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Feeding Practices and Nutritional Outcomes in Neonates with Sepsis in Rural Health Facilities of Northern Ghana: A Mixed-Methods Analysis.

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Abstract

Purpose: To study feeding habits, nutritional adequacy, and rehabilitation practices among septic neonates in rural Northern Ghana, identifying critical gaps in diagnosis, referral, and feeding guidelines that contribute to poor outcomes.

Methodology: A convergent mixed-methods design was employed in Gushegu and Nkwanta South. The study included 322 neonates diagnosed with sepsis, 20–25 caregivers, and 10–12 healthcare providers selected through multistage sampling. Quantitative data were analyzed using SPSS and STATA, while qualitative interviews were coded with NVivo. Ethical approval was obtained (GHS-ERC008/03/20), and rigorous measures were implemented to ensure data quality and protect participants' rights.

Findings: Exclusive breastfeeding (EBF) was practiced in 58.1% of septic neonates, with slightly higher prevalence in Nkwanta South (59.6%) compared to Gushegu (56.6%). The mean age of admission was 6.4 days, and 59.0% experienced feeding delays exceeding 12 hours. Early EBF was associated with significant weight gain (18.4 ± 2.4 g/day), faster recovery (6.2 ± 1.2 days), and high tolerance (91.2%). Recovery odds ratios were higher in Nkwanta South (2.9) than Gushegu (2.6). Daily feeding frequency correlated positively with weight gain ($r = 0.62$), while delayed feeding was negatively associated with hospitalization duration ($\rho = -0.47$, $p < 0.01$).

Unique Contribution to Theory, Practice, and Policy: Early EBF enhances sepsis recovery in the newborns in low-income setting conditions defined by cultural factors, structural impediments and care practices. The study contributes to our understanding of theory by connecting feeding to recovery pathways, practice by focusing on caregiver knowledge and provider training, and policy by advocating for integrated protocols, more robust referral systems, and supervision practices to minimize neonatal death among the poor.

Keywords: *Neonatal Sepsis, Feeding Practices, Rural Ghana, Health Facilities*

Introduction

Neonatal sepsis continues to be one of the most frequently reported causes of infant morbidity and mortality worldwide, causing about 2.3 million neonatal deaths annually (World Health Organization [WHO], 2023), mostly in low- and middle-income countries (Jiang et al., 2025; Mu et al., 2025). Infectious diseases are an important challenge in low-resource environments like rural Northern Ghana. Abnormal metabolic profiles, feeding intolerance, and systemic inflammatory responses pose a risk for malnutrition in neonates, thus limiting growth and recovery (Afeke et al., 2021).

Studies have demonstrated that an extra day of sufficient nutrient provision substantially reduces mortality risks in septic neonates, thereby emphasizing a need for effective timely and appropriate nutritional interventions in such areas. Comparable interventions have demonstrated significant positive effects on early growth and emphasize the imperative need for prompt action to rectify nutritional deficiencies in affected areas(BSPGHAN, 2023; Ibraheem, 2023). Although critical in neonatal survival, the evidence is limited in respect of the feeding practices of septic neonates in rural healthcare facilities(Ali et al.,2025). Cultural beliefs, resource constraints, institutionally-oriented practices are factors that influence feeding decisions and without more meaningful nutritional support, antimicrobial therapy is not enough (BSPGHAN, 2023) Gastrointestinal dysfunction and delayed feeding, particularly in preterm or low-birthweight babies, also hinder recovery (Quitadamo et al., 2023). Disadvantaged, resource-limited districts, where standardized feeding guidelines are absent, caregiver misconceptions arise, and implementation of early enteral nutrition is inconsistent, lead to adverse outcomes (e.g.: UNICEF & University of Pretoria, 2022; Johns Hopkins All Children's Hospital, 2023). In Ghana, neonatal sepsis is among the three leading causes of neonatal mortality at 23 per 1,000 live births (Ghana Statistical Service, 2023). Delayed diagnosis, inappropriate resource utilization, or ineffective feeding patterns, among others, represent persistent systemic issues that limit the successful management of sepsis in districts within Ghana such as Gushegu and Nkwanta South (Ghana Health Service, 2021).

