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Prevalence and Determinants of Severe Acute Malnutrition Among Children of Age 6-59 Months Presenting to Pediatrics Department Holy Family Hospital Rawalpindi

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ABSTRACT

Background: Severe acute malnutrition (SAM) remains a leading cause of childhood morbidity and mortality in developing countries, with Pakistan experiencing persistently high rates despite ongoing public health interventions. Identifying the prevalence and determinants of SAM in local clinical settings is critical for designing effective prevention and treatment strategies. **Objective:** To determine the prevalence of severe acute malnutrition among children aged 6–59 months presenting with malnutrition to the Pediatrics Department of Holy Family Hospital, Rawalpindi, and to assess demographic, maternal, and socioeconomic factors associated with SAM. **Methods:** This cross-sectional observational study included 270 children aged 6–59 months recruited consecutively from Oct 6 2024 to April 5 2025 Anthropometric measurements were obtained following World Health Organization protocols, and relevant clinical and sociodemographic data were recorded using a structured proforma. Severe acute malnutrition was defined as a weight-for-height Z-score below –3 or the presence of nutritional edema. Data were analyzed using SPSS v25, with chi-square tests and odds ratios calculated for associations, and significance set at $p < 0.05$. **Results:** The prevalence of severe acute malnutrition was 43.3%. No statistically significant associations were observed between SAM and gender, age group, maternal BMI, socioeconomic status, or exclusive breastfeeding. Trends suggested higher SAM risk in children aged 13–35 months and among those with suboptimal feeding practices, though these did not reach statistical significance. **Conclusion:** Severe acute malnutrition remains highly prevalent in this population, with no single demographic or maternal factor demonstrating a significant association. Comprehensive, multi-pronged public health interventions targeting early childhood remain essential to reduce the burden of SAM.

Keywords: Severe Acute Malnutrition, Pediatrics, Prevalence, Risk Factors, Pakistan, Anthropometry, Public Health

INTRODUCTION

Malnutrition, encompassing both undernutrition and overnutrition, remains a significant global health challenge, with undernutrition contributing substantially to childhood morbidity and mortality (1). Severe acute malnutrition (SAM), characterized by markedly low weight-for-height, visible wasting, or nutritional edema, poses an especially grave threat in developing nations, accounting for approximately 3.1 million child deaths annually and representing nearly 45% of total mortality among children under five years of age (2, 3). The pathogenesis of SAM is multifactorial, involving inadequate dietary intake, frequent infections, and socio-economic constraints, all of which interact to compromise children's nutritional status and survival prospects (4).

In South Asia, including Pakistan, the burden of malnutrition remains alarmingly high, despite ongoing health interventions, with studies reporting SAM prevalence ranging from 30% to 50% among children under five, especially in low-income or rural populations (5, 6).

Pakistan has persistently reported high rates of childhood undernutrition, with factors such as low maternal education, poor maternal nutritional status, suboptimal infant feeding practices, household food insecurity, and limited access to healthcare services contributing to this public health crisis (7, 8). While national surveys and global estimates highlight the widespread prevalence of malnutrition, regional disparities persist, underscoring the need for context-specific data to guide targeted interventions (9). Prior

research has linked maternal nutritional status, particularly undernutrition, with increased risk of intrauterine growth restriction and low birth weight, subsequently predisposing children to malnutrition during infancy and early childhood (10, 11). In addition, inadequate immunization coverage and recurrent infections such as diarrhea and pneumonia have been shown to exacerbate nutritional deficiencies and increase mortality risk among malnourished children (12, 13). Although exclusive breastfeeding during the first six months of life is considered protective, its benefits may diminish without timely and appropriate complementary feeding, potentially contributing to nutritional deficits in older infants and toddlers (14).

Despite various governmental and non-governmental efforts aimed at reducing malnutrition, Pakistan continues to grapple with high rates of SAM, reflecting persistent gaps in understanding region-specific determinants and their relative contributions to this complex condition (15). Many studies have assessed the prevalence and risk factors of SAM in different settings across Pakistan; however, there remains a paucity of data specific to urban healthcare facilities like Holy Family Hospital, Rawalpindi, which serves a diverse population from both urban and peri-urban communities. This gap hinders the development of targeted policies and interventions tailored to local needs (16, 17). Given the high burden and significant consequences of SAM, it is imperative to explore both the prevalence and potential determinants of this condition in specific healthcare contexts to inform evidence-based preventive and therapeutic strategies.

