1]. Severe acute malnutrition may result from multiple factors such as shortage of food, current illness, or inadequate child feeding [2].

Acute malnutrition is a serious public health problem reaching to epidemic proportions in certain regions of the world. Globally in 2020, according to the World Health Organization, 149 million children under 5 were stunted, 45 million were wasted, and 38.9 million were overweight or obese [3]. Locally in Pakistan, the burden of undernutrition among children <5 years old has been estimated to be very high [4].

Several factors can contribute to malnutrition such as maternal education, maternal nutrition, child feeding practices, maternal working and financial status, and any co-morbidities the child may be suffering from [5]. Other drivers of under-nutrition include poor access to healthcare and safe drinking water and increased workload of the mothers [6].

It has been reported that children with severe malnutrition have weakened immunity and are prone to developmental delays, with a higher mortality risk from common childhood illnesses such as diarrhea, pneumonia and malaria [7, 8]. Children surviving acute malnourishment are more susceptible to poor educational performance, and low productive life [9]. Improper nutrition status is also causative of about a third of mortality during the first five years of life [8]. All these facts point out the need of prioritizing interventions based on local evidence for prevention and control of severe acute malnutrition in children.

In the given context, it is important to continue to evaluate and update the current magnitude and possible associated factors of malnutrition in Pakistan. To the best of the investigator's knowledge, recent local literature on the prevalence of malnutrition and its associated factors is limited at best [10-12]. The current study was therefore conducted to find out the prevalence of severe

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acute malnutrition and to identify its associated factors in children aged 6-59 months.

METHODS

A cross-sectional study was conducted from November 2021 to February 2023 at District Headquarter Hospital, District Qamber Shahdadkot, Sindh, Pakistan. Children aged 6-59 months attending District Headquarter Hospital, District Qamber Shahdadkot, Sindh whose parents were willing to participate were included in the study. In contrast, children with any physical deformity hindering their anthropometric assessment were excluded from this study.

Keeping the percentage frequency of the study outcome at 50% for a most liberal estimate, with 95% confidence level and 7% precision, the required sample size was calculated to be 196 children using the following formula: n = z2 x (p) x (1-p) / c2 Against the calculated sample size, a total of 200 children were included in the study using non-probability purposive sample technique.

A questionnaire was specifically designated for the study to record study variables such as child's age, child gender, parents' education, parents' employment status, monthly household income, type of family, source of drinking water, number of siblings, age of weaning, the immunization status of child, history of diarrhea and pneumonia and for severe acute malnutrition assessment, height, weight and mid-upper arm circumference.

A questionnaire was filled out for each participant of the study. Data collection was started after obtaining written informed consent from the parents. Height was measured using a height board (Stadio Meter), weight was measured using SECA digital weighting scale while mid upper arm circumference was measured using MUAC tape. The length of infants and children under 24 months of age was measured in lying down (supine) position. Children over 24 months of age had their heights measured while standing. Similarly, the weight of the children under 24 months of age was measured in lying down position and children above 24 months of age had their weight measured in standing position with the help of the measuring scale. Mid-upper arm circumference was measured using standard UNICEF MUAC tape in the left arm at a flexed position. Each of the weight, length and mid-upper arm circumference were measured twice by two trained medical doctors, always available at nutrition clinic in district EPI centers from where data were collected, and an average of each value was taken as the final measurement. If the inter-observer difference was more than 0.5 cm, measurements were repeated. These measurements were then used to calculate weight for length/height z scores using the World Health Organization growth charts [13].

Data were entered and analyzed by statistical package for social science (SPSS version 20) whereas graphs and tables were made by MS Excel. Descriptive analysis such as frequencies and percentages were calculated for categorical variables while means and standard deviation were generated for continuous variables. For inferential analysis, binary logistic regression was applied to compute univariate odd ratios with 95% confidence interval for determining the association of socio-demographic characteristics with the nutritional status of children. Variables with $p<0.25$ and other important variables irrespective of $p<0.25$ in univariate analysis were used to build a multivariable regression model to compute adjusted odd ratios with a 95% confidence interval. A two-tailed p-value of ≤0.05 was considered statistically significant.