Nutritional indicators are available in District Health Information Management System (DHIMS) II, however, uptake of feeding recommendations is still variable. Health workers suffer training shortages, decisions of carers are driven by cultural and economic values, and the distance traveled makes it difficult to get care (United Nations Children's Emergency Fund [UNICEF] & University of Pretoria, 2022). Proper feeding of septic neonates is clinically essential but misconceptions, lack of breastfeeding or formula and a lack of documentation limit the provision of support. Investigation into feeding patterns and nutrition status of septic neonates in rural Ghana is needed to combat these issues. This study, situated in Gushegu and Nkwanta South Districts, is designed to provide evidence to strengthen context-based interventions, enhance health systems, and guide policy reform efforts. The study aims to inform District Level planners as it accentuates potential health-system dividends (i.e. reduced length of hospital stay, decreased treatment costs and better allocation of resources). This is key knowledge needed to reduce neonatal

mortality, increase recovery rates, achieve fair and quality neonatal care from vulnerable sub-populations, and ensure broad-based support for sustainable health improvement.

The study investigated feeding practice, nutritional outcomes and recovery after sepsis in Gushegu and Nkwanta South Districts of Ghana, with a focus on identifying systemic deficiencies and suggesting localized strategies to improve neonatal survival.

1. Literature Review

2.1 Theoretical Background

Two related theoretical models underpin this study; the Health Belief Model (HBM) and Systems Theory. Perceived severity of illness, vulnerability to a disease state, benefit of intervention and barriers, according to HBM influence disease behavior (Peters et al., 2020). Caregivers' perceptions in terms of illness severity, advantages or disadvantages regarding feeding during illness, impact on their decision making in regards to neonatal feeding (e.g., initiating breastfeeding or selecting formula) in the neonatal setting. The way these are navigated is guided by clinical guidelines and sociocultural norms. Conversely, Systems Theory regards neonatal care as a system of inter-dependent entities involving caregivers, healthcare professionals, facilities, and policy making. Failing to manage any one of these—poor caregiver knowledge and skills, insufficient staff training, lack of feeding protocols, poor referral systems—may compromise the entire continuum of care (Peters et al., 2020) and ultimately jeopardize the health and nutrition of neonates. Together, these models provide an excellent foundation for considering the interplay of individual (e.g., feeding practices, nutritional recovery) and systemic (e.g., structural) factors in supporting feeding practices of septic newborns.

2.2 Empirical Review

There is a growing body of well-established international and Ghana-specific literature on the importance of early and adequate feeding in improving neonatal health. The use of breastfeeding and initiation of breastfeeding early is a known effective intervention with the same efficacy in increasing the immunity of neonates and minimizing the risk of infections and maximizing survival (Quitadamo et al., 2023; Victora et al., 2023). Systematic interventions, namely enteral nutrition and standardized feeding pathways, have proven effective in reducing mortality and length of stay in hospitalized patients (Freysdottir, 2023). In Ghana,Adedokun et al. (2022) and Aryeetey et al. (2021) found that cultural beliefs, budgetary constraints, and inadequate provider guidance strongly impacted feeding decisions. As mentioned by Aryeetey in his research in the Eastern Region, although the awareness for exclusive breastfeeding is high, lack of support and misconceptions have thwarted its application. Similarly, Biks et al. (2021) noted that the majority of caregivers in Northern Ghana delay breastfeeding because of traditional roles or the weakness of the neonate. These results are consistent with findings from that used in the Gushegu and Nkwanta South study, which also demonstrated widespread maternal delay in initiation of the feeding strategy. Unlike most Ghanaian studies with regard to

general infant feeding, this study specifically associates feeding practices with clinical recovery outcomes in septic neonates using the multivariate regression analysis.

Despite efforts to explore how feeding habits impact weight gain, feeding tolerance and recovery time, there is a dearth of studies in the literature. Further analysis in this space allows researchers to focus on these relationships between eating behaviors and these effects.

