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**Original Research Article**

# Feeding Intolerance and Nutritional Outcome in Rapid Versus Gradual Advanced Feeding Protocols in Preterm Low Birth Weight Neonates

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**Abstract:** ***Background*:** The optimal rate of feeding advancement in preterm LBW infants remains uncertain, especially in low-resource settings. This study aimed to compare feeding intolerance and nutritional outcomes between rapid and gradual feeding protocols. ***Aim of the Study*:** The aim of the study was to compare feeding intolerance and nutritional outcomes in preterm low birth weight neonates receiving rapid versus gradual advanced feeding protocols. ***Methods*:** This randomized controlled trial at the Department of Neonatology, Bangladesh Shishu Hospital & Institute (BSH&I), Dhaka, from July 2022 to June 2024, included 88 low birth weight preterm neonates. Neonates were randomized to receive either rapid or gradual feeding advancement. Primary outcomes included feed intolerance, sepsis, NEC, hospital stay, and mortality. Data were analyzed using SPSS with a significance level of $p < 0.05$. ***Results*:** The study compared two feeding protocols in preterm low birth weight neonates. There were no significant differences in gestational age or birth weight between the groups. Feed intolerance was more common in group A (29.5%) than in group B (15.9%), but not significantly ($p = 0.127$). Group A reached full feeds faster (7.0 vs. 8.5 days, $p = 0.004$) and required less parenteral nutrition (5.0 vs. 7.5 days, $p = 0.001$). Group B had a longer hospital stay (10.0 vs. 7.0 days, $p = 0.002$), but no difference in weight at discharge ($p = 0.740$). ***Conclusion*:** Rapid enteral feeding in low-birth-weight preterm neonates improves nutritional outcomes without increasing feed intolerance.

**Keywords:** Feeding Intolerance, Nutritional Outcome, Preterm Neonates.



## INTRODUCTION

Enteral feeding plays a vital role in the care of preterm infants, requiring careful planning and individualized strategies to promote optimal growth and development while reducing potential risks [1]. With advancements in neonatal intensive care, survival rates for premature low birth weight infants (LBWIs) have greatly improved [2]. These infants, due to their biochemical immaturity, rapid growth, and higher metabolic needs, require specialized nutritional support to foster postnatal growth that mimics normal fetal development at the same gestational age [3, 4]. However, many preterm infants, especially those with very low birth weight (VLBW), struggle to achieve normal fetal growth rates, resulting in postnatal growth restriction [5]. This underscores the necessity of providing appropriate nutrition to prevent long-term complications, such as extrauterine growth restriction and developmental delays [6, 7].

Nutritional strategies for preterm infants commonly involve enteral feeding, which is crucial for providing essential nutrients, promoting rapid growth, supporting gastrointestinal tract maturation, and preventing severe complications like necrotizing enterocolitis (NEC) [8]. Human milk is considered the optimal choice for preterm infants due to its multiple health benefits, including immune support from antibodies and bioactive components. Despite its advantages, the approach to initiating and advancing enteral feeding remains a topic of debate. Some practices

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recommend a gradual increase in feeding, while others advocate for a more rapid advancement to promote growth and reduce reliance on intravenous nutrition [9-12]. Research suggests that early enteral feeding may help accelerate growth and shorten the duration of parenteral nutrition [13, 14], however, concerns regarding the risk of NEC and feeding intolerance continue to be important considerations.

Previous studies have produced varying conclusions regarding the best feeding protocols for preterm infants. Research indicates that early full enteral feeding is linked to quicker attainment of full enteral feeds and better growth, with no significant increase in the risk of necrotizing enterocolitis (NEC) [15]. On the other hand, a recent Cochrane review found no definitive evidence suggesting that early complete enteral feeding elevated the risk of NEC, although it emphasized the need for more randomized controlled trials to investigate how increased enteral feed volumes might impact clinical outcomes [16]. In low-resource settings, there is growing interest in starting total enteral feeding as early as the first day of life for stable very low birth weight (VLBW) infants [17], as this approach may reduce the need for parenteral nutrition, which is both costly and logistically challenging.

Despite numerous studies on enteral feeding strategies in preterm infants, there remains a lack of consensus on the optimal rate of feed advancement, particularly in low-resource settings where balancing growth promotion with safety is critical. While some evidence supports early and rapid enteral feeding to improve nutritional outcomes and reduce dependence on parenteral nutrition, concerns about feeding intolerance and the risk of NEC continue to influence clinical practices. Moreover, limited data exist comparing the effects of rapid versus gradual feeding advancement on tolerance and growth outcomes in stable preterm LBW infants in such settings. The purpose of the study was to compare feeding intolerance and nutritional outcomes in preterm low birth weight neonates receiving rapid versus gradual advanced feeding protocols.

