

NUTRITION

Malnutrition among Infants under Six Months in Rumbek, South Sudan: A Retrospective Analysis of Feeding Practices and Associated Risk Factors

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Abstract

Background: Malnutrition in infants younger than six months is an important but frequently under-recognized clinical and public health problem. During this period, infants depend predominantly on breast milk, and disruption of breastfeeding may rapidly compromise nutritional status. This study described the characteristics, feeding-related problems, and documented risk factors among malnourished infants younger than six months managed in an outpatient nutrition clinic in Rumbek, South Sudan.

Methods: A retrospective descriptive study was conducted using routine clinical records from a specialized outpatient clinic for malnourished infants younger than six months. Seventy-two infants were included. Information on age, sex, clinic attendance, presenting problems, feeding practices, and documented maternal or infant-related risk factors was extracted from clinical records. Anthropometric assessment included weight, length, weight-for-length Z score, and mid-upper arm circumference. Descriptive statistics were used to summarize the data.

Results: Among 72 infants, 37 (51.4%) were male and 35 (48.6%) were female. The mean documented age was 3.64 months; age was missing for seven infants (9.7%). Twenty-four infants (33.3%) presented with reported insufficient breast milk and five (6.9%) with weight loss, while the presenting medical complaint was incompletely documented for 43 (59.7%). Feeding-related risk factors were documented for 44 infants (61.1%). Among all 72 infants, maternal death and maternal breast-related problems each affected 10 infants (13.9%), early use of other feeds affected nine (12.5%), multiple birth or prematurity affected eight (11.1%), and primigravidity affected seven (9.7%); 28 records (38.9%) did not specify a risk factor. Thirty infants (41.7%) were documented as successfully discharged or transferred for continued age-appropriate nutrition care.

Conclusion: Suboptimal breastfeeding and circumstances that interfere with effective breastfeeding were prominent documented features among malnourished infants in this clinic. Maternal death, breast problems, early introduction of non-breast-milk feeds, multiple birth or prematurity, and first pregnancy were commonly recorded. The high proportion of incomplete records limits causal interpretation. Strengthening lactation support, maternal and newborn care, early identification of feeding difficulties, and standardized clinical documentation may improve care for nutritionally vulnerable infants younger than six months.

Keywords: infants under six months; infant malnutrition; severe acute malnutrition; breastfeeding; exclusive breastfeeding; infant and young child feeding; maternal health; lactation support; nutrition; Rumbek; South Sudan

1 Introduction

Malnutrition during early infancy can have immediate and long-term consequences for survival, growth, neurodevelopment, and susceptibility to infection. Infants younger than six months

represent a particularly vulnerable group because nutritional intake during this period depends largely on effective breastfeeding and on the health and caregiving capacity of the mother or primary caregiver.

Historically, many nutrition programmes have concentrated on children aged six to 59 months. However, malnutrition in younger infants is increasingly recognized as a distinct clinical and programmatic challenge. Infants in this age group may become malnourished because of inadequate milk transfer, maternal illness or death, breast conditions that interfere with feeding, prematurity, low birth weight, congenital or chronic illness, inappropriate replacement feeding, or a combination of maternal, infant, household, and health-system factors.

Exclusive breastfeeding during the first six months of life provides nutritional and immunological benefits. Nevertheless, exclusive and effective breastfeeding can be disrupted by poor positioning or attachment, perceived or actual insufficient milk production, painful breast conditions, maternal separation or death, cultural feeding practices, and insufficient skilled support. When alternative feeds are introduced without appropriate indication, preparation, hygiene, or nutritional adequacy, infants may face additional risks.

Evidence specifically describing malnutrition among infants younger than six months in routine clinical settings in South Sudan remains limited. Better characterization of affected infants and the circumstances surrounding inadequate feeding can support earlier recognition, improve breastfeeding and maternal support, and inform nutrition programming.

