

Defecation Frequency and Stool Form in a Coastal Eastern Indian Population

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Background/Aims

Data on normal stool form and frequency, which are important for defining constipation, are scanty; hence, we studied these in an eastern Indian population.

Methods

One thousand and two hundred apparently healthy asymptomatic subjects were evaluated for predominant stool form (Bristol chart with descriptor) and frequency. Data on demographic and life-style (diet and physical activity) were collected.

Results

Of 1,200 subjects (age 42 ± 14.5 years, 711, 59% male), most passed predominantly Bristol type IV stool (699 [58.2%]; other forms were: type I (23 [1.9%]), type II (38 [3.2%]), type III (99 [8.2%]), type V (73 [6%]), type VI (177 [14.7%]), type VII (7 [0.6%]) and an irregular combination (84 [7%]). Weekly stool frequency was 12.1 ± 4.7 (median 14, range 2-42). Less than 3 stools/week was noted in 32/1,200 (2.6%). Female subjects ($n = 489$) passed stools less frequently than males ($n = 711$) (11.1 ± 5.6 /week vs. 12.8 ± 3.8 /week, $P < 0.001$) and tended to pass harder forms (type I: 17, type II: 20, type III: 39 vs. 6, 18 and 60, respectively, $P = 0.061$). Vegetarians ($n = 252$) and physically active ($n = 379$) subjects tended to pass stool more frequently than occasional ($n = 553$) and regular non-vegetarian ($n = 395$) (11.8 ± 4.5 and 12.8 ± 4.7 vs. 11.3 ± 4.7 ; $P < 0.05$) and sedentary ($n = 464$) and intermediately active ($n = 357$) subjects (13.4 ± 4.0 and 12.3 ± 4.5 vs. 10.9 ± 5.1 , $P = 0.080$) in different age groups, respectively. Older age was associated with less frequent stool, particularly among female population. Female gender and age > 35 years were significant on multivariate analysis.

Conclusions

Median stool frequency in the studied population was 14/week (range 2-42) and predominant form was Bristol type IV. Older age was associated with lesser stool frequency, particularly among female subjects.

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Key Words

Constipation; Functional gastrointestinal disorder; Gastrointestinal transit; Irritable bowel syndrome

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Introduction

There are limited data on stool form and frequency among healthy subjects, which are important for defining constipation; most studies available in the literature on this issue are from Western populations.¹⁻⁵ Bowel habits of different population may vary widely due to several factors including dietary habit, quantity of fiber intake and difference in gut transit time.⁶⁻⁸ Data on normal bowel habit in different populations are important to define abnormalities in this function, which is the basis for definition of constipation. In the Western population, a stool frequency between 3-21/week is considered normal.^{1,9} This was the basis for an earlier frequency-based definition of constipation, which mentioned that a stool frequency less than 3 per week should be considered as constipation.¹⁰ However, this definition may not apply to a non-Western population, where a large proportion of patients with irritable bowel syndrome remained unclassified into either constipation or diarrhea using a stool frequency-based criteria.^{7,11-13}

A few studies reported that mean stool frequency is higher in several Asian populations (e.g., Beijing, China 7.09/week, Iran 12.5-14/week).^{14,15} There is no data on stool form and only a few studies on frequency in Indian population.^{11,16} Diet of Indian population is quite different from many other regions of the world. Vegetarianism, which is associated with higher fiber intake, is common in India.¹⁷ A study from northern India showed that mean fecal weight among 514 healthy subjects older than 15 years was 311 g/24 hour, a value much higher than that in Western population.¹⁶ It is therefore, important to study stool frequency and form in Indian population in relation to their dietary habit. Accordingly, the present study was undertaken with the following aims: (1) to evaluate the stool form and frequency among general adult population in coastal eastern India and (2) to study relationship between demographic (age, gender) and life-style (diet, physical activity) variables and bowel habit.

