

Variations in the feeding practices and moderate acute malnutrition of infants weaned at 3-6 months and 6-9 months in Kitwe District, Zambia

Margaret Pansho¹
Jason Mwanza²

¹panshomargaret@gmail.com (+260973969423)

²jasonmwanza2@gmail.com (+260977945790)

^{1,2}The University of Zambia, Zambia

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ABSTRACT

A major cause of newborn morbidity and long-term health issues is moderate acute malnutrition (MAM), especially when a baby transitions from exclusive breastfeeding to supplemental feeding. Maternal perceptions of newborn hunger and breast milk sufficiency, along with cultural norms, greatly influence infant feeding practices in many areas, including Kitwe District, Zambia. These dynamics align with the UNICEF Conceptual Framework of Malnutrition, which explains malnutrition as resulting from interconnected basic, underlying, and immediate causes. This study investigated the relationship between the frequency of MAM in Kitwe District among infants aged three to nine months, the timing of weaning, and infant feeding practices. A total of 751 infants were enrolled at three months of age using an observational longitudinal design. Follow-up evaluations at 6 and 9 months included 630 and 600 infants, respectively. Anthropometric measurements evaluated nutritional status, whereas standardized questionnaires collected data on eating behaviors and weaning status. Appropriate statistical tests were used to analyze the associations among eating habits, weaning timing, and MAM prevalence. The results showed that cultural attitudes strongly influenced feeding behaviors, including early water introduction, the use of low-nutrient supplementary foods, and reliance on maize porridge. Based on the UNICEF framework, these behaviors reflect core cultural influences and caregiving issues that lead to insufficient food intake, a direct cause of malnutrition. Exclusive breastfeeding provided partial protection against MAM; however, infants who were weaned later without access to nutritionally adequate supplemental foods were at higher risk. The risk of MAM remained significant despite a 9-month increase in dietary diversity, highlighting the importance of food quality, preparation, feeding frequency, and weaning timing. The prevalence of MAM varied significantly between the weaning groups ($p < 0.001$). The study concludes that MAM among neonates in Kitwe District results from the interaction of immediate dietary deficiencies, underlying feeding practices, and broader cultural factors, as outlined in the UNICEF framework. To promote healthy infant growth and long-term child health, interventions to reduce MAM must be tailored to the specific context and culturally appropriate, emphasizing improvements in the quality and adequacy of supplemental feeding while encouraging optimal nursing behaviors.

Keywords: Complementary Feeding, Cultural Norms, Infant Feeding Practices, Moderate Acute Malnutrition, Weaning, Zambia

I. INTRODUCTION

Moderate Acute Malnutrition (MAM) is a form of acute undernutrition that significantly increases the risk of infant illness and makes children more vulnerable to severe malnutrition and related health issues. According to the World Health Organization (WHO), MAM is defined by an anthropometric measure: a weight-for-height Z-score between -3 and -2 standard deviations, or a mid-upper arm circumference (MUAC) between 115 mm and 125 mm, in children aged 6-59 months. It is a key component of global acute malnutrition (GAM) used to assess nutritional status in vulnerable populations. These conditions result from sudden drops in food intake or diet quality and are linked to poor feeding practices and other immediate factors such as infection and caregiving challenges (UNICEF; 2019).

Proper nutrition during the first two years is crucial for an infant's survival, growth, cognitive development, and long-term health. WHO (2021) and UNICEF (2020) recommend exclusive breastfeeding for the first six months. Afterward, safe, nutritious complementary foods should be introduced, and breastfeeding should continue until the child is at least 2 years old or older (WHO, 2023). Growth faltering is more likely as infants transition from exclusive breastfeeding to supplemental foods, when their energy and nutritional needs are no longer fully met by breast milk. During this period, infants and young children in low- and middle-income settings may face undernutrition and illness due to irregular feeding schedules, limited food variety, and infrequent feeds (Masuke et al., 2021).

Despite international standards, actual feeding practices often diverge from guidelines due to household food availability, cultural norms, perceptions of newborn hunger, milk sufficiency, and economic constraints. As a result, complementary meals with different nutritional effects may be introduced either early or later. Suboptimal breastfeeding and supplemental feeding practices remain key causes of childhood undernutrition, especially MAM, in Zambia and

many other low-resource countries. Despite national and international nutrition initiatives promoting exclusive breastfeeding and timely, adequate supplemental feeding, healthy baby growth remains challenged by the early introduction of complementary foods before six months of age, as well as by inadequate feeding frequency and diversity.

