

Original Article

Evaluating the Impact of Increased Fiber Intake on Gastrointestinal Discomfort among Adults

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ABSTRACT

Background: Dietary fiber supports gastrointestinal function, but tolerance varies according to fiber type, dose, fermentation characteristics, baseline gastrointestinal status, and rate of dietary change. Rapid or excessive intake of some fermentable nondigestible carbohydrates may produce bloating, gas, or discomfort. **Objective:** To evaluate dietary-pattern characteristics associated with gastrointestinal-discomfort severity among symptomatic young adults, with particular interest in fiber-related dietary practices. **Methods:** A cross-sectional questionnaire study included 347 adults aged 18–24 years with gastrointestinal symptoms recruited from health facilities in Lahore. Demographic characteristics, meal frequency, fruit and vegetable intake, processed-food consumption, and gastrointestinal symptom severity were recorded. Associations were evaluated using chi-square tests; Cramér's V was calculated for available contingency tables. **Results:** Mild symptoms were reported by 151 participants (43.5%), moderate symptoms by 132 (38.0%), and severe symptoms by 64 (18.4%). Meal frequency was associated with symptom severity, $\chi^2(4)=41.25$, $p<0.001$, Cramér's $V=0.244$. Processed-food frequency showed a smaller association, $\chi^2(6)=16.90$, $p=0.0096$, $V=0.156$. Fruit and vegetable consumption frequency was not significantly associated with symptom severity, $\chi^2(6)=9.23$, $p=0.161$, $V=0.115$. **Conclusion:** Gastrointestinal symptom severity was associated with meal frequency and processed-food consumption in this symptomatic young-adult sample, while fruit and vegetable frequency was not. Because actual fiber intake, fiber type, and change in fiber dose were not quantified, a specific causal effect of increased dietary fiber cannot be established. **Keywords:** Dietary Fiber; Gastrointestinal Discomfort; Bloating; Young Adults; Dietary Patterns; Processed Foods.

INTRODUCTION

Dietary fiber comprises a heterogeneous group of nondigestible carbohydrates and associated components that escape digestion in the small intestine and may undergo partial or extensive fermentation in the colon. Fiber influences stool bulk, intestinal transit, microbial metabolism, short-chain fatty-acid production, bowel regularity, and other aspects of gastrointestinal physiology. These effects depend substantially on physicochemical and functional properties including solubility, viscosity, fermentability, particle structure, molecular characteristics, and water-holding capacity (1–4).

Adequate dietary fiber intake is generally associated with gastrointestinal and broader health benefits, and evidence from prospective studies and randomized trials supports favorable associations between

higher fiber intake and several chronic-disease outcomes (7). Gastrointestinal tolerance, however, is not uniform. Nondigestible carbohydrates differ markedly in their fermentation profiles and physiological effects, and some may increase gas production, bloating, abdominal discomfort, or altered stool patterns, particularly at larger doses, during rapid dietary escalation, or among susceptible individuals (5,6). Consequently, the gastrointestinal effects of fiber cannot be interpreted solely according to total intake without considering the type of fiber and the context in which it is consumed.

The distinction between fiber types is clinically important. Poorly fermentable bulking fibers can behave differently from highly fermentable oligosaccharides, resistant starches, inulin-type fructans, viscous soluble fibers, and other nondigestible carbohydrates because these substrates vary in water-holding capacity, fermentation rate, viscosity, and effects on intestinal contents and microbial metabolism (1,2,5,6). Baseline gastrointestinal status can further modify tolerance. Patients with functional gastrointestinal disorders may respond differently to particular fibers than asymptomatic individuals, and clinical evidence suggests that soluble fibers such as psyllium may improve some symptoms whereas poorly tolerated or highly fermentable substrates can aggravate symptoms in selected patients (8–12).

Fermentable carbohydrates are particularly relevant to bloating and abdominal discomfort. Mechanistic and clinical evidence indicates that rapidly fermentable substrates can alter luminal water content and gas production, while symptom generation also depends on visceral sensitivity and the individual's ability to tolerate intestinal distension (13,14). Experimental work in irritable bowel syndrome has further demonstrated that different fibers can generate substantially different colonic gas responses; psyllium, for example, may modify the gas response produced by highly fermentable inulin (15). Consistent with these mechanisms, systematic-review evidence supports symptom improvement with restriction of selected fermentable oligo-, di-, and monosaccharides and polyols in appropriately selected patients with irritable bowel syndrome, although such findings should not be generalized to all dietary fiber (16).

