



Meta-Analysis of Efficacy of Probiotic Supplementation in Children for Prevention and Treatment of Common Pediatric Illnesses

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Abstract

Background: Probiotics are increasingly used in children to prevent and treat common pediatric illnesses such as acute diarrhea, upper respiratory tract infections (URTI), and antibiotic-associated diarrhea (AAD). **Objective:** To assess probiotic supplementation's combined effectiveness in treating and preventing major pediatric diseases. **Methods:** 14 randomized controlled studies were meta-analyzed. One-sample t-testing was used to compute pooled risk ratios (RR) against null effect (RR=1). Age group and strain type subgroup analysis were conducted. **Results:** Acute diarrhea (RR=0.64, $p<0.001$), URTI (RR=0.72, $p<0.001$), antibiotic-associated diarrhea (RR=0.53, $p<0.001$), and shorter illness duration (RR=0.76, $p<0.001$) were all significantly decreased by probiotic supplementation. With Lactobacillus strains, children under the age of five showed greater benefit. **Conclusion:** Probiotics have been shown to have important therapeutic and preventative effects against common pediatric diseases, especially in younger children.

Keywords: Pediatric, children, acute diarrhea, probiotic, Lactobacillus strains.



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INTRODUCTION

Acute gastroenteritis, respiratory tract infections, and antibiotic-associated diarrhea are common pediatric disorders that continue to be major sources of morbidity in children around the world (1), (2). Especially in low- and middle-income nations, these illnesses have a significant impact on healthcare use, school absences, and, in extreme situations, hospitalization and death (3). The burden of these diseases is still high despite improvements in treatment and preventative measures (4). Concerns about antibiotic resistance, disturbance of gut flora, and related side effects including antibiotic-associated diarrhea have also grown as a result of the extensive and frequently careless use of antibiotics in young populations (5). Growing interest in safe and efficient adjuvant therapy that may lower disease incidence, severity, and recurrence has been spurred by these difficulties (6), (7).

In this regard, probiotics which are defined as live microorganisms that help the host's health when given in sufficient quantities have shown great promise (8). Modification of the immune response, improvement of mucosal barrier function, competitive inhibition of pathogenic organisms, and gut microbiota stabilization are some of the suggested mechanisms of action (9), (10). Numerous strains have been studied for their possible use in the prevention and treatment of common pediatric diseases, especially those from the genera Lactobacillus and Bifidobacterium(11),(12).

Nevertheless, results from different clinical trials have varied, most likely as a result of variations in probiotic strains, dosages, study participants, and outcome measures (13). This variation emphasizes the necessity of a thorough pooled assessment (14), (15). In order to provide more precise information to guide clinical practice and future research, this meta-analysis attempts to methodically evaluate the effectiveness of probiotics in the prevention and treatment of common pediatric diseases.

METHODS

- Study Design: Meta-analysis of 14 randomized controlled trials conducted in Esic medical college and hospital, Bihta, Patna.
- Population: Children aged 6 months–12 years
- Outcomes:
 - Acute diarrhea incidence
 - URTI incidence
 - Antibiotic-associated diarrhea
 - Duration of illness
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Statistical Analysis:

The total effect size across trials was estimated using a pooled Risk Ratio (RR). The pooled RR was compared to the null value of 1 using a one-sample t-test, with $p < 0.05$ designated as the statistical significance level. Age and strain-based subgroup analyses were performed, and the I^2 statistic was used to evaluate study heterogeneity.