According to anecdotal evidence, early weaning (before 6 months) and delayed introduction of complementary foods (beyond 6 months) may coexist in the Kitwe District. The effects of these various timing patterns on nutrition and health, especially regarding the prevalence of MAM, have, however, not been well examined. To design context-specific interventions to promote adequate newborn nutrition in this situation, it is crucial to understand how these feeding habits affect moderate acute malnutrition. Consequently, to inform nutrition policy and community-based feeding recommendations, this study compares the prevalence of MAM and infant feeding behaviours between infants weaned at 3-6 months and those weaned at 6-9 months.

1.1 Research Objective

To explain the differences in incidences of malnutrition in the 3 to 6-month cohorts and the 6 to 9-month cohort.

1.2 Research Question

To explain the differences in incidences of malnutrition in the 3 to 6-month cohorts and the 6 to 9-month cohort.

II. LITERATURE REVIEW

2.1 Theoretical Review

This research is based on the UNICEF Conceptual Framework of Malnutrition, which states that a combination of immediate, underlying, and fundamental factors can lead to malnutrition (WHO, 2023). A child's nutritional status is immediately affected by both illness and insufficient food intake. Inadequate feeding practices for infants and young children, food insecurity in households, and restricted access to healthcare services are some of the underlying factors. Cultural ideas, traditional conventions, maternal education, gender roles, and socioeconomic conditions are examples of broader contextual factors related to the basic causes. The paradigm acknowledges that decisions about infant feeding are socially rooted in community-level cultural knowledge systems, even though individual practices may vary according to a child's behaviour, illness experiences, or access to information and resources (Steinman et al., 2010).

2.2 Empirical Review

2.2.1 Infant Feeding Practices and Timing of Complementary Feeding

One recognized factor influencing baby nutritional outcomes is the timing of supplementary feeding, which marks the transition from exclusive breastfeeding to solid or semi-solid foods. Around six months of age, the World Health Organization recommends beginning supplemental feeding because breast milk no longer fully meets an infant's increasing energy and nutritional needs (WHO, 2010). Both early and delayed introduction of supplemental foods have been linked to inadequate nutrient intake and higher exposure to infections, increasing the risk of undernutrition (Dewey & Brown, 2003). Various weaning approaches, such as traditional spoon-feeding, baby-led weaning, and mixed methods, are associated with distinct nutrient intake patterns, particularly for iron and total energy, which may influence growth trajectories, according to data from prospective cohort studies (Cameron et al., 2012). The mother's attitudes and beliefs also shape feeding decisions. For example, studies in rural Bangladesh show that while maternal knowledge alone does not consistently predict good practices, positive maternal attitudes toward supplemental feeding are associated with more appropriate timing (Saha et al., 2008).

2.2.2 Complementary Feeding Practices and Nutritional Outcomes

The growth and development of children heavily rely on the quality of supplemental nutrition. There is a consistent link between a child's nutritional status and indicators such as minimal dietary diversity, minimum meal frequency, and minimum tolerable diet (WHO & UNICEF, 2021). Many infants and young children in India are found to consume monotonous, low-variety diets, which can lead to micronutrient deficiencies and poor nutritional outcomes (Molani-Gol et al., 2023). Data from Sub-Saharan Africa indicate that feeding practices are affected by maternal education, household structure, and community literacy, with only a small percentage of children aged 6-23 months receiving nutritionally adequate supplemental feeding (Issaka et al., 2014). Conversely, a Malawian propensity score-matching study found that proper complementary feeding practices significantly reduced the risk of stunting, wasting, and underweight in children aged 6-23 months (Twabi et al., 20121).

2.2.3 Feeding Practices in Zambia and Comparable Contexts

Despite widespread awareness of recommended infant and young child feeding (IYCF) guidelines, gaps still exist between caregivers' knowledge and actual feeding practices in Zambia (World Health Organization [WHO], 2020).