2.3 Conceptual Framework

This conceptual framework is composed of four main strands. The first strand, Feeding, includes type of feeding (exclusive breastfeeding, mixed breastfeeding, or formula), timing of initiation (early or delayed), and feeding frequency (scheduled, demand and continuous). The second strand, Nutrition Measures, has indicators of weight gain (grams per day), feeding tolerance (e.g., vomiting or abdominal distension), and recovery time (days to discharge or stabilization). The third strand, Contextual Effects, involves caregiver beliefs, provider training, facility protocols, available resources, and services offered. Nutrition Measures are affected by Feeding and Contextual Effects. The fourth strand, Outcomes, represents broader health and system-level results related to the preceding strands. These include shorter hospital stays, decreased treatment costs, improved resource allocation, improved nutritional status, and increased neonatal survival rates. All strands are interdependent and dynamically interact. Feeding practices are influenced by Contextual Effects, which affect Nutrition Measures that in turn influence Outcomes. Feedback loops exist between Nutrition Measures and Feeding, as well as between Outcomes and Contextual Effects. These interactions highlight the importance of integrated interventions. This framework is used to inform the study's analysis and to predict recovery through multivariate regression and stratified analyses for targeted interventions. These techniques aim to optimize neonatal health and system performance.

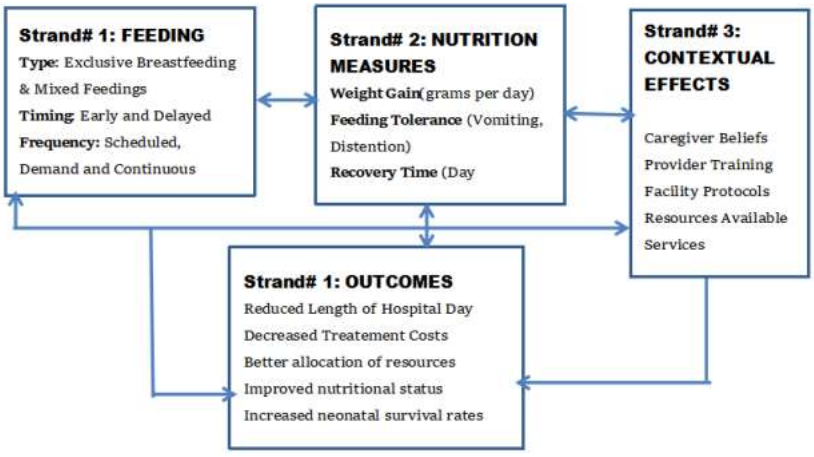

Figure 1. Conceptual Framework for Neonatal Feeding and Recovery

2.4 Research Gaps

Although both early and exclusive breastfeeding in neonates with sepsis is well-established to promote recovery, there is limited research on their effects, especially in rural Ghana (Aguayo et al., 2007; Edmond et al., 2006). Most existing literature is centered around the general knowledge of infant nutrition or on maternal knowledge of nutrition and has very little insight into the clinical and operational consequences of feeding choices during neonatal illness (WHO, 2020). Additionally, relatively few studies have used large-scale statistical analyses to establish associations linking feeding behaviors with recovery parameters such as the weight gain or length of hospital stay (Edmond et al., 2006). To fill these gaps, this study: 1) Investigated septic neonates, a high-risk population that has been given required by researchers; 2) Enclosed mixed methods to uncover statistical trends as well as in situ narratives; 3) Using multivariate regression to identify predictors of nutritional recovery and 4) Comparing results for two rural districts for both contextual and policy relevance. Bridging behavioral, clinical, and systemic perspectives, this study provides a new, evidence-based perspective on neonatal feeding in low-resource settings.

3. Methodology

3.1 Study Setting and Design

The study was conducted in rural health facilities in Gushegu (Northern Region) and Nkwanta South (Oti Region), districts selected due to their high burden of neonatal sepsis, limited access to specialized care, and systemic challenges such as delayed diagnosis and inconsistent feeding practices (Ghana Statistical Service, 2023; UNICEF & University of Pretoria, 2022). In 2021, Gushegu recorded 2,184 live births and Nkwanta South recorded 2,976; in 2022, these figures rose to 2,309 and 3,102 respectively (Ghana Health Service, 2023).

The study employed a convergent parallel mixed-methods design, integrating quantitative and qualitative approaches to explore feeding practices, nutritional outcomes, and recovery among septic neonates. This design was chosen for its strength in addressing complex health systems issues and enabling triangulation of findings for deeper contextual understanding (Creswell & Plano Clark, 2022; Fetters et al., 2022).

