International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Impact of Probiotic Supplementation on Preterm Neonatal Outcomes: A Case Control Study

Dr. Jaykumar S. Chopda[1], Dr. Maulik Shah[2], Dr. Hemangini Kharadi[3], Dr. Tejash Joshi[4], Dr. Bhadresh R. Vyas[5]

[1]Postgraduate Student, Department of Pediatrics, Shri M.P. Shah Government Medical College and Guru Gobind Singh Hospital, Jamnagar, Gujarat, India

[2]Associate Professor, Department of Pediatrics, Shri M.P. Shah Government Medical College and Guru Gobind Singh Hospital, Jamnagar, Gujarat, India

[3]Assistant Professor, Department of Pediatrics, Shri M.P. Shah Government Medical College and Guru Gobind Singh Hospital, Jamnagar, Gujarat, India.

[4]Postgraduate Student, Department of Pediatrics, Shri M.P. Shah Government Medical College and Guru Gobind Singh Hospital, Jamnagar, Gujarat, India

[5]Professor and Head, Department of Pediatrics, Shri M.P. Shah Government Medical College and Guru Gobind Singh Hospital, Jamnagar, Gujarat, India
Corresponding Author Email: *bhadreshrvyas[at]yahoo.co.uk*

Abstract: ***Background: Preterm neonates face complications such as necrotizing enterocolitis (NEC), feeding intolerance, and sub-optimal postnatal growth [1,2]. Probiotic supplementation is a cost-effective intervention proposed to improve outcomes [3]. Objective: To assess the impact of Lactobacillus acidophilus and Bifidobacterium bifidum supplementation on feeding milestones, growth parameters, NEC incidence, and safety in preterm neonates. Methods: This hospital-based case–control study enrolled 65 preterm neonates (<37 weeks, <2500 g birth weight) admitted to the NICU at Shri M.P. Shah Government Medical College, Jamnagar. Thirty-five neonates received probiotics for 28 days (cases), and 30 received standard care (controls). Outcomes included time to full enteral feeds, growth velocity, NEC incidence, and hospital stay. Statistical significance was set at p<0.05. Results: Probiotic group infants achieved full feeds earlier (8.7 ± 2 vs. 9.7 ± 2 days; p = 0.04) and had higher discharge weight (2473 ± 446 g vs. 2376 ± 436 g; p = 0.04) and larger head circumference (33.5 ± 1.8 cm vs. 32.5 ± 1.7 cm; p = 0.02). NEC was absent in the probiotic group vs. 3.3% in controls (p = 0.31). No increase in mortality or adverse events was noted. Conclusion: Probiotics are safe, improve feeding tolerance and growth, and may reduce NEC in preterm neonates.***

Keywords: Probiotics, preterm neonates, NEC, feeding tolerance, growth

1. Introduction

Preterm birth (<37 weeks gestation) accounts for over 15 million births annually and is the leading cause of neonatal mortality worldwide [1]. India contributes nearly 3.5 million preterm births each year, representing almost 25% of the global burden [2]. These neonates are at high risk for respiratory distress syndrome, late-onset sepsis, feeding intolerance, necrotizing enterocolitis (NEC), and impaired postnatal growth [3,4].

NEC is one of the most severe gastrointestinal emergencies in preterm infants, with mortality rates ranging from 20% to 50% [5]. The underdeveloped gastrointestinal barrier, increased intestinal permeability, and gut dysbiosis predispose preterm neonates to NEC and infections [6,7].

Probiotics, defined as "live microorganisms that confer a health benefit on the host when administered in adequate amounts," are known to improve gut barrier integrity and modulate the intestinal microbiome [8]. Multiple clinical trials and meta-analyses suggest that probiotics reduce NEC incidence and improve feeding outcomes [9,10]. However, Indian data are limited [11]. This study evaluates the impact of multi-strain probiotics on feeding tolerance and growth in preterm neonates admitted to a tertiary NICU in Western India.

