

# Is Defecation Posture and Diet Associated with Functional Constipation in Indian Children?

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## ABSTRACT

**Background:** Functional constipation accounts for over 95% of cases of constipation in children >1 years of age. This can have serious and chronic health consequences.

**Objective:** To assess whether defecation posture and diet are associated with functional constipation in Indian children.

**Study design:** Case-control, hospital-based.

**Participants:** Children between the ages of 2–18 years presenting to outpatient department (OPD) of a tertiary care hospital (Artemis Hospitals, Gurugram, Haryana, India) between 15<sup>th</sup> December 2020 and 15<sup>th</sup> February 2022.

**Results:** A higher proportion of cases were using a Western toilet (71.3 vs 49.3%) and consuming a mixed diet (44 vs 27.3%) compared to controls.

**Conclusion:** Sitting defecation posture (Western toilet) and mixed diets are associated with functional constipation in Indian children.

**Keywords:** Bristol stool chart, Children, Diet, Functional constipation, Toilet.

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## INTRODUCTION

Constipation is a common condition affecting the gastrointestinal (GI) system and it impacts populations of all ages. Primarily, there are two types of constipation—functional and organic. Functional constipation refers to persistently difficult, infrequent, or incomplete defecation, in the absence of any evidence of a primary anatomic, pathological, or biochemical cause.<sup>1</sup> This definition is further supported by the “Rome IV” diagnostic criteria, which requires the presence of at least two of six symptoms describing the various presentations of constipation in terms of stool frequency, hardness, size, fecal incontinence, or voluntary stool retention, with the prerequisite that all organic causes of constipation are ruled out by a detailed evaluation.<sup>2,3</sup>

Functional constipation accounts for nearly 95% of all cases of constipation in healthy children above the age of 1.<sup>4</sup> A delay in identification or inadequate untimely management may result in voluntary stool-withholding behavior which can further worsen constipation and have grave psychosocial consequences. In some cases, the cause may be organic, in which case the role of the clinician is vital in prompt identification and offering early and appropriate treatment.

In a majority of cases, organic causes of constipation can be excluded on the basis of a detailed history and physical examination. Judicious laboratory and radiographic testing should be performed for children with atypical features (warning signs of possible organic constipation), or for those who do not respond to a well-structured and timely administered intervention program for at least 6 months.

Previous studies have found that factors such as age, gender, socioeconomic status, education level, anxiety, dietary habits, posture, and psychological factors such as depression likely contribute toward functional constipation.<sup>5–9</sup>

A hot topic of discussion amongst functional GI disorder specialists is posture. The anorectal angle changes depending on

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the posture during defecation. This angle is straighter in a squatting position, which helps in easing the defecation process. It leads to decreased requirements for the pressure needed for complete evacuation and therefore prevents constipation and as an extension, hemorrhoids. Some studies have been able to demonstrate a reduction in the overall time required for defecation and the number of straining episodes in subjects using a squatting posture.<sup>10</sup>

The Indian toilet is designed to void by squatting. Whereas, in comparison, Western toilets are designed for sitting, where this mechanism of anorectal angle straightening does not occur sufficiently or fails entirely, thus leading to a theoretically incomplete evacuation. However, it needs to be studied whether the type of toilet does in fact have any impact on the prevalence of constipation.

Dietary fiber is known to help improve defecation by improving the fecal bulk and water retention.<sup>11</sup> It is well established in the literature that it reduces rates of constipation. However, it is not yet

known if having a purely vegetarian diet is considered beneficial over a mixed diet.

## MATERIALS AND METHODS

This was a case-control study, undertaken in a tertiary care hospital (Artemis Hospitals, Gurugram) in India from 15 December 2020 to 15 February 2022. A total of 150 children and adolescents with functional constipation and another 150 controls (total = 300) were enrolled between the ages of 2 and 18 with the help of convenient nonrandom sampling. The study was conducted in the OPD. A detailed history and physical examination were done once informed consent was obtained from the parents and assent was taken from the children >14 years of age.