3.2 Study Population and Sampling

From February to November 2023, the study targeted neonates aged 0–28 days diagnosed with sepsis and admitted to rural health facilities in Gushegu and Nkwanta South Districts. It also included their primary caregivers and healthcare providers such as nurses, midwives, and pediatricians. These groups were selected to provide a comprehensive understanding of feeding practices and decision-making processes surrounding neonatal sepsis management. Facilities were purposively selected based on systemic care challenges and sepsis burden (Ghana Health Service, 2023). A multistage sampling strategy was used: 322 neonates were recruited through consecutive sampling, while 25 caregivers and 12 providers were selected via maximum variation sampling to capture

diverse perspectives across facility types, roles, and experiences (Creswell & Plano Clark, 2022).

3.3 Data Collection Methods

Both quantitative and qualitative data collection methods were used to capture a comprehensive view of neonatal feeding practices and outcomes. For the quantitative component, clinical and nutritional data were extracted from facility records using structured forms. Key variables included feeding practices (e.g., breastfeeding initiation, formula use), nutritional outcomes (e.g., weight gain, feeding tolerance), and demographic and clinical characteristics such as birth weight and gestational age (Ghana Health Service, 2023).

For the qualitative component, in-depth interviews and focus group discussions were conducted using semi-structured guides to explore caregiver beliefs, provider experiences, and barriers to optimal feeding. All sessions were audio-recorded, transcribed, and translated where necessary, with field notes used to capture contextual and non-verbal insights (Braun & Clarke, 2021).

3.4 Data Analysis

Quantitative data were analyzed using SPSS version 27 and Stata version 17. Descriptive statistics summarized feeding practices and nutritional outcomes, while inferential tests—including chi-square, t-tests, ANOVA, and multivariate logistic regression—identified predictors of nutritional recovery. Correlation analyses explored relationships between feeding variables and recovery outcomes. Statistical significance was set at $p < 0.05$, and multiple imputation addressed missing data to reduce bias (Rubin, 2021). Also, qualitative data were analyzed using NVivo version 14, following Braun and Clarke's (2021) six-step thematic framework. Transcripts were coded both inductively and deductively, with themes mapped onto the Health Belief Model and Systems Theory to contextualize caregiver behaviors and facility-level influences on feeding practices.

Mixed-methods integration revealed both alignment and divergence between data types. Exclusive breastfeeding was statistically associated with improved recovery and supported by caregiver narratives. However, inconsistencies in facility support and caregiver understanding highlighted areas where qualitative insights enriched quantitative trends (Fetters et al., 2022). Methodological rigor was ensured through pre-testing, triangulation, member checking, and audit trail maintenance, enhancing the study's reliability and transferability (Creswell & Plano Clark, 2022; Nowell et al., 2017).

Ethical approval was granted by the Ghana Health Service Ethics Review Committee (GHS-ERC 012/06/22), with informed consent obtained and participant rights strictly upheld (World Health Organization, 2011).

4. Results and Discussion

4.1 Neonatal Feeding Practices: Breastfeeding Initiation and Prevalence of Exclusive Breastfeeding

Average age at admission in 322 neonates admitted with sepsis was 6.4 days (range: 1–27 days). District-mean were similar with Gushegu = 6.2 days (range 1–26) and Nkwanta South = 6.6 days (range 1–27). The sample was comprised of 53.7% of male and 46.3% female participants. Both districts had exclusive breastfeeding as the most common feeding method (58.1%), then mixed feeding (27.0%) and formula-only feeding (14.9%). Among neonates, breastfeeding initiation was delayed for the majority, with 59.0% being fed for the first time more than 12 hours post admission. These delays were mainly explained by clinical instability of the neonate or caregiver-related factors. For the first time we see this trend in figure 1, showing that these trends were statistically similar in both districts. It highlights systemic constraints to appropriate and timely neonatal feeding within rural health facilities.

Qualitative interview data of caregivers added context to the quantitative data, as it revealed the experiences driving the pattern observed. For instance, a mother of 28 from Gushegu said, “The nurse told me to wait because my baby was weak and needed medicine first. At the time, I was scared, but I did as they told me.” The 34-year-old caregiver from Nkwanta South said: “I wanted to breastfeed right away, but was told to rest after delivery. It was already late when I tried.” Both of these accounts underline the role of clinical protocols and caregiver circumstances in delayed initiation. Nevertheless, mothers were reliably committed to exclusive breastfeeding following feeding, highlighting the importance of timely and guiding intervention in the first few hours of neonatal care. These findings are consistent with national numbers as exclusive breastfeeding rates in Ghana vary considerably among districts with many regions reporting rates which are below 50% (Ghana Statistical Service, 2022). The current study reports the exclusive breastfedding rate of 58.1%, slightly above the national average, although huge gaps remain in early initiation rates. Previous studies such as Setorglo et al. (2020) observed that within one hour of birth, less than half of neonates in Adentan Municipality had initiated within that time period indicating that delay is common in both urban and rural settings. Similarly, Appiah et al. (2021) found cultural beliefs and maternal fatigue were a frequent factor in delayed initiation, in contrast with the current finding that exclusive breastfeeding is well-established.