Cross-sectional studies in the Kafue and Mazabuka districts show that although many caregivers are aware of exclusive breastfeeding and complementary feeding recommendations, early introduction of complementary foods and low dietary diversity remain common (Katepa- Bwalya et al., 2015; Banda et al., 2023). Household food insecurity worsens these issues, as evidence from rural Zambia indicates that poor household dietary diversity is linked to suboptimal complementary feeding and inadequate dietary intake among children aged 6-23 months (Bwalya et al., 2023; Marinda et al., 2022). Broader evidence from sub-Saharan Africa also reveals that optimal complementary feeding practices are generally low and affected by maternal education, community factors, and access to health services (Mekonen et al., 2024). Additionally, scoping reviews in low- and middle-income countries identify socioeconomic, maternal, and cultural factors as key drivers of suboptimal feeding practices (Makwela & Mashaba, 2025). These findings highlight how socioeconomic constraints influence feeding behaviors and emphasize the need for interventions that address both knowledge gaps and structural barriers to good nutrition in low-resource settings. Overall, this research shows that improving infant and young child feeding practices requires strategies that combine caregiver education with broader household and community support.

2.2.4 Weaning Methods and Growth Outcomes

In addition to timing, the method of weaning can influence both development and nutritional quality (Rowan, Lee & Brown, 2019). Systematic reviews comparing traditional spoon-feeding and baby-led weaning have yielded mixed results, and current research has not demonstrated clear benefits of either approach for developmental outcomes (D'Auria et al., 2018). Factors such as maternal feeding behaviors, dietary variety, and the way foods are prepared and presented may be just as important or more so than the weaning method itself because they significantly affect micronutrient intake and feeding habits (Brown & Lee, 2011; Cameron, Taylor & Heath, 2013; Rowan, Lee & Brown, 2019).

2.3 Conceptual Framework

The conceptual model for this study, based on the UNICEF framework, illustrates how baby-feeding practices are shaped by cultural beliefs, maternal knowledge, household decision-making, gender roles, economic status, and community factors. These behaviors directly influence the risk of Moderate Acute Malnutrition (MAM) and nutritional adequacy. Furthermore, the framework demonstrates how context-specific interventions can help mediate these interactions and improve nutritional outcomes. Such interventions include culturally relevant nutrition education, behavior change communication, community-based support, and health system strengthening (UNICEF, 2021).