**Objective**

- The aim of the study was to compare feeding intolerance and nutritional outcomes in preterm low birth weight neonates receiving rapid versus gradual advanced feeding protocols.

# METHODOLOGY & MATERIALS

This randomized controlled trial was conducted at the Department of Neonatology, Bangladesh Shishu Hospital & Institute (BSH&I), Dhaka, Bangladesh, from July 2022 to June 2024. A total of 88 low birth weight preterm neonates were enrolled based on specific inclusion and exclusion criteria:

**Inclusion Criteria:**

- Hemodynamically stable neonates
- Birth weight between 1000 g and <2500 g
- Gestational age between 30 and <37 weeks

**Exclusion Criteria:**

- Neonates requiring resuscitation beyond initial steps
- Critically ill neonates
- Major congenital anomalies
- Need for head box oxygen or vasopressor support at randomization
- Refusal to provide consent

Sample size calculation, based on a study by Salas *et al*., (2018), determined that 35 neonates per group were needed to achieve 90% power and a 5% significance level, with a final sample size of 88, accounting for a 20% attrition rate. Purposive sampling was used to select eligible neonates, who were randomized into two groups using computer-generated randomization. Group a (intervention) received rapid enteral feeding advancement, while Group B (control) received gradual feeding advancement. Feeding was initiated within 72 hours of birth, and neonates were closely monitored for feed intolerance, sepsis, and necrotizing enterocolitis (NEC). Study variables included gestational age, birth weight, and time to achieve full enteral feeding, while primary outcomes were feed intolerance, sepsis, NEC, hospital stay duration, and mortality. Data were analyzed using SPSS version 26.0, with Chi-square, Fisher's exact test, and Mann-Whitney U test applied for statistical comparisons. A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee of BSH&I, and informed consent was provided by the guardians of all participants.

# RESULTS

**Table 1: Comparison of Neonates by Gestational Age (n = 88)**

| Gestational Age (in weeks) | Group A (n = 44) | Group B (n = 44) | p value |
|---|---|---|---|
| 30–31 | 10 (22.7%) | 7 (15.9%) | 0.423 |
| 32–33 | 17 (38.6%) | 23 (52.3%) | |
| 34–35 | 17 (38.6%) | 14 (31.8%) | |
| **Median [IQR]** | **33.0 [32.0, 34.0]** | **32.5 [32.0, 34.0]** | **0.772** |

The distribution of gestational age was comparable between groups. In group A, 10 (22.7%) neonates were 30–31 weeks, 17 (38.6%) were 32–33 weeks, and 17 (38.6%) were 34–35 weeks. In group B, the respective figures were 7 (15.9%), 23 (52.3%), and 14 (31.8%). Median gestational age was 33.0 [32.0, 34.0]

weeks in group A and 32.5 [32.0, 34.0] weeks in group B. The difference was not statistically significant (p = 0.772).

**Table 2: Comparison of Neonates by Birth Weight (n = 88)**

| Birth Weight (in grams) | Group A (n = 44) | Group B (n = 44) | p-value |
|---|---|---|---|
| <1500 | 27 (61.4%) | 31 (70.5%) | 0.368 |
| ≥1500 | 17 (38.6%) | 13 (29.5%) | |
| **Median [IQR]** | **1400.0 [1200.0, 1600.0]** | **1356.5 [1230.5, 1500.0]** | **0.300** |

Most neonates in both groups had a birth weight <1500 grams. The median birth weight was 1400.0 [1200.0, 1600.0] grams in group A and 1356.5 [1230.5, 1500.0] grams in group B. The difference in birth weight distribution between the groups was not statistically significant (p > 0.05).