This study presents neonatal clinical instability as a significant driver of delayed feeding, in contrast to all previous studies. Where in previous works maternal or cultural determinants were the focus of interest, these results indicate that medical protocols in rural settings, including holding off feeds until stabilization, may inadvertently drive late initiation. This is an important difference because it shifts the responsibility from caregivers to systemic healthcare. While research often emphasizes Ghana’s development of exclusive breastfeeding, however, it typically ignores continuing delays in initiation. The present research questions this perspective as almost 60% of neonates received their

first feed more than 12 hours after admission, a delay which has adverse effects on neonatal immunology and survival. Including caregiver perspectives also enhances understanding of how health system practice and maternal experience in conjunction impact feeding. The district-level focus of the study on sepsis patients provides in-depth understanding about the connection between neonatal illness and feeding habits. Through the combination of quantitative data with qualitative narratives, this research both reveals prevalence and elucidates the root causes for delayed initiation. The mixed methods evidence provide actionable information to inform policy makers, pointing towards actionable recommendations, that interventions must relate to both caregiver education and clinical practices to promote early initiation of breastfeeding for a rural Ghana population.

4.2 Nutritional Outcomes

4.2.1 Weight Gain

Table 1 shows that neonates who received exclusive breastfeeding at an early stage had better nutritional status in Gushegu and Nkwanta South districts. The average weight gain of these neonates was 18.4 ± 2.4 g/day, and they regained strength after 6.2 ± 1.2 days, better than those infants who were given mixed feeding (14.6 ± 2.4 g/day, 8.5 ± 1.6 days) or formula-only feeding (13.1 ± 1.9 g/day, 9.3 ± 1.8 days).

Breastfed neonates also obtained the highest feed tolerance (91.2%) and had less vomiting and abdominal distension. The homogeneity of the results between study areas in two districts highlights the success of exclusive early feeding in the treatment of sepsis in infants. These findings complement global evidence demonstrating that exclusive breastfeeding is associated with better neonatal growth and faster recovery than formula or mixed feeding. Victora et al. (2016) reported better weight-gain trajectories and lower morbidity for breastfed infants that is in line with the current study's findings with exclusively breastfed neonates gaining substantially more weight per day.

In Ghana, Agyekum et al. (2022) discovered that higher birth weight and exclusively breastfed infants were more likely to maintain healthy growth patterns, supporting the nutritional rationale for exclusive breastfeeding. The study published in the Ghana Demographic and Health Survey (2022) highlighted a comparable variation in the exclusive breastfeeding status in the region with higher rates of breastfeeding in districts reporting better infant nutrition. Unlike previous studies, the current study adds nuance with this study focusing specifically on neonates with sepsis, an inpatient population that is often excluded from breastfeeding outcomes analyses. Other existing literature has reported some general advantages of exclusive breastfeeding that include improved immunity, less morbidity, and improved growth, though a small number of studies have quantified daily weight gain and recovery time for neonates that have clinical issues (Agyekum et al., 2022; Victoria et al., 2016). The current results thus illustrate that although exclusive breastfeeding has demonstrated benefits in neonatal sepsis (weight gain, 18.4 g/day vs 13.1 g/day for formula-fed infants) and quicker recovery rates, its therapeutic benefit lies beyond a simple nutritional requirement. The use of formula

feeding is sometimes recommended in clinical practice for convenience or safety reasons; however, our findings suggest that the formula-fed neonates gained less weight, with an increased recovery period and less tolerance to feed. These results challenge existing assumptions in some clinical guidelines and show evidence that exclusive breastfeeding is necessary, even if the neonates are ill. The major contribution of the current study is the district level examination of Gushegu and Nkwanta South and provide thorough evidence that exclusively feeding the infant improves nutritional outcomes in pediatric infants with sepsis. Through the measurement of weight gain and time to recover and corresponding to feeding behaviors, the study provides usable information to clinicians and policymakers. Increasing encouragement of exclusive breastfeeding among rural healthcare workers would in turn be a critical component towards increasing survival and recovery for the ill neonates

