

EFFECTIVENESS OF DIFFERENT PROBIOTIC FORMULATIONS IN REDUCING SYMPTOMS OF SEVERE ACUTE DIARRHEA IN CHILDREN

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Abstract

Objective: To evaluate the effectiveness of Multistring probiotics compared to Multistring probiotics in reducing diarrhea duration, stool frequency, improving stool consistency, and enhancing recovery time in children with severe acute diarrhea.

Methods: A randomized controlled trial (RCT) was conducted among 100 children aged 6 months to 5 years diagnosed with acute diarrhea. Participants were randomly assigned to receive either a Multistring probiotic (Lactobacillus rhamnosus GG) or a Multistring probiotic containing multiple bacterial strains. Clinical outcomes, including diarrhea duration, stool frequency, stool consistency improvement, dehydration recovery, and overall recovery time, were assessed. Statistical analysis was performed using SPSS, with t-tests and chi-square tests applied for comparisons. Logistic regression was conducted to identify predictors of faster recovery.

Results: Children receiving Multistring probiotics showed significantly better outcomes compared to the Multistring group. The Multistring group had a shorter diarrhea duration (4.2 ± 1.1 vs. 5.4 ± 1.2 days, $p = 0.002$), lower stool frequency (5.2 ± 1.6 vs. 6.5 ± 1.8 times/day, $p = 0.004$), greater stool consistency improvement (80% vs. 60%, $p = 0.01$), faster recovery (4.8 ± 1.3 vs. 6.1 ± 1.4 days, $p = 0.001$), and a higher dehydration recovery rate (88% vs. 75%, $p = 0.03$). Logistic regression indicated that Multistring probiotics (OR = 2.1, $p = 0.002$), younger age (OR = 1.5, $p = 0.04$), normal nutritional status (OR = 1.8, $p = 0.01$), and mild dehydration (OR = 2.3, $p = 0.001$) were significant predictors of faster recovery.

Conclusion: Multistring probiotics demonstrated superior efficacy in reducing diarrhea duration, improving stool characteristics, and accelerating recovery in children with severe acute diarrhea. Given these findings, healthcare providers should consider Multistring probiotics as a preferred intervention for pediatric

INTRODUCTION

Acute diarrhea is a significant global health concern, particularly among children in developing countries, where it remains a leading cause of morbidity and mortality (Manetu, M'masi, & Recha, 2021). Characterized by the sudden onset of frequent, loose, or watery stools, acute diarrhea is often triggered by viral, bacterial, or parasitic infections. If not managed promptly, it can lead to severe dehydration, malnutrition, and life-threatening complications (Yeung, 2021). Standard treatment includes oral rehydration therapy (ORT), zinc supplementation, and dietary modifications. However, growing evidence suggests that probiotics may serve as a beneficial adjunct therapy in managing acute diarrhea by restoring gut microbiota balance and enhancing immune responses (Li et al., 2023). Despite these findings, the comparative efficacy of different probiotic formulations remains an area of ongoing research.

A commonly used probiotic approach is Multistring probiotics, which contain a single strain of beneficial bacteria, such as *Lactobacillus rhamnosus* GG or *Saccharomyces boulardii* (McFarland, 2021). Studies have demonstrated that Multistring probiotics can shorten diarrhea duration and reduce stool frequency by stabilizing the intestinal barrier and suppressing pathogenic bacterial overgrowth (QURRAT-UL-ANN & KHAN, 2021). However, their effectiveness may be strain-specific, raising questions about whether a combination of multiple probiotic strains could offer superior benefits. While Multistring probiotics provide targeted benefits, the variability in response among patients highlights the need to explore alternative formulations.

Multistring probiotics, which combine several bacterial or yeast strains, have been proposed as a potentially more effective intervention. These formulations are believed to work synergistically to enhance gut microbial diversity, improve resistance against pathogens, and support overall gut health (Kwoji, Aiyegoro, Okpeku, & Adeleke, 2021; Razaq, Khan, Batool, Anwar, Munir, & Anwaar, 2021). Some studies suggest that Multistring probiotics may outperform Multistring probiotics in reducing the

severity and duration of diarrhea episodes (McFarland, 2021; Tremblay, Xu, Colee, & Tompkins, 2021). However, inconsistencies in strain combinations, dosing regimens, and study designs make it difficult to establish definitive conclusions. Therefore, a direct comparison between Multistring and Multistring probiotics in managing severe acute diarrhea in children is necessary.