RESULTS

The study results showed that 124 (62.0%) of the respondents were mothers, 134 (67.0%) mothers were illiterate, 94 (47.0%) fathers were illiterate,178 (89.0%) mothers were student or housewives, 158 (79.0%) fathers were unemployed, 152 (76.0%) had up to 25,000/- monthly household income, 130 (65.0%) lived in Joint family system, all (100%) participants used tap water without boiling whereas 196 (98.0%) had the facility of toilet at their homes (**Table 1**).

The study results further showed the mean age of study children to be 26.58±14.54 months, 101 (50.5%) of

Table 1: Socio-demographic characteristics of parents.

Parents' Characteristics (n=200)	Count (%)
Relationship of the Respondent with the Child	
Father	62 (31.0)
Mother	124 (62.0)
Grandfather	3 (1.5)
Grandmother	11 (5.5)
Mother's Education	
Illiterate	134 (67.0)
Able to read and write	3 (1.5)
Primary	43 (21.5)
Secondary	11 5.5)
Intermediate or above	6 (3.0)
Religious Education only	3 (1.5)
Father's Education	
Illiterate	94 (47.0)
Able to read and write	4 (2.0)
Primary	48 (24.0)
Secondary	29 (14.5)
Intermediate or above	24 (12.0)
Religious Education only	1 (0.5)
Mother's Employment Status	
Unemployed	10 (5.0)
Employed or Self employed	12 (6.0)
Student or House wife	178 (89.0)
Father's Employment Status	
Unemployed	158 (79.0)
Employed or Self employed	42 (21.0)

Parents' Characteristics (n=200)	Count (%)
Monthly Household Income (Rupees)	
Up to 25000	152 (76.0)
26000 to 50000	40 (20.0)
51000 to 75000	7(3.5)
More than 75000	1 (0.5)
Type of Family	
Nuclear	70 (35.0)
Joint	130 (65.0)
What type of water is used for drinking purpose in the house?	
Tap Water without boiling	200 (100.0)
Availability of toilet	
Yes	196 (98.0)
No	4(2.0)
If yes, where	
In House	196 (98.0)
Outside House	4 (2.0)

them were less than 2 years old, 109 (54.5%) of them were male, 57 (28.5%) of them were oldest whereas 53 (23.5%) were youngest among their siblings, 90 (45.5%) of them had 2 siblings, 149 (74.5%) of them were exclusively breastfeed for 6 months, only 19 (9.5%) of them started weaning between the age of 4 to 6 months, 147 (73.5%) of them were completely immunized, only 4 (2.0%) had diarrhea whereas all 200 (100%) of them did not have pneumonia (**Table 2**).

It was further seen that the mean weight of the study children was 9.92±2.59 kg, their mean height was 82.68±10.70 cm, their mean mid-upper arm circumference was 13.40±1.20 cm, 86 (43.0%) of them had mid-upper arm circumference >13.5 cm whereas none of them had bilateral edema (**Table 3**).

Table 2: Characteristics of children.

Child Characteristics (n=200)	Mean±SD/Count (%)
Age (Months)	26.58±14.54 (range 59-7)
Age Group (Months)	
Less than 2 Years	101 (50.5)
2 Years or Older	99 (49.5)
Gender	
Male	109 (54.5)
Female	91 (45.5)
Position of Child in Siblings	
1st	57 (28.5)
2nd	55 (27.5)
3rd	35 (17.5)
4th or above	53 (26.5)
Number of Sibling under 5 Years of Age	
0	2 (1.0)
1	69 (34.5)
2	90 (45.5)
3	36 (18.0)
4	3 (1.5)
Exclusive Breastfeeding during First Six Months of Age	
Yes	149 (74.5)
No	51 (25.5)
Age of Child at Weaning (Months)	
Up to 3 Months	48 (24.0)
4 to 6 Months	19 (9.5)
7 Months or Above	133 (66.5)
Immunization Status of Child for Age as per EPI* Schedule	
Un Immunized	3 (1.5)
Partially Immunized	50 (25.0)
Completely Immunized	147 (73.5)
Diarrhea	
Yes	4 (2.0)
No	196 (98.0)
Pneumonia	
Yes	Nil
No	200 (100)

*Expanded program on immunization.