Materials and Methods

Methods

In this prospective study, conducted at Cuttack, Orissa (Fig. 1) from January 2011 to July 2012, 1,200 apparently healthy asymptomatic subjects were interviewed using questionnaire earlier used for a multi-centric study (MIIBS)¹⁸ after informed

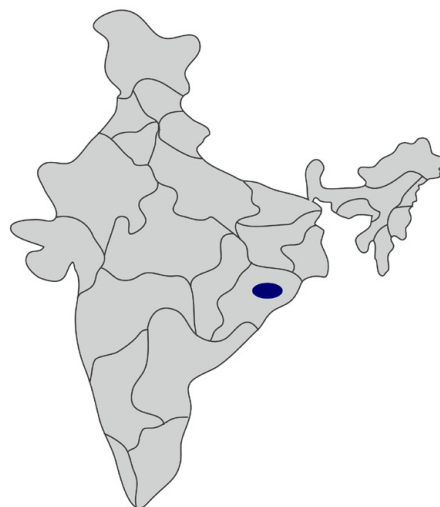


Figure 1. Map of India showing the study area.

consent. Each subject was interviewed to record their demographic (age, gender), life-style parameters (diet, physical activity) and stool frequency and form (using Bristol stool chart containing pictures as well as descriptors).¹⁹ Dietary habit was recorded as vegetarian (those who do not consume any animal items except milk and its products) and non-vegetarian (those who consume animal products); non-vegetarians were further classified as occasional or regular (almost daily). Levels of physical activity of subjects were classified as active (e.g., manual laborers), intermediately active (people doing exercise ≥ 3 days/week) and sedentary life style.

Statistical Methods

Data were checked for normal distribution using Shapiro-Wilk test. Categorical and continuous data were presented as proportion and mean, standard deviation and 95% confidence intervals, respectively. Chi-square and unpaired *t* tests were used to compare between categorical and continuous data, respectively. Weekly stool frequency in different age group in relation to gender, dietary habit and physical activity was compared using Poisson regression. For multivariate analysis, stepwise logistic regression method was used. *P*-values below 0.05 were considered significant for all statistical analysis. Statistical analysis was done using R, Epicalc and R-studio software (R development core team, Vienna, Austria) and SPSS version 15 (SPSS, Inc., Chicago, IL, USA).

Results

Of 1,200 subjects (age 42 ± 14.5 years, range 18-70 years),

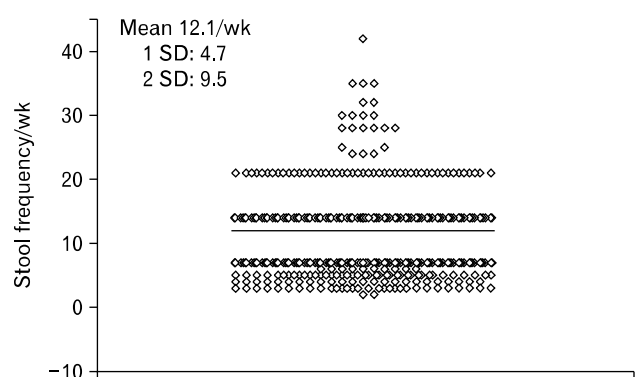


Figure 2. Dot plot showing weekly stool frequency of 1,200 apparently healthy subjects from eastern India. The horizontal line represents mean value.

711 (59%) were male and 489 (41%) were female. Weekly stool frequency was 12.1 (1 SD 4.7, 2 SD 9.5, Fig. 2; median 14, range 2-42). Most people passed predominantly Bristol type IV stool (699 [58.2%]); other stool forms were: type I (23 [1.9%]), type II (38 [3.2%]), type III (99 [8.2%]), type V (73 [6%]), type VI (177 [14.7%]), type VII (7, 0.6%) and an irregular combination (84, 7%). Of 1,200 people, 32 (2.6%) passed less than 3 stools/week, 24 (2%) between 3-4 stools/week, 40 (3.3%) between 4-5 stools/week and 10 (0.8%) between 5-6 stools/week.

Relationship Between Gender, Age and Stool Frequency and Form

Table shows stool frequency and forms in relation to gender. Female population had lesser frequency and harder forms of stool than male. Stool frequency was lesser among people of older age (> 35 years) than among those with younger age (≤ 35 years, Fig. 3A). Reduction in stool frequency with older age (> 35 years) was more among female than among male populations (Fig. 3B). Reduction in stool frequency was noted to start in

Table. Demographic, Life-style and Bowel Pattern of 1,200 Subjects in Relation to Gender