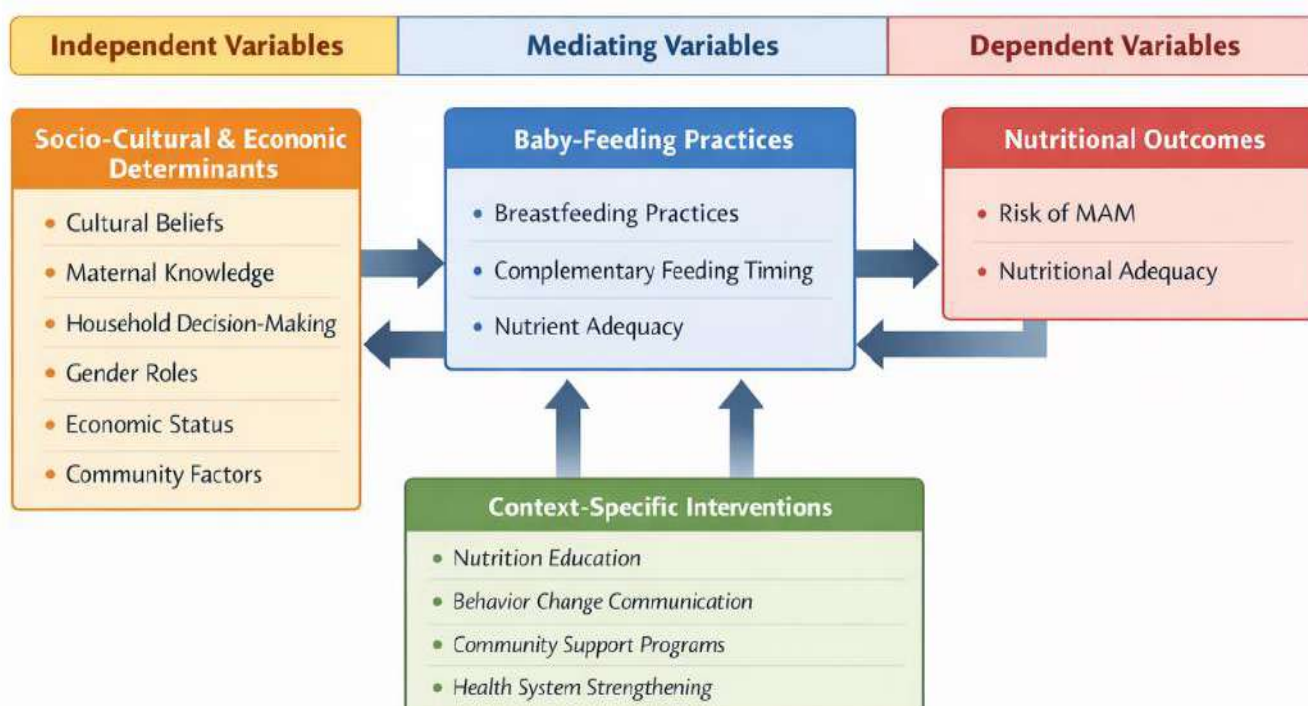


Figure 1

Conceptual Model of Infant Feeding Practices and Nutritional Outcomes

2.4 Synthesis and Identified Gap

Overall, research shows that although the timely introduction of supplemental feeding and exclusive breastfeeding for the first six months is generally advised, actual practices are often suboptimal due to complex cultural and socioeconomic factors. According to Dewey and Brown (2003) and Issaka et al. (2014), poor feeding practices are associated with nutrient gaps and an increased risk of undernutrition, including stunting and wasting. Few studies, however, specifically examine weaning age groups, for example, 3 to 6 months versus 6 to 9 months, in relation to moderate acute malnutrition in particular local contexts, such as the Kitwe District, Zambia. This discrepancy clearly justifies the focus of the current investigation on feeding timing and MAM outcomes.

III. METHODOLOGY

3.1 Study Design

To investigate the link between baby-feeding practices, the timing of weaning, and the prevalence of Moderate Acute Malnutrition (MAM) among infants aged 3 to 9 months in Kitwe District, Zambia, this study used a prospective, longitudinal observational design. Using the prospective strategy, feeding practices and nutritional outcomes could be recorded as they developed organically over time, free from the researchers' interference or modification. In nutritional epidemiology, where ethical constraints prohibit experimental exposure to potentially hazardous dietary practices, this design is suitable. Prospective observational studies are ideal for determining the temporal correlations between exposures and health outcomes, according to Hennekens & Buring (1987). The study began when the infants were three months old, and they were monitored at six and nine months, which are crucial developmental stages when the transition from exclusive nursing to supplemental feeding occurs.

3.2 Study Setting

The study focused on six public health institutions that provide standard child health services in the Kitwe District of Zambia's Copperbelt Province. Kitwe is an urban and peri-urban area characterized by high population density and diverse socioeconomic conditions. Infant feeding practices in the district are shaped by maternal awareness, household food security, cultural norms, and the availability of health information. The district was selected for documented cases of undernutrition among children and for the presence of medical facilities that offer regular follow-up and growth monitoring.

3.3 Study Population and Sample Size

Infants who were 3 months old at recruitment and living in Kitwe District comprised the study population. At baseline, 751 infants were recruited; 630 were followed up at six months, and 600 completed the study at nine months. Household movement, loss to follow-up, and caregiver consent withdrawal were the primary causes of attrition. The residual sample size was sufficient for statistical analyses and remained generally representative of the study population despite attrition.

Infants who were three months old at baseline, lived in Kitwe District for the expected duration of the trial, and had their caregivers provide informed consent were all eligible. To reduce confounding of nutritional outcomes, infants with severe illness requiring hospitalization at enrolment or those with congenital defects affecting feeding or growth were excluded.

3.4 Sampling Technique

Participants were recruited through facility-based sampling. Eligibility screening was conducted for infants receiving regular immunizations and developmental monitoring at participating health facilities. Written informed consent was obtained after caregivers of eligible infants were fully informed about the study's goals and methods. This approach, which utilized established healthcare contact points, enabled longitudinal follow-up and ensured effective access to the target age group.

3.5 Study Variables

Using anthropometric measures, the main outcome variable was moderate acute malnutrition. Weaning practice, divided into two categories based on when supplementary feeding was started, early weaning (3 to 6 months) and later weaning (six to nine months), was the primary exposure variable. Contextual elements such as home influences and cultural attitudes, infant age and sex, breastfeeding status, feeding frequency, and types of supplemental meals were additional variables. These factors were thought to have the potential to alter the link between feeding habits and nutritional status or to cause confounding.