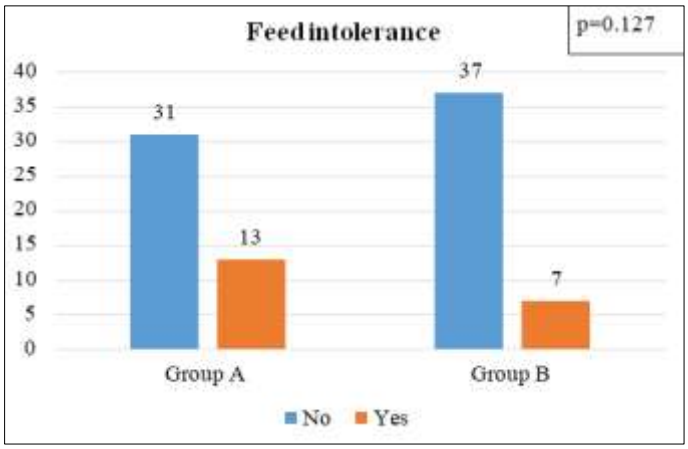


**Figure 1: Distribution of Neonates by Feed Intolerance (n = 88)**

Figure 1 illustrates that feed intolerance occurred in 13 (29.5%) neonates in group A and 7 (15.9%) in group B. Although the incidence was lower in group B, the difference between the groups was not statistically significant (p = 0.127).

**Table 3: Comparison of Neonates by Time to Achieve Full Feed and Duration of Parenteral Nutrition (n = 87)**

| Criteria (in days) | Group A (n = 43) | Group B (n = 44) | p-value |
|---|---|---|---|
| | Median [IQR] | Median [IQR] | |
| Time to achieve full feed | 7.0 [6.0, 10.0] | 8.5 [7.0, 10.0] | 0.004 |
| Duration of parenteral nutrition | 5.0 [5.0, 9.0] | 7.5 [6.2, 9.0] | 0.001 |

Table 3 shows that the median time to achieve full feed was significantly shorter in group A (7.0 [6.0, 10.0] days) compared to group B (8.5 [7.0, 10.0] days; p = 0.004). Similarly, the median duration of parenteral nutrition was significantly lower in group A (5.0 [5.0, 9.0] days) than in group B (7.5 [6.2, 9.0] days; p = 0.001).

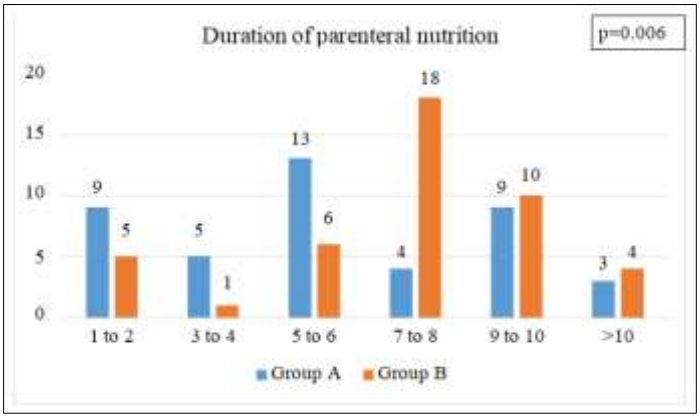


**Figure 2: Distribution of Neonates by Duration of Parenteral Nutrition (n = 87)**

Figure 2 illustrates that in group A, most neonates received parenteral nutrition for ≤6 days, with 13 (30.2%) receiving it for 5–6 days. In contrast, group B had longer durations, with 18 (40.9%) receiving it for 7–8 days and 10 (22.7%) for 9–10 days. A statistically significant difference in duration of parenteral nutrition was observed between the groups.

**Table 4: Comparison of Neonates by Hospital Stay and Weight at Discharge (n = 84)**

| Criteria | Group A (n = 43) | Group B (n = 41) | p-value |
|---|---|---|---|
| | Median [IQR] | Median [IQR] | |
| Hospital stay (in days) | 7.0 [7.0, 11.0] | 10.0 [8.5, 11.0] | 0.002 |
| Weight at discharge (in grams) | 1300.0 [1100.0, 1450.0] | 1230.0 [1110.0, 1400.0] | 0.740 |

Table 4 shows that the median hospital stay was significantly longer in group B [10.0 (8.5–11.0) days] compared to group A [7.0 (7.0–11.0) days] (p = 0.002). However, no significant difference was observed in weight at discharge between the groups (p = 0.740).