Table 3: Anthropometric parameters of study children.

Child Characteristics (n=200)	Mean ± SD/Count (%)
Weight of Children aged <2 years (kg)	8.00±1.37
Weight of Children aged ≥2 years (kg)	11.89±2.01
Height of Children aged <2 years (cm)	74.81±6.03
Height of Children aged ≥2 years (cm)	90.71±8.14
MUAC Category (cm)	
<11	8 (4.0)
11.5 to 12.5	31 (15.5)
12.5 to13.5	75 (37.5)
>13.5	86 (43.0)
Bilateral Edema	
No	200 (100.0)
Yes	Nil

Moreover, it was found that 26 (13.0%) of the study children had severe acute malnutrition (**Fig. 1**).

Furthermore, it was seen that severe acute malnutrition was more prevalent in children aged 2 years or less as compared to children aged more than 2 years (20.8% *vs.* 5.1%) (**Fig. 2**).

Logistic regression analysis between socio-demographic characteristics and nutritional status of children showed that only the child's age was significantly associated with the nutritional status of children where children who were aged less than 2 years had significantly higher odds of having severe acute malnutrition than those who were aged 2 years or above (AOR 4.07, 95% CI 1.14-14.48, p=0.030) (**Table 4**).

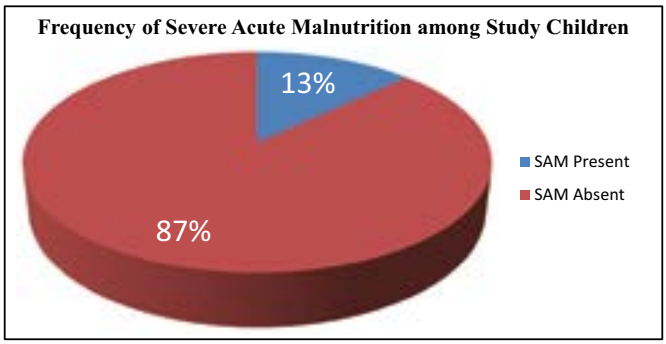

Fig. (1): Frequency of severe acute malnutrition among study children.

Table 4: Logistic regression analysis of association between socio-demographic characteristics and nutritional status of children.

Socio-Demographic Characteristics (n=200)	Crude Odds ratio	95% CI		p-value	Adjusted Odds ratio	95% CI		p-value
		Lower	Upper			Lower	Upper	
Child Age								
Less than 2 years	4.93	1.78	13.68	0.002	4.07	1.14	14.48	0.030
2 years or above	Reference Category				Reference Category			
Child Gender								
Male	0.97	0.42	2.21	0.943	1.09	0.4	2.96	0.855
Female	Reference Category				Reference Category			
Child Position in Siblings								
First or second	Reference Category				Reference Category			
Third or above	1.32	0.57	3.03	0.510	2.08	0.75	5.77	0.156
Exclusive Breast Feeding								
Yes	Reference Category				Reference Category			
No	2.96	1.26	6.93	0.012	6.63	0.84	52.1	0.072
Age at Weaning								
Up to 3 months	Reference Category				Reference Category			
4 to 6 months	0.81	0.19	3.39	0.776	1.95	0.27	14.12	0.506
7 months or more	0.51	0.2	1.26	0.148	3.72	0.43	32.01	0.231
Immunization Status of Child								
Unimmunized/Partially immunized	5.92	2.48	14.13	<0.001	3.02	0.97	9.37	0.055
Completely immunized	Reference Category				Reference Category			
Mother Education								
Illiterate/Able to read and write/Religious education only	0.96	0.2	4.62	0.967	0.44	0.05	3.53	0.444
Primary	1.71	0.32	9.04	0.525	1.12	0.13	9.25	0.913
Secondary/Intermediate or above	Reference Category				Reference Category			
Father Education								
Illiterate/Able to read and write/Religious education only	1.45	0.48	4.31	0.503	1.47	0.32	6.77	0.615
Primary	1.92	0.58	6.33	0.284	1.23	0.26	5.75	0.789
Secondary/Intermediate or above	Reference Category				Reference Category			
Mother Employment								
Working	0.64	0.14	2.92	0.566	1.06	0.17	6.59	0.946
Non-working	Reference Category				Reference Category			
Father Employment								
Unemployed	3.58	0.81	15.81	0.092	2.55	0.23	28.37	0.445
Employed/Self-employed	Reference Category				Reference Category			
Monthly Household Income (Rs.)								
Up to 20,000	9.25	1.21	70.2	0.031	5.21	0.35	77.12	0.230
More than 20,000	Reference Category				Reference Category			
Type of Family								
Nuclear	0.98	0.41	2.33	0.965	1.65	0.58	4.63	0.341
Joint	Reference Category				Reference Category			