3.6 Data Collection Procedures

Using standardized and pre-tested questionnaires, data were collected at three time points: baseline (three months), six months, and nine months of age. Caregiver interviews recorded breastfeeding habits, the timing and frequency of supplemental feedings, and the types of meals and liquids given. To contextualize eating behaviors, information on cultural beliefs, home norms, and social influences on feeding decisions was also gathered. At each visit, anthropometric measurements were taken according to WHO guidelines. Nutritional status was assessed by measuring the infant's weight, length, and mid-upper arm circumference (MUAC). According to WHO recommendations, moderate acute malnutrition was defined as a MUAC between 115 mm and 125 mm or a weight-for-height Z-score between minus three and minus two standard deviations. To minimize inter-observer variability, data collectors received standardized training. To ensure clarity, reliability, and cultural relevance, every tool was pre-tested.

3.7 Data Quality Assurance

Data collectors were trained in anthropometric measurement protocols, ethical behaviour, and interview techniques to ensure data validity. Every day, completed surveys were checked for consistency and completeness, and equipment was regularly calibrated. Field verification was used to address the problems identified. To reduce transcription errors, data entry and validation were performed in duplicate.

3.8 Ethical Considerations

The University of Zambia Biomedical Research Ethics Committee (UNZA-HSREC) approved the study's ethical aspects. Before participating, all caregivers signed informed consent forms. Confidentiality was maintained through secure data storage and the use of unique identifiers. Caregivers were told that participation was voluntary and they could withdraw at any time without any fees. In line with national and WHO guidelines, infants diagnosed with MAM were referred to suitable healthcare facilities for nutritional assessment and care.

3.9 Data Analysis

SPSS version 28 was used to analyse the data. At each time point, participant characteristics, food habits, and nutritional markers were summarized using descriptive statistics. At the ages of three, six, and nine months, the prevalence of MAM was determined. The incidence of MAM varied between infants weaned early and those weaned later, as shown in comparative analyses. For continuous data, independent-samples t-tests were used, while chi-square tests were used for categorical data. Repeated-measures ANOVA assessed changes in nutritional status over time. A p-value of less than 0.05 was considered statistically significant.

IV. FINDINGS & DISCUSSION

4.1 Participant Follow-Up

At baseline, 751 infants aged 3 months were recruited. At six months ($n = 630$) and nine months ($n = 600$), follow-up evaluations were carried out. Household migration, loss to follow-up, and caregiver permission withdrawal were the causes of attrition. Moderate Acute Malnutrition (MAM) is the dependent variable among infants retained at each follow-up point, and all analyses in this section examine the relationship between infant feeding practices and the weaning schedule (independent variables).

4.2 Infant Feeding Practices, Weaning Timing, and MAM at Six Months

Exclusive nursing and breastfeeding, along with early introduction of water, were the primary feeding habits of infants at 6 months of age. At this stage, infants were divided into two groups based on the expected age at weaning: early weaning (3-6 months) and later weaning (6-9 months). MAM status was the outcome variable, and feeding techniques were the main independent variables. Of the 370 infants weaned early (3-6 months), 24 (6.5%) had MAM. In comparison, 47 of 260 infants (18.1%) in the later-weaning group (6-9 months) who were still exclusively breastfed at 6 months were identified as having MAM.

At six months, the total prevalence of MAM was 11.3%, and there was a statistically significant difference between the weaning groups ($p < 0.001$). This implies that the link between feeding patterns and nutritional status is altered by the date of weaning. In both groups, early administration of plain water along with nursing was common and did not decrease the prevalence of MAM. Before 6 months of age, a small percentage of infants in the early-weaning group received supplemental foods like soft cereals or thin porridge. The risks associated with early supplemental feeding were further highlighted by the connection between these low-energy meals and nutritional vulnerability.

