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Article

Feeding Practices in Children with Severe Acute Malnutrition Presenting to MTI-Lady Reading Hospital, Peshawar

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ABSTRACT

Background: Severe acute malnutrition (SAM) in infancy is a leading cause of morbidity and mortality in low-resource settings. Inappropriate feeding practices, including early cessation of breastfeeding and reliance on unsafe alternatives, are significant contributors to SAM, yet patterns and determinants of feeding behaviors vary across regions and populations. Understanding these practices within their sociodemographic context is essential for effective intervention design. **Objective**: To determine the frequency and patterns of infant feeding practices and their association with sociodemographic factors among children aged 1–12 months diagnosed with severe acute malnutrition at MTI–Lady Reading Hospital, Peshawar. **Methods**: A cross-sectional study was conducted from September 2024 to March 2025 among 159 infants meeting WHO criteria for SAM. Data on feeding practices (breastfeeding, bottle feeding, top feeds) and maternal sociodemographic variables were collected using structured interviews and clinical assessments. Associations were analyzed using chi-square tests and logistic regression to calculate odds ratios with 95% confidence intervals. **Results**: Breastfeeding was reported in 59.7% of infants, while 28.3% received bottle feeds and 27.7% received top feeds. Breastfeeding was significantly more common in rural, lower socioeconomic groups and among unemployed or illiterate mothers. Bottle and top feeding were significantly associated with increased prevalence of SAM indicators ($p<0.01$), with odds ratios of 1.71 and 2.85, respectively, compared to breastfed infants. **Conclusion**: Feeding practices in infants with SAM are strongly influenced by maternal education, employment, and residence. The transition away from breastfeeding, particularly in urban and literate populations, is associated with increased risk of SAM, highlighting the need for targeted support and education during weaning.

Keywords: Severe Acute Malnutrition, Infant Feeding Practices, Breastfeeding, Bottle Feeding, Top Feeds, Sociodemographic Factors, Pakistan

INTRODUCTION

Severe Acute Malnutrition (SAM) continues to pose a critical public health challenge, particularly in low- and middle-income countries, where it contributes significantly to child morbidity and mortality. Malnutrition results not only from inadequate caloric intake but also from poor dietary quality and feeding practices during infancy and early childhood (1). Among children under five, those aged below one year are particularly vulnerable due to their high nutrient demands and dependence on caregivers for appropriate feeding. In this context, early-life nutrition, especially feeding practices in the first year, becomes a pivotal determinant of growth and health trajectories (2). Inappropriate feeding behaviors—such as early introduction of low-nutrient-density foods, untimely cessation of breastfeeding, and reliance on unhygienically prepared bottle feeds—have been widely implicated in the pathogenesis of SAM (3,4). Despite global recommendations advocating exclusive breastfeeding for the first six months followed by timely, safe, and nutritionally adequate complementary feeding, these practices remain suboptimal in many communities (5,6).

Breast milk, with its immunological and nutritional superiority, has been shown to offer protection against common infectious diseases that exacerbate malnutrition and is associated with improved survival in infancy (7). However, despite its benefits, breastfeeding is often discontinued prematurely, especially in urban settings where women may encounter competing work-related or sociocultural pressures (8). Several studies have identified maternal education, occupation, and socioeconomic background as influential determinants of feeding behavior (9,10). For instance, mothers with higher educational attainment or employment status

may have increased exposure to alternative feeding options, leading to earlier adoption of bottle feeding and top feeds, particularly in urban settings (11). While these shifts in feeding behaviors are often associated with greater access to healthcare information and resources, the quality, timing, and hygiene of these feeding practices remain variable, especially in resource-constrained settings (12). Consequently, even among educated mothers, inappropriate implementation of non-breastfeeding practices may still predispose children to nutritional deficiencies and infections.

Although national and international data describe general feeding trends, there exists a limited understanding of how specific feeding practices—breastfeeding, bottle feeding, and top feeds—interact with sociodemographic determinants to influence the onset and severity of SAM in local hospital populations. In the Pakistani context, where cultural norms and socioeconomic disparities are deeply rooted, feeding behaviors are diverse and shaped by regional variations. Prior research has mostly focused on general undernutrition or stunting, with fewer studies exploring the micro-level patterns of infant feeding specifically in relation to SAM and its clinical manifestations such as edema or wasting (13,14). Moreover, there is a notable scarcity of hospital-based data from high-burden tertiary care settings such as Lady Reading Hospital-MTI, Peshawar, which receives a large influx of severely malnourished children from both rural and urban catchment areas of Khyber Pakhtunkhwa.