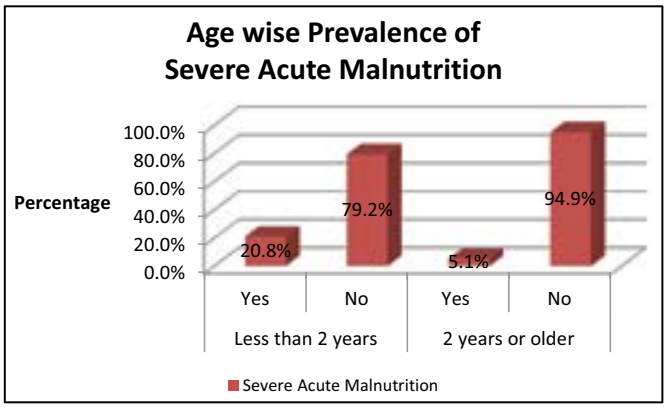

Fig. (2): Prevalence of severe acute malnutrition with respect to age.

DISCUSSION

In the present study, it was found that 13% of the children were suffering from severe acute malnutrition. Previous studies conducted in Pakistan have also reported a high prevalence of severe acute malnutrition in Sindh and other provinces [11, 12]. A hospital-based study conducted in Tharparkar-Sindh, Pakistan found that 47.6% of children were from suffering severe acute malnutrition and were undernourished among overall children admitted to the hospital in one month [11]. Another local study conducted in Quetta, Pakistan concluded that the prevalence of severe acute malnutrition was very high *i.e.* 37.6% in that area [12]. Furthermore, the Pakistan Demographic and Health Survey Pakistan during 2017-18 evaluated

that overall 38% of children under age 5 were stunted, with 17% severely stunted; 7% were wasted, with 2% severely wasted; and 23% were underweight, with 8% severely underweight [14]. There are many possible reasons for such a high prevalence of severe acute malnutrition among Pakistani children, including lower socioeconomic status, large family size, illiteracy of parents and inadequate access to healthcare. Regionally though, the prevalence of severe acute malnutrition has been reported to be lower than Pakistani figures. An earlier study reported the prevalence of severe acute malnutrition among children to be 2.2% in Northern India [15]. Another study conducted in Ethiopia reported that 3.3% of children aged <5 years old are suffering from severe acute malnutrition [16].

The study results showed that the prevalence of severe acute malnutrition was significantly associated with the age of the child where children under 2 years of age were more affected by severe acute malnutrition as compared to those older than 2 years. These results are well in line with the published literature. A previous study concluded that the frequency of severe acute malnutrition was higher among children in the age range of 1-3 years and lower among children older than this age range [12]. Another study reported the same results and concluded that children under the age of 1 year and between 1 to 2 years of age were more affected by severe acute malnutrition as compared to those aged more than 2 years [17]. Yet another study found that children under the age of 2 years suffered more from severe acute malnutrition than those older than 2 years of age [18]. The possible reason for this finding could be the cessation of exclusive breastfeeding before six months of the child's age or the improper feeding pattern of the child in the early months of life.

Moreover, the gender of the children was not significantly associated with severe acute malnutrition in the present study, a finding in line with the published literature. A recent local review reported that no gender difference exists in terms of malnutrition among children [19]. Similarly, a previous study did not find child gender to be significantly associated with severe acute malnutrition [20].

