

ORIGINAL ARTICLE

Functional Constipation and Its Musculoskeletal and Biochemical Correlates in Pakistani Adults: A Cross-Sectional StudyUrfa Zaryab Mir^{1*}, Tauqeer Ahmad², Aima Tahir³, Muhammad Usman Sajid⁴, Faizah Mughal⁵, Fasiha Yousaf³**ABSTRACT**

Objective: To assess the association of functional constipation with age, dietary and lifestyle habits, musculoskeletal symptoms, and serum biochemical parameters.

Study Design: Analytical cross-sectional comparative study.

Place and Duration of Study: This study was conducted at the Department of Community Medicine, District Headquarter Hospital, Abbottabad, and Jinnah International Hospital, Abbottabad, KPK, Pakistan, from December 2024 to June 2025.

Methods: A total of 250 individuals were recruited by using a consecutive sampling technique, and 220 participants who completed the study were included in the final analysis. Functional constipation was diagnosed using the Rome IV criteria. Data on demographics, dietary habits, lifestyle factors, and clinical symptoms were collected through structured face-to-face interviews. Musculoskeletal pain was assessed using the Visual Analog Scale (VAS). Serum levels of vitamin D, calcium, magnesium, sodium, and potassium were measured using standard laboratory methods. Group comparisons between constipated and non-constipated individuals were performed using Chi-Square and independent t-tests. Multivariate logistic regression analysis was used to identify independent predictors of functional constipation.

Results: Functional constipation was significantly associated with older age, female gender, smoking, and caffeine use ($P < 0.05$). Normal BMI, physical activity, and a high-fiber diet were protective. Participants with functional constipation had significantly higher VAS pain scores than non-constipated participants (6.7 ± 1.9 vs. 3.1 ± 1.5 ; $P < 0.001$). Serum analysis demonstrated significantly lower levels of vitamin D, calcium, sodium, potassium, and magnesium in constipated individuals ($P < 0.05$). Logistic regression identified low fiber intake (AOR 2.95), smoking (AOR 2.61), age ≥ 60 years (AOR 1.84), and vitamin D deficiency (AOR 1.73) as significant predictors.

Conclusion: Functional constipation is associated with higher musculoskeletal pain scores and lower serum vitamin D, sodium, potassium, magnesium, and calcium. Strong predictors of functional constipation are a low fiber diet, old age, smoking, and vitamin D deficiency.

Keywords: Analog Pain Scales, Constipation, Electrolytes, Musculoskeletal Pain, Vitamin D.

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Introduction

Functional constipation is a common gastrointestinal disorder that remains under-recognized despite its high global prevalence. It is characterized by infrequent or difficult defecation, passage of hard stools, and a persistent sensation of incomplete evacuation, largely due to reduced gut motility. Functional constipation is a ubiquitous gastrointestinal disease, but unfortunately, it is less discussed and misdiagnosed.¹ Although it affects all

age groups, it is particularly prevalent among children and is influenced by dietary patterns, socioeconomic conditions, and environmental factors. Individuals with chronic functional constipation often report impaired quality of life, frequent healthcare visits, and frustration due to persistent symptoms.² Functional constipation increases the socioeconomic burden due to frequent clinic visits, overuse of laxatives with decreased fecundity. All builds frustration in these person. In 2019, the Global Burden of Disease Study ranks constipation as the main leading cause of years lived with disability (YLDs), which has more impact on women and the elderly. This issue is more common in the South Asian population, where poor and bad dietary habits, sedentary lifestyles, urbanization with less public awareness are the main reasons that are increasing its prevalence.³ According to hospital-based data in Pakistan, the presence of functional constipation is found in 24.5% adults. Although this condition is widespread but poorly quantified. In our society, cultural barriers and hesitation with embarrassment are the key factors that discourage patients from discussing these issues with a physician to get timely medical treatment.⁴