2. Materials and Methods

Study Design and Participants

A case–control study was conducted in the NICU of Shri M.P. Shah Government Medical College, Jamnagar, Gujarat. A total of 65 preterm neonates (<37 weeks, <2500 g) were enrolled:

- **Cases (n=35):** Received multi-strain probiotics (*Lactobacillus acidophilus* and *Bifidobacterium bifidum*) for 28 days plus standard NICU care.
- **Controls (n=30):** Received standard care alone.

Inclusion Criteria

- Preterm neonates (<37 weeks gestation) with birth weight <2500 g.
- Admitted within 7 days of life.
- Clinically stable.

Exclusion Criteria

- Major congenital anomalies.
- Severe perinatal asphyxia.
- Transfer before 72 hours of life.

Intervention

- Probiotics were administered once daily mixed with expressed breast milk. Feeding milestones, weight gain, and adverse events were monitored up to 42 days or until discharge.

Outcomes

- **Primary:** Time to achieve full enteral feeds (≥150 ml/kg/day) and NEC (Bell's Stage II or higher).
- **Secondary:** Weight gain, head circumference, late-onset sepsis, and hospital stay.

Statistical Analysis

- Data were analyzed using SPSS v20. Continuous variables were expressed as mean ± SD and compared using the t-test. Categorical variables were compared using Chi-square tests. Significance was set at $p<0.05$.

3. Results

a) Baseline Characteristics

Both groups were similar in gestational age, birth weight, sex, and delivery mode (Table 1).

b) Feeding Outcomes

Probiotic group neonates achieved full feeds earlier (8.7 ± 2 days) compared to controls (9.7 ± 2 days; p=0.04).

c) Growth Outcomes

- Discharge weight was significantly higher in the probiotic group (2473 ± 446 g vs. 2376 ± 436 g; p=0.04)
- Head circumference: 33.5 ± 1.8 cm vs. 32.5 ± 1.7 cm (p=0.02).
- Growth velocity: 70.3 g/kg/day vs. 65.9 g/kg/day (p=0.04).

d) Clinical Complications

No NEC was observed in the probiotic group vs. 3.3% in controls (p=0.31). Sepsis and mortality were similar between groups (Table 4).

Tables

Table 1: Baseline Characteristics

Variable	Probiotic (n=35)	Control (n=30)	p-value
Gestational age (weeks)	32.9 ± 1.5	32.8 ± 1.5	0.72
Birth weight (g)	1620 ± 325	1630 ± 304	0.81
Female sex (%)	60	46.7	0.23
LSCS (%)	25.7	40	0.21
Singleton Birth(%)	88.6	96.7	0.19
Twin Birth(%)	5.7	3.3	0.64
Birth Order 1 (%)	51.4	40	0.38
NG/OG Feeds(%)	42.9	46.7	0.77
PROM	0	3.3	0.31

Table 2: Feeding Outcomes

Outcome	Probiotic	Control	p-value
Time to full feeds (days)	8.7 ± 2	9.7 ± 2	0.04
Birth weight regain (days)	11.5 ± 6.2	13.3 ± 6.3	0.03

Table 3: Growth Outcomes

Outcome	Probiotic	Control	p-value
Discharge weight (g)	2473 ± 446	2376 ± 436	0.04
Length at discharge (cm)	45.5 ± 3.1	44.8 ± 3.0	0.06
Head circumference (cm)	33.5 ± 1.8	32.5 ± 1.7	0.02
Growth velocity (g/kg/day)	70.3	65.9	0.04

Table 4: Clinical Complications

Complication	Probiotic (%)	Control (%)	p-value
NEC	0	3.3	0.31
Sepsis	2.9	3.3	0.93
Pneumonia	2.9	3.3	0.93
Mortality	2.9	3.3	0.93

4. Discussion

Our findings suggest that probiotic supplementation accelerates feeding tolerance and improves growth outcomes without safety concerns. These results align with global meta-analyses and RCTs, including Cochrane reviews and the ProPrems trial [12,13]. The absence of NEC, though not statistically significant due to the small sample, reinforces findings from Panigrahi et al. [14].