Furthermore, the absence of exclusive breastfeeding during the first six months of life was found to be marginally insignificantly associated with severe acute malnutrition in the present study. This shows the importance of providing exclusive breastfeeding to the child during the early period of life to reap its potential benefits concerning child growth and development. This is also consistent with previous literature which supports the notion that the absence of exclusive breastfeeding during the six months of life is a positive predictor of malnutrition during the six months of life [21-24].

It was further observed that children from families with lower monthly household income had higher, though statistically insignificant, odds of severe acute malnutrition as compared to their counterparts with higher monthly household income. Poverty and lower monthly household income have been reported to be associated with severe acute malnutrition in previous studies [1, 19, 23-24]. Limited resources result in failure to provide a sufficient balanced diet to the child. This predisposes children to risk of undernutrition and ultimately severe acute malnutrition. Unlike the study results though, an earlier study reported an insignificant association of severe acute malnutrition with monthly household income [25]. A smaller sample size and the difference in categories of monthly household income used in that study are the possible reasons for this difference in results.

The study results did not show maternal employment to be significantly associated with severe acute malnutrition in this study. Likewise, Eshete *et al.,* in 2017 did not find maternal employment to have a significant association with the nutritional status of children [26]. If the father is working, and the monthly household income is sufficient for the family, maternal employment status may not necessarily affect the nutritional status of children.

Moreover, children who were unimmunized or partially immunized had higher, though marginally insignificant, odds of severe acute malnutrition than children who were completely immunized. This finding is consistent with previous studies by Bashir *et al.,* in 2021 [12] and Gizaw *et al.,* in 2018 [27] which showed that the immunization status of a child is a possible risk factor for severe acute malnutrition. Vaccination as a preventive measure offers protection to the child against many infectious diseases and therefore such a finding was well expected.

Parental education was not significantly associated with severe acute malnutrition in the current study. An earlier study reported only the father's educational level to be significantly associated with severe acute malnutrition in children and not the mother's [24]. Another study though reported parental educational status to be significantly associated with severe acute malnutrition in children [28]. Parental education is an important aspect of the upbringing of children and it can be reasonably expected that parents with higher education are better able to cater to the nutritional requirements of their children however ever rising inflation means that the nutritional requirements of children are increasingly becoming difficult for many families to meet thus resulting in their malnourishment.

Number of siblings was also not significantly associated with severe acute malnutrition in the current study. A recent study though reported a number of siblings to be significantly associated with severe acute malnutrition in children [28]. Depending upon the socioeconomic status of the household, a total number of siblings may not necessarily affect the nutritional status of a child

because a family with a good source of income but with more children may be financially similar to a family with not so good source of income but with fewer children.

This study has certain limitations. Being a single-center study with a moderate sample size, it is acknowledged that the generalizability of study findings is limited. It is further acknowledged that maternal nutritional status may play a crucial role in determining the nutritional status of the child which was not evaluated in this study.

CONCLUSION

Among the study sample, 13% of children had severe acute malnutrition. Moreover, among the socio-demographic characteristics studied, only the age of child was found to be significantly associated with the nutritional status of a child.

Based upon the findings of this study, it is recommended that disease prevention through vaccination can be fundamental to maintaining the nutritional status of children. Moreover, the promotion of exclusive breastfeeding among new mothers may prove crucial in preventing the development of severe acute malnutrition in their children. Multicenter collection of data is recommended for future studies to achieve better generalizability of study results.

ETHICAL APPROVAL

To the best of authors' knowledge, the study procedures were in line with the institutional ethical standards for human experiments and the Helsinki Declaration, including taking written informed consent from all the participants. The ethical approval from Baqai Institute of Health Sciences was also duly taken (Reference # FHM 65-2021).

CONSENT FOR PUBLICATION

Before data collection, written informed consent was taken from each participant of the study.

AVAILABILITY OF DATA

Data cannot be shared publicly because it is the intellectual property of Baqai Institute of Health Sciences. Data are available from the Baqai Institute of Health Sciences (contact *via* manager.mph@baqai.edu.pk).

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Declared none.

AUTHORS' CONTRIBUTION

KA: Study concept, designing, manuscript drafting, and revision of initial draft.

SMZHN: Study designing, result analysis and interpretation, critical review and revision of initial draft.

NJ: Critical review and revision of initial draft.

All authors have read and approved the manuscript.

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