According to research, functional constipation is not only an existing gastrointestinal disorder but can be influenced by other physiological systems. There are so many studies that are pointing out its correlation with musculoskeletal issues, especially chronic lower back pain and pelvic discomfort. Literature suggests that biochemical factors, such as deficiency of vitamin D, electrolyte imbalances, and thyroid dysfunction, are all linked with both constipation and musculoskeletal disorders.⁵ Despite all these findings, from a multisystem perspective in routine clinical settings of countries like Pakistan constipation is rarely evaluated. All lead to a delayed diagnosis of diseases, care, and management.⁴

In recent years, focus has been shifted towards the understanding of the multisystem involvement of functional constipation. According to research, uncoordinated gut-brain signals are among the main causes of impaired neuromuscular coordination and hormonal imbalance.⁶ Recent studies have highlighted the connection between gastrointestinal dysfunction and musculoskeletal symptoms. A study by Arai YC et al. found that patients experiencing

chronic constipation also frequently reported musculoskeletal pain, including lower back and pelvic discomfort, pointing toward a shared neuromuscular or inflammatory mechanism.⁷ Moreover, the work done by Panarese A et al. demonstrated that a significant proportion of constipated patients had low serum vitamin D levels, which could decrease the functioning of the neuromuscular system and gut motility.⁸ The associations between chronic constipation and biochemical markers such as calcium, magnesium with some other electrolytes (Sodium and Potassium) are well described by some researchers. All of these play integral roles in muscle contraction and proper nerve conduction.⁹

As compared to Pakistan, in western countries more work is done on relation between functional constipation and musculoskeletal disorders. The infrastructure of the healthcare system of Pakistan is more focused towards acute and infectious diseases, but inadequate attention is given to functional conditions like constipation.¹⁰ In clinical practice, due to this gap, most cases are misdiagnosed, leading to treatment failure with poor patient outcomes. To date, there appears to be no comprehensive study from Pakistan that simultaneously explores the relationship between functional constipation, musculoskeletal pain, and biochemical factors by using validated diagnostic and screening tools. This represents a significant gap in the literature, which this study seeks to address by a comparative, interdisciplinary approach. To address this gap, the present study investigates the association between functional constipation, musculoskeletal pain, and selected biochemical parameters within the Pakistani population. Specifically, the study aims: (1) to compare musculoskeletal pain levels assessed through the Visual Analog Scale (VAS) between individuals with and without functional constipation, (2) to evaluate and compare biochemical markers including vitamin D, calcium, magnesium, sodium and potassium and (3) to identify predictors of functional constipation through multivariate logistic regression analysis.

Methods

This analytical cross-sectional, comparative study was conducted at Department of Community Medicine, District Headquarter Hospital,

Abbottabad and Jinnah International Hospital, Abbottabad, KPK, Pakistan from December 2024 to June 2025. The study design was used because it allows simultaneous measurement of exposure variables (biochemical parameters and musculoskeletal pain) and outcome (functional constipation) to evaluate their associations within a defined population at a single point in time. After taking an ethical letter from the Institutional Ethical Review Board of Women's Medical College, Abbottabad, vide letter no: WMC/RC/IRB/17, dated 25th September 2024. Participants were recruited from both outpatient and inpatient settings to ensure representation of a broader population. All the patients were recruited from District Headquarter Hospital Abbottabad and Jinnah International Hospital Abbottabad, both affiliated with Women's Medical and Dental College, Abbottabad. The target population included adult patients aged 18 years and older, irrespective of gender, who were capable of giving informed consent. A consecutive sampling technique was used, whereby all eligible patients presenting during the data-collection period were approached and enrolled until the required sample size was achieved. The sample size was calculated using the WHO sample size calculator based on the expected prevalence of functional constipation reported in previous regional studies with a 95% confidence level and 5% margin of error. To account for potential nonresponse, 250 participants were recruited; 220 completed the study and were included in the final analysis. Participants who completed the questionnaire and fulfilled the eligibility criteria were included. Individuals younger than 18 years, pregnant women, those with a history of gastrointestinal surgery, neurological disorders, known hypothyroidism, diabetes mellitus, chronic kidney disease, irritable bowel syndrome, opioid or antidepressant use, or incomplete questionnaires were excluded to minimize potential confounding. Functional constipation was diagnosed according to the Rome IV diagnostic criteria. Participants fulfilling at least two of the Rome IV criteria for a minimum of three months, with symptom onset at least six months before diagnosis, were classified as having functional constipation.¹¹

