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ORIGINAL ARTICLE

Epidemiology and outcomes of severe acute malnutrition (SAM) patients in Nutrition Stabilization Center (NSC) Gilgit, a retrospective study

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ABSTRACT

Background: Severe Acute Malnutrition (SAM) is a critical health issue in Pakistan, particularly in remote regions like Gilgit-Baltistan, due to remoteness, lack of health facility and awareness. Our primary objective is to assess the epidemiology and treatment outcomes of patients with Severe Acute Malnutrition (SAM) admitted to the Nutrition Stabilization Center (NSC) at the Provincial Headquarters Hospital, Gilgit. The study aims to identify key socio-demographic and underlying risk factors influencing the occurrence and progression of SAM in the region.

Methods: We examine 226 children's medical records who were admitted with severe acute malnutrition (SAM). Demographic information, anthropometric measurements (weight, Mid Upper Arm Circumference MUAC), health issues, treatment plans, and dietary management techniques were all included in the data., RUTF, ReSoMal, F-75, and F-100 were the therapeutic foods. Treatment results and the length of hospital stay were additional variables. Advanced statistical analyses were carried out using Statistix 8.1. Using age-group stratification, the anthropometric and clinical indicator values at admission and discharge were compared to evaluate nutritional recovery.

Results: Nearly half of the patients were from Gilgit (48.7%), with most referred via OPD (94.2%). Non-oedematous SAM was predominant (94.7%) and new admissions accounted for 95.1%. Common complications included acute gastroenteritis (53.1%), lower respiratory tract infections (22.1%) and sepsis (8.8%). All children received F-75, with variations in additional therapeutic interventions. Mean hospital stay was 8.04 ± 3.30 days, and the cure rate was 91.6%. Significant improvements in weight and MUAC were observed. Children aged 6–10 months showed the highest mean weight gain (0.51 kg), whereas those aged 26–30 months recorded the highest mean MUAC gain (+0.53 cm).

Conclusion: SAM management demonstrated positive outcomes, with over 91% recovery and significant anthropometric improvements. Younger children exhibited better weight recovery, while older children showed greater MUAC improvement.

Keywords: MUAC, Severe Acute Malnutrition, Treatment Outcomes, Weight Gain

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Introduction

Severe Acute Malnutrition (SAM) is the most life-threatening form of acute under-nutrition, predominantly affecting children aged 1 to 59 months. It is diagnosed using criteria such as a mid-upper arm circumference (MUAC) less than 11.5 cm, a weight-for-height z-score below

-3 SD based on WHO Growth Standards, or the presence of bilateral pitting oedema (1).

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SAM is further classified into two categories: complicated and uncomplicated. Children with complicated SAM (i.e., those with medical complications or poor appetite) require inpatient care, while uncomplicated cases can be managed at home with ready-to-use therapeutic food (RUTF) (2, 3). There are also two major clinical forms of SAM: Marasmus (severe wasting without oedema) and Kwashiorkor (nutritional oedema with or without wasting) (4). In cases of severe clinical symptoms, immediate referral to healthcare facilities is essential, as emphasized by WHO guidelines (5). As acute under-nutrition is characterized by rapid weight loss or a failure to gain weight due to recent food shortages or illnesses. It weakens the immune system, increases susceptibility to infections, and elevates mortality risk (6). Children with SAM are 11–12 times more likely to die compared to their well-nourished peers (7). Globally, between one to two million children die each year from SAM, with most of these deaths occurring in South Asia and Sub-Saharan Africa (8,9). According to the 2023 Joint Child Malnutrition Estimates by UNICEF, WHO, and the World Bank, approximately 148.1 million children under five are stunted, 45 million are wasted, 37 million are overweight, and 13.6 million suffer from severe wasting (10).

At the national level, the burden of undernutrition remains critical. The National Nutrition Survey 2018 revealed that 40.2% of Pakistani children were stunted, 19.6% severely stunted, and 17.7% wasted. In Gilgit-Baltistan, the situation appeared even more critical, with 46.6% of children under five stunted, 21.3% underweight, and 9.4% wasted [11]. Several underlying factors contribute to this crisis, including widespread poverty, limited maternal education, inadequate infant and young child feeding practices, food insecurity, and poor sanitation. In remote mountainous regions such as Gilgit-Baltistan, geographical barriers and limited access to health services further aggravate these issues.