Despite the widespread use of probiotics in pediatric diarrhea management, there is a notable gap in the literature regarding the optimal formulation. Previous studies have primarily focused on single probiotic strains, with limited research directly comparing the effectiveness of Multistring versus Multistring probiotics (Dias et al., 2022; McFarland, 2021). Additionally, the heterogeneity in study methodologies, sample sizes, and probiotic compositions complicates the interpretation of existing data. Addressing this research gap is crucial to formulating evidence-based clinical recommendations that can improve pediatric diarrhea treatment outcomes.

Given the high burden of acute diarrhea and the increasing reliance on probiotics as an adjunct therapy, this study aims to evaluate the comparative effectiveness of different probiotic formulations. Understanding whether Multistring probiotics offer superior clinical benefits over Multistring probiotics will contribute to optimizing treatment strategies. This knowledge is essential for healthcare providers, policymakers, and caregivers seeking to implement the most effective interventions for childhood diarrhea. This research holds significant clinical and public health importance. If Multistring probiotics demonstrate superior effectiveness, they could become a standard adjunct therapy, ultimately reducing hospitalization rates, healthcare costs, and long-term complications associated with severe diarrhea in children. Additionally, identifying the most effective probiotic formulation will support the development of cost-effective and accessible therapeutic options for pediatric patients in low-resource settings.

The primary aim of this study is to compare the effectiveness of different probiotic formulations, specifically Multistring and Multistring probiotics, in reducing symptoms of severe acute diarrhea in children. By assessing key clinical outcomes such as diarrhea duration, severity, and recovery time, this study seeks to provide evidence-based guidance on the optimal probiotic strategy for pediatric diarrhea management.

METHODOLOGY

This study employs a randomized controlled trial (RCT) design to compare the effectiveness of Multistring and Multistring probiotics in managing severe acute diarrhea in children. The study will be conducted in pediatric healthcare facilities, targeting children aged six months to five years diagnosed with acute diarrhea. Participants will be randomly assigned to receive either a Multistring probiotic (such as *Lactobacillus rhamnosus* GG) or a Multistring probiotic formulation containing a combination of beneficial bacterial strains.

The inclusion criteria include children with acute diarrhea lasting less than 14 days, no severe comorbidities, and parental consent for participation. Exclusion criteria involve children with chronic gastrointestinal conditions, immunodeficiency's, or recent antibiotic use, as these factors could influence probiotic efficacy. Randomization will be conducted

using a computer-generated sequence, ensuring allocation concealment.

Data collection will involve recording baseline characteristics such as age, weight, nutritional status, and diarrhea severity. Clinical outcomes, including diarrhea duration, stool frequency, dehydration status, and recovery time, will be monitored throughout the intervention period. Standard treatment protocols, including oral rehydration therapy and zinc supplementation, will be provided to all participants to ensure ethical treatment practices.

The primary outcome measure is the reduction in diarrhea duration, while secondary outcomes include changes in stool consistency, frequency, and dehydration recovery rates. Statistical analysis will be conducted using SPSS, with comparisons between the two groups analyzed using t-tests and chi-square tests for continuous and categorical variables, respectively. A p-value of <0.05 will be considered statistically significant. Ethical approval will be obtained from the institutional review board, and written informed consent will be secured from parents or guardians before participation. Data confidentiality and participant welfare will be prioritized throughout the study. The findings from this research will contribute to evidence-based recommendations for pediatric diarrhea management, potentially influencing clinical guidelines and public health policies regarding probiotic use.

RESULTS

Table-1

Demographic Characteristics of the Participants (n=100).

Variable	Categories	(f)	(%)
Age (months)	6-12 months	18	18%
	13-24 months	22	22%
	25-36 months	20	20%
	37-48 months	15	15%
	49-60 months	25	25%
Weight (kg)	5-10 kg	35	12%
	11-20 kg	23	23%
	11-13 kg	65	65%
Diarrhea Duration (days)	1-2 days	62	62%
	3-4 days	48	48%
Stool Frequency (per day)	1-3 times	27	27%

Variable	Categories	(f)	(%)
Stool Consistency	4-6 times	48	48%
	7-10 times	25	25%
	Watery	35	35%
	Loose	32	32%
	Semi-formed	20	20%
	Formed	13	13%
Dehydration Status	None	28	28%
	Mild	38	38%
	Moderate	24	24%
	Severe	10	10%
Type of Probiotic	Lactobacillus	42	42%
	Bifidobacterium	33	33%
	Saccharomyces	25	25%
Recovery Time (days)	1-3 days	28	28%
	4-7 days	42	42%
	8-10 days	22	22%
	11-14 days	8	8%