Therefore, the present study was conducted to determine the prevalence of severe acute malnutrition among children aged 6–59 months presenting to the Pediatrics Department of Holy Family Hospital, Rawalpindi, and to identify the demographic, socio-economic, maternal, and child-related factors associated with SAM. The aim was to address the existing knowledge gap by providing hospital-based data that could contribute to more effective public health interventions and policy formulation in this region.

MATERIAL AND METHODS

This cross-sectional observational study was conducted to determine the prevalence and determinants of severe acute malnutrition among children aged 6–59 months presenting with malnutrition to the Pediatrics Department of Holy Family Hospital, Rawalpindi. The rationale for employing a cross-sectional design was to capture a snapshot of both the burden of severe acute malnutrition and associated risk factors in this patient population over a defined period, allowing for estimation of prevalence and exploration of potential associations without the constraints of longitudinal follow-up. The study took place in the Pediatric outpatient and inpatient services of Holy Family Hospital, a tertiary-care public teaching hospital in Rawalpindi, Pakistan, over a period of six months from Oct 6 2024 to April 5 2025 Participants included all children aged 6 to 59 months presenting with clinical features of malnutrition during the study period. Children were eligible if they belonged to either gender, were between the specified age range, and had parental or guardian consent for participation. Exclusion criteria comprised children with malnutrition secondary to known systemic illnesses, including congenital heart disease, metabolic disorders, cleft lip and palate, inflammatory bowel disease, celiac disease, cystic fibrosis, cerebral palsy, hemolytic anemia, renal failure, endocrine disorders, and tuberculosis.

Additionally, children with birth weight below 2.5 kg, including both preterm infants and those with intrauterine growth restriction, as well as children younger than 6 months or older than 59 months, were excluded. Participants were selected through a non-probability consecutive sampling technique, whereby all eligible children presenting during the data collection window were recruited until the predetermined sample size was reached.

Following initial clinical evaluation by the attending pediatrician, recruitment was carried out by the principal investigator, who provided parents or guardians with detailed information about the study's purpose, procedures, and potential risks and benefits. Written informed consent was obtained from all parents or legal guardians prior to enrollment. Data were collected prospectively at the point of care, using a structured, self-designed proforma developed specifically for the study to capture relevant demographic, clinical, anthropometric, and socioeconomic variables.

Anthropometric measurements were performed by the principal investigator following standardized World Health Organization (WHO) protocols to ensure accuracy and reproducibility. Weight was measured using the RGZ20 digital weighing scale, with children lightly clothed and without shoes, recorded to the nearest 0.1 kg. For children older than two years, standing height was measured using a calibrated stadiometer to the nearest 0.1 cm, while recumbent length for children under two years was measured using an infantometer. Mid-upper arm circumference (MUAC) was assessed using a non-stretchable measuring tape placed at the midpoint between the acromion and olecranon on the left arm. Occipitofrontal circumference (OFC) was also measured to assess head growth parameters. Growth indicators were analyzed using WHO Anthro software, which calculated Z-scores for weight-for-height, height-for-age, and weight-for-age according to WHO child growth standards.

Key variables measured in the study included child's age, sex, weight, height or length, MUAC, OFC, family size, birth weight, birth order, and distance to the nearest health facility. Categorical variables comprised gender, maternal education level, maternal health status based on BMI classification, history of exclusive breastfeeding, vaccination status, socioeconomic status, and presence of recent illnesses such as diarrhea or pneumonia. Severe acute malnutrition was operationally defined according to WHO criteria as weight-for-height Z-score below −3 standard deviations or the presence of nutritional edema (3). Socioeconomic status was determined based on monthly household income as reported by parents, classified into lower or higher income groups. Maternal health was assessed through BMI measurements and categorized as underweight, normal, overweight, or obese per WHO standards. Exclusive breastfeeding was defined as feeding the infant only breast milk without any other liquids or solids for the first six months

of life. Vaccination status was documented based on Expanded Program on Immunization (EPI) cards, categorized as fully vaccinated, partially vaccinated, or unimmunized.