Table 1 Nutritional Outcomes by Feeding Type and District

Variable	District	Mean Weight Gain (g/day)	Mean Recovery Time/days	Feeding Tolerance
Exclusive Breastfeeding	**Gushegu (G)**	**18.6 ± 2.3**	6.1 ± **1.1**	**91.5**
	Nkawanta South (NS)	18.2 ± **2.5**	6.3 ± **1.2**	**90.8**
	Both (G&NS)	18.4 ± **2.4**	6.2 ± **1.2**	**91.2**
Mixed Feeding (F+BF)	**Gushegu (G)**	14.7 ± **2.0**	8.4 ± **1.5**	**76.3**
	Nkawanta South (NS)	14.5 ± **2.5**	8.6 ± **1.6**	**75.9**
	Both (G&NS)	14.6 ± **2.4**	8.5 ± **1.6**	**76.1**
Formula (F-only)	**Gushegu (G)**	13.2 ± **1.8**	9.1 ± **1.7**	**76.1**
	Nkawanta South (NS)	13.0 ± **1.9**	9.2 ± **1.8**	**69.4**
	Both (G&NS)	13.1 ± **1.9**	9.3 ± **1.8**	**69.0**

4.3 Feeding Tolerance

The results of the present study show that exclusively breastfed neonates had the highest feeding tolerance percentage (91.5% in Gushegu and 90.8% in Nkwanta South; 91.2%) of the group. The results indicate an infrequent occurrence of gastrointestinal disorders including vomiting and abdominal distension. Caregiver narratives reiterated this conclusion. A 26-year-old mother from Gushegu said, “When I give my baby breast milk, he did not vomit like before, and the nurses said his stomach likes the milk well.” Similarly, a 32-year-old caregiver from Nkwanta South stated, “The breast milk was gentle on his stomach, unlike when we tried formula which made him restless.” These reports demonstrate how exclusive breastfeeding was viewed by caregivers as a strategy for minimizing the risk for gastrointestinal complications and the process of healing. Exclusive breastfeeding, although potentially beneficial, is not the only answer and formula feeding is still potentially necessary when breastfeeding is not possible such as due to supply-chain problems or extra maternal burden. A 91% tolerance ratio potentially leads to a 2–3 day reduction in inpatient stay time due to a reduction in gastrointestinal complications, which frees up critical resources and allows easier bed rotation. Mixed

feeding resulted in a moderate tolerance level (76.3% Gushegu, 75.9% Nkwanta South) with an average of 76.1% for both districts; likely leading to longer stays and more interventions. Gushegu had 76.1% tolerance for formula-only feeding and Nkwanta South 69.4%, a combined average of 69.0%. Exclusive breastfeeding can be beneficial to newborns in terms of digestive status, which can potentially improve sepsis in neonates. Although previous studies have highlighted nutritional benefit and immunological benefit, there are limited assessments of feeding tolerance in neonates with a history of clinical complications.

Existing literature supports exclusive breastfeeding in terms of growth and decreased gastrointestinal intolerance and promotes recovery of ill neonates, as well as strengthens recovery pathways (Agyekum et al., 2022; Victoria et al., 2016), and the present study extends it. The focus on sepsis in rural Ghana neonates provides district-level evidence for exclusive breastfeeding as an effective digestive care strategy, specifically targeted at improving digestive stability. Consistent with global trends to provide greater maternal-child health equity, these findings emphasize the critical importance of better supportive services to address rural-urban survival disparities related to breastfeeding. Using tolerance outcomes to determine nutritional recovery reflects a fresh assessment of nutritional recovery and is evidence that breastfeeding should be prioritized as part of neonatal care. This evidence is valuable for practitioners and health workers because it illustrates the promise of exclusive breastfeeding as a cost-effective approach to neonatal survival as well as health promotion in resource-constrained settings. The introduction of exclusive breastfeeding immediately following admission is, therefore, essential to patient care, and guidelines at the district level should be developed to facilitate this timely introduction of practice.