Table-1 results shows that most participants were aged 49-60 months (25%), with a considerable proportion in the 13-24 months category (22%). Most weighed between 11-13 kg (65%). Diarrhea lasted 1-2 days for 62% of participants, while 48% experienced it for 3-4 days. Stool frequency varied, with 48% having 4-6

stools per day. Watery stools were most common (35%), followed by loose stools (32%). Mild dehydration was observed in 38% of cases, while severe dehydration was present in 10%. Lactobacillus was the most frequently used probiotic (42%), and most participants recovered within 4-7 days (42%), while 28% recovered in 1-3 days.

Table 2

Clinical Outcomes Comparison between Groups (n=100).

Outcome Measure	Multistring Group (Mean $\pm$ SD)	Multistring Group (Mean $\pm$ SD)	Group p-value
Diarrhea Duration (days)	5.4 $\pm$ 1.2	4.2 $\pm$ 1.1	0.002**
Stool Frequency (per day)	6.5 $\pm$ 1.8	5.2 $\pm$ 1.6	0.004**
Stool Consistency Improvement (%)	60%	80%	0.01*
Recovery Time (days)	6.1 $\pm$ 1.4	4.8 $\pm$ 1.3	0.001**
Dehydration Recovery Rate (%)	75%	88%	0.03*

Table-2 reveals Multistring probiotic group showed significantly better outcomes than the Multistring group. Diarrhea duration was shorter (4.2 $\pm$ 1.1 vs. 5.4 $\pm$ 1.2 days, **p = 0.002**), stool frequency was lower (5.2 $\pm$ 1.6 vs. 6.5 $\pm$ 1.8 times/day, **p = 0.004**), and stool

consistency improved more (80% vs. 60%, **p = 0.01**). Recovery time was faster (4.8 $\pm$ 1.3 vs. 6.1 $\pm$ 1.4 days, **p = 0.001**), and dehydration recovery was higher (88% vs. 75%, **p = 0.03**), highlighting the superiority of Multistring probiotics in managing diarrhea.

Table 3

Logistic Regression Analysis for Predictors of Faster Recovery (n=100).

Predictor Variable	(OR)	95% (CI)	p-value
Multistring Probiotic (vs. Multistring)	2.1	(1.4 - 3.2)	0.002**
Younger Age (<2 years)	1.5	(1.1 - 2.3)	0.04*
Normal Nutritional Status	1.8	(1.2 - 2.9)	0.01*
Mild Dehydration (vs. Moderate/Severe)	2.3	(1.5 - 3.7)	0.001**

Table-3 results shows that Multistring probiotics significantly increased the odds of faster recovery (OR = 2.1, $p = 0.002$), confirming their effectiveness. Younger participants (<2 years) had a 1.5 times higher likelihood of faster recovery ($p = 0.04$), while those with normal nutritional status had 1.8 times greater odds ($p = 0.01$). Mild dehydration was the strongest predictor, with a 2.3 times higher chance of quicker recovery ($p = 0.001$), emphasizing the role of overall health and probiotic choice in recovery speed.

DISCUSSION

This research aimed to evaluate the comparative effectiveness of Multistring and Multistring probiotics in reducing the symptoms of severe acute diarrhea in children. The results demonstrate significant differences in clinical outcomes between the two treatment groups, suggesting that Multistring probiotics may offer superior benefits over Multistring probiotics in managing severe acute diarrhea.

The findings of this study indicate that the use of Multistring probiotics significantly enhances clinical outcomes in children with diarrhea compared to Multistring probiotics. The results demonstrate that participants receiving Multistring probiotics had shorter diarrhea duration, lower stool frequency, improved stool consistency, faster recovery time, and a higher dehydration recovery rate. These findings align with previous research emphasizing the effectiveness of probiotics in managing pediatric diarrhea (Huang, Xing, Liu, Chen, & Tang, 2021; Wang, Zhao, Wang, Dai, & Ma, 2022).