To address potential biases and confounding factors, the study ensured uniformity in measurement techniques by training the principal investigator in standardized anthropometric assessments. Data collection instruments were pre-tested on a subset of patients not included in the final analysis to ensure clarity and consistency of the proforma. Stratification was performed during analysis for potential confounders, including age, gender, socioeconomic status, maternal health, and breastfeeding practices, to identify independent associations with severe acute malnutrition.

The sample size was calculated based on the anticipated prevalence of severe acute malnutrition reported as 47.6% in a prior regional study (6), employing the formula for estimating a single proportion with a confidence level of 95% and a precision of 6%. Using the equation $n = Z^2 \times p \times (1 - p) / d^2$, where $Z = 1.96$, $p = 0.476$, and $d = 0.06$, the calculated sample size was 270 participants, which was achieved during the study period.

Data entry and analysis were performed using IBM SPSS Statistics version 25. Quantitative variables such as age, weight, height, MUAC, OFC, family size, birth weight, birth order, and distance to health facility were described using means and standard deviations. Categorical variables were summarized as frequencies and percentages. To evaluate associations between severe acute malnutrition and categorical independent variables, chi-square tests were used, with a significance threshold set at $p < 0.05$. Data were stratified by key demographic and clinical variables to assess potential effect modification or confounding. No imputation was performed for missing data, as completeness was ensured during data collection through real-time review of proformas. All analyses were conducted with the intention of maintaining reproducibility, and data integrity was upheld through double-checking data entry and cross-validation of critical variables against source documents.

Ethical approval for the study was obtained from the College of Physicians and Surgeons Pakistan's Institutional Review Board. Confidentiality of participants' data was maintained throughout the research process, with all records anonymized and stored in secure, password-protected digital files accessible only to the research team. Written informed consent was secured from all parents or guardians prior to enrollment, ensuring adherence to ethical standards for research involving human participants.

RESULTS

The study enrolled a total of 270 children aged between 6 and 59 months, with a mean age of 24.84 ± 15.05 months. The average weight of participants was 9.77 ± 3.04 kg, and their mean height was 78.31 ± 14.12 cm. Mid-upper arm circumference averaged 12.44 ± 2.10 cm, while the mean occipitofrontal circumference was 41.48 ± 7.01 cm. Families of the enrolled children had an average size of 5.85 ± 1.73 members, with the mean birth weight of the children recorded at 3.40 ± 0.39 kg. The average birth order was 2.36 ± 1.03, and the mean distance from the family's residence to the nearest health facility was 4.17 ± 1.51 kilometers (Table 1).

Among the study population, 141 children (52.2%) were male and 129 (47.8%) were female. In terms of age distribution, 105 children (38.9%) were aged 6–12 months, 107 children (39.6%) were aged 13–35 months, and 58 children (21.5%) were older than 35 months. Regarding maternal education, 90 mothers (33.3%) were illiterate, 80 (29.6%) had primary-level education, 85 (31.5%) had secondary education, and 15 (5.6%) had attained higher education. Analysis of maternal health status based on body mass index revealed that 54 mothers (20.0%) were underweight, 157 (58.1%) had normal weight, 47 (17.4%) were overweight, and 12 (4.4%) were obese. Exclusive breastfeeding was reported for 144 children (53.3%), whereas 126 children (46.7%) were not exclusively breastfed. Regarding immunization, 50 children (18.5%) were fully vaccinated, 144 (42.2%) were partially vaccinated, and 106 (39.3%) were unimmunized. Socioeconomic status was classified as lower in 124 children (45.9%) and higher in 146 children (54.1%). Only 19 children (7.0%) had a recent history of diarrhea, and 16 children (5.9%) had experienced pneumonia. Severe acute malnutrition was observed in 117 children, representing 43.3% of the total sample, while the remaining 153 children (56.7%) did not meet criteria for severe malnutrition (Table 2).