4.4 Perceptions among Givers and Providers.

4.4.1 Qualitative findings from qualitative research: Perception and decision making in terms of neonatal feeding.

Qualitative Interviews/focus group discussions indicated a widespread reliance on conventional wisdom and popular advice by caregivers on how to feed infected young neonates. In Gushegu district, a 29-year-old caregiver said, “My mother-in-law told me the baby should not be breastfed until her body cools down. This is how we handle it in our village.” Likewise, a 34-year-old caregiver in Nkwanta South said, “We rely on herbal water first, before giving breast milk. It will help soothe the baby’s stomach.” Generational norms influenced these culturally rooted practices. Financial realities and limited access to formula were also big issues. “I wanted to buy formula, but it costs too much,” said a 22-year-old caregiver from Nkwanta South. “I just gave what I could.” A 31-year-old Gushegu caregiver said, “Sometimes we share leftover powdered milk of other mothers if our baby is too weak to suck.” Patients indicated the lack of consistency in feeding methods while providers expressed a lack of training. A 38-year-old nurse from Gushegu added, “We don’t have guidelines for feeding septic babies. Everyone does what he believes best.” “We were taught how breastfeed children, but not how to feed sick

newborns," said a 42-year-old midwife from Nkwanta South. "We need more training." The absence of standardized protocols was widely recognized. "There's no protocol here," said a 45-year-old nurse on a pediatric ward in Nkwanta South. "We improvise depending on how the baby's doing and what the mother can give." "If we had feeding charts or protocols, it would help us give better care, especially for babies with sepsis," a 36-year-old nurse from Gushegu said. "These findings fit with previous studies in Ghana and Nigeria showing the impacts of cultural beliefs and poverty on neonatal feeding practices (Agyekum et al., 2022; Ogbo et al., 2017). While Victoria et al. (2016) emphasized that exclusive breastfeeding has global nutritional and immunological benefits; however, our research indicates entrenched traditions—for example, keeping women from giving colostrum or using herbal remedies—have a legacy in rural areas. Unlike previous literature which primarily focused on maternal knowledge deficits, the current study shows how the decision-making of caregivers is deeply rooted in community norms and constrained by poverty, which contributes to delay in optimal feeding initiation and compromises the recovery of the neonate.

In addition to research, our study is evidence-based and presents the findings of previous studies on the topic and provides some important lessons for future studies through empirical study. Equally pressing is the systemic dimension, as is shown by provider accounts. The lack of standardized principles and practices with regard to feeding septic neonates seems to be in stark contrast to World Health Organization (WHO) recommendations for providing guidance and training for providers to ensure early initiation and exclusive breastfeeding (World Health Organization, 2018). This deficit implies that existing policy has not been sufficiently mobilized for operationalization in rural Ghana. The study adds significance through its perspective of caregiver and provider perspectives, which helps make district-specific evidence available that reflects both cultural and systemic barriers. Applying qualitative narratives and quantitative evidence, this work offers useful information that can inform policymakers in order to create culturally competent education programs, enhance provider training, and implement standardized feeding protocols to enhance neonatal survival in resource-limited settings

4.5 Nutrition and Recovery Outcomes

Early initiation of exclusive breastfeeding was associated with rapid recovery from neonatal sepsis, according to the findings of this study. In Gushegu, neonates who commenced exclusive breastfeeding early had significantly greater odds of rapid recovery (OR = 2.6, 95% CI: 1.4–4.7). Frequency of feeding positively predicted weight gain ($r=0.59$, $p<0.01$), while delayed feeding was moderately negatively associated with duration of hospital stay ($\rho=-0.45$, $p<0.01$). This was similar to the results reported in Nkwanta South, where neonates with early exclusive breastfeeding also developed a faster recovery (OR = 2.9, 95% CI: 1.7–5.1).

Weight gain was also associated with the frequency of feeding ($r=0.64$, $p<0.01$) compared to the non-frequent feeding, which was also related to the length of stay ($\rho=-0.49$, $p<0.01$). When the results of each district were pooled, the relationships were clear and statistically

significant. Early exclusive breastfeeding also remained a robust predictor of recovery (OR = 2.8, 95% CI: 1.6–4.9); frequency of feeding was positively associated with weight gain ($r=0.62$, $p<0.01$), and delayed feeding prolonged the length of hospital stay ($\rho=-0.47$, $p<0.01$). These results coincide with those also made in international literature that exclusive breastfeeding can increase immunity, decrease the infection burden, and accelerate recovery (Victoria et al., 2016).