	Female (n = 489)	Male (n = 711)	P-value
Age (mean \pm SD, yr)	39.3 \pm 12.3	43.8 \pm 15.6	< 0.001
Stool frequency			
> 21/wk	12 (2.5)	9 (1.3)	< 0.001
3/day	16 (3.3)	31 (4.4)	
2/day	252 (51.5)	506 (71.2)	
1/day	115 (23.5)	153 (21.5)	
> 3/wk	62 (12.7)	12 (1.7)	
≤ 3 /wk	32 (6.5)	0 (0)	
Number per week (mean \pm SD)	11.1 \pm 5.7	12.8 \pm 3.8	< 0.001
Bristol stool forms			
Type 1	17 (3.5)	6 (0.8)	< 0.001
Type 2	20 (4.1)	18 (2.5)	
Type 3	39 (8)	60 (8.4)	
Type 4	243 (49.7)	456 (64.1)	
Type 5	31 (6.3)	42 (5.9)	
Type 6	88 (18)	89 (12.5)	
Type 7	3 (0.6)	4 (0.6)	
An irregular combination	48 (9.8)	36 (5.1)	
Physical activity			
Active	43 (8.8)	336 (47.3)	< 0.001
Sedentary	284 (58.1)	180 (25.3)	
Intermediate	162 (33.1)	195 (27.4)	
Diet			
Vegetarian	76 (15.5)	176 (24.8)	< 0.001
Non-vegetarian	198 (40.5)	197 (27.7)	
Occasional non-vegetarian	215 (44)	338 (47.5)	

