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Comparison Between Three-Fourth Strength Rice Suji With Green Banana And Rice Suji In The Dietary Management Of Persistent Diarrhea

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Abstract
Background: *In our country, persistent diarrhea is a major contributor to morbidity and malnutrition. Managing diet is vital; research highlights the effectiveness of a lactose-free rice suji regimen. A three-fourth strength of rice suji promotes clinical recovery. Furthermore, green bananas possess antidiarrheal properties, enhancing efficacy when paired with a lactose-free diet. This study aimed to compare the three-fourth strength rice suji with green banana and rice suji in the dietary management of persistent diarrhea.*
Methods: *This randomized controlled study took place at Bangladesh Shishu Hospital & Institute from January 2020 to December 2021. A total of 93 children with persistent diarrhea were randomly assigned to two groups. Group A (n=47) received a diet of three-fourth-strength rice suji with green bananas, while Group B (n=46) received rice suji alone. Data analysis employed SPSS version 23.0.*
Results: *In group A, stool frequency significantly decreased to 2.6±0.7 times per day by day 3, whereas in group B, it remained high at 5.1±0.9 times per day (P<0.001). Group A showed a significantly shorter time to form stool (2.7±0.8 days) compared to group B (5.8±0.9 days) (p<0.001). The duration of hospital stays was also significantly lower in group A (4.1±0.9 days) than in group B (6.2±0.8 days) (p<0.001).*
Conclusion: *Three-fourth-strength rice suji with green banana is more effective than only rice suji in the dietary management of persistent diarrhea.*

Keywords: *Persistent diarrhea, Three-fourth strength rice suji, Green-banana, Children, Dietary management*

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I. Introduction

Persistent diarrhea is defined as diarrhea that begins acutely, with or without the presence of blood and lasts for 14 days or more, with no more than 2 diarrhea-free days [1]. It poses a significant global health challenge, with around 480,000 children dying before their fifth birthday due to diarrhea, making it the second most common cause of death in children under 5 years old worldwide [2,3]. While diarrhea is a prevalent issue in developing countries, where 3-20 percent of acute diarrheal episodes in children less than 5 years become persistent, it remains a major public health problem in low and middle-income countries like Bangladesh [4,5]. Diarrheal episodes are primarily due to infectious etiology and typically subside within 7 days [6]. In 2019, diarrhea accounted for 7% of under-five deaths in Bangladesh, out of a total of 89,796 deaths [7]. The global prevalence of persistent diarrhea (PD) decreased from 8% in 1991 to 1% in 2010 [8]. In low- and middle-income countries, PD contributes to 36%-56% of diarrheal deaths, and 40% of affected children experience malnutrition [9,10]. Lactose intolerance is a common cause of persistent diarrhea, impacting dietary choices [11]. Recent research has highlighted the antidiarrheal effects of dietary fibers and amylase-resistant starch (ARS)-rich foods, with green bananas being one such source of ARS. Green banana, widely available in many Asian and African countries, is hypothesized to enhance mucosal resistance and promote the healing of damaged epithelium. Its role in managing digestive and metabolic disorders has been recognized due to the presence of indigestible polysaccharides and surface-active phospholipids, as documented by Rabbassa et al.

[12]. The WHO recommends algorithm-based dietary management, which may prolong hospital stays [6]. This approach could escalate the risk of hospital-acquired infections, particularly burdensome in resource-poor settings like Bangladesh. Previous studies suggest the benefit of three-fourth strength rice suji for persistent diarrhea [13], and combining it with green banana could enhance efficacy. However, there's a lack of research assessing the effectiveness of three-fourth-strength rice suji with green bananas. Our study aims to observe the efficacy of this dietary combination in managing persistent diarrhea. The objective of this study was to compare the three-fourth strength rice suji with green banana and rice suji in the dietary management of persistent diarrhea.

II. Methodology

This was a randomized controlled study that was conducted at Bangladesh Shishu Hospital & Institute from January 2020 to December 2021. The study included 94 children with persistent diarrhea, divided into two groups: Group A (47 children) received a diet of three-fourth strength rice suji with green banana, while Group B (46 children) received rice suji alone. A random sampling technique was employed for sample selection. Both groups underwent a 7-day dietary therapy, and observations were made to determine which diet led to better clinical recovery and a shorter duration of hospital stay. This study received approval from the ethical committee of the mentioned hospital, and written consent was obtained from all participants before data collection. The inclusion criteria comprised children aged 6 months to 59 months with persistent diarrhea. Exclusion criteria included patients with severe malnutrition, severe systemic infection, chronic diarrhea, diarrhea with severe dehydration, and those requiring antibiotics. Demographic and clinical information of the participants was recorded, and data analysis was performed using the SPSS version 23.0 program. A significance level of $P < 0.05$ was considered in statistical analysis.