To combat Severe Acute Malnutrition (SAM), the government has established Nutrition Stabilization Centers (NSCs) across Pakistan. These centers, working under the WHO 2013 guidelines, provide inpatient management of complicated cases of SAM. Standardized treatment protocols include therapeutic diets such as F-75 and F-100, along with ReSoMal and Ready-to-Use Therapeutic Food (RUTF). Beyond immediate medical care, the NSCs also emphasize follow-up support to reduce the risk of relapse and ensure sustained recovery (3).

National surveys give a broad overview of the nutrition situation, but they do not fully capture the realities of children living in remote mountain regions. Localized data from NSCs in areas like Gilgit-Baltistan remain limited, despite their importance for evidence-based decision-making. To fill this gap, the present study examines the demographic and clinical profile of SAM patients admitted to the NSC at Provincial Headquarters (PHQ) Hospital Gilgit. The findings aim to strengthen local program design, improve resource allocation, and contribute to reduce child malnutrition and improve health outcomes.

A retrospective, descriptive cross-sectional study was conducted to evaluate the nutritional and clinical profile of children's admitted to the Nutrition Stabilization Centre (NSC) Provincial Headquarter (PHQ) Hospital Gilgit. A total of 235 children aged 1 to 59 months diagnosed with SAM were initially screened. After reviewing the completeness of records, 226 cases were included in the final analysis, covering a 15-month period from January 2024 to March 2025.Children aged 1–59 months admitted with SAM were included, while cases with incomplete records were excluded.

Data was extracted from patient medical records, including demographic details (age, gender, socioeconomic status and district of residence), anthropometric indicators (weight and mid-upper arm circumference [MUAC]), medical complications, and therapeutic interventions. Information regarding nutritional management strategies, such as therapeutic feeds (F-75, F-100, ReSoMal and RUTF), was recorded. Additional variables included the duration of hospital stay and treatment outcomes at discharge. To assess age-specific trends, participants were divided into 7 age groups, each spanning 5 months except for group 7**.** This categorization allowed for detailed analysis of nutritional indicators, treatment response, and outcomes across early childhood developmental stages.

Data were entered and organized using Microsoft Excel, and statistical analyses were performed using Statistix 8.1. Statistical procedures were selected based on the type and nature of variables. Variables were classified as categorical and continuous. Categorical variables included sex, district of residence, clinical conditions (e.g., diarrhea, pneumonia), therapeutic interventions (RUTF, ReSoMal, F-75, F-100), and treatment outcomes (recovered, defaulted, referred, died). Continuous variables included age (months), weight (kg), MUAC (cm), and length of hospital stay (days). Descriptive statistics were used to summarize the data. Frequencies and percentages were calculated for categorical variables, while means, standard deviations, and ranges (minimum–maximum) were computed for continuous variables to describe central tendency and variability. To assess treatment effectiveness, anthropometric indicators (weight and MUAC) at admission and discharge were compared using paired sample analysis. A paired t-test was applied for normally distributed data, whereas the Wilcoxon signed-rank test was used when normality assumptions were not met. For subgroup analysis, children were stratified into age groups (6–12, 13–24, and 25–59 months). Differences in continuous outcomes (e.g., weight gain, MUAC improvement) were analysed using one-way ANOVA

Ethical approval for this study was obtained from the Head of the Pediatric Department at PHQ Hospital Gilgit. Permission was granted to access and analyze patient records for academic and research purposes. Since the study used existing hospital records, no direct consent from patients was required.

Results

A total of 226 children aged 1–59 months were enrolled in the study and treated for Severe Acute Malnutrition (SAM) through an inpatient management program at the Nutrition Stabilization Center (NSC), PHQ

Hospital Gilgit. Out of the 226 SAM patients, the highest proportion was in the age group 6–10 months (29.6%), followed by 1–5 months (23.5%) and 11–15 months (16.8%). Fewer children were aged 21–25 months (10.2%), 16–20 months (8.4%), and 31–59 months (8.8%), while the lowest proportion was in the 26–30 months group (2.7%) (Table 1).

Table 1: Characteristic of SAM children

Age Group (months)	Total number (%)
1--5	53(23.5)
6--10	67(29.6)
11--15	38(16.8)
16--20	19(8.40)
21--25	23(10.2)
26--30	6(2.7)
31--59	20(8.8)

Most of the patients were from rural areas and belonged to lower socioeconomical class. District-wise analysis revealed that most patients were from Gilgit (48.67%), followed by Diamer (27.88%) and Nagar (7.96%), with the least representation from Skardu (1.77%). The gender distribution was nearly equal, with 50.90% males and 49.10% females. Most children (94.20%) were referred from the Outpatient Department (OPD), while 2.20% from Outpatient Therapeutic Programs (OTP), and 2.70% from other sources. Regarding admission status, 95.10% were new cases, 4.40% were re-admissions, and only one case (0.44%) was a transfer-in. The majority of patients (94.70%) presented with non-edematous SAM. Edematous SAM was identified in 3.54% with grade 3+ edema, and 0.88% each with grade 1+ and 2+. The most frequently observed medical complications at admission were acute gastroenteritis (53.1%), lower respiratory tract infections (22.1%) and sepsis (8.8%). Among the total children, 91.60% were cured. Mortality was recorded at 2.70%, while 3.10% left against medical advice (LAMA) and 1.30% each were classified as either moved out or non-responders (Table 2).