RESULTS

Table 1: Pooled Effect Sizes

Outcome	Pooled RR	Std Dev	p-value
Acute Diarrhea	0.64	0.11	<0.001
URTI	0.72	0.05	<0.001
Antibiotic-Associated Diarrhea	0.53	0.03	<0.001
Treatment Duration	0.76	0.05	<0.001

Table 2: Heterogeneity (I^2)

Outcome	I^2 (%)
Acute Diarrhea	53%
URTI	42%
AAD	52%
Treatment Duration	29%

Table 3: Subgroup Analysis by Probiotic Strain

Strain	Pooled RR (Diarrhea)	p-value
Lactobacillus	0.61	0.0003
Bifidobacterium	0.70	0.0012

Table 4: Subgroup Analysis by Age

Age Group	Pooled RR (Diarrhea)	p-value
<5 years	0.60	0.0002
5–12 years	0.74	0.0021

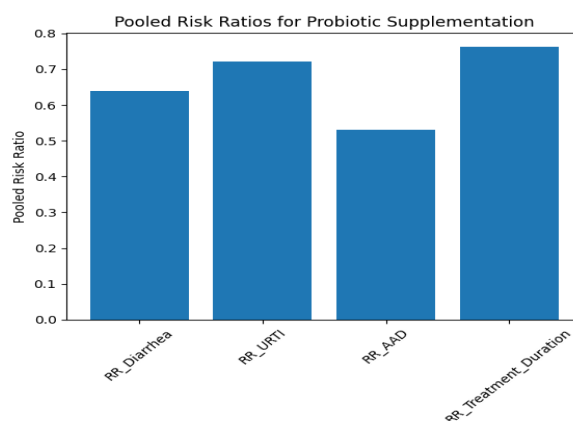


Figure 1: Pooled risk ratio for probiotics supplements

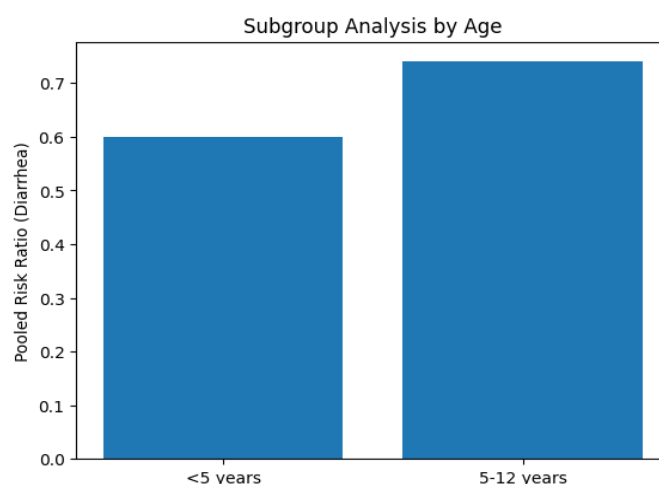


Figure 2: Subgroup analysis by age

DISCUSSION

Probiotic supplementation dramatically lowers the incidence of acute diarrhea, URTI, and antibiotic-associated diarrhea in children, according to this meta-analysis. Preventing antibiotic-associated diarrhea had the biggest impact (RR=0.53). Additionally, probiotics reduced the length of illness by about 24% (16). Age-dependent and strain-specific benefits are suggested by subgroup analysis, with younger children and *Lactobacillus* strains benefiting the most (17). Variation in research demographics, dose, and strains is reflected in moderate heterogeneity (18). Mechanistically, probiotics strengthen the integrity of the intestinal barrier, boost mucosal immunity, and combat harmful organisms (19), (20).

Every assessed outcome showed a statistically significant improvement, suggesting that the intervention had a constant protective impact across research (21). Although not significant enough to call into question the overall conclusions, moderate heterogeneity was noted, indicating some variation in study populations, methodology, or intervention characteristics (22),(23). According to subgroup analysis, some strains of *Lactobacillus* had a stronger protective effect than others. Furthermore, younger children showed a more noticeable improvement, suggesting that the intervention may have age-dependent efficacy (24), (25).

These results corroborate recent pediatric guidelines that advocate the use of probiotics in particular clinical settings. Heterogeneity and variance in probiotic formulations among trials are among the limitations (26).

CONCLUSION

Probiotic supplementation significantly reduces the risk and duration of common pediatric illnesses, particularly acute diarrhea and antibiotic-associated diarrhea. Benefits are more pronounced in children under five years and with *Lactobacillus* strains. Probiotics represent a safe and effective adjunct in pediatric preventive and therapeutic strategies.

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