This study therefore aimed to describe the demographic and clinical characteristics of malnourished infants younger than six months attending an outpatient nutrition clinic in Rumbek and to examine the documented feeding-related and maternal risk factors associated with inadequate or suboptimal breastfeeding.

2 Methods

2.1 Study design and setting

This was a retrospective descriptive study based on routine records from an outpatient nutrition clinic for malnourished infants younger than six months in Rumbek, South Sudan. The clinic operated during 2023 and provided clinical assessment, breastfeeding and caregiver counselling, growth monitoring, follow-up, and infant formula when clinically indicated and available. Infants with medical complications could receive inpatient therapeutic care before outpatient follow-up, while clinically stable infants could be enrolled directly in the outpatient service.

2.2 Study population and sample

All 72 infants recorded as having received care in the clinic during the study period were included in the review. Because the analysis used the available clinic population rather than a sampled subset, no separate sample-size calculation was performed.

2.3 Eligibility criteria

Eligibility was defined as age younger than six months with severe wasting based on weight-for-length and/or bilateral pitting oedema, with mid-upper arm circumference also recorded in the clinical assessment. Infants with chronic conditions considered to be the principal explanation for

malnutrition, such as cerebral palsy or congenital heart disease, were excluded. Because diagnostic criteria for infants younger than six months have evolved and the original records used programme-specific criteria, the eligibility definitions should be interpreted in the context of the clinical protocol used at the time of care.

Inclusion criteria. Infants younger than six months with:

1. weight-for-length Z score below -3 , with or without bilateral pitting oedema; and
2. MUAC 110 cm.

Exclusion criteria. Infants younger than six months with underlying chronic clinical conditions causing malnutrition, e.g. cerebral palsy or congenital heart disease.

2.4 Data collection

Data were extracted from routine clinical documentation completed during clinic visits. Variables available for analysis included infant sex, age, number of clinic visits, presenting problem, programme outcome, and documented maternal or feeding-related factors that could interfere with breastfeeding. Missing information was retained as missing or undocumented rather than imputed.

2.5 Anthropometric assessment

Weight was measured using a SECA 354 digital infant scale and recorded to the nearest 0.1 kg. Recumbent length was measured with an infantometer to the nearest 0.1 cm. Weight-for-length Z scores were determined using the WHO 2006 Child Growth Standards. Mid-upper arm circumference was measured using a graduated MUAC tape according to the clinic protocol.

2.6 Statistical analysis

The dataset was entered and analyzed using SPSS version 18. Continuous variables were assessed for distribution and summarized using appropriate measures of central tendency and dispersion, while categorical variables were summarized using frequencies and percentages. The present manuscript emphasizes descriptive findings because the available aggregated results do not provide a clearly defined comparison group or sufficient cross-tabulated data to support causal or inferential claims. Statistical significance, where originally calculated, should therefore not be interpreted as evidence of causation.

2.7 Ethical considerations

Ethical clearance was reported as having been obtained from the Ethics and Research Committee of the relevant health authority in Rumbek, South Sudan. The study used retrospective routine clinical records. No personally identifying patient information is presented in this manuscript.

3 Results

3.1 Participant characteristics

A total of 72 infants were included. Thirty-seven (51.4%) were male and 35 (48.6%) were female. The youngest documented infant was 1.5 months old and the oldest was 5.9 months old. The mean documented age was 3.64 months. Age was not recorded for seven infants (9.7%). The largest documented age category was 5.0–5.9 months, comprising 24 infants (33.3%) (Table 1).

Table 1. Sex and age distribution of the infants (n = 72).