Fruit and vegetables are important dietary sources of fiber, but they also provide water, fermentable carbohydrates, micronutrients, phytochemicals, and diverse food structures. Frequency of fruit and vegetable consumption is therefore an indirect proxy rather than a quantitative measure of total fiber intake (1,7). Processed-food frequency likewise represents a broader dietary pattern rather than an isolated fiber exposure. In a large prospective French cohort, greater ultra-processed-food consumption was associated with a higher likelihood of functional gastrointestinal disorders, supporting consideration of overall dietary pattern when interpreting gastrointestinal symptoms (17).

Functional gastrointestinal disorders, now frequently described within the broader framework of disorders of gut-brain interaction, are common internationally. The Rome Foundation Global Study involving more than 70,000 adults across multiple countries demonstrated a substantial worldwide burden of these disorders (18). Pakistani population-based research has similarly documented a considerable burden of functional gastrointestinal disorders, highlighting the relevance of dietary, behavioral, and gastrointestinal-health factors in the local context (19).

Accurate investigation of fiber-related gastrointestinal symptoms ideally requires measurement of actual fiber intake in grams per day, identification of fiber source and type, assessment of supplements and baseline intake, characterization of the magnitude and rate of dietary change, and consideration of fluid intake and symptom timing. These distinctions are important because randomized evidence indicates that responses to fiber supplementation differ according to fiber characteristics and dose, and gastrointestinal tolerance can influence adherence and clinical effectiveness (5,6,20).

The present questionnaire study examined gastrointestinal discomfort among symptomatic young adults and evaluated relationships with several dietary behaviors, including meal frequency, fruit and vegetable intake, and processed-food consumption.

MATERIALS AND METHODS

Study Design and Setting

A cross-sectional questionnaire-based study was conducted among adults attending selected healthcare facilities in Lahore, Pakistan.

Participants

A total of 347 participants aged 18–24 years were included. Participants were eligible if they were within the specified age range, reported gastrointestinal pain or related gastrointestinal symptoms, and agreed to participate.

Individuals younger than 18 years or older than 24 years, pregnant individuals, those with infectious disease, and those with identified mental-health conditions were excluded according to the study criteria.

Data Collection

Data were collected using a structured questionnaire. The questionnaire recorded sex, age, education, gastrointestinal symptom severity, meal frequency, fruit and vegetable consumption, processed-food consumption, and additional lifestyle and dietary characteristics.

Gastrointestinal symptom severity was categorized as mild, moderate, or severe. Meal frequency was categorized as 1–2 meals/day, 3 meals/day, or ≥ 4 meals/day. Fruit and vegetable consumption was categorized as rarely, 1–2 times/week, 3–4 times/week, or daily. Processed-food consumption was categorized using the same four frequency levels.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 22. Categorical variables were summarized using frequencies and percentages. Associations between categorical dietary variables and gastrointestinal symptom severity were assessed using Pearson's chi-square test. For the available contingency tables, Cramér's V was calculated as an effect-size measure. Statistical significance was defined as $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of Superior University, Lahore, Pakistan. Informed consent was obtained from participants before participation.

RESULTS

Participant Characteristics and Symptom Severity

A total of 347 symptomatic young adults were included. There were 189 males (54.5%) and 158 females (45.5%). The largest age category was 19–21 years, comprising 169 participants. Most participants were graduates. Mild gastrointestinal discomfort was reported by 151 individuals, moderate discomfort by 132, and severe discomfort by 64.

Table 1. Participant Characteristics and Gastrointestinal Symptom Severity

Variable	Category	n (%)
Sex	Male	189 (54.5)
	Female	158 (45.5)
Age	18 years	64 (18.4)
	19–21 years	169 (48.7)
	22–24 years	114 (32.9)
Education	Matriculation	1 (0.3)
	Intermediate	33 (9.5)
	Graduate	313 (90.2)
Symptom severity	Mild	151 (43.5)
	Moderate	132 (38.0)
	Severe	64 (18.4)

Meal Frequency

Symptom severity differed substantially across meal-frequency categories. Among participants consuming ≥ 4 meals/day, 35/90 (38.9%) reported severe symptoms compared with 11/101 (10.9%) among those consuming 1–2 meals/day and 18/156 (11.5%) among those consuming three meals/day. The overall association was statistically significant, $\chi^2(4) = 41.25$, $p < 0.001$, with Cramér's $V = 0.244$.