Studies in Ghana link exclusive breastfeeding to a healthier trajectory for growth, though usually only in common populations rather than in critically ill neonates (Agyekum et al., 2022). In contrast, this study gives outcome-based evidence tailored to septic neonates, underscoring that feeding practices per se, especially the initiation early and frequency, have a significant impact on clinical recovery. Previous studies have highlighted cultural and maternal resistance to exclusive breastfeeding (Ogbo et al., 2017), but this study critiques that bias by demonstrating that the clinical outcomes of feeding practices are just as paramount. Furthermore, despite the choice of formula feeding in some of these contexts when the person is sick, the associations observed here suggest that formula use is associated with inferior weight gain and prolonged hospital stay, questioning some of the popular notions that formula feeding could be safer or more convenient.

The unique value of this study is its district-level outcome-based evidence that effectively integrates Gushegu and Nkwanta South results to show the beneficial effects of sustained recovery (Ali, Bawumia Ali & Nwadike, 2025). By connecting quantitative patterns and frontline perspectives, this research suggests that exclusive breastfeeding at an early age and with high frequency has not only nutritional value but is also therapeutic for septic neonates in rural Ghana. Insights gained from these approaches enable protocol development, caregiver education, and providing better training to staff. This will undoubtedly advance both hospital efficiency and neonatal survival in resource-poor settings.

Overall, this study established that exclusive breastfeeding significantly increases recovery among septic neonates in rural Ghana. Based on Gushegu and Nkwanta South, early initiation increased recovery odds (OR = 2.6 and OR = 2.9, respectively), and pooled analysis resulted in good predictive value (OR = 2.8, 95% CI: 1.6–4.9). Increased rates of feeding were positively related to weight gain, while delayed feedings corresponded to longer hospital stays. A somewhat stronger association in Nkwanta South indicates contextual factors like staffing or caregiver training. While exclusive breastfeeding rates are very high, more than half of the neonates have delayed initiation, reflecting systemic gaps and confirming worldwide findings of cultural norms and insufficient protocols. Socioeconomic restrictions also influenced feeding decisions, as found in Ethiopia and Nigeria. This aligns with WHO (2023) recommendations and the wider literature (Khan et al., 2022) for personalized, context-sensitive efforts to maximize neonatal survival.

5. Conclusion

In rural Ghana, this study investigated the effects of early initiation and exclusive breastfeeding on septic neonatal recovery. Neonates with exclusive breastfeeding within

the first few days of life had better recovery outcomes than their mixed or formula-fed peers. Caregiver beliefs, clinical instability, and systemic barriers, including insufficient training and lack of standardized practice guidelines, contributed to delayed initiation of feeding. Qualitative findings indicated that cultural and financial considerations informed decisions by caregivers, and healthcare providers offered only limited guidance. Based on these results, we infer that optimal feeding habits are related to recovery in septic neonates. It was the intended aim of this study to address an important knowledge gap by illustrating the impact of breastfeeding support on neonatal survival. Timely and exclusive breastfeeding within low-resource environments can reduce hospital burden and improve the well-being of at-risk infants.

Recommendations

Finally, this study offers strong evidence supporting the nutritionally beneficial as well as clinical therapeutic benefits of early and exclusive breastfeeding in septic neonates in rural Ghana. Targeted interventions addressing cultural, economic, and systemic barriers are potential avenues for improving neonatal survival and health equity. Some limitations include the focus on district-level issues, which potentially do not capture larger national variability in practice, and reliance on self-reported caregiver practices, which could create biases. Further studies must broaden to incorporate multi-district and longitudinal designs, introduce caregiver interventions, and assess the influence of common feeding protocols on neonatal outcomes.

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Conflict of Interest

The authors declare no conflict of interest

Contribution to the Study Design: M.Ali, RA.Ali and BK Yeboah; Data Analysis and Interpretation: M.Ali, EA Mensah and RB Ali; Drafting and Editing of Manuscript: M.Ali, RA Ali, EA Mensah, BK Yeboah and V.Nwadike. All authors have read and approved of this manuscript

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