Table 1*Infant Feeding Practices and Moderate Acute Malnutrition at Six Months by Weaning Status (n = 630)*

Feeding Practice	Feeding Frequency	Type of Food/Fluid	Weaning Group	n	MAM, (%)	n	p-value
Exclusive breastfeeding	8–12 times/day	Breast milk only	3–6 months (early weaned)	370	24 (6.5)	—	—
Exclusive breastfeeding	8–12 times/day	Breast milk only	6–9 months (later weaning)	260	47 (18.1)	—	—
Exclusive breastfeeding (total)	—	—	All infants	630	71 (11.3)	—	< 0.001
Breastfeeding + water	6–10 times/day	Breast milk + plain water	3–6 months (early weaned)	370	24 (6.5)	—	—
Breastfeeding + water	6–10 times/day	Breast milk + plain water	6–9 months (later weaning)	260	47 (18.1)	—	—
Early complementary foods	1–3 times/day	Thin porridge, soft cereals	3–6 months (early weaned)	370	24 (6.5)	—	—

4.3 Infant Feeding Practices, Weaning Timing, and MAM at Nine Months

The group had adopted supplemental feeding by the time they were nine months old. At this point, the dependent variable was still MAM status, while the independent factors were the kind of complementary foods, feeding frequency, and weaning schedule. The most popular supplemental food was porridge made with maize meal. Thirty out of 280 infants (10.7%) who were weaned early (3–6 months) had MAM. Conversely, 98 of 320 infants (30.6%) who were weaned later (6–9 months) had MAM. At nine months, the total prevalence of MAM was 21.3%, and there was a statistically significant difference between the weaning groups ($p < 0.001$). MAM prevalence remained high, even though the later-weaning group's infants ate a greater variety of foods, including fruits, legumes, yogurt, fermented dairy products, and enriched porridge. This suggests that nutritional adequacy was not guaranteed by dietary diversity alone, and that feeding frequency, preparation techniques, nutrient density, and quantity all likely had a significant impact.

Table 2*Infant Feeding Practices and Moderate Acute Malnutrition at Nine Months by Weaning Status (n = 600)*

Feeding Practice	Feeding Frequency	Type of Food/Fluid	Weaning Group	n	MAM, (%)	n	p-value
Maize porridge	1–3 times/day	Maize meal porridge	3–6 months (early weaned)	280	30 (10.7)	—	—
Maize porridge	1–3 times/day	Maize meal porridge	6–9 months (later weaned)	320	98 (30.6)	—	—
Maize porridge (total)	—	—	All infants	600	128 (21.3)	—	< 0.001
Enriched porridge	1–2 times/day	Porridge with milk, sugar, peanut butter, or beans	6–9 months (later weaned)	320	98 (30.6)	—	—
Legume-based foods	Occasional/weekly	Beans or legume soups	6–9 months (later weaned)	320	98 (30.6)	—	—
Fermented dairy	1–3 times/week	Sour milk (maas)	6–9 months (later weaned)	320	98 (30.6)	—	—
Yogurt	1–3 times/week	Commercial or homemade	6–9 months (later weaned)	320	98 (30.6)	—	—
Fruits	Occasional/weekly	Banana, oranges, seasonal fruits	6–9 months (later weaned)	320	98 (30.6)	—	—
Mixed feeding	3–5 times/day	Breast milk + semi-solids	6–9 months (later weaned)	320	98 (30.6)	—	—

4.4 Variable Relationship Summary

Moderate Acute Malnutrition (dependent variable) was statistically significantly correlated with newborn feeding practices and weaning schedule (independent variables) at both follow-up intervals. Vulnerability to MAM was increased by both early supplementary feeding with low-nutrient diets and later weaning without sufficient complementary feeding. These results show that the quality, frequency, and cultural context of feeding practices, along with the timing of weaning, all affect optimal nutritional outcomes.

4.5 Discussion

The results of this study demonstrate the complex relationship among weaning techniques, culture-influenced eating behaviors, and the risk of Moderate Acute Malnutrition (MAM) in newborns in Kitwe District. Inadequate feeding methods can quickly jeopardize growth and development during the well-known critical phase for baby nutrition, the shift from exclusive nursing to supplemental feeding. The study shows that the timely and effective introduction of supplementary foods is crucial for maintaining optimal nutritional status, especially in resource-limited settings, consistent with global evidence (WHO, 2023). "Even if breastfeeding continues, delaying the introduction of nutrient-dense complementary foods may prolong nutrient deficiencies and increase susceptibility to moderate acute malnutrition (MAM) (Dewey & Adu-Afarwuah, 2008; WHO, 2020)." Infant feeding methods are heavily influenced by cultural norms and maternal beliefs. Beliefs that breast milk is insufficient for a baby's growth often led to practices like early water introduction and low-nutrient supplemental feeding. Studies in sub-Saharan Africa show that cultural views on infant hunger, milk sufficiency, and family food supply frequently affect actual feeding behaviors, even though exclusive breastfeeding is recommended for the first six months worldwide. Replacing breast milk with energy- or micronutrient-deficient meals can unintentionally harm newborn nutrition and increase the risk of MAM.