When assessing the relationship between severe acute malnutrition and gender, 47.0% of males (55 of 117) were affected compared to 53.0% of females (62 of 117), though this difference was not statistically significant ($p = 0.13$; OR 0.69; 95% CI 0.43–1.12). Age-wise, the highest proportion of SAM cases occurred in the 13–35 months age group, accounting for 45.3% (53 of 117) of cases, followed by the 6–12 months group at 36.8% (43 of 117), and those older than 35 months at 17.9% (21 of 117). However, age group differences were not significant ($p = 0.21$), and the odds of SAM were slightly higher in children aged 13–35 months compared to those over 35 months (OR 1.27; 95% CI 0.72–2.24) (Table 3).

Analysis of socioeconomic status showed that SAM prevalence was nearly evenly split between lower and higher income groups, with 49.6% of affected children (58 of 117) from lower-income households and 50.4% (59 of 117) from higher-income households, yielding a non-significant association ($p = 0.29$; OR 1.29; 95% CI 0.80–2.08). Regarding maternal health, SAM was more common among children of mothers with normal weight (60.7%; 71 of 117), followed by children of underweight mothers (18.8%; 22 of 117), overweight mothers (17.9%; 21 of 117), and obese mothers (2.6%; 3 of 117), but maternal BMI categories did not show significant associations with SAM ($p = 0.56$). Children who were exclusively breastfed exhibited a higher proportion of SAM at 58.1% (68 of 117) compared to 41.9% (49 of 117) among those who were not exclusively breastfed, though this association was not statistically significant ($p = 0.16$; OR 1.40; 95% CI 0.85–2.28).

Table 1. Descriptive Statistics for Quantitative Variables (n = 270)

Variable	Mean ± SD	Minimum	Maximum
Age (months)	24.84 ± 15.05	6	59
Weight (kg)	9.77 ± 3.04	4.1	19.3
Height (cm)	78.31 ± 14.12	52	109
Mid-upper arm circumference (MUAC, cm)	12.44 ± 2.10	7.0	18.0
Occipitofrontal circumference (OFC, cm)	41.48 ± 7.01	27	54
Family size (persons)	5.85 ± 1.73	2	12
Birth weight (kg)	3.40 ± 0.39	2.5	4.8
Birth order	2.36 ± 1.03	1	6
Distance to health facility (km)	4.17 ± 1.51	1	8

Table 2. Distribution of Participants by Demographic and Clinical Characteristics (n = 270)

Characteristic	n (%)
Gender	
Male	141 (52.2)
Female	129 (47.8)
Age Group	
6–12 months	105 (38.9)
13–35 months	107 (39.6)
>35 months	58 (21.5)
Maternal Education	
Illiterate	90 (33.3)
Primary	80 (29.6)
Secondary	85 (31.5)
Higher	15 (5.6)
Maternal Health (BMI)	
Underweight	54 (20.0)
Normal	157 (58.1)
Overweight	47 (17.4)
Obese	12 (4.4)
Exclusive Breastfeeding	
Yes	144 (53.3)
No	126 (46.7)
Vaccination Status	
Fully vaccinated	50 (18.5)
Partially vaccinated	144 (42.2)
Unimmunized	106 (39.3)
Socioeconomic Status	
Lower	124 (45.9)
Higher	146 (54.1)
Diarrhea History	
Yes	19 (7.0)
No	251 (93.0)
Pneumonia History	
Yes	16 (5.9)
No	254 (94.1)
Severe Acute Malnutrition	
Yes	117 (43.3)
No	153 (56.7)

Overall, none of the investigated factors, including gender, age group, socioeconomic status, maternal BMI, or exclusive breastfeeding practices, demonstrated a statistically significant relationship with severe acute malnutrition, as all corresponding p-values exceeded the threshold of 0.05. Despite the lack of significant associations, trends observed in this cohort suggest complex interactions between demographic, maternal, and socioeconomic variables influencing nutritional outcomes. Furthermore, figure 1 showed that across the three age strata, the mean weight-for-height Z-score improved incrementally from −2.8 in the 6–12 month group to −2.4 in children older than 35 months, with each group's 95% confidence interval remaining below the clinical threshold for severe acute malnutrition (WHZ < −3.0). Despite this modest upward trend, the highest prevalence of severe acute malnutrition was observed in the 13–35 month group at 45.3%, compared to 36.8% in 6–12 months and 17.9% in those older than 35 months.