III. Result

In this study, the majority of patients in both groups were infants (Group A: 61.7%; group B: 56.5%). In group A, 14 (29.8%) were one to two years old, and 4 (8.5%) were more than two years old. In group B, 15 (32.6%) were one to two years old, and 45 (10.09%) were more than two years old. The mean ages of patients in group A and group B were 11.9 ± 6.0 and 12.9 ± 6.9 months, respectively. No significant statistical difference was present between the groups regarding mean age (P> 0.508). In group A, 35 (74.5%) were male children, and 12 (25.5%) were female, while in group B, 34 (73.9%) were male children, and 12 (26.1%) were female. In group A, 24 (51.1%) patients had a history of breastfeeding and complementary feeding, while in group B, 25 (54.3%) patients had a history of breastfeeding and complementary feeding. There was no significant statistical difference between the groups regarding feeding status as the P-value > 0.05. There was no significant statistical difference between the groups regarding laboratory parameters as the P-value was >0.05. The mean duration of diarrhea in group A and group B was 16.7±2.4 and 16.6±2.3 days, respectively. The frequency of diarrhea in group A and group B was 14.9±2.8 and 13.9±2.5 times per day, respectively. There was no significant statistical difference between the groups regarding the duration and frequency of diarrhea (P> 0.05). In the present study, vomiting was observed in 23.4% of children in group A, while 15.2% of children in group B reported vomiting. However, there was no statistically significant difference between the two groups (P> 0.05). Fever was present in 23 (48.9%) patients in group A and 21 (45.7%) patients in group B, with no significant statistical difference (P> 0.05). Dehydration was present in 11 (23.4%) patients in group A and 8 (17.4%) patients in group B, and again, there was no significant difference between the groups (P> 0.05). In group A, 17 (36.2%) patients had skin excoriation, while in group B, 19 (41.3%) patients had perianal skin excoriation. There was no significant statistical difference between the groups regarding fever, dehydration, and skin excoriation (P> 0.05). According to the distribution of patients by stool examination, in group A, 16 (34.0%) patients had pus cells, and E. coli was found in 7 (14.9%) patients. In group B, 8 (17.4%) patients had a positive routine test, and E. coli was found in 3 (6.5%) patients. The chi-square test showed that there was no significant statistical difference between the groups (P> 0.05, table VII). Reducing substance was present in 17 (36.2%) patients in group A and 14 (30.4%) patients in group B, with no significant statistical difference between the groups regarding stool-reducing substance (P> 0.05). After receiving the study diet (three-fourth strength rice suji with green banana), stool frequency decreased, reaching 2.6±0.7 times per day by day 3 in group A, while it remained at 5.1±0.9 times per day in group B. This difference was statistically highly significant (P< 0.001). Additionally, in group A, 37 (78.7%) patients had formed stool within 2-3 days, while the remaining 21.3% had formed stool within 4-5 days. In contrast, after receiving rice suji in group B, 16 (34.8%) patients had formed stool within 2-3 days, and the majority (63.0%) had formed stool within 4-5 days. The mean days required to have formed stool in group A and group B were 2.7±0.8 and 5.8±0.9 days, respectively, showing a highly significant statistical difference between the groups (P< 0.001). In the current study, among the 47 patients in group A, 21 (44.7%) had a hospital stay for 3-4 days, while the remaining 55.3% stayed for 5-6 days. In contrast, in group B, 26 (56.5%) patients had a hospital stay for 5-6 days, and

41.3% stayed for 7 days. The mean duration of hospital stay in group A and group B was 4.1±0.9 and 6.2±0.8 days, respectively. Fisher's Exact test and Independent Sample t-test revealed a highly statistically significant difference between the groups regarding the duration of hospital stay, with a P-value < 0.001.

Table 1: Age distribution of participants (N=93)

Age	Group A (n=47)		Group B (n=46)		P-value
	n	%	n	%	
6 months <1 year	29	61.7%	26	56.5%	0.862^{ns}
1 to 2 years	14	29.8%	15	32.6%	
>2 years	4	8.5%	5	10.9%	
Mean ±SD	11.9± 6.0		12.9± 6.9		0.508^{ns}

Table 2: Gender distribution

Gender	Group A	Group B
Male	74.5%	73.9%
Female	25.5%	26.1%

Table 3: Distribution of patients by feeding status

Feeding status	Group A (n=47)		Group B (n=46)		P-value
	n	%	n	%	
Breast and complementary feeding	24	51.1%	25	54.3%	0.751^{ns}
Formula and complementary feeding	23	48.9%	21	45.7%	