The shorter diarrhea duration observed in the Multistring probiotic group (4.2 days vs. 5.4 days, $p = 0.002$) is consistent with the findings of Tremblay and colleagues (2021), who reported that Multistring probiotics containing *Lactobacillus* and *Bifidobacterium* strains significantly reduce diarrhea

duration compared to Multistring formulations (Tremblay et al., 2021). The lower stool frequency in the Multistring group (5.2 times/day vs. 6.5 times/day, $p = 0.004$) supports previous studies highlighting the synergistic effect of multiple probiotic strains in restoring gut homeostasis (Habiballah, Li, & Jiang, 2025; Razaq, Farooq, Shahzaib, Imtiaz, & Siddique, 2025).

Moreover, stool consistency improvement was notably higher in the Multistring group (80% vs. 60%, $p = 0.01$), which corroborates findings by Han et al. (2022), who suggested that probiotic combinations are more effective in enhancing gut barrier function and reducing inflammation (Han, You, Cha, Kim, Sohn, & Park, 2023). Similarly, the faster recovery time observed in the Multistring group (4.8 days vs. 6.1 days, $p = 0.001$) agrees with a Review by Karukuvelraja et al. (2025), which found that children receiving Multistring probiotics recover more quickly than those receiving Multistring probiotics (Karukuvelraja & Saranya, 2025).

The logistic regression analysis further supports these findings, as Multistring probiotic intake was the strongest predictor of faster recovery (OR = 2.1, $p = 0.002$). These results align with the work of Salminen et al. (2020), who reported that probiotic diversity enhances microbial resilience, leading to improved gastrointestinal recovery. Additionally, younger age (<2 years) was a significant predictor of faster recovery (OR = 1.5, $p = 0.04$), which supports findings by Catassi et al. (2024) that suggest infants respond more effectively to probiotic interventions due to their developing gut microbiota (Catassi, Aloï, Giorgio, Gasbarrini, Cammarota, & Ianaro, 2024).

Nutritional status also played a crucial role in recovery, with participants having normal nutritional status exhibiting a 1.8 times higher chance of faster recovery ($p = 0.01$). This is consistent with the findings

of Omar et al. (2024), who emphasized the role of adequate nutrition in supporting gut health and probiotic efficacy (Omar, Gado, Kandel, Farrag, & Shukry, 2024). Additionally, mild dehydration was the most significant predictor of faster recovery (OR = 2.3, $p = 0.001$), which aligns with previous researches that found children with mild dehydration respond more favorably to probiotic treatment compared to those with moderate or severe dehydration (Sehar, Khan, Razaq, Chaudhary, Khan, & Siddique; Sheikh, Ijaz, Kalsoom, Asif, Anwar, & Minhas, 2025).

CONCLUSION

The findings of this research highlight the significant clinical benefits of Multistring probiotics in managing pediatric diarrhea compared to Multistring probiotics. Children receiving Multistring probiotics exhibited shorter diarrhea duration, reduced stool frequency, improved stool consistency, faster recovery time, and a higher dehydration recovery rate. The logistic regression analysis further confirmed that Multistring probiotics, younger age, normal nutritional status, and mild dehydration were significant predictors of faster recovery.

LIMITATION AND RECOMMENDATION OF THE STUDY

This study has certain limitations that should be considered when interpreting the findings. The sample size was relatively small ($n=100$), which may limit the generalizability of the results to larger populations. Additionally, the study was conducted at a single healthcare facility, making it difficult to apply the findings to diverse demographic groups. The short follow-up period focused primarily on short-term clinical outcomes without assessing the long-term effects of probiotic use on gut health. Potential confounding variables, such as dietary habits, antibiotic use, and genetic predispositions, were not controlled, which may have influenced the observed outcomes. Moreover, stool consistency and frequency were reported by caregivers, introducing a possibility of recall bias.

Future research should incorporate larger multi-center studies to enhance the generalizability of the findings across different populations. Longitudinal studies evaluating the sustained impact of Multistring probiotics on gut microbiota composition and

immune function would provide deeper insights into their clinical benefits. Controlling dietary and lifestyle factors in future studies can minimize potential confounding effects, ensuring more reliable results. Comparative studies assessing the efficacy of Multistring probiotics alongside other treatments, such as zinc supplementation and oral rehydration solutions, can help determine the most effective therapeutic approach. Furthermore, incorporating objective laboratory-based assessments of stool composition and gut microbiota analysis could provide more precise and accurate data. Addressing these aspects in future research will contribute to a more comprehensive understanding of the role of Multistring probiotics in managing pediatric diarrhea.

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