Table 3. Association Between Severe Acute Malnutrition and Participant Characteristics (n = 270)

Male	Severe Acute Malnutrition n (%)	No Severe Acute Malnutrition n (%)	Odds Ratio	95% CI	p-value
Gender					
	55 (47.0)	86 (56.2)	0.69	0.43 – 1.12	0.13
Female	62 (53.0)	67 (43.8)	Ref	–	–
Age Group					
6–12 months	43 (36.8)	62 (40.5)	0.73	0.41 – 1.29	0.21
13–35 months	53 (45.3)	54 (35.3)	1.27	0.72 – 2.24	–
>35 months	21 (17.9)	37 (24.2)	Ref	–	–
Socioeconomic Status					
Lower	58 (49.6)	66 (43.1)	1.29	0.80 – 2.08	0.29
Higher	59 (50.4)	87 (56.9)	Ref	–	–
Maternal Health (BMI)					
Underweight	22 (18.8)	32 (20.9)	0.92	0.49 – 1.74	0.56
Normal	71 (60.7)	86 (56.2)	1.23	0.74 – 2.05	–
Overweight	21 (17.9)	26 (17.0)	1.07	0.53 – 2.17	–
Obese	3 (2.6)	9 (5.9)	Ref	–	–
Exclusive Breastfeeding					
Yes	68 (58.1)	76 (49.7)	1.40	0.85 – 2.28	0.16
No	49 (41.9)	77 (50.3)	Ref	–	–

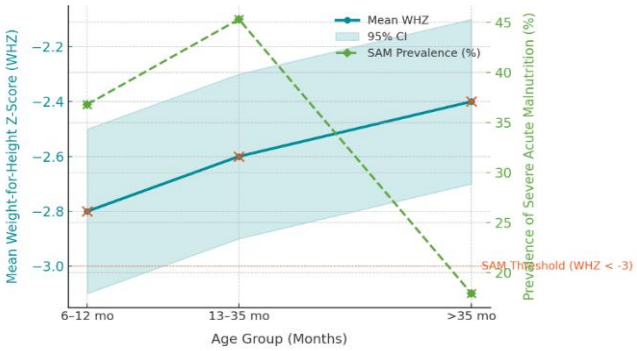

Figure 1 Distribution of Weight-for-Height Z-Scores and SAMDiscussion

DISCUSSION

The present study explored the prevalence and determinants of severe acute malnutrition among children aged 6–59 months attending the Pediatrics Department at Holy Family Hospital, Rawalpindi, revealing a substantial prevalence rate of 43.3%. This finding underscores that nearly half of the children evaluated were afflicted with SAM, emphasizing that despite progress in public health programs and clinical care in Pakistan, malnutrition remains a persistent public health crisis. The observed prevalence is consistent with previous studies from Pakistan and neighboring regions, where prevalence rates of severe acute malnutrition among hospitalized children have ranged between 30% and 50%, highlighting the endemic nature of this problem in South Asia (5, 6). Studies from rural Sindh, for instance, reported a prevalence of SAM as high as 48% in hospitalized children, closely aligning with the figures observed in this study and reflecting shared socio-economic challenges, cultural practices, and healthcare access barriers across diverse regions of Pakistan (6).

Interestingly, none of the demographic or clinical factors examined in this cohort showed statistically significant associations with the presence of SAM, a finding that may reflect the multifactorial etiology of malnutrition in this setting. While previous literature has consistently highlighted factors such as low maternal education, poor maternal nutritional status, lower socioeconomic standing, and inadequate infant feeding practices as significant predictors of child malnutrition, the absence of significant associations in the current study warrants careful interpretation (7-9). It is plausible that the high burden of SAM cuts across different demographic and socio-economic strata in this hospital-based sample, diluting the strength of associations and suggesting that malnutrition may not be confined solely to traditionally recognized high-risk groups. The lack of significant associations in this study may also be partly attributable to sample size limitations or to the possibility that other unmeasured factors, such as micronutrient deficiencies, household food security, or environmental exposures, exert significant influence but were not captured in this analysis.