Patients with an identified organic condition were excluded from the study. Since patients with organic constipation were beyond the ambit of this study, no separate data on numbers and diagnoses was maintained. The Rome IV criteria was used for diagnosing patients with functional constipation. Use of Indian vs Western toilets was used as proxy for identifying defecation posture that is, squatting vs sitting respectively. An attempt was made to only enroll patients who limited their use to a specific type of toilet only, that is, either Indian or Western (without any aids).

An equal number of controls were also enrolled from the OPD from a pool of patients who came for vaccination, routine health, flu-like illnesses, and school health check-up. A detailed history was taken to ensure that the controls did not have any bowel-related complaints or illnesses.

Assuming an odds ratio of 3.6 based on a study by Modi et al.,<sup>12</sup> the sample size was calculated to be 320 for 90% power and expecting 5% exposure in controls. A *post-hoc* sample analysis found sample size adequate for 97.6% power with 300 samples.

The assistance of the hospital dietician was taken for identifying appropriate questions for obtaining dietary history and to assess fiber intake with the help of 24-hour recall method. In this study, as far as diet was concerned, there were mainly two groups of patients—vegetarians and nonvegetarians.

### Statistical Analysis

Data entry was done in MS Excel 2016 and data analysis was carried out using Statistical Package for the Social Sciences version 23.0. Means and proportions were calculated for continuous and

categorical variables respectively. Difference in proportions were tested for statistical significance using Chi-squared test. Difference in means were tested using independent sample student *t*-test after checking normal distribution of data. Adjusting for potential confounders was done using binary logistic regression analysis. A *p*-value < 0.05 was considered statistically significant.

### Ethical Clearance

Ethical Committee clearance was obtained before initiating the study.

## RESULTS

A total of 300 participants—150 cases and 150 controls were enrolled.

Both the study groups were comparable in terms of age distribution, sex distribution, and body mass index (BMI), and no significant difference was observed between the groups. The same is shown in Table 1.

Median age of presentation of functional constipation across the study group was 8.9 years, however, an accurate age of onset could not be estimated due to prolonged course and chronicity, and reliance solely on history provided by parents which was not immune to subjectivity.

Higher proportion of cases (71.3%) were using a Western toilet as compared to controls (49.3%). This can be seen in Table 2.

Higher proportion of cases (44%) were consuming a mixed diet as compared to controls (27.3%). This association was found to be statistically significant as shown in Table 3.

Binary multivariate logistic regression analysis was performed which found low fiber diet and Western toilet to be independently related to functional constipation as shown in Table 4.

## DISCUSSION

As a general rule, a person should be able to pass stools without significant straining or discomfort.

In this study, cases and controls were comparable in terms of age, sex, and BMI. Hard stool was reported by most of the cases (96%). We find that a higher proportion of cases (71.3%) were using a Western toilet compared to controls (49.3%). Tanjung et al.<sup>13</sup> assessed the relationship between functional constipation and defecation posture (sitting vs squatting) in children between

**Table 1:** Distribution of the study groups by their demographic characteristics

	Study group		Total n (%)	<i>p</i> -value*	Odds ratio and confidence interval
	Cases n (%)	Controls n (%)			
Age (years)					
2–5	56 (37.3)	53 (35.3)	109 (36.3)	0.952	0.974 (0.832–1.141)
6–10	60 (40.0)	63 (42.0)	123 (41.0)		
11–16	34 (22.7)	34 (22.7)	68 (22.7)		
Total	150 (100.0)	150 (100.0)	300 (100.0)		
Sex					
Female	69 (46.0)	77 (51.3)	146 (48.7)	0.355	1.443 (0.865–2.407)
Male	81 (54.0)	73 (48.7)	154 (51.3)		
Total	150 (100.0)	150 (100.0)	300 (100.0)		
BMI (kg/m <sup>2</sup> )					
BMI	19.8 ± 3.3	19.7 ± 3.2	–	0.782	0.977 (0.805–1.187)