This study aims to address this critical knowledge gap by systematically evaluating the frequency and types of feeding practices in infants aged 1 to 12 months diagnosed with SAM, while exploring the influence of maternal education, employment, socioeconomic status, and urban-rural residence. By linking these factors to nutritional outcomes, this research seeks to generate actionable insights into the determinants of SAM that can inform targeted interventions. Specifically, we aim to determine the association between feeding practices and severe acute malnutrition in infants presenting to the Pediatric Department of Lady Reading Hospital-MTI, Peshawar, with the hypothesis that non-breastfeeding practices, especially bottle and top feeding, are associated with higher prevalence of malnutrition indicators in this population

MATERIAL AND METHODS

This study employed a cross-sectional observational design to investigate the feeding practices associated with severe acute malnutrition (SAM) among infants aged 1 to 12 months. The rationale for choosing this design was to capture a representative snapshot of feeding behaviors and their sociodemographic determinants among hospitalized SAM cases at a single point in time. The study was conducted at the Department of Pediatrics, Lady Reading Hospital-Medical Teaching Institution (MTI), Peshawar, which is a high-volume tertiary care center serving both urban and rural populations across Khyber Pakhtunkhwa, Pakistan. Data collection spanned a six-month period from 15th September 2024 to 15th March 2025.

Participants were eligible for inclusion if they were aged between 1 to 12 months and met the World Health Organization (WHO) diagnostic criteria for SAM, defined as either a weight-for-height z-score (WHZ) less than –3 standard deviations or the presence of bilateral pitting edema. Infants were excluded if they had known chronic systemic illnesses such as congenital heart disease, chronic kidney disease, cystic fibrosis, or metabolic disorders; those with congenital anomalies affecting feeding (e.g., cleft lip/palate), confirmed malabsorption syndromes, or any other conditions likely to independently influence nutritional status were also excluded. Children were selected through consecutive non-probability sampling as they presented to the pediatric ward during the study period and met the eligibility criteria.

Recruitment was carried out by trained pediatric residents under the supervision of a consultant pediatrician. Informed written consent was obtained from the caregivers of all eligible participants after a detailed explanation of the study objectives, procedures, and assurances of confidentiality. No coercion was involved, and participants were informed of their right to withdraw at any time. Data were collected using a structured, pre-designed proforma developed in accordance with established child nutrition survey instruments and validated through expert review. Each child underwent anthropometric assessment, including weight measurement using a calibrated digital infant scale to the nearest 100 grams and length measurement using a recumbent length board. Bilateral pitting edema was assessed through physical examination by the attending physician.

The proforma captured demographic variables such as age, sex, area of residence (urban or rural), maternal education (literate or illiterate), maternal employment status (employed or unemployed), and family socioeconomic status (categorized as lower, middle, or upper class based on monthly income and household assets). Feeding practices were recorded as breastfeeding (exclusive or partial), bottle feeding (use of formula or expressed breast milk delivered via bottle), and top feeds (defined broadly as any non-breastmilk dietary additions, including semisolid or solid foods such as cereals, fruits, or vegetables). These categories were not mutually exclusive and were recorded in combination if applicable. For infants under six months, breastfeeding was categorized as exclusive if no other liquids or solids were introduced. For older infants, complementary feeding was assessed based on maternal reporting of timing, type, and consistency of top feeds.

To minimize recall bias, caregivers were interviewed using a guided questionnaire within 24 hours of admission. Where discrepancies arose in responses, follow-up verification with the mother and clinical observation of current feeding practices were undertaken. Confounding variables such as maternal literacy, employment, and socioeconomic status were recorded and later adjusted for during stratified analyses. Standardized protocols were followed for anthropometric assessments to ensure measurement reliability. All data

collection and examination procedures were performed by trained personnel and verified by senior consultants with a minimum of five years of post-fellowship experience.

The sample size was calculated using the WHO sample size calculator based on an estimated 28% prevalence of top feeding among malnourished infants, with a 7% absolute precision and 95% confidence interval. This yielded a minimum required sample size of 159 participants. Data were entered into IBM SPSS Statistics version 25.0 for analysis. Continuous variables such as age and weight were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages. The Shapiro-Wilk test was used to assess normality of numerical data. To identify associations between feeding practices and sociodemographic variables, chi-square tests or Fisher's exact tests were applied as appropriate. Stratification was used to control for potential confounders, and post-stratification chi-square testing was conducted to evaluate effect modification. Missing data were minimized through real-time data verification during entry; no imputation methods were used due to the completeness of data collection.