The study also shows that even after supplementary foods are introduced, dietary adequacy still remains an issue. Nutritional outcomes remain inadequate, even as infants diversify their diets with fruits, dairy products, legumes, and fortified oatmeal. This aligns with earlier studies that shown that if complementary foods are poorly cooked, have low nutritional densities, or are not consumed in appropriate amounts, dietary diversification alone is not enough to prevent undernutrition (Arimond & Ruel, 2004). The results illustrate that feeding practices influence not only food availability but also its quality, frequency, and cultural acceptability, all of which significantly affect early childhood nutritional status.

The study emphasizes the importance of incorporating cultural sensitivity into dietary interventions from a broader perspective. Despite evidence-based recommendations, programs that do not account for local eating practices often experience poor adherence, according to previous studies in low- and middle-income countries (Bwalya et al., 2023). Therefore, while honouring regional customs and beliefs, effective interventions should include advice on timely, age-appropriate, and nutrient-dense supplemental feeding, as well as nutrition education for caregivers. This strategy might improve nutritional outcomes and compliance.

Additionally, the findings suggest that the timing of weaning and the nutritional adequacy of supplementary foods interact to influence the occurrence of MAM. "While properly planned weaning combined with nutritionally sufficient complementary foods can support optimal growth and development, delayed weaning without the timely introduction of nutrient-rich complementary foods may unintentionally keep infants in a nutrient-deficient state (Victoria et al., 2016; World Health Organization [WHO], 2020)." These results emphasize the importance of interventions that address both the timing and quality of supplemental feeding, highlighting the critical role of what and when newborns are fed.

Overall, this study provides key evidence that weaning timing and culturally influenced feeding practices are crucial factors affecting infant nutritional outcomes. Instead of focusing only on nursing duration or dietary diversity, managing MAM in similar settings requires interventions that are tailored to the context and culturally sensitive, emphasizing the nutritional quality of supplementary foods. Such strategies are vital for supporting long-term child health and development and reducing the risk of malnutrition during the critical first year of life.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study highlights the complex relationship among nutritional outcomes, culturally influenced feeding behaviors, and weaning practices among infants in the Kitwe District aged 3 to 9 months. The findings show that two key factors affecting Moderate Acute Malnutrition (MAM) are the timing of supplemental feeding and the nutritional quality of the foods provided. While exclusive breastfeeding offers significant protection in the early stages of infancy, this protective effect is influenced by perceived milk adequacy, maternal nutrition, and the appropriateness of transitioning to supplemental feeding.

Infant feeding behaviours are greatly influenced by cultural norms and household practices, such as the early introduction of water, the use of low-nutrient supplementary foods, and the predominance of maize porridge, all of which led to long-term nutritional vulnerability. The findings also show that when complementary foods have low nutrient density or are offered in insufficient amounts or frequencies, greater dietary diversity alone does not ensure better nutritional outcomes. Overall, the results align with the UNICEF Conceptual Framework of Malnutrition, illustrating that immediate nutritional deficiencies, underlying care practices, and broader cultural and socioeconomic factors all contribute to infant malnutrition in this setting. Interventions for MAM must therefore address the quality, preparation, and cultural acceptance of supplemental feeding, as well as promote appropriate timing for weaning.

5.2 Recommendations

The study's conclusions lead to the following suggestion: Make Culturally Appropriate Nutrition Education Stronger: To challenge dominant cultural ideas about early water introduction, breast milk inadequacy, and supplemental feeding, community-based nutrition education programs should be strengthened. Encourage Complementary Foods High in Nutrients. Support should be provided to caregivers so they can prepare nutrient-dense supplemental meals using readily available ingredients in their area. Increase Portion Adequacy and Feeding Frequency. To ensure infants meet their energy and micronutrient needs, nutrition interventions should emphasize the types of foods and the proper frequency and portion sizes of feeding. Support Maternal Nutrition and Household Food Security Programmes, addressing infant malnutrition, should also consider maternal nutrition and household food security. Further research should examine longitudinal dietary intake, portion sizes, and micronutrient adequacy, as well as the role of caregiver decision-making and household dynamics, to deepen understanding of the pathways leading to MAM in similar urban and peri-urban settings.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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