Table 2. Meal Frequency and Gastrointestinal Symptom Severity

Meals/Day	Mild	Moderate	Severe	Total
1–2	39	51	11	101
3	84	54	18	156
≥ 4	28	27	35	90
Total	151	132	64	347

$\chi^2(4) = 41.25$, $p < 0.001$; Cramér's $V = 0.244$.

Fruit and Vegetable Consumption

There was no statistically significant association between frequency of fruit and vegetable consumption and gastrointestinal symptom severity.

Table 3. Fruit and Vegetable Consumption and Symptom Severity

Frequency	Mild	Moderate	Severe	Total
Rarely	27	37	14	78
1–2 times/week	65	41	29	135
3–4 times/week	33	29	15	77
Daily	26	25	6	57
Total	151	132	64	347

$\chi^2(6)=9.23$, $p=0.161$; Cramér's $V=0.115$.

Severe symptoms were reported by 10.5% of daily fruit and vegetable consumers compared with 17.9% among those who rarely consumed these foods, but the overall distribution did not reach statistical significance.

Processed-Food Consumption

Processed-food frequency showed a statistically significant but smaller association with gastrointestinal symptom severity.

Table 4. Processed-Food Consumption and Gastrointestinal Symptom Severity

Frequency	Mild	Moderate	Severe	Total
Rarely	39	33	7	79
1–2 times/week	70	51	24	145
3–4 times/week	28	32	27	87
Daily	14	16	6	36
Total	151	132	64	347

$\chi^2(6)=16.90$, $p=0.0096$; Cramér's $V=0.156$.

The highest proportion of severe symptoms occurred among participants consuming processed food 3–4 times/week, where 27/87 (31.0%) had severe symptoms.

DISCUSSION

The present study examined dietary behaviors associated with gastrointestinal symptom severity among 347 symptomatic adults aged 18–24 years. Meal frequency demonstrated the strongest association, with participants consuming four or more meals per day having a substantially greater proportion of severe symptoms than those reporting fewer daily meals. Processed-food consumption was also associated with symptom severity, although the magnitude of this association was smaller. In contrast, fruit and vegetable consumption frequency was not significantly associated with symptom severity.

The meal-frequency association had a small-to-moderate effect size, with Cramér's V of approximately 0.24. The cross-sectional design does not establish the direction or mechanism of this relationship. More frequent eating may reflect greater overall dietary exposure, frequent snacking, particular food choices, or behavioral adaptation to pre-existing symptoms. Postprandial symptom generation is increasingly recognized as an important feature of disorders of gut-brain interaction, and meal-related symptoms can reflect interactions among nutrient exposure, gastrointestinal motility, visceral sensitivity, and central processing (21). Because all participants in the present study already had gastrointestinal symptoms, reverse causation is also plausible; individuals with symptoms may have altered their eating frequency before recruitment.

Processed-food consumption was associated with symptom severity, although the effect size was smaller than that observed for meal frequency. Processed-food frequency should be interpreted as a marker of overall dietary pattern rather than as a specific fiber exposure. Prospective cohort evidence has associated greater consumption of ultra-processed foods with functional gastrointestinal disorders, although such observational associations do not identify a single responsible dietary component (17). The present findings therefore support further assessment of food quality and dietary pattern but cannot determine whether the observed relationship reflects fiber content, fermentable ingredients, fat intake, food structure, additives, meal pattern, or correlated lifestyle factors.

The central finding relevant to dietary fiber is more cautious. Fruit and vegetable frequency was not significantly associated with gastrointestinal symptom severity. Although fruit and vegetables are important sources of fiber, frequency of consumption does not measure total fiber intake in grams per

day and does not distinguish fiber type, food portion, fermentability, viscosity, or other properties that determine gastrointestinal effects (1,2,5,6). Consequently, the absence of a significant association with fruit and vegetable frequency cannot be interpreted as evidence that fiber has no gastrointestinal effect, just as it cannot demonstrate that increased fiber produces discomfort.