# DISCUSSION

Enteral feeding is a critical component of neonatal care, particularly for preterm low birth weight infants, as it plays a pivotal role in promoting growth, preventing complications, and supporting gastrointestinal development. Feeding protocols in these neonates have been widely debated, with varying approaches to advancing enteral feeding. Rapid versus gradual feeding advancements are commonly practiced, yet the impact of these protocols on feeding intolerance, growth, and other clinical outcomes remains uncertain. The present study aimed to compare feeding intolerance and nutritional outcomes in preterm low birth weight neonates receiving rapid versus gradual advanced feeding protocols. A total of 88 neonates were enrolled at the Department of Neonatology, Bangladesh Shishu Hospital & Institute (BSH&I). These neonates were randomized into two groups: Group A (rapid feeding advancement) and Group B (gradual feeding advancement).

The distribution of gestational age between the two groups in our study showed no significant differences. Group A (rapid advancement) had a slightly higher proportion of neonates in the 30–31 weeks range, while Group B (gradual advancement) had more neonates in the 32–33 weeks range. Despite these differences, the median gestational age in both groups was nearly identical (33.0 weeks for Group A and 32.5 weeks for Group B), with no statistically significant difference (p = 0.772). This suggests that the comparison of feeding intolerance and nutritional outcomes between the two feeding protocols is not influenced by gestational age, providing a balanced comparison between the groups.

In this study, the distribution of birth weight between the rapid (Group A) and gradual (Group B) feeding groups was similar, with 61.4% and 70.5% of neonates in Group A and Group B, respectively, having a birth weight less than 1500 grams. The median birth weight was also comparable between the two groups (1400.0 g vs. 1356.5 g). Statistical analysis revealed no significant differences in birth weight between the groups (p = 0.368 for <1500 g and p = 0.300 for the median). This suggests that birth weight did not influence the feeding protocols' outcomes, allowing for a more focused comparison of feeding intolerance and nutritional outcomes across the two feeding strategies.

In this study, feed intolerance occurred in 29.5% of neonates in the rapid feeding group (Group A) and 15.9% in the gradual feeding group (Group B), with no statistically significant difference (p = 0.127). These results are similar to those of Yang *et al*., [18], who found that rapid feed advancement slightly reduced the risk of feed intolerance, but the effect was modest. This suggests that while rapid feeding may increase intolerance, the difference between feeding protocols is not substantial in preterm low birth weight neonates.

In this study, neonates in the rapid feeding group (Group A) achieved full enteral feeding significantly earlier and required a shorter duration of parenteral nutrition compared to the gradual group (Group B). The median time to reach full feeds was 7.0 days in Group A versus 8.5 days in Group B, while the duration of parenteral nutrition was 5.0 days versus 7.5 days, respectively. These findings align with previous observations that early advancement of feeds can enhance nutritional outcomes and reduce dependence on intravenous support, highlighting the potential benefits of a rapid feeding approach in preterm low birth weight neonates [19].

In this study, the duration of parenteral nutrition was significantly shorter in the rapid advancement group (Group A), where most neonates required support for ≤6 days, compared to the gradual advancement group (Group B), where a greater proportion needed 7–10 days. This finding highlights the nutritional advantage of initiating and advancing feeds more rapidly, as it reduces dependence on parenteral nutrition, which is often associated with risks such as infections and metabolic disturbances. The observed difference aligns with previous research suggesting that early initiation and shorter duration of parenteral nutrition can enhance weight gain, improve feeding tolerance, and reduce hospital stay [20, 21]. These results underscore the potential clinical benefit of a rapid feeding protocol in promoting earlier transition to full enteral nutrition and

improving overall nutritional outcomes in preterm low birth weight neonates.

In this study, neonates in the rapid feeding advancement group (Group A) had a significantly shorter hospital stay compared to those in the gradual advancement group (Group B), with median durations of 7 and 10 days, respectively. Although the discharge weights were comparable between groups, the reduced hospitalization in Group A may reflect earlier achievement of full feeds and less dependence on parenteral nutrition. These findings are in line with those of Mehretie *et al*., [22], who reported a median hospital stay of 24 days among very-low-birth-weight neonates, and Mahovo *et al*., [23], who found a median duration of 39 days, with both studies highlighting the influence of gestational age and clinical complications on prolonged hospitalization.

**Limitations of the Study**

In this study involving outborn neonates, the lack of complete antenatal information may have led to the omission of important maternal and perinatal risk factors for conditions such as sepsis and necrotizing enterocolitis, potentially affecting the comprehensiveness of the analysis.

## CONCLUSION

Rapid enteral feeding advancement in low-birth-weight preterm neonates leads to earlier achievement of full feeds, shorter duration of parenteral nutrition, and reduced hospital stay compared to gradual feeding advancement, without increasing the risk of feed intolerance or affecting discharge weight.

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