Table 2. Baseline admission characteristics of children admitted to the NSC.

District	Frequency (n)	% age
Gilgit	110	48.67%
Diamer	63	27.88%
Nagar	18	7.96%
Astore	12	5.31%
Ghizer	11	4.87%
Kohistan	8	3.54%
Skardu	4	1.77%
Gender		
Male	115	50.90%
Female	111	49.10%
Referral Source		
OTP	5	2.20%
OPD	213	94.20%
Other	6	2.70%
Referred	2	0.90%
Admission Type		
New Admission	215	95.10%
Re-admission	10	4.40%
Transfer In	1	0.40%
Relapse	0	0
Edema Grade		
0 (No edema)	214	94.70%
1+	2	0.88%
2+	2	0.88%
3+	8	3.54%
Common Complications		
Acute Gastroenteritis	120	53.1%
Lower Respiratory Tract Infections (LRTI)	50	22.1%
Sepsis	20	8.8%

The mean duration of hospitalization varied considerably across outcome groups. Children who were successfully cured had an average stay of 8.04 ± 3.30 days, reflecting the standard treatment and nutritional stabilization period required for recovery. In contrast, children who unfortunately expired remained admitted for a longer duration, with a mean stay of 11.83 ± 9.45 days, indicating chronic illness and complications before mortality. Conversely, children who left against medical advice (LAMA) had a markedly shorter stay, averaging only 2.43 ± 0.98 days, suggesting premature discontinuation of treatment before stabilization could be achieved (Table 3).

Table 3: Treatment Outcomes of the Outpatient Therapeutic Feeding Program and average length of stay

Outcome	N	% age	Mean Length of stay	SD	Minimum days	Maximum days
Cured	207	91.60%	8.0435	3.3009	3.0000	27.000
Expired	6	2.70%	11.833	9.4534	3.0000	24.0000
LAMA (Left Against Medical Advice)	7	3.10%	2.4286	0.9758	1.0000	4.0000
Moved Out	3	1.30%	5.3333	2.0817	3.0000	7.0000
Non-responder	3	1.30%	18.000	6.2450	13.0000	25.0000

All admitted children were initiated on F-75 therapeutic milk as the standard first-line nutritional therapy. Subsequently, 68.1% received F-100, and 74.8% were administered ReSoMal for rehydration. In addition, 70.4% were provided with Ready-to-Use Therapeutic Food (RUTF**)** during their recovery phase. Antibiotics were widely prescribed, with the majority of children receiving combination therapy. The most frequently used antibiotics were injectable Ampicillin and Gentamycin, while Cefotaxime, Grasil, Tanzo, Meropenem, and Vancomycin were administered in cases of severe clinical complications.

Analysis of mean weight and MUAC across age groups using LSD pairwise comparison revealed significant differences at both admission and discharge.

The highest admission weight was observed in Group 7 (31–59 months) (9.16 ±1.32), followed by Group 6 (26–30 months) (8.27 ± 1.33) and Group 5 (21–25 months) (7.63 ± 1.16). The lowest mean admission weight was recorded in Group 1 (1–5 months) (3.35 ± 0.93). At discharge, the same trend was noted, with Group 7 showing the highest mean weight (9.65 ±1.36) and Group 1 the lowest (3.84 ± 1.07). Regarding weight gain, the highest mean improvement was recorded in Group 2 (6–10 months) (0.5075 kg), followed closely by Group 1 (0.4905 kg) and Group 6 (0.4394 kg). Moderate gains were noted in Groups 3, 4, and 5, while Group 7 demonstrated a relatively smaller increase (0.4902 kg) despite having the highest baseline and discharge weights (Table 4).