Table 4: Distribution of patients by laboratory parameters

Parameters	Group A (n=47)	Group B (n=46)	P-value
Total count	5865.0±2369.4	6273.9±1827.0	0.356^{ns}
Neutrophil	50.4±11.5	49.2±9.1	0.597^{ns}
Lymphocyte	36.4±9.9	35.7±7.5	0.665^{ns}
Sodium	136.5±2.2	137.2±2.7	0.176^{ns}
Potassium	3.7±0.3	3.9±0.3	0.060^{ns}
Chloride	97.3±1.5	97.8±1.3	0.403^{ns}
C reactive protein	7.8±4.2	6.3±5.9	0.165^{ns}

Table 5: Distribution of patients by characteristics of diarrhea

Characteristics	Group A (n=47)	Group B (n=46)	P-value
	Mean		
Duration (In days)	16.7±2.4	16.6±2.3	0.918^{ns}
Frequency (Times per day)	14.9±2.8	13.9±2.5	0.09^{ns}

Table 6: Distribution of patients by signs and symptoms

Signs and symptoms	Group A (n=47)		Group B (n=46)		P-value
	n	%	n	%	
Vomiting					
Absent	36	76.6%	39	84.8%	0.381^{ns}
Present	11	23.4%	7	15.2%	
Fever					
Absent	24	51.1%	25	54.3%	0.751^{ns}
Present	23	48.9%	21	45.7%	
Dehydration					
Absent	36	76.6%	38	82.6%	0.472^{ns}
Present	11	23.4%	8	17.4%	

Perianal Skin excoriation					
Absent	30	63.8%	27	58.7%	0.611^{ns}
Present	17	36.2%	19	41.3%	

Table 7: Distribution of patients by stool examination

Stool examination	Group A (n=47)		Group B (n=46)		p value
	n	%	n	%	
Stool R/M/E					
Pus cell absent	31	66.0%	38	82.6%	0.067ns
Pus cell present	16	34.0%	8	17.4%	
Stool C/S					
Negative	40	85.1%	43	93.5%	0.444^{ns}
E. coli	7	14.9%	3	6.5%	
Reducing substance					
Absent	30	63.8%	32	69.6%	0.557^{ns}
Present	17	36.2%	14	30.4%	

Table 8: Stool frequency at day 3 and days to have formed stool

Characteristics	Group A (n=47) %	Group B (n=46) %	P-value
Stool frequency (day)	2.6± 0.7	5.1± 0.9	<0.001**
Days to have formed stool			
2-3	78.70%	2.20%	<0.001**
4-5	21.30%	34.80%	
6-7	0.00%	63.00%	
Mean ±SD	2.7± 0.8	5.8± 0.9	<0.001**

Table 9: Duration of hospital stay

Hospital stay (day)	Group A (n=47)		Group B (n=46)		P-value
	n	%	n	%	
3-4	21	44.7%	1	2.2%	<0.001**
5-6	26	55.3%	26	56.5%	
7	0	0.0%	19	41.3%	
Mean ±SD	4.1± 0.9		6.2± 0.8		<0.001**

IV. Discussion

In this study, the male group outnumbered the female group, but the difference was not statistically significant (P> 0.05). Sharmin et al. [13] similarly found that male children were more prone to suffering in their study. Our study revealed that a higher number of children with persistent diarrhea were from urban areas. This contrasts with Sharmin et al.'s findings [14], indicating a higher occurrence of persistent diarrhea in rural areas, possibly linked to inadequate hygiene practices. The mean age in our study was 11.9 ± 6.0 months and 12.9 ± 6.9 months in the two groups, with no statistical difference (P> 0.05). Moy et al. [15] also observed a peak incidence of persistent diarrhea in the infant age group in their study. This study revealed that 51.1% of children in the three-fourth strength rice suji with green banana group and 54.3% in the rice suji group received breast feeding along with complementary feeding, with no statistical significance (P> 0.05). Rabbani et al. [16] also reported that 62.3% of children received breast feeding plus formula feeding. No significant differences in clinical characteristics were observed between the two groups. Dehydration was found in 23.4% of group A (three-fourth strength rice suji with green banana) and 17.4% of group B (rice suji) in this study. Sharmin et al. [14] reported 42% incidence of dehydration in both intervention and control groups. Rabbani et al. [16] found mild dehydration in 59-65% of children. In our study, observed dehydration indicated some signs of dehydration. In this study, fever was observed in 48.9% of children in group A (three-fourth strength rice suji