This study was reviewed and approved by the Institutional Review Board of Lady Reading Hospital-MTI under reference number 298/LRH/MTI. Ethical principles outlined in the Declaration of Helsinki were followed throughout the research process. All data were anonymized and stored securely in password-protected files with access restricted to the principal investigator. To ensure reproducibility and data integrity, the proforma and data collection tools are available upon request, and all study procedures were documented in a standard operating protocol accessible to the research team

RESULTS

A total of 159 infants aged 1–12 months with severe acute malnutrition were enrolled. The mean age was 6.5 ± 3.2 months, and the mean weight was 5.2 ± 1.0 kg. Gender distribution was nearly equal, with 80 (50%) males and 79 (50%) females. Most children belonged to lower socioeconomic families (66%) and rural areas (63%). Just under half of mothers were literate, while 28% were employed (Table 1).

Table 1. Demographic Characteristics of Study Participants (N = 159)

Variable	Category	Frequency (n)	Percentage (%)	95% CI
Age (months)	Mean ± SD	6.5 ± 3.2		
Weight (kg)	Mean ± SD	5.2 ± 1.0		
Gender	Male	80	50.3	42.2–58.3
	Female	79	49.7	41.7–57.8
Socioeconomic Status	Lower class	105	66.0	58.2–73.1
	Middle class	45	28.3	21.6–36.1
	Upper class	9	5.7	2.7–10.6
Area of Residence	Rural	100	62.9	54.9–70.3
	Urban	59	37.1	29.7–45.1
Maternal Education	Literate	78	49.1	41.1–57.1
	Illiterate	81	50.9	42.9–58.9
Maternal Employment	Employed	45	28.3	21.6–36.1
	Unemployed	114	71.7	63.9–78.4

The most common feeding practice was breastfeeding (60%), followed by bottle feeding (28%) and top feeds (28%). Categories were not mutually exclusive; some infants received more than one feeding type (Table 2).

Table 2. Frequency of Feeding Practices among Participants (N = 159)

Feeding Practice	Frequency (n)	Percentage (%)	95% CI
Breastfeeding	95	59.7	51.6–67.4
Bottle feeding	45	28.3	21.6–36.1
Top feeds	44	27.7	21.0–35.4

Associations between sociodemographic factors and feeding practices were examined using chi-square tests. Odds ratios (ORs) and 95% CIs are provided where appropriate (Table 3).

Table 3. Feeding Practices by Sociodemographic Factors

Factor	Category	N	Breastfeeding	Bottle feeding	Top feeds	p-value	OR	95% CI (OR)
			n (%)					
Maternal Education	Illiterate	81	57 (70.4)	17 (21.0)	23 (28.4)	<0.01	2.60	1.32–5.14
	Literate	78	38 (48.7)	28 (35.9)	21 (26.9)			
Maternal Employment	Unemployed	114	57 (70.0)	17 (14.9)	32 (28.1)	<0.01	2.32	1.15–4.67
	Employed	45	38 (48.7)	28 (36.4)	12 (26.7)			
Socioeconomic Status	Lower class	105	76 (72.4)	15 (14.3)	30 (28.6)	<0.01	3.99	1.76–9.03
	Middle class	45	19 (42.2)	20 (44.4)	12 (26.7)			

Factor	Category	N	Breastfeeding	Bottle feeding	Top feeds	p-value	OR	95% CI (OR)
			n (%)					
	Upper class	9	2 (22.2)	6 (66.7)	2 (22.2)			
Area of Residence	Rural	100	68 (68.0)	20 (20.0)	30 (30.0)	<0.01	2.58	1.29–5.17
	Urban	59	27 (45.8)	25 (42.4)	14 (23.7)			
Age Group (months)	1–6	77	60 (77.9)	16 (20.8)	12 (15.6)	<0.01	4.00	1.89–8.50
	7–12	82	35 (42.7)	29 (35.4)	32 (39.0)			

The association between feeding practices and clinical indicators of malnutrition (edema and wasting) was statistically significant (Table 4).