\*Chi-squared test was applied to test statistical difference in proportions

**Table 2:** Distribution of the study groups by their toilet type (defecation posture)

Type of toilet (posture)	Study group		Total n (%)	p-value*	Odds ratio and confidence interval
	Cases n (%)	Controls n (%)			
Indian (squat)	43 (28.7)	76 (50.7)	119 (39.7)	<0.001	2.718
Western (sit)	107 (71.3)	74 (49.3)	181 (60.3)		(1.611–4.586)
Total	150 (100.0)	150 (100.0)	300 (100.0)		

\*Chi-squared test was applied to test statistical difference in proportion

**Table 3:** Distribution of the study groups by their dietary history

Dietary history	Study group		Total n (%)	p-value*	Odds ratio and confidence interval
	Cases n (%)	Controls n (%)			
Mixed	66 (44.0)	41 (27.3)	107 (35.7)	0.003	2.357 (1.387–4.007)
Vegetarian	84 (56.0)	109 (72.7)	193 (64.3)		
Total	150 (100.0)	150 (100.0)	300 (100.0)		

\*Chi-squared test was applied to test statistical difference in proportions

**Table 4:** Binary multivariate logistic regression analysis

Parameter	Odds ratio	p-value
Age	0.97 (0.832–1.141)	0.74
Sex	1.44 (0.865–2.407)	0.16
Weight	0.99 (0.897–1.111)	0.97
Height	1.00 (0.944–1.068)	0.89
Mixed diet	2.35 (1.387–4.007)	0.002
Western toilet use	2.71 (1.611–4.586)	<0.001

the ages of 12 and 15 and found a significant correlation [relative risk = 0.06, (0.02–0.25);  $p = 0.0001$ ]. They state that functional constipation was more likely to have occurred in children who defecated in a sitting posture. Though the above study was done only among children in the age group of 12–15 years, the results obtained were identical to that of the findings noted in the present study. However, in contrast, a Turkish cross-sectional descriptive study<sup>14</sup> of 41 patients between 4–18 years of age with functional constipation found that the constipated group children used the squatting toilet more frequently.

Sikirov et al.<sup>15</sup> in their study reported that the time needed to feel a sensation of satisfactory and complete bowel emptying was reduced sharply in all those volunteers who were squatting compared to sitting. Sakakibara et al.<sup>16</sup> objectively demonstrated that the anorectal angle on squatting was larger than that with normal sitting (126 vs 100°) and with hip-flex sitting (99°). These above discussed studies further strengthen the evidence generated in the present research work and provided support for biological plausibility of association between defaecation posture and functional constipation.

Low consumption of dietary fiber has long been considered as a significant risk factor. Undigested fibers within the colon increase the time required to transit through and increase stool output. Lee et al.<sup>11</sup> found that kindergarten children with constipation had a significantly lower median dietary fiber intake compared to nonconstipated children. Other studies among older children have also noted that children with constipation consume smaller amounts of dietary fiber compared to controls.<sup>17,18</sup> Analyzing the total fiber consumption was beyond the scope of our study however when assessing whether purely vegetarian vs mixed diet had any association with functional constipation, we found

a significant positive association between consumption of mixed diet and functional constipation ( $p = 0.003$ ). This association does find support in some literature.<sup>19</sup>

Our study was limited by the selection bias resulting from choosing patients from a single center which was a hospital. There is also the possibility of some confounding variables that might have been missed.

In conclusion, we can see that sitting posture as seen in those who use a Western style of toilet is significantly associated with functional constipation in Indian children. A mixed diet is also associated with functional constipation. Patients with symptoms of functional constipation should be identified early and targeted intervention should be introduced as early as possible.

We recommend the use of Indian style toilets or squatting modifications to Western toilets as well as vegetarian diets for children with functional constipation.

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