The improvement in weight gain and head circumference can be attributed to better gut maturation, reduced inflammation, and enhanced nutrient absorption [15,16].

Limitations include the single-center design and moderate sample size. Multi-center randomized trials are warranted.

5. Conclusion

Probiotic supplementation with *Lactobacillus acidophilus* and *Bifidobacterium bifidum* significantly improves feeding tolerance and growth outcomes and shows a protective trend against NEC in preterm neonates. Implementation in NICU protocols can enhance neonatal care.

References

[1] WHO. Preterm Birth Fact Sheet, 2023.
[2] Blencowe H, Cousens S, Chou D, et al. Born too soon: The global epidemiology of 15 million preterm births. *Reprod Health.* 2013;10(Suppl 1): S2.
[3] Patel RM, Denning PW. Therapeutic use of probiotics to prevent necrotizing enterocolitis. *Semin Fetal Neonatal Med.* 2013; 18:374–382.
[4] Stoll BJ, Hansen NI, Adams-Chapman I, et al. Neurodevelopmental and growth impairment among extremely low-birth-weight infants with neonatal infection. *JAMA.* 2004;292(19):2357–2365.
[5] Neu J, Walker WA. Necrotizing enterocolitis. *N Engl J Med.* 2011; 364:255–264.
[6] Deshpande G, Rao S, Patole S, Bulsara M. Updated meta-analysis of probiotics for preventing necrotizing enterocolitis in preterm neonates. *Pediatrics.* 2010;125(5):921–930.
[7] Panigrahi P, Parida S, Pradhan L, et al. Effect of probiotic supplementation on sepsis in very low birth weight neonates: A randomized controlled trial. *Lancet.* 2017;389(10080):1617–1627.

[8] Underwood MA. Probiotics and the prevention of necrotizing enterocolitis. *J Pediatr Surg.* 2019;54(3):405–412.
[9] Thomas DW, Greer FR, et al. Probiotics and prebiotics in pediatrics. *Pediatrics.* 2010;126(6):1217–1231.
[10] AlFaleh K, Anabrees J. Probiotics for prevention of necrotizing enterocolitis in preterm infants. *Cochrane Database Syst Rev.* 2014;(4):CD005496.
[11] FAO/WHO. Health and nutritional properties of probiotics in food including powder milk with live lactic acid bacteria. FAO/WHO Joint Expert Consultation Report. 2001.
[12] Sari FN, Dizdar EA, Oguz S, Erdeve O, Uras N, Dilmen U. Oral probiotics: *Lactobacillus reuteri* for prevention of necrotizing enterocolitis in very low birth weight preterm infants: A randomized controlled trial. *Early Hum Dev.* 2011;87(12):735–739.
[13] Manzoni P, Mostert M, Stronati M. Probiotics and the prevention of necrotizing enterocolitis in preterm infants: A review of the literature. *Early Hum Dev.* 2011;87(Suppl 1):S77–S83.
[14] Abrahamsson TR, Jakobsson HE, Andersson AF, Bjorksten B, Engstrand L, Jenmalm MC. Low diversity of the gut microbiota in infants with atopic eczema. *J Allergy Clin Immunol.* 2012;129(2):434–440.
[15] Costeloe K, Hardy P, Juszczak E, Wilks M, Millar MR. Bifidobacterium breve BBG-001 in very preterm infants: A randomized controlled phase 3 trial. *Lancet.* 2016;387(10019):649–660.
[16] Jacobs SE, Tobin JM, Opie GF, Donath S, Tabrizi SN, Pirotta M, et al. Probiotic effects on late-onset sepsis in very preterm infants: a randomized controlled trial. *Pediatrics.* 2013;132(6):1055–1062.