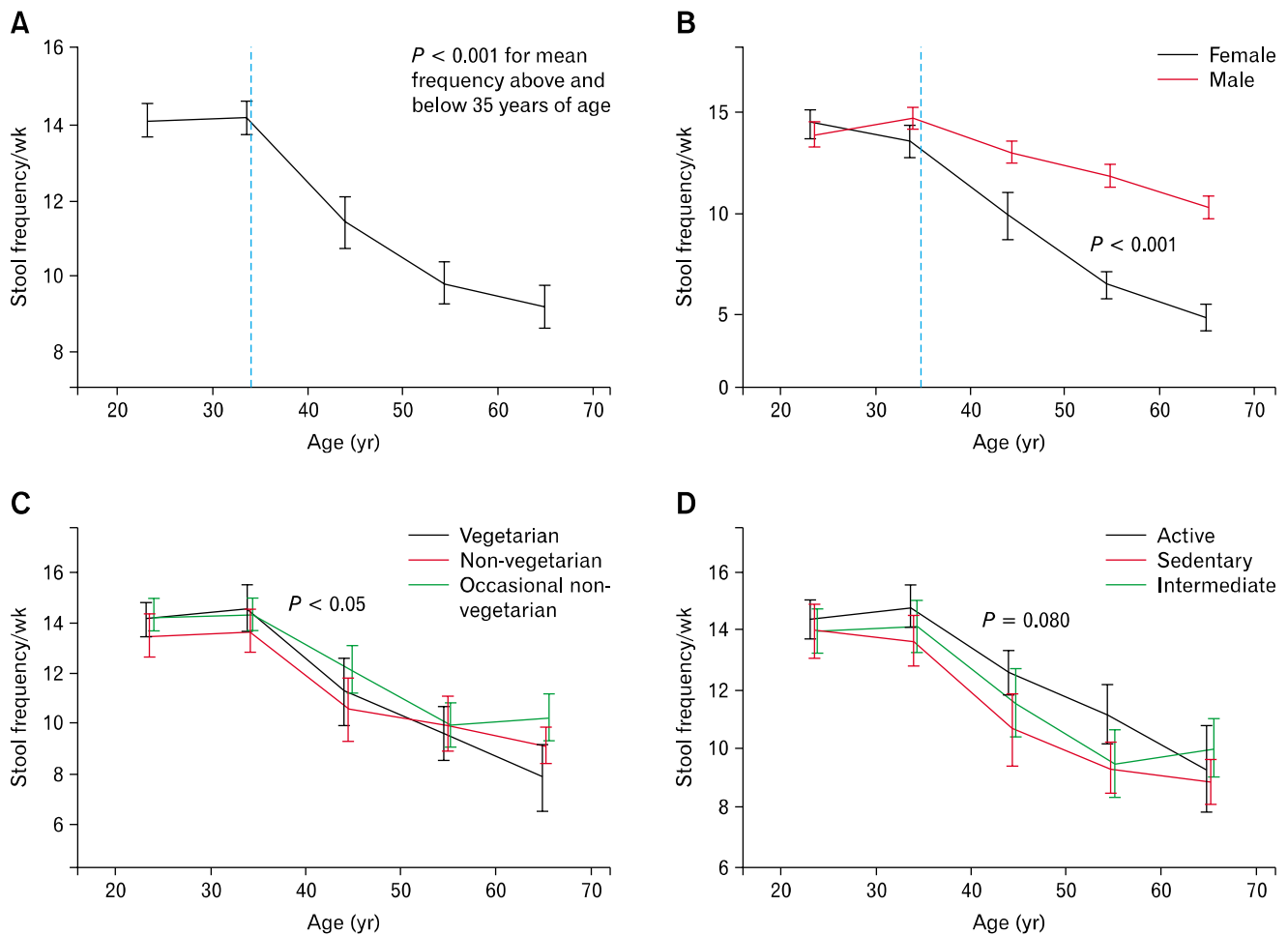


Figure 3. Aggregate plots showing. (A) Weekly stool frequency in relation to age of the study population (blue dotted line indicates the age at which stool frequency started reducing), (B) Weekly stool frequency with increasing age in relation to gender (blue dotted line indicates the age at which stool frequency started reducing), (C) Weekly stool frequency with increasing age in relation to diet and (D) Weekly stool frequency with increasing age in relation to physical activity.

mid-fourth decade of life both in male and female populations (Fig. 3A and 3B). Number of subjects 35 years old or younger was 437/1,200 (36%). Of 32 subjects who reported passing ≤ 3 stools/week, all were female and only one of them was younger than 35 years.

Relationship Between Diet and Stool Frequency and Form

Two hundred and fifty-two (21%), 395 (33%) and 553 (46%) subjects were vegetarian, non-vegetarian and occasional non-vegetarian, respectively. Vegetarians and occasional non-vegetarians passed stool more frequently than non-vegetarians (11.8 ± 4.5 and 12.8 ± 4.7 vs. 11.3 ± 4.7 , $P < 0.05$). Reduced stool frequency among non-vegetarian population was seen with

increasing age (Fig. 3C).

Relationship Between Physical Activity and Stool Frequency and Form

Three hundred and seventy-nine (31.6%), 464 (38.6%) and 357 (29.7%) reported active, sedentary and intermediately active life style, respectively. Subjects with active and intermediate activity tended to pass stool more frequently than sedentary people (13.4 ± 4.0 and 12.3 ± 4.5 vs. 10.9 ± 5.1 , $P = 0.080$). Reduced stool frequency among sedentary people tended to be seen with increasing age (Fig. 3D).

Multivariate Analysis

On multivariate analysis, female gender (< 0.001) and age

> 35 years (< 0.001) were independent predictors of passing ≤ 3 stools per week but vegetarianism and physical activity were not significant.

Discussion

The present study showed that an apparently healthy study population from eastern India passed 14 stools/week (range 2-42) and the predominant form was Bristol type IV. On multivariate analysis, female gender and age > 35 years were independent predictors of passing ≤ 3 stools per week.

Bowel habit varies widely in different population across the world.^{6,7} In Western population, a stool frequency between 3/week to 3/day is considered normal.^{1,9} This is the basis for an older frequency-based definition of constipation, which suggested that a stool frequency less than 3/week should be considered as constipation.¹⁰ However, this definition may not apply widely in different parts of the world including Asia as several studies showed that frequency of defecation to be higher in several Asian populations.^{14,15} Chen et al²⁰ from Singapore found that most respondents (59%) in their cross-sectional study reported bowel movement about once a day. Average stool weight in 514 healthy Indians older than 15 years was 311 g per day.¹⁶ In contrast, stool weight greater than 200 g per day is diagnostic of diarrhea in Western population.²¹ In some non-Asian population also, a high frequency of bowel movement has been reported. In a Nigerian study on 1,115 adolescent subjects, 77% passed 1 stool/day, 17% once on each alternate day and only 5% passed once in > 3 days.²² A postal survey from New Zealand showed the normal frequency of bowel motions was 2-17 per week in their general population.²³ Bassotti et al⁴ from Italy reported a mean defecation frequency of 1.00 ± 0.4 /day. In the British study from East Bristol, once daily bowel movement occurred only in a minority in both the sexes.¹ In this study, they found that less than once daily bowel habit was less common than a more than once daily among men (14.4% vs. 47.8% respectively, $P < 0.002$), though in women they were equally prevalent (31.6% and 32.7%).¹ In the East Bristol study, type 4 stool form predominated in both sexes (48.6% in males and 46.1% in females).¹ Current data showed that among an eastern Indian population, mean bowel movement was 14/week, which is much higher than that reported from most Western countries.^{1,9} Though this study is from eastern India, it is possible that the bowel pattern in other parts of India may be similar. Regional difference in stool form in India has never been studied. However, we do not expect it to be

widely different as in an earlier pan-Indian study on 4500 community subjects, stool frequency was reported to be somewhat similar (> 3 stools/day, 167 subjects [3.7%]; 3 stools/day, 242 [5.4%]; 2 stools/day, 1,535 [34%]; 1 stool/day 2,520 [56%]; and ≤ 3 stools/week [43, 1%]). Stool form in Indian population was not studied earlier. Since this study presents normal bowel frequency and form in an apparently healthy Indian population, these data should be taken into consideration while defining constipation in this population.

Differences in gut transit time, dietary variation including fiber intake and consumption of non-vegetarian foods such as meat have been suggested to explain variation in stool frequency among different areas of the world in several earlier studies.^{16,24-27} However, in current study, dietary factors were not significant on multivariate analysis. This observation is in contrast to earlier studies. Davies et al²⁸ in their study on bowel function measurements of individuals with different eating patterns showed all measurements of bowel function were significantly correlated with total dietary fiber. In this study, bowel habit was assessed in 51 subjects. A group of seventeen subjects (10 females, 7 males) each consumed omnivorous, vegan and vegetarian diet, which is associated with mean fiber intake of 23, 37 and 47 g, respectively. Mean gut transit time was comparable among the 3 groups of subjects. Vegans passed softer and more frequent stools. Increasing dietary fiber was associated with shorter transit, more frequent stools and softer forms (mean transit time, frequency of defecation/24 hour, wet weight of feces in g/24 hour of omnivorous [51.8 ± 19.4 , 1.0 ± 0.2 and 153 ± 79], vegetarian [48.5 ± 27.2 , 1.2 ± 0.5 and 168 ± 56] and vegans [44.7 ± 21 , 1.7 ± 0.9 and 225 ± 91] respectively). Men produced a greater quantity of softer, less formed feces than women.²⁸ Study from UK showed mean bowel frequency was higher in vegetarians (10.5 in men, 9.1 in women) and especially in vegans (11.6 in men, 10.5 in women) compared with participants who ate meat (9.5 in men, 8.2 in women) supports our finding.²⁹ On multivariate analysis, diet did not influence bowel habit in contrast to age and gender, suggesting the latter two factors to be more important. Fast transit time,³⁰ and higher physical activity¹⁹ are known to increase stool frequency. In an earlier pan-Indian study on 4,500 subjects, 99% passed at least one stool per day.¹⁵ Cultural factors also influence bowel habit. Quite early in their life, children in some parts in India, including the region where the current study was undertaken are exposed to the adage "*He who defecates twice a day; remains healthy - keeps the doctor away.*"

Lower stool frequency, harder stool forms and constipation

have been reported to be commoner among females than males.^{3,31} Women had fewer bowel movements on average than men, and were less likely to have daily bowel movements.²⁹ In another study from London, females less often passed stool than males.⁹ This has been explained by the hypothesis that female sex hormones reduce gut transit.¹⁷ However, our finding of decreasing stool frequency with increasing age, particularly among females, cannot be explained by the hormonal hypothesis. Another study from Germany found that mean stool frequency was 1.02/day, with 95% of the studied normal population having between 2 stool per day and one every 2 day, and becoming less frequent with age.³² One possible explanation for reduction in stool frequency with aging among female population could be related to the development of pelvic floor disorders with aging among females. This can be further compounded by the effect of parturition on pelvic floor. Vaginal delivery and higher parity increased the risk of both urinary and defecatory symptoms of pelvic floor dysfunction.³³ This is further supported by the finding that reduction in stool frequency started at the middle of fourth decade (Fig. 3B), when female hormones are reduced; by this age, however, a large proportion of female population would have undergone parturition. This issue requires further study.

In conclusion, healthy Indian passed 14 stools per week and predominant form was Bristol type IV. These data should be taken into consideration while defining constipation in India and other geographical areas with similar bowel habit. Female gender, sedentary life-style and non-vegetarianism were associated with lesser stool frequency and harder forms; on multivariate analysis, female gender and age > 35 years were independent predictors of passing \leq 3 stools per week. Older age was associated with lesser stool frequency, particularly among female subjects. These factors may influence epidemiology and pathogenesis of constipation in Indian population.

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