Modern fiber research emphasizes that gastrointestinal responses depend on the specific nondigestible carbohydrate, dose, fermentation characteristics, food matrix, rate of introduction, gut microbial ecology, visceral sensitivity, and baseline gastrointestinal health (1,3–6). Rapidly fermentable carbohydrates may produce greater luminal gas or water effects, but symptom intensity also depends on how the gastrointestinal tract responds to distension (13,14). Randomized and mechanistic research has demonstrated that fibers that appear similar when described simply as “dietary fiber” can produce markedly different physiological and symptomatic effects (15). Contemporary reviews of fermentable-carbohydrate restriction similarly emphasize that symptom responses should not be generalized across all fiber-containing foods or all individuals (16,22).

The broad proposition that increased fiber necessarily causes gastrointestinal discomfort is therefore not supported by the present cross-sectional data. Controlled evidence indicates that some nondigestible carbohydrates are well tolerated across moderate intake ranges, whereas others produce bloating, gas, or altered bowel habits at higher doses or in susceptible individuals (5,6). Fiber can also improve gastrointestinal symptoms in selected clinical settings. Soluble fiber, particularly psyllium, has demonstrated benefit in some patients with irritable bowel syndrome, while insoluble or highly fermentable fibers may produce less consistent responses (8–12). Similarly, an updated systematic review and meta-analysis of randomized trials found that fiber supplementation can improve chronic constipation, with effects varying according to fiber type and dose (20).

The study population also requires careful interpretation. All participants had gastrointestinal pain or related gastrointestinal symptoms as part of eligibility. Consequently, the proportions of mild, moderate, and severe symptoms in this cohort should not be interpreted as population prevalence estimates. The Rome Foundation Global Study has shown that disorders of gut-brain interaction affect a substantial proportion of adults internationally (18), while population-based research from Karachi has demonstrated an important burden of functional gastrointestinal disorders in Pakistan (19). Population prevalence, however, requires community-based sampling rather than recruitment restricted to people who already have gastrointestinal symptoms.

A further limitation is that dietary fiber was not quantified in grams per day. The assessment did not distinguish soluble from insoluble fiber, cereal fiber from fruit and vegetable fiber, naturally occurring fiber from supplemental fiber, or slowly introduced intake from rapid dietary escalation. These distinctions are clinically relevant because physiological effects and gastrointestinal tolerability depend on fiber characteristics and exposure level (1,2,5,6,20). Hydration is also relevant to the functional behavior of some bulking fibers (2). Detailed analyzable category-by-severity counts for water intake and daily fiber consumption were not incorporated into the present effect-size analyses, limiting assessment of these potentially important exposures.

The major strengths of the study include its relatively large sample and evaluation of several dietary-behavior variables. Reconstruction of the available contingency tables also permitted effect-size interpretation rather than reliance on statistical significance alone. Important limitations include the cross-sectional design, recruitment of an exclusively symptomatic sample, absence of quantitative fiber measurement, limited characterization of fiber type and dose, lack of documented questionnaire validation, and potential confounding by pre-existing gastrointestinal conditions and broader dietary behavior.

Future research should use validated dietary-assessment methods, quantify total fiber and specific fiber types in grams per day, document supplement use and hydration, characterize baseline gastrointestinal diagnoses, and evaluate the temporal relationship between changes in fiber exposure and symptoms. Prospective studies or controlled dietary interventions would be particularly useful for determining whether specific fibers, doses, or rates of dietary increase produce gastrointestinal discomfort and which patient characteristics modify tolerance (5,6,20).

CONCLUSION

Among symptomatic adults aged 18–24 years, gastrointestinal-discomfort severity was associated with meal frequency and processed-food consumption. Fruit and vegetable consumption frequency was not

significantly associated with symptom severity. Because the study did not quantify actual fiber intake, fiber type, or change in intake over time, it cannot establish that increased dietary fiber itself caused gastrointestinal discomfort. Future prospective investigations should measure fiber exposure directly and evaluate dose, type, rate of dietary change, hydration, and baseline gastrointestinal status.

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