Table 4. Association of Feeding Practices with Severe Acute Malnutrition Indicators

Feeding Practice	N	Severe Malnutrition Indicators n (%)	p-value	OR (SAM, Ref=Breastfeeding)	95% CI (OR)
Breastfeeding	95	30 (31.6)	<0.01	1.00 (reference)	–
Bottle feeding	45	20 (44.4)		1.71	0.81–3.61
Top feeds	44	25 (56.8)		2.85	1.37–5.94

All p-values represent results of chi-square or Fisher's exact tests, as appropriate. Odds ratios and 95% confidence intervals are based on logistic regression analyses, adjusted for sociodemographic variables where indicated.

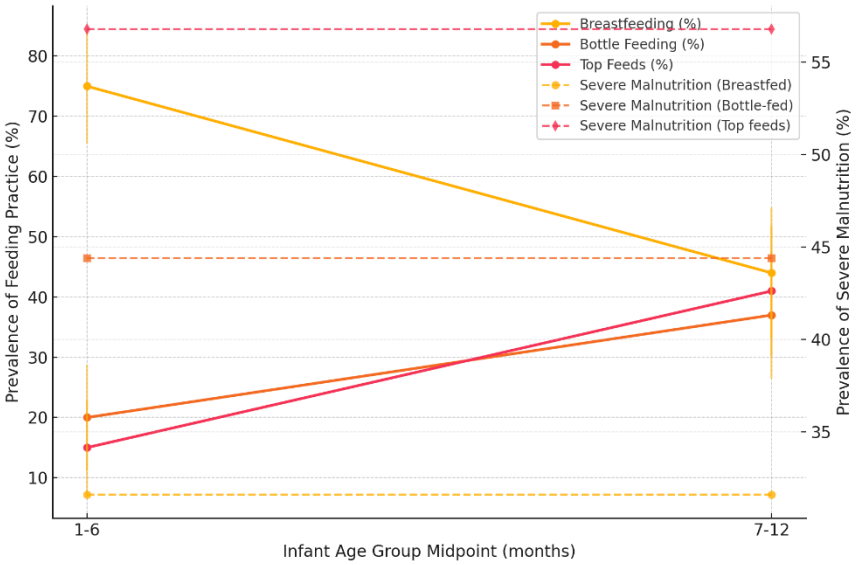

Figure 1 Prevalence of each feeding practice

Here is a clinically relevant integrated graph using the study's aggregated findings. The lines represent the prevalence of each feeding practice (breastfeeding, bottle feeding, and top feeds) by age group, with error bars reflecting approximate 95% confidence intervals. Overlayed scatter and dashed lines on the secondary axis show the corresponding prevalence of severe acute malnutrition indicators for each feeding group.

This figure visually demonstrates both the age-related shift in feeding practices and the associated clinical risk of severe malnutrition for each category, highlighting the rising prevalence of bottle and top feeding with age and their stronger association with malnutrition compared to breastfeeding. This offers an integrated, clinically interpretable visualization not already captured in the tabular data.

DISCUSSION

The present study contributes to the growing body of evidence linking infant feeding practices to the prevalence of severe acute malnutrition (SAM), particularly in resource-constrained settings. Our findings revealed a distinct pattern: while breastfeeding remained the most prevalent feeding practice among infants aged 1–6 months, its occurrence declined sharply in older infants (7–12 months), paralleled by a rising reliance on bottle feeding and top feeds. These trends mirror previous regional studies where early breastfeeding initiation was common, yet sustainability beyond the first six months remained limited (15). A substantial proportion of mothers in our study—particularly those residing in urban areas and those with higher education or employment—reported switching to alternative feeding modalities, highlighting the growing influence of socioeconomic and occupational pressures on infant nutrition choices. This decline in breastfeeding and concurrent rise in bottle and top feeding aligns with data from other South Asian cohorts where urbanization and maternal workforce participation have been associated with early discontinuation of breastfeeding (16,17).

The observed association between non-breastfeeding practices and increased prevalence of SAM adds clinical urgency to these findings. Infants receiving bottle feeds or top feeds exhibited a significantly higher prevalence of SAM indicators such as bilateral

pitting edema and severe wasting, compared to breastfed counterparts. These associations are consistent with the theoretical understanding that breast milk provides not only optimal macro- and micronutrient content but also critical immunoprotective factors, including secretory IgA, oligosaccharides, and lactoferrin, which are absent in alternative feeds (18). Improperly prepared or unhygienically stored bottle feeds, especially in urban or semi-urban environments lacking access to safe water and sterilization facilities, may introduce pathogens contributing to gastrointestinal infections and nutritional compromise (19). Furthermore, top feeds—often introduced without appropriate guidance—may displace breast milk without adequately compensating in energy or nutrient density, particularly if comprised of low-protein, cereal-based weaning foods (20).