Characteristic	n	%
Male	37	51.4
Female	35	48.6
Age 1.0–1.9 months	2	2.8
Age 2.0–2.9 months	15	20.8
Age 3.0–3.9 months	15	20.8
Age 4.0–4.9 months	9	12.5
Age 5.0–5.9 months	24	33.3
Age not documented	7	9.7

3.2 Clinic attendance and programme outcome

Clinic follow-up was generally scheduled every two weeks, with more frequent review when growth was unsatisfactory. Twenty-three infants (31.9%) attended once, 18 (25.0%) attended twice, 12 (16.7%) attended three times, 10 (13.9%) attended four times, and nine (12.5%) attended five times (Table 2). Thirty infants (41.7%) were documented as successfully discharged from the clinic or transferred to an ambulatory therapeutic feeding programme after reaching the relevant age. Among the remaining 42 infants (58.3%), some were lost to follow-up and others could not complete the planned outpatient pathway because infant formula became unavailable and the clinic subsequently closed. The source records did not provide a sufficiently detailed breakdown to distinguish these outcomes numerically.

Table 2. Number of clinic visits (n = 72).

Number of clinic visits	Patients (n)	%
1	23	31.9
2	18	25.0
3	12	16.7
4	10	13.9
5	9	12.5

3.3 Presenting problems and documented feeding-related risk factors

Insufficient breast milk was recorded as the main presenting concern for 24 infants (33.3%), while five infants (6.9%) presented with weight loss. For 43 infants (59.7%), other medical complaints were mentioned in the source records but were not sufficiently documented to permit meaningful categorization.

A specific risk factor for inadequate or suboptimal breastfeeding was documented for 44 infants (61.1%). Across the full cohort of 72 infants, maternal death was recorded for 10 (13.9%), maternal breast-related problems for 10 (13.9%), early use of other feeds for nine (12.5%), multiple birth or prematurity for eight (11.1%), and primigravidity for seven (9.7%). Twenty-eight records (38.9%) did not specify the risk factor (Table 3).

When the denominator was restricted to the 44 infants with a documented risk factor, maternal death and maternal breast-related problems each accounted for 22.7% of documented factors, early introduction of other feeds for 20.5%, multiple birth or prematurity for 18.2%, and primigravidity for 15.9%.

Table 3. Documented risk factors for inadequate or suboptimal breastfeeding.

Documented factor	n	% of all 72	% of 44 documented
Maternal death / maternal orphanhood	10	13.9	22.7
Maternal breast-related problems	10	13.9	22.7
Early use of other feeds	9	12.5	20.5
Multiple birth / prematurity	8	11.1	18.2
Primigravidity	7	9.7	15.9
Risk factor not documented	28	38.9	–

4 Discussion

This retrospective review describes malnourished infants younger than six months managed in a specialized outpatient clinic in Rumbek. The findings highlight breastfeeding difficulty as a central feature of the clinical histories that were documented. However, the study design and the extent of missing information do not allow the conclusion that suboptimal breastfeeding was the sole cause of malnutrition. A more defensible interpretation is that impaired or inadequate breastfeeding was the predominant documented pathway among the risk factors captured in routine records.

Maternal death was one of the most frequently documented factors. The nutritional vulnerability of a young infant can increase substantially when the mother dies because breastfeeding is interrupted and replacement feeding may be difficult to provide safely, consistently, and affordably. Maternal survival, access to skilled obstetric care, timely referral, and practical feeding support for motherless infants therefore have direct relevance to infant nutrition.

Maternal breast-related problems were equally prominent. Conditions such as flat or inverted nipples, painful or damaged nipples, engorgement, mastitis, and breast abscess can interfere with attachment, milk transfer, feeding frequency, or maternal willingness to breastfeed. Many breastfeeding problems can be improved through early assessment, skilled positioning and attachment support, treatment of maternal breast conditions, and close follow-up. Integrating lactation assessment into maternal, newborn, and nutrition services may therefore help prevent deterioration before severe malnutrition develops.

Early use of cow's milk, goat's milk, cereal-based feeds, water, or incorrectly prepared infant formula was also documented. Such practices may reflect perceived insufficient breast milk, cultural beliefs, maternal absence, feeding difficulties, or limited access to professional counselling. In young infants, inappropriate replacement or supplementary feeding may reduce breastfeeding stimulation and expose infants to nutritionally inadequate feeds or infection when preparation and hygiene are suboptimal. Counselling should therefore address both the physiology of breastfeeding and the practical concerns that lead families to introduce other feeds.