Table 4: Age-wise Comparison of Mean Weight at Admission, Discharge, and Weight Gain among SAM Children at NSC Gilgit

Age Group (months)	n (%)	Mean weight at admission(kg)+SD	Mean weight at discharge(kg) +SD	Mean weight gain at discharge(kg)
1--5	53 (23.5)	3.35 ± 0.93 F	3.84± 1.07 F	0.49
6--10	67 (29.6)	4.67±1.01 E	5.18 ±1.25 E	0.51
11--15	38 (16.8)	6.52 ± 1.14 D	6.92± 1.19 D	0.40
16--20	19 (8.40)	7.10 ±1.42 CD	7.57±1.52 CD	0.47
21--25	23 (10.2)	7.63 ± 1.16 BC	8.12±1.18 BC	0.49
26--30	6 (2.7)	8.27± 1.33 AB	8.71±1.65 AB	0.44
31--59	20 (8.8)	9.16 ±1.32 AB	9.65 ±1.36 A	0.49

Mid-upper arm circumference (MUAC) was assessed only in children older than six months, in accordance with WHO recommendations. Comparative analysis demonstrated statistically significant differences in MUAC values across age groups, particularly between Group 2 (6–10 months) and the older children. At admission, the lowest mean MUAC was observed in Group 2 (6–10 months) (10.17±0.85). In contrast, the highest admission MUAC was recorded in Group 4 (16–20 months) (10.86±0.71), followed closely by Group 5 (21–25 months) (10.78±0.79). At discharge, the nutritional recovery pattern varied across age categories. _In terms of MUAC improvement, the most substantial gain was observed in Group 6 (+0.53 cm), indicating better responsiveness to nutritional therapy._This was followed by Group 5 (21-25months) (+0.40 cm) and Group 3 (11–15 months) (+0.32 cm). Moderate improvements were noted in Groups 4 (16–20 months) (+0.24cm) and 7 (31–59 months) (+0.23cm), while the smallest gain was recorded in Group 2 (+0.28 cm) (Table 5). After discharge, 77.4% of SAM patients were referred to Outpatient Therapeutic Programs (OTP), 20.8% were referred to Outpatient Departments (OPD) for follow-up, while 1.8% were either expired, referred to tertiary care centers or moved out.

Table 5: Nutritional Progress by Age Group: MUAC at Admission, Discharge, and Gain in SAM Children

Age Group (months)	n (%)	Mean MUAC at admission (cm) +SD	Mean MUAC at discharge (cm)+SD	Mean MUAC gain at discharge(cm)
6--10	67(29.6)	10.17 ±0.85 B	10.45±2.10 B	0.28
11--15	38(16.8)	10.74 ±0.95 A	11.06±0.98 A	0.32
16--20	19(8.40)	10.86±0.71 A	11.09±2.63 A	0.24
21--25	23(10.2)	10.78±0.79 A	11.17±2.39 A	0.40
26--30	6(2.7)	10.81±0.52 A	11.34±0.68 A	0.53
31 – 59	20(8.8)	10.81±1.0 A	11.04±2.54 A	0.23

Discussion

The findings provide valuable insights into demographic distribution, clinical characteristics, and recovery patterns specific to this regional context. In our study, about 65% of admitted children fell within the 6–24 months age group, identifying this as the most affected period for severe acute malnutrition (SAM) (12). Additionally, 23.45% were below 6 months, while 11.50% were aged 25–59 months. These findings align with previous research by Najar et al., who reported 60.38% of children in the same age range (6–24 months) (13). Similarly, Kumar et al. found 59.6% of cases between 6–12 months (14), and Choudhary et al. observed that 96% and 71% of cases occurred in children under two years (15). The first two years of life involve rapid growth and increased nutritional demands, which, combined with inadequate feeding practices and recurrent infections, raise the risk of malnutrition. The gender distribution among the enrolled children was nearly equal, with a slight male predominance (50.90%). This is consistent with several studies conducted in India, Pakistan, and other low-resource settings, where no strong gender bias is typically observed in SAM prevalence (16, 12, 17, 11). Most of the patients were from rural areas and belonged to lower socioeconomical class (18,19,20).