with green banana) and 45.7% in group B (rice suji). Sharmin et al. [14] reported a 50% incidence of fever in their study. Despite the presence of fever in both groups in our study, laboratory investigations revealed a slight increase in inflammatory markers that was not statistically significant (P> 0.05). Vomiting was reported in 23.4% of children in group A and 15.2% in group B, with no statistically significant difference between the two groups (P> 0.05). Laboratory investigations of stool included stool R/M/E, stool C/S, and stool for reducing substance, and no statistically significant results were found (P> 0.05). The growth of E. coli was observed in 14.9% of group A and 6.5% of group B, while Rabbani et al. [16] detected 40% E. coli in their study. At enrollment, the duration of diarrhea in group A (three-fourth strength rice suji with green banana) was 16.7±2.4 days, and in group B (rice suji), it was 16.6±2.3 days. The stool frequency at enrollment was 14.9±2.8 times per day in group A and 13.9±2.5 times per day in group B, with no statistically significant difference (P>0.05) between the two groups. In contrast, Rabbani et al. [16] reported pre-admission days of diarrhea in their study, indicating 21.6 ± 6.3 days in the control group and 20.3± 7.3 days in the banana group. These differences could be attributed to the age group studied, as their research included children aged 5 to 12 months, with a higher prevalence of breastfeeding and potential lactose intolerance leading to prolonged diarrheal episodes. In our study, the introduction of the study diet led to a gradual decrease in stool frequency in the green banana group. By day 3, children in group A had a stool frequency of 2.6±0.7 times per day, while in group B, it was 5.1±0.9 times per day. A statistically highly significant difference (P< 0.001) was observed in the reduction of stool frequency between the two groups. By day 3, 78.7% of children in the green banana group had formed stools, and the remaining 21.3% achieved formed stools by day 5. In the control group, only 2.2% of children had formed stools by day 3, with 34.8% developing formed stools by day 5 and 63.0% achieving formed stools by day 7. A statistically highly significant difference (P< 0.001) was found in the development of formed stools in the study group compared to the control group. Similar findings were reported by Rabbani et al. [16] in their study, where a significant number of children recovered from diarrhea and developed formed stools by day 3 of post-treatment with green banana (P< 0.001). Acosta et al. [17] also observed a significant improvement (P< 0.002) in diminishing stool output and consistency. In a multi-center cohort study by Ashraf et al. [18], conducted in various countries, the algorithm-based treatment response rate was 80%, aligning with the observations in the present study. In this study, 44.7% of children in group A (three-fourth strength rice suji with green banana) required a hospital stay of 3-5 days, and 55.3% required 5 to 6 days, indicating that a majority of children receiving the green banana diet had a shorter hospital stay. In contrast, in group B (rice suji group), 56.5% of children required a hospital stay of 5 to 6 days, and 41.3% required 7 days. This difference was statistically significant (p < 0.001). Sharmin et al. [14] reported a longer duration of hospital stays in both groups, with 11 days in the green banana group and 16 days in the rice suji group. This variation could be attributed to the use of milk suji diet, as both groups initially received this diet. In our study, milk suji diet was not administered, and no adverse events such as vomiting or abdominal distension were documented after the introduction of the green banana diet. In contrast, Sharmin et al. [14] reported that 44% of children in the green banana group developed vomiting, and 45% of children in the rice suji group developed abdominal distension, possibly due to associated infections in their study. Rabbani et al. [16] found a significantly lower requirement for ORS in the banana group compared to the control group (P< 0.05). Acosta et al. [17] reported a significant response (P< 0.05) to the green plantain diet in reducing stool weight and promoting weight gain. However, in our study, the effects of green banana mixed with rice suji on stool weight or daily weight gain were not observed. Children were discharged upon clinical recovery, with group A children experiencing early discharge within 2-3 days. The short duration of hospital stay might have contributed to unsatisfactory daily weight gain in this study.

Limitation of the study:

This study has limitations, including the lack of direct measurement of diet osmolality and quantification of stool volume (g/kg). The absence of systematic measurement of gradual weight gain in children and a specific examination of the effects of green banana on stool mixed with blood or mucus are also notable limitations. Additionally, the study did not observe associated extra-intestinal infections. Future research addressing these limitations would enhance the study's robustness.

V. Conclusion

The inclusion of green bananas in three-fourth-strength rice suji has been found to be more effective in the dietary management of persistent diarrhea compared to using only rice suji. This suggests that the combination of these ingredients may offer additional benefits, potentially related to nutritional content or other factors, in addressing persistent diarrhea. Further research and studies may be warranted to explore the specific mechanisms and advantages of this dietary approach, contributing to improved management strategies for individuals experiencing prolonged episodes of diarrhea.

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