Despite the absence of significant statistical associations, certain trends observed in the data are noteworthy and resonate with existing research. A higher proportion of SAM was recorded among children aged 13–35 months, a period characterized by weaning, increased vulnerability to infections, and shifting dietary patterns, all of which can precipitate nutritional deficits if complementary

feeding practices are inadequate or inappropriate (10, 11). Although the association between exclusive breastfeeding and SAM was not statistically significant, it is striking that a higher proportion of exclusively breastfed children in this study suffered from SAM. This counterintuitive observation may reflect misclassification, where exclusive breastfeeding was continued beyond six months without adequate complementary feeding, inadvertently contributing to nutritional inadequacies—a phenomenon reported in other studies from South Asia, where cultural practices sometimes delay timely introduction of complementary foods (14). Such findings emphasize the critical need not only to promote exclusive breastfeeding in the first six months but also to ensure timely and nutritionally sufficient complementary feeding thereafter to prevent malnutrition (12, 14). The near-equal distribution of SAM across lower and higher socioeconomic groups in this study suggests that malnutrition may transcend income barriers in certain contexts. While poverty remains a significant risk factor for malnutrition globally, rapid urbanization and evolving food practices in urban Pakistan may contribute to nutritional risks even among families with relatively higher incomes, potentially linked to factors such as consumption of calorie-dense but nutrient-poor diets, limited nutrition literacy, and disruptions in traditional food systems (9, 15). This finding supports the argument that interventions must be tailored not solely based on income levels but also consider behavioral, cultural, and knowledge-related determinants of child nutrition.

This study contributes valuable data to the regional understanding of malnutrition, with strengths including rigorous measurement of anthropometric indicators following WHO protocols, systematic data collection, and the use of standardized software for growth assessment. The relatively large sample size for a single-center hospital-based study adds robustness to prevalence estimates. However, certain limitations must be acknowledged. The use of a cross-sectional design precludes causal inference, and the hospital-based setting limits generalizability to the broader community, as the study likely captured a higher proportion of clinically symptomatic or severe cases than would be found in the general population. The reliance on parental recall for certain variables, such as exclusive breastfeeding and immunization status, introduces the possibility of recall bias. Additionally, factors like micronutrient deficiencies, household food security, environmental hygiene, and maternal mental health, which are known contributors to child malnutrition, were not assessed in this study and may confound the observed relationships. The absence of significant associations may reflect either a true lack of relationship or insufficient statistical power to detect modest effects, underscoring the need for further research.

Future studies should aim to expand upon these findings by incorporating community-based designs that capture asymptomatic malnutrition and explore a broader range of potential determinants, including dietary diversity, food security status, maternal mental health, and detailed infection histories. Longitudinal studies would be particularly valuable to clarify causal pathways and the temporal relationship between risk factors and the development of SAM. Moreover, qualitative research exploring parental knowledge, attitudes, and practices regarding infant and young child feeding could provide crucial insights for designing culturally appropriate and effective interventions. In clinical practice, these findings underscore the importance of universal screening for malnutrition in all pediatric encounters, regardless of socio-economic status or parental educational background, to ensure timely identification and management of SAM. In conclusion, while this study identified a high prevalence of severe acute malnutrition among children attending a tertiary care facility in Rawalpindi, it did not demonstrate significant associations between SAM and traditionally recognized demographic or maternal risk factors. These findings highlight the complex and multifaceted nature of malnutrition in this context and emphasize the need for integrated public health strategies focusing on maternal health, nutrition education, timely complementary feeding, and broader socio-economic interventions to effectively address this persistent public health challenge (16, 17).

CONCLUSION

This cross-sectional study conducted at the Pediatrics Department of Holy Family Hospital, Rawalpindi, revealed a high prevalence of severe acute malnutrition, affecting 43.3% of children aged 6–59 months presenting with malnutrition, yet none of the examined demographic, maternal, or socioeconomic factors demonstrated statistically significant associations with SAM, suggesting that malnutrition in this setting is a pervasive issue transcending traditional risk boundaries and underscoring the complex interplay of underlying determinants; these findings highlight the urgent need for universal screening, comprehensive public health strategies focusing on maternal health, timely and appropriate complementary feeding, and robust vaccination coverage to mitigate the burden of SAM, while also indicating the necessity for future community-based and longitudinal research to unravel nuanced risk factors and inform targeted interventions for improving child health outcomes.

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