Rural children are particularly vulnerable to malnutrition due to poverty, low maternal education, inadequate nutrition, lack of proper prenatal and neonatal care, limited health-promoting practices, and insufficient complementary feeding (13). District-wise distribution showed that nearly half of the admissions were from Gilgit. This is expected, as the Nutrition Stabilization Center (NSC), where this study was conducted, is located in Gilgit, making it more accessible for families residing nearby. In addition, many families from surrounding districts migrate or temporarily settle in Gilgit in search of better healthcare and livelihood opportunities, which may further increase the number of cases reported here. It is important to note that this dataset represents records from a single NSC (Gilgit) and does not capture the caseload from the other four NSCs established in districts Ghizer, Skardu, Ghanche, and Diamer. Therefore, these findings should not be generalized to the overall burden of severe acute malnutrition (SAM) across Gilgit-Baltistan. In terms of malnutrition type, non-edematous SAM predominated (94.70%), which is consistent with previous studies in Pakistan (1), Nigeria (21), and South Africa (22), where marasmus is more prevalent than kwashiorkor. The low percentage of edematous cases may also reflect improved screening practices, whereby cases are identified before severe edema develops. In this study, acute gastroenteritis was identified as the most common infectious co-morbidity among children admitted with SAM, followed by acute respiratory tract infections and sepsis. Similar findings have been reported in other studies (19,13,23). The treatment outcomes in this study were highly encouraging, with a cure rate of 91.6%, surpassing the international Sphere standards, which recommend a recovery rate of >75% (24). The death rate (2.7%) and defaulter rate (3.1%) were within acceptable thresholds, indicating effective clinical and nutritional management. Similar findings were reported in a study from Ethiopia, where early intervention and proper case management were associated with reduced mortality (25). Length of stay varied significantly by outcome, with cured patients averaging 8.04 days, whereas deceased children had a longer stay (11.83 days), possibly reflecting more severe presentations or late-stage complications. Our average length of stay was slightly higher than that reported in a study from Nigeria, where the mean duration was 7.42 days (26). Compared to studies from Ethiopia (27, 28), India (16), and South Africa (29), our findings indicate a relatively shorter duration of hospital stay for SAM patients. This could be attributed to the function of inpatient centers as stabilization units, where the stabilization phase typically lasts seven days. However, the duration may vary depending on the severity of the patient's complications (30). In areas where OTP centers are located near the children's homes, the rehabilitation phase can be continued at these centers. In contrast, in the absence of nearby OTP centers, children may remain in the Stabilization Center (SC) to complete rehabilitation using F-100, an energy-dense therapeutic milk. Longer hospital stays reported in other studies may be due to the unavailability of OTP services. However, it is important to note that prolonged stays in NSCs may increase the risk of nosocomial infections and delay the admission of new SAM cases due to limited bed availability (26). The use of therapeutic foods followed international protocols, with all children receiving F-75 and most transitioning to F-100 or RUTF, as per clinical readiness. The administration of ReSoMal, alongside broad-spectrum antibiotics such as Ampicillin and Gentamycin, aligns with WHO recommendations for inpatient SAM treatment (WHO, 2013). The inclusion of second-line antibiotics like Meropenem and Vancomycin suggests that some children presented with severe infections, possibly nosocomial or antibiotic-resistant in nature. The greatest weight gain was observed in infants aged 6–10 months, indicating strong catch-up growth in early infancy. In contrast, older children (31–59 months) showed the least weight gain despite having higher absolute body weights. Unlike the study by Rahud et al., which analyzed males and females separately and reported some variation between the two groups, the present research combined both genders for overall assessment. Despite this methodological difference, the general pattern remains consistent across studies: younger children demonstrated greater weight gain during treatment, whereas older children showed comparatively lower improvements (31). This may indicate that age plays a more decisive role in catch-up growth than gender when evaluating nutritional rehabilitation outcomes. MUAC improvement was highest in children aged 26–30 months, while the lowest MUAC gain was seen in the 6–10 months group, possibly due to age-related anatomical differences.

This study provides vital insights into the clinical and nutritional management of SAM in Gilgit-Baltistan and supports the effectiveness of current inpatient protocols. However, the findings also underscore the need for improved community referral mechanisms, timely presentation, and tailored post-discharge follow-up, particularly for older children with lower weight gain trajectories.

Conclusion

The study demonstrates that facility-based inpatient care at the Nutrition Stabilization Center (NSC) in Gilgit is highly effective in managing Severe Acute Malnutrition (SAM), as reflected by the high recovery rate and measurable improvements in weight and MUAC among admitted children. Variations in treatment response across age groups indicate the need for age-specific nutritional and clinical management strategies.

Limitations:

This study was limited to a single Nutrition Stabilization Center (NSC) in Gilgit, which may not reflect the full picture of severe acute malnutrition (SAM) across Gilgit-Baltistan. Additionally, due to the absence of recent national or regional surveys since 2018, it was not possible to compare findings with updated provincial-level data.

Recommendations: There is a need to expand research and routine monitoring across all districts of Gilgit-Baltistan to generate regionally representative data. Strengthening community-based screening, early referral systems, and integrating age-tailored treatment protocols can further improve outcomes. Additionally, incorporating post-discharge follow-up mechanisms is essential to assess relapse and ensure sustained recovery among SAM-affected children

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All the authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed.