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CONTENTS

Prevalence and public health correlates of constipation among adults in U. S. Nagar, Uttarakhand

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ABSTRACT: Functional constipation is a prevalent but under-recognized public health issue in India, especially in semi-urban populations undergoing dietary and lifestyle transitions. This community-based cross-sectional study assessed the prevalence and correlates of functional constipation among 995 adults aged 18–60 years in Udham Singh Nagar, Uttarakhand, using the Bristol Stool Form Scale (BSFS). Constipation was defined as stool types 1–3. Data on dietary patterns, fluid intake, physical activity, and family history were collected through structured interviews. The overall prevalence was 23.51%, with higher rates among females and adults aged 30–50 years. Significant associations were found with low fiber, water intake, physical inactivity, meal irregularity, and maternal history of constipation ($p \leq 0.05$). Participants using fiber supplements and consuming sufficient fluids showed better stool profiles. The study highlights the need for targeted community interventions focusing on dietary improvement, hydration and routine bowel health screening.

Keywords: Constipation, Dietary Fibre, diet, prevalence, public health

Constipation is a prevalent functional gastrointestinal disorder characterized by infrequent or difficult bowel movements and a persistent sensation of incomplete evacuation. Clinically, it is defined as fewer than three bowel movements per week; however, individuals often perceive it based on symptoms such as excessive straining, passage of hard or lumpy stools, unproductive urges, or a general sense of discomfort during defecation (Ghoshal *et al.,* 2017). Its global prevalence and clinical presentation vary considerably due to multiple influencing factors, including geographical region, ethnicity, dietary fiber intake, fluid consumption, and intestinal transit time (Daniyam *et al.,* 2011). As a multifactorial condition, constipation is frequently linked to lifestyle and behavioral determinants such as physical inactivity, imbalanced or low-fiber diets, and the unsupervised use of medications that can affect gastrointestinal motility (Moharana and Moharana, 2011). Functional constipation—commonly assessed using tools like the Bristol Stool Form Scale—is typically chronic and shaped by both physiological and psychosocial factors (Storr and Andrews, 2012). In the Indian context, particularly in rural and peri-urban settings, constipation remains underreported and underdiagnosed due to cultural stigma, lack of awareness, and poor access to gastrointestinal healthcare. The diversity of dietary habits and occupation-related routines in these regions further compounds the issue. In view of these complexities, the present study was undertaken in the Udham Singh Nagar district of Uttarakhand to assess the prevalence of constipation and its association with key demographic, dietary, and lifestyle variables. The findings are intended to support the design of evidence-based, community-focused interventions aimed at improving bowel health and overall quality of life.

MATERIALS AND METHODS

Study Design: This study was designed as a cross-sectional community-based survey to estimate the prevalence of constipation and identify its associated demographic and lifestyle factors among adults in Udham Singh Nagar, Uttarakhand. The district was selected due to its diverse population and varied dietary and occupational patterns. These socio-environmental factors provided an appropriate context

for studying bowel health behaviours and their potential correlates.

Sampling: A total of 995 adults aged 18–60 years were selected using stratified random sampling to ensure balanced representation across gender, age groups, and residential areas. The minimum required sample size was determined using a standard epidemiological formula (Charan and Biswas, 2013), considering an expected constipation prevalence of 20% (Bharucha *et al.,* 2013), which yielded a calculated minimum of 245 participants. To improve the statistical power and generalizability of the findings, the sample size was expanded to four times the minimum requirement. Data were collected using a structured, pre-tested interview schedule along with the Bristol Stool Form Scale (BSFS), a validated clinical tool for assessing stool form and frequency. Constipation was operationally defined as stool types 1 to 3 on the BSFS, indicating hard, lumpy, and infrequent stools, in accordance with established clinical guidelines (Heaton and Lewis, 1997).

Inclusion and Exclusion Criteria: Adults aged 18 to 60 years who were permanent residents of the study area and provided informed consent were included in the study. Both male and female participants were considered; however, among females, only non-pregnant and non-lactating (NPNL) women were eligible to eliminate physiological variations related to pregnancy and lactation that may influence bowel function or nutrient metabolism. Individuals who reported altered bowel habits were further screened using the Bristol Stool Form Scale (BSFS). Participants were excluded if they had recently undergone gastrointestinal surgery, had a diagnosed bowel disorder such as irritable bowel syndrome or inflammatory bowel disease, or were taking medications known to affect gastrointestinal motility. Pregnant or lactating women and individuals with cognitive impairments were also excluded to ensure data consistency and sample homogeneity.

Data Collection Tools: A structured and pre-validated interview schedule was employed to collect comprehensive information on sociodemographic characteristics (age, sex, education, and occupation), dietary intake patterns, and fluid consumption, levels of physical activity, and bowel movement frequency and type. To ensure the validity of the interview schedule, it was pre-tested on 10 constipated subjects aged 20–60 years from a demographically similar population. Feedback from the pre-test led to necessary modifications before using the revised schedule in the present study. Content validity was further established through expert review by three faculty members from the Department of Foods and Nutrition. The Bristol Stool Form Scale (BSFS), a widely recognized clinical tool for categorizing human stool into seven types, was utilized as the primary diagnostic measure to identify individuals with constipation (Heaton and Lewis, 1997).

Ethical Considerations: Prior approval for the study was obtained from the Institutional Ethics Committee of GovindBallabh Pant University of Agriculture and Technology, Pantnagarvide letter no. CHS/Ethical Committee/330. All participants were informed of the study's objectives, and their voluntary written consent was secured before participation.

Statistical Analysis: The collected data were coded and entered into SPSS software for statistical analysis. Descriptive statistics, including means, frequencies, and percentages, were used to summarize sociodemographic characteristics and prevalence rates. To assess associations between constipation and independent variables such as dietary habits, fluid intake, and physical activity, the chi-square (χ^2) test was applied. A p-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Prevalence of Constipation: Table 1 presents the distribution of stool types among 995 participants assessed using the Bristol Stool Form Scale (BSFS). Based on Asian criteria, stool types 1 (severe), 2 (moderate), and 3 (mild) are indicative of functional constipation. A total of 234 individuals (23.51%) fell into this category, with type 2 being the most common (11.65%), followed by type 3 (10.25%) and type

1 (1.60%). In contrast, normal stool forms (types 4 and 5) were reported by 668 participants (67.13%), with type 5 being the most prevalent overall (40.30%), suggesting effective gut transit in the majority. Diarrheal stool types (6–7) were observed in 93 individuals (9.34%), indicating a smaller proportion experiencing loose stools. These findings reveal that while most individuals had normal bowel patterns, nearly one-fourth exhibited functional constipation. The stratified BSFS data facilitate identification of those needing dietary or clinical intervention. The observed prevalence aligns with other Indian studies reporting rates between 5% and 20% (Ghoshal *et al.,* 2017; Ford and Suares, 2011), underscoring the significance of constipation as a common yet underrecognized health issue.

Correlates of Constipation

Gender and Age: Table 2 presents the distribution of stool forms across age and sex groups using the Bristol Stool Form Scale (BSFS), where types 1–3 indicate constipation, types 4–5 represent normal stool patterns, and types 6–7 denote diarrheal forms. In the 20–29 age group, 26.26% of participants were constipated, with a slightly higher prevalence among males (28.34%) than females (25.75%), though the association with age was not statistically significant (χ^2 = 3.8766, p = 0.1439). Among individuals aged 30–39 years, 21.92% reported constipation, more frequently in females (23.73%) than males (14.29%) (χ^2 = 2.0575, p = 0.3574). Diarrheal stool types in this group (10.96%) were lower than national estimates (Srivastava *et al.,* 2022). A statistically significant association between age and stool type was observed in the 40–49 age group (χ^2 = 11.4918, p = 0.0031), with 15.09% constipated and 25.81% of males experiencing diarrhoea. Among individuals aged $\geq$50 years, 15.90% reported constipation, but no significant age-wise association was found. Across all age groups, constipation prevalence was consistently higher in females. Constipation preva-

Table 1: Distribution of frequency percentage of stool types in population

Stool types as per Bristol stool form scale (BSFS)		Prevalence of Functional Constipation (N=995, N %)			
		Frequency	Total	Percentage	Total
Type 1	Severe	16	234	1.60	23.51
Type 2	Moderate	116		11.65	
Type 3	Mild	102		10.25	
Type 4	Normal	267	668	26.83	67.13
Type 5	Normal	401		40.30	
Type 6	Diarrhea	71	93	7.13	9.34
Type 7	Diarrhea	22		2.21	

Table 2: Frequency distribution of stool form as per age and sex (N=995)

Age	Sex	Type 1–3 (Asian criteria of constipation) N=234		Type 4–5 (Normal) N=668		Type 6–7 (Diarrheal) N=93		Total	Chi-square test [p value]
		Frequency	%	Frequency	%	Frequency	%		
20–29	Male	36	28.34	75	59.0	16	12.59	127	3.8766, (0.1439)
	Female	136	25.75	351	66.48	41	7.77	528	
	Total	172	26.26	426	65.04	57	8.70	655	
30–39	Male	4	14.29	22	78.57	2	7.14	28	2.0575, (0.3574)
	Female	28	23.73	76	64.41	14	11.86	118	
	Total	32	21.92	98	67.12	16	10.96	146	
40–49	Male	3	9.68	20	64.52	8	25.81	31	11.4918, (0.0031)[*]
	Female	13	17.33	59	78.67	3	4	75	
	Total	16	15.09	79	74.53	11	10.38	106	
$\geq$50	Male	2	10.53	15	78.95	2	10.53	19	0.5282, (0.7678)
	Female	12	17.39	50	72.46	7	10.14	69	
	Total	14	15.90	65	73.86	9	10.23	88	

*Significant at p $\leq$ 0.05

Table 3: Chi-square analysis for association of Bristol Stool Form Scale types with associated factors

Associated factor		Bristol stool scale type 1-3		Bristol stool scale type 4-5		Bristol stool scale type 6-7		Chi-square test [p value]
		n	%	n	%	n	%	
1. Dietary pattern								
Water intake	1-2 lit.	57	71.25	12	15.00	80	8.04	0.0346*, χ^2=129.994
	2-4 lit	148	18.13	598	73.28	816	82.01	
	More than 4 lit.	29	29.29	58	58.58	99	9.94	
Fiber supplement intake	Yes	32	5.52	476	82.07	580	58.29	0.0001*, χ^2=248.6421
	No	202	48.44	192	26.04	417	41.90	
Eating pace	Fast, I usually finish First	154	57.46	30	11.19	268	26.93	0.0001*, χ^2=598.3116
	Neither fast nor slow	38	6.15	574	92.88	618	62.11	
	Slow, I usually finish last	42	38.53	64	58.72	109	10.95	
Skipping of meal	Yes	144	36.73	180	45.92	392	39.39	0.0206*, χ^2=135.7135
	No	90	14.93	488	80.93	603	60.60	
Remedies used during constipation	Drugs	47	47.47	6	6.06	99	9.94	0.0001*, χ^2=256.9625
	Lemon water	58	19.80	232	79.18	293	29.40	
	Home remedies	128	21.23	430	71.31	603	60.60	
2. Life style								
Physical activity	Sedentary	124	18.39	476	70.31	677	68.04	0.0001*, χ^2= 50.4657
	Moderate	105	37.91	158	57.04	277	27.83	
	Heavy	5	12.20	34	82.93	41	4.12	
Family history of constipation	Mother	129	76.79	36	21.42	168	16.88	0.0078*, χ^2=334.3449
	Father	9	31.03	22	75.86	29	29.14	
	Sibling	8	44.44	8	44.44	18	1.80	
	Do not known	88	11.28	609	78.08	780	75.39	
3. Defecation pattern								
Constipation associated complication	Headache	72	69.23	14	13.46	104	17.31	0.0001*, χ^2= 601.2175
	Flatulence	14	20.00	2	2.86	70	77.14	
	Lack of appetite	148	18.03	652	79.22	821	2.56	
Time of bowel movement	Morning	34	4.70	655	90.47	724	72.768	0.0218*, χ^2=820.1599
	Day	88	72.73	5	4.13	121	12.16	
	Evening	112	74.67	8	5.33	150	15.07	
Change in bowel movement in some cases	Yes	212	90.59	662	68.81	962	96.68	0.0002*, χ^2=40.4359
	NO	22	9.40	6	18.18	33	3.31	
Strain during evacuation	Yes	220	87.30	3	1.19	252	25.32	0.0098*, χ^2= 804.0872
	No	14	1.88	665	89.50	743	74.67	
Difficult or painful evacuative	Yes	230	99.13	1	0.43	232	23.31	0.0029*, χ^2=961.8938
	No	4	0.52	667	87.41	763	76.68	
Satisfactory evacuative	Yes	2	0.26	658	87.96	748	75.17	0.0051*, χ^2=906.2388
	No	232	93.92	10	4.04	247	24.82	

		1	0.17	580	86.82	2	2.15	583	58.59	0.0032*, χ^2=1033.2812
Abdominal pain during bowel movement	Never									
	Rarely	3	3.03	75	11.22	21	22.58	99	9.945	
	Sometimes	34	14.52	12	1.79	42	45.16	88	8.84	
	Usually/always	196	83.76	1	0.14	28	30.10	225	22.10	
Average time for attempt to have a bowel movement	Less than 5 min.	12	1.61	643	86.65	87	11.72	742	74.57	0.0045*, χ^2= 833.8606
	5-10 min	24	47.05	23	3.44	4	4.30	51	5.12	
	10-20 min.	134	98.52	1	0.73	1	0.73	136	13.67	
	More than 20 min.	64	96.96	1	1.51	1	1.51	66	6.63	

Significant at p $\leq$ 0.05

lence in previous population-based studies has ranged from 5% to 20%, with higher rates consistently reported among women and urban populations (Ghoshal et al., 2017; Rao et al., 2012). The mean age of constipated participants was 37.8 years, in agreement with findings from previous Indian and Asian studies (Rao et al., 2012; Jun et al., 2006). Globally, the prevalence of constipation ranges from 8.75% in the Asia-Pacific region to as high as 27% in Western countries (Longstreth et al., 2006)."Low Dietary Fiber Intake: Although fiber intake was not directly quantified in grams, the use of fiber supplements served as a proxy measure. Among participants who consumed fiber supplements, only 5.52% exhibited BSFS types 1–3 (constipation), while a significant 82.07% had normal stool forms. In contrast, 48.44% of those who did not take fiber supplements fell into the constipated category. This association was highly significant reinforcing the crucial role of fiber in maintaining stool bulk and bowel regularity. Fiber increases stool bulk and accelerates intestinal transit; its deficiency is widely recognized as a leading cause of functional constipation. Diets high in refined cereals, processed snacks, and low veg-

etable content were commonly observed. This reinforces the role of fiber in promoting bowel regularity (Bharucha et al., 2013)."Inadequate Fluid Intake: Water intake showed a significant association with stool consistency, with the highest constipation rate (71.25%) observed among participants consuming only 1–2 liters daily. In contrast, constipation was reported by 18.13% of those consuming 2–4 liters and 29.29% of those drinking more than 4 liters, indicating a strong correlation between inadequate hydration and constipation. Notably, 71% of constipated individuals consumed less than the recommended 1.5–2 liters per day. Adequate hydration is vital for softening stool and supporting colonic transit, while dehydration—whether from insufficient intake or high physical exertion—can lead to hardened, infrequent stools (Storr and Andrews, 2012). These findings highlight the interrelated roles of hydration, fiber, eating pace, and meal regularity in maintaining bowel health. The adverse effects of low fluid intake on stool form are Constipation prevalence in previous population-based studies has ranged from 5% to 20%, with higher rates consistently reported among women and urban populations (Ghoshal et al., 2017; Rao et al., 2012). The mean age of constipated participants was 37.8 years, in agreement with findings from previous Indian and Asian studies (Rao et al., 2012; Jun et al., 2006). Globally, the prevalence of constipation ranges from 8.75% in the Asia-Pacific region to as high as 27% in Western countries (Longstreth et al., 2006).

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Physical Inactivity: Constipation was significantly more prevalent among sedentary individuals (18.39%) compared to those engaging in heavy physical activity (12.20%), highlighting the role of physical activity in maintaining intestinal motility. Occupational patterns also influenced constipation risk. Homemakers and office workers showed higher prevalence due to irregular routines, prolonged sitting, or poor dietary control at work (Bharucha *et al.,* 2013; NICE, 2015). Notably, 64% of constipated individuals reported low physical activity levels, predominantly in urban and peri-urban areas. Inactivity slows gut motility and leads to stool retention, whereas even moderate physical activity can reduce constipation risk (NICE, 2015). Anneke *et al.* (2005) further demonstrated that regular brisk walking or home-based exercises improve colonic transit and bowel function. Thus, structured physical activity emerges as a key non-pharmacological intervention for preventing and managing functional constipation in adults.

Family History: A positive family history of constipation was noted in 33.6% of constipated respondents, mostly on the maternal side which is shown in Table 3. A strong association was observed with maternal history of constipation; 76.79% of these individuals had BSFS types 1–3. Those unaware of their family history showed the lowest constipation prevalence (11.28%). Research supports the familial clustering of gastrointestinal disorders through both behavioural and genetic pathways (Pashankar and Bishop, 2001).

Meal Skipping and Irregular Food Timings: Meal irregularity, especially skipping meals, was strongly associated with constipation as depicted in Table 3. Among those who skipped meals, 36.73% reported BSFS types 1–3, significantly higher than the 14.93% observed in non-skippers ($\chi^2 = 135.7135$, p = 0.0206). Conversely, individuals who maintained regular meal intake exhibited healthier bowel patterns, with 80.93% falling under BSFS types 4–5, and only 14.93% showing constipation symptoms. These trends emphasize the role of consistent meal timing and frequency in promoting bowel regularity. Irregular eating patterns, especially skipping breakfast, were common among students and working adults. Skipping meals interferes with the gastrocolic reflex, a natural signal that prompts bowel movement after eating. Participants with inconsistent meal patterns had significantly more reports of constipation, echoing findings that timing and regularity of meals are important to gastrointestinal health (Rathi *et al.,* 2018).

Type of Diet and Meal Quality: Indirect indicators such as fiber supplement use and eating pace shed light on the quality of diet. Individuals who ate rapidly, often finishing first, had the highest prevalence of constipation (57.46%), suggesting low dietary mindfulness or consumption of less fibrous, processed foods. Those with moderate or slow eating pace reported significantly fewer cases of constipation ($\chi^2 = 598.3116$, p = 0.0001). Breakfast skipping, in particular, disrupts the gastro colic reflex, which normally stimulates morning bowel movements. Its absence delays defecation and contributes to stool retention, while late meals may interfere with

peristalsis due to circadian disruption (Rathi *et al.,* 2018).

Beyond fiber content, the overall dietary pattern plays a significant role in determining bowel health. In the present study, respondents with constipation commonly consumed monotonous, starch-heavy diets, often comprising refined cereals, potatoes, and tea, with minimal intake of fruits, vegetables, and whole grains. This is typical of economically constrained groups where meal diversity is low and fiber-dense foods like leafy greens, pulses, and coarse cereals are less consumed either due to cost or preference. Such diets lack both soluble and insoluble fiber, which impairs stool bulk formation and hinders regular evacuation (Bharucha *et al.,* 2013).

In addition, frequent consumption of tea and processed snacks, particularly in the evening, was observed among younger respondents. These foods have a diuretic or constipating effect due to low water and fiber content, and high fat or caffeine concentration, potentially contributing to harder stool formation and decreased colonic motility (Staller and Barshop, 2016).

Use of Laxatives and Traditional Remedies: Among those using pharmaceutical drugs, 47.47% were constipated, while 46.46% showed diarrheal stool types, indicating alternating bowel patterns likely due to over-reliance or misuse of laxatives. In contrast, home remedies were associated with more stable stool types (21.23% constipated). These trends were statistically significant, suggesting the potential benefits of gentler, traditional interventions for managing bowel health. While such practices provide temporary relief, overuse may impair gut reflexes and exacerbate dependency. Additionally, the stigma associated with discussing constipation openly often leads to delayed diagnosis. (Storr and Andrews, 2012).

Defecation Timing and Symptoms: Among individuals with constipation, defecation was more commonly reported during the daytime or evening, whereas those with normal bowel habits (BSFS types 4–5) predominantly passed stools in the morning,

with 90.47% citing morning defecation as their usual routine. Symptom-specific analysis revealed a strong association between constipation (BSFS types 1–3) and classic indicators of impaired bowel function. Straining during defecation was reported by 87.30% of constipated participants, while 99.13% experienced painful evacuation, and 96.96% required more than 10 minutes to complete a bowel movement. All associations were statistically significant ($p \leq 0.01$), highlighting their clinical relevance in identifying functional constipation. While morning defecation was the norm for most, constipated individuals often experienced delayed or irregular bowel movements, accompanied by symptoms such as flatulence. These manifestations not only indicate constipation but also contribute to reduced daily functioning and diminished quality of life (Belsey *et al.,* 2010).

Modifiable risk factors such as low dietary fiber intake, sedentary lifestyle, and psychological stress have been well-documented in the literature (Bytzer *et al.,* 2001; Mugie *et al.,* 2011). The prevalence rate of 23.51% identified in the present study aligns with global estimates (2–27%) but marginally exceeds previously reported national figures. The findings underscore the need for policy-level interventions that integrate public health nutrition education into existing community health programs, emphasizing the role of dietary fiber, hydration, and regular meal patterns. Routine constipation screening at primary healthcare centers, coupled with gender-sensitive approaches, can ensure early detection and tailored management, especially for women who face cultural and logistical barriers in addressing bowel health concerns.

CONCLUSION

This study highlights a 23.51% prevalence of functional constipation among adults in Udham Singh Nagar, Uttarakhand, attributing the condition to a complex interplay of dietary, behavioral, socio-demographic, and environmental factors. Key contributors included low fiber and fluid intake, physical inactivity, and irregular eating habits. Cultural stigma and lack of privacy led many, especially women, to delay defecation or resort to home remedies without

medical consultation. These findings reflect a gap between awareness and practice in bowel health management. The study advocates for community-level strategies encompassing dietary counseling, improved hygiene access, regular meals, and stress reduction. Routine screening using tools like the Bristol Stool Form Scale at the primary care level can facilitate early detection and intervention. Recognizing constipation as both a medical and social issue is essential to advancing comprehensive health and well-being in semi-urban Indian populations.

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