Multiple birth or prematurity was another important documented factor. Preterm and low-birth-weight infants may have weaker suck, difficulty coordinating feeding, greater nutritional require-

ments, and increased risk of illness. Mothers of twins or higher-order multiples also face greater feeding demands. These families may benefit from early identification, individualized breastfeeding support, expressed breast-milk strategies when appropriate, maternal nutrition support, and closer growth monitoring.

Primigravidity was recorded in seven infants. First-time mothers may have less practical breastfeeding experience and may be particularly dependent on the quality of antenatal, delivery, postnatal, family, and community support. The finding should not be interpreted as evidence that first pregnancy independently causes infant malnutrition; rather, it identifies a group in whom anticipatory breastfeeding counselling and early postnatal support may be useful.

The findings also demonstrate an important health-information issue. More than one-third of records lacked a specified feeding-related risk factor, and most presenting medical complaints were not adequately categorized. Inconsistent routine documentation limits clinical continuity, programme evaluation, and research interpretation. A standardized assessment form for infants younger than six months could capture maternal status, birth history, gestational age, birth weight, breastfeeding observation, milk transfer, maternal breast examination, replacement feeding, comorbidities, anthropometry, social circumstances, and programme outcome.

The programme outcome data require cautious interpretation. Although 30 infants were documented as successfully discharged or transferred for continued nutrition care, the remaining infants included both loss to follow-up and programme interruption related to formula availability. These are clinically and operationally different outcomes and should be recorded separately in future programmes.

5 Strengths and limitations

This study provides routine programme evidence from a population that is often underrepresented in nutrition research and draws attention to practical maternal and feeding-related challenges encountered in the care of malnourished young infants. It also identifies documentation and continuity-of-care gaps that are directly relevant to programme improvement.

Several limitations are important. The study was retrospective and involved only 72 infants from a single clinic, limiting generalizability. Routine records were incomplete, including missing age, presenting complaints, and risk-factor information. The absence of a comparison group prevents estimation of relative risk or independent associations. Several exposures may have occurred simultaneously, but the available summary data treated them as primary categories. The clinic's interruption because of infant-formula availability also affected follow-up and outcome classification. Finally, the available aggregated data do not permit robust multivariable analysis or causal inference.

6 Programmatic and public health implications

- Introduce standardized assessment and follow-up tools specifically for nutritionally vulnerable infants younger than six months.
- Strengthen skilled breastfeeding assessment and lactation support at antenatal, maternity, postnatal, primary-care, and nutrition-service levels.
- Ensure rapid clinical management and referral for maternal breast conditions that interfere with breastfeeding.

- Establish clear, safe, and sustainable feeding pathways for motherless infants and infants for whom breastfeeding is temporarily or permanently not possible.
- Provide enhanced follow-up for preterm, low-birth-weight, twin, and other high-risk infants.
- Use community engagement to address misconceptions about colostrum, water, prelacteal feeds, and early introduction of other foods.
- Strengthen maternal health services, skilled birth attendance, referral systems, and continuity between maternal, newborn, and nutrition care.
- Improve programme supply planning so that clinically indicated nutritional support is not interrupted.

7 Conclusion

Malnutrition among infants younger than six months in this Rumbek clinic was frequently accompanied by documented breastfeeding difficulties and maternal or household circumstances that could compromise effective feeding. Maternal death, maternal breast problems, early introduction of other feeds, multiple birth or prematurity, and primigravidity were the principal recorded factors. Because a substantial proportion of records were incomplete, the findings should be interpreted descriptively rather than causally. Early breastfeeding support, stronger maternal and newborn care, targeted follow-up of high-risk infants, safe alternatives when breastfeeding is not possible, and improved routine documentation are practical priorities for reducing nutritional vulnerability in this age group.

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