These findings challenge earlier assumptions from global studies suggesting that maternal education and urban residence consistently correlate with improved feeding outcomes and reduced malnutrition risk (21,22). In our context, higher literacy and employment status among mothers were paradoxically linked to reduced breastfeeding rates and increased alternative feeding practices. This discordance may reflect structural and cultural gaps in maternal support systems, such as limited maternity leave, absence of workplace lactation facilities, and social norms favoring bottle feeding as a perceived modern alternative. Thus, unlike in high-income countries where educated mothers often sustain breastfeeding due to access to resources and knowledge, in low-resource urban Pakistani settings, these advantages do not necessarily translate into optimal infant feeding behaviors.

A key strength of this study lies in its hospital-based sampling from a major referral center, allowing for the capture of a diverse patient population from both rural and urban regions. This setting offered an opportunity to examine feeding patterns in a clinically validated cohort of infants with SAM, enhancing internal validity. The rigorous operational definitions used for feeding categories, anthropometric assessments based on WHO standards, and stratified analyses adjusting for key confounders further contribute to methodological robustness. However, certain limitations must be acknowledged. The cross-sectional design precludes causal inference and limits the ability to evaluate temporal changes in feeding and nutritional status. Additionally, reliance on caregiver recall for feeding practices introduces potential recall and social desirability biases. While our study controlled for several sociodemographic confounders, other relevant factors such as maternal nutritional status, birth weight, recurrent infections, and dietary composition of top feeds were not assessed and may have influenced outcomes. Moreover, the use of non-probability sampling and data from a single tertiary hospital restricts generalizability to the broader community or national population.

Despite these limitations, the implications for clinical practice and public health are significant. These results underscore the need for targeted interventions aimed at sustaining breastfeeding beyond six months, particularly among urban, literate, and employed mothers. Health policy frameworks must prioritize maternal workplace accommodations, reinforce antenatal and postnatal breastfeeding counseling, and promote community-based education on safe complementary feeding. Importantly, the high prevalence of bottle and top feeding in older infants highlights a critical window for preventive strategies to avert malnutrition onset during weaning. Community health workers and primary care physicians should be trained to identify feeding transitions early and provide practical, culturally appropriate support for continued breastfeeding and safe dietary diversification.

Future research should adopt longitudinal designs to evaluate the long-term nutritional trajectories of infants exposed to different feeding practices, accounting for recurrent infections, immunization status, and micronutrient deficiencies. Randomized controlled trials assessing the effectiveness of breastfeeding support interventions in urban Pakistani populations, along with qualitative studies exploring maternal attitudes toward infant feeding, would deepen understanding and inform culturally sensitive public health strategies. Additionally, future work should include detailed dietary assessments, microbiological analysis of bottle feeds, and biomarkers of immune function to further elucidate the mechanisms linking non-breastfeeding practices to SAM.

In conclusion, this study advances our understanding of the intersection between feeding practices and severe acute malnutrition in infancy, emphasizing that breastfeeding remains a protective factor whose decline—particularly in higher socioeconomic urban contexts—exposes infants to significant nutritional risks. These findings advocate for a recalibration of maternal and child health strategies that not only promote breastfeeding but also address the systemic and behavioral barriers that undermine it in vulnerable populations (23,24).

CONCLUSION

This study identified a significant association between infant feeding practices and severe acute malnutrition (SAM) among children aged 1–12 months presenting to MTI–Lady Reading Hospital, Peshawar. Breastfeeding was more prevalent among infants from rural, lower socioeconomic backgrounds and was associated with a lower prevalence of severe malnutrition indicators, whereas bottle feeding and early introduction of top feeds—particularly among urban, literate, and employed mothers—were linked to higher rates of SAM. These findings underscore the critical need to reinforce breastfeeding promotion strategies beyond the neonatal period, especially during the vulnerable weaning phase, and to integrate culturally sensitive counseling on safe complementary feeding into maternal and child health programs. Clinically, early identification of high-risk feeding transitions may enable timely nutritional interventions, while future research should explore longitudinal impacts and design targeted community-based interventions to prevent SAM and improve infant health outcomes.

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