Data were collected through structured face-to-face

interviews. The questionnaire covered demographics, dietary habits, lifestyle factors, gastrointestinal symptoms, and musculoskeletal pain. The questionnaire was translated into Urdu, Punjabi, and Pashto. Back translated into English to ensure linguistic accuracy. Information regarding demographic characteristics, dietary habits, smoking status, caffeine intake, physical activity, body mass index, gastrointestinal symptoms, and medical history was recorded. A high-fiber diet was defined as the regular consumption of fruits, vegetables, and whole grains in accordance with dietary recommendations, while regular physical activity was defined as at least 150 minutes of moderate-intensity exercise per week. Musculoskeletal pain was assessed using the Visual Analog Scale (VAS), a validated 10-cm horizontal line ranging from 0 (no pain) to 10 (worst imaginable pain). Participants were asked to indicate the intensity of their pain by marking the point that best represented their current level of discomfort, and the measured score was recorded as a continuous variable.¹²

Blood samples (5–10 mL) were collected from both groups by using aseptic techniques to evaluate biochemical contributors to constipation and musculoskeletal symptoms. The tests performed were Serum Vitamin D (25-hydroxyvitamin D): Measured using chemiluminescent immunoassay and Calcium, Magnesium, Sodium, and Potassium: Assessed via spectrophotometry to evaluate neuromuscular balance and electrolyte imbalances affecting gut and muscle function.

All data were entered into Google Forms and analyzed by using SPSS version 23.0. Continuous variables were expressed as mean $\pm$ standard deviation, whereas categorical variables were presented as frequencies and percentages. Group comparisons between constipated and non-constipated participants were performed using the independent-samples t-test for normally distributed continuous variables and the Chi-Square test for categorical variables. Multivariate logistic regression analysis was performed to identify independent predictors of functional constipation. Variables including age, gender, body mass index, physical activity, smoking status, caffeine use, high-fiber diet, and vitamin D deficiency were entered into the regression model based on their clinical relevance

and univariate analysis. The results are presented as Adjusted Odds Ratios (AORs) with 95% confidence intervals (95% CI). A two-tailed *P*-value of less than 0.05 was considered statistically significant.

Results

A total of 250 participants were recruited for the study. After excluding 30 participants for incomplete questionnaires or failure to meet eligibility criteria,

220 participants were included in the final analysis. Based on the Rome IV diagnostic criteria, 105 participants (47.7%) were classified as having functional constipation, while 115 participants (52.3%) were categorized as non-constipated. The demographic characteristics, musculoskeletal pain scores, biochemical parameters, and predictors of functional constipation are presented in Tables 1 to 4.

Table 1: Comparison of Demographic and Clinical Characteristics between Constipated and Non-Constipated Groups

Variable	Constipated (N = 105)	Non Constipated (N = 115)	Chi-Square test value	P-value
Age ≥ 60 years	35 (33.3%)	10 (8.7%)	19.2	<0.001
Gender (Female)	60 (57.1%)	42 (36.5%)	9.8	0.001
Gender (Male)	45(42.9%)	73 (63.5%)	9.8	0.001
BMI (18–22.9 kg/m ²)	18 (17.1%)	42 (36.5%)	5.4	0.02
Physical Activity (Yes)	32 (30.5%)	95 (82.6%)	45.6	<0.001
High Fiber Diet	20 (19.0%)	66 (57.4%)	34.2	<0.001
Smoking (Yes)	46 (43.8%)	29 (25.2%)	9.6	0.002
Caffeine Use	80 (76.2%)	58 (50.4%)	16.8	<0.001

Statistical Test Applied: Chi-square test for categorical variables

Table 2: Comparison of Mean VAS Scores between Constipated and Non-Constipated Groups

Group	N	Mean VAS Score ± SD	t- test value	P-value
Constipated	105	6.7 ± 1.9	15.2	<0.001
Non constipated	115	3.1 ± 1.5		

Statistical Test Applied: Independent t-test

Table 3: Comparison of Biochemical Parameters between Groups

Parameters with reference ranges	Constipated (Mean ± SD)	Non- Constipated (Mean ± SD)	t- test value	P-value
Serum Vitamin D (20–50 g/mL)	18.3 ± 7.2	25.1 ± 8.7	6.2	< 0.001
Calcium (8.5- 10.5 mg/dL)	8.9 ± 0.4	9.3 ± 0.3	8.5	< 0.001
Magnesium (1.7-2.4 mg/dL)	1.7 ± 0.2	1.9 ± 0.3	5.1	< 0.01
Sodium (135-145 mEq/L)	138.1 ± 4.2	140.3 ± 3.1	4.2	< 0.01
Potassium (3.5-5.0 mEq/L)	4.0 ± 0.6	4.2 ± 0.4	2.1	0.05

Reference ranges are based on standard adult laboratory values. Statistical comparisons were performed using the independent-samples t-test

Table 4: Logistic Regression Analysis of Factors Associated with Constipation

Variable	AOR (95% CI)	Chi-Square test value	P-value
Age $\geq$ 60	1.84 (1.03–3.29)	4.1	0.04
Low Fiber Diet	2.95 (1.76–4.94)	18.6	< 0.001
Smoking	2.61 (1.58–4.31)	15.2	< 0.001
Vitamin D Deficiency	1.73 (1.02–2.93)	4.6	0.032

Multivariate model adjusted for relevant demographic and lifestyle variables

Discussion

The results of categorical variables of this study, when evaluated by the Chi-Square test, are shown in Table 1. According to the findings functional constipation was significantly related to old age, female gender, caffeine usage and smoking. Whereas, physical activity, normal BMI, and consumption of a high fiber diet were negatively associated with functional constipation. Similar outcomes have been observed by Diaz S et al. and Yurtdaş Depboylu G et al.^{13,14}

As documented in Table 2, the mean VAS scores were significantly higher in the constipated group than in the non-constipated group (Table 2), indicating severe pelvic pain and musculoskeletal discomfort associated with prolonged functional constipation. A possible explanation for this may be related to the normal anatomy and physiology of the pelvic floor, which is composed of the iliococcygeus, pubococcygeus, puborectalis, and levator ani muscles. Co-ordinated movement of these muscles along with diaphragm provide strength to pelvic floor, pelvic organs, maintain intra-abdominal pressure and control urination and defecation process. Impaired co-ordination of these muscles may contribute to incomplete evacuation of rectum and discomfort at time of defecation.¹⁵ The study of A Ashrafi in 2020 also found a positive correlation between the symptoms of chronic functional constipation and dysfunction of pelvic floor muscles. The author suggested that prolonged straining and tension in the pelvic floor muscles may irritate their fascia and may induce hyperactivity, which could contribute to abdominal and lumbosacral discomfort.¹⁶ Thus our study proved that chronic functional constipation is not just gut motility disorder, but also linked to noticeable musculoskeletal pain.

Results of biochemical parameters (Table 3) in this study showed reduced vitamin D and serum calcium

levels in the functional constipation group as compared to the healthy group ($P < 0.05$). These results are in accordance with the results of the study of Metwally in 2024 that highlighted a significant prevalence of vitamin D deficiency and insufficiency in children suffering from chronic functional constipation. The effects of vitamin D deficiency on gastrointestinal motility disorders are not yet completely understood. It has been proposed that vitamin D facilitates intestinal calcium absorption, while calcium is involved in the contraction and peristalsis of intestinal smooth muscles. Therefore, deficiency of vitamin D and calcium may contribute to reduced gastrointestinal motility and constipation.¹⁷ Oladian M et al. mentioned in their study that vitamin D receptors are located on intestinal epithelial cells and intestinal immune cells, e.g., macrophages and lymphocytes, and may play a role in maintaining intestinal immune homeostasis.^{17,18} Consequently, vitamin D deficiency could be associated with chronic gastrointestinal disorders, including constipation.¹⁸ This study also demonstrated significantly lower serum sodium, potassium, and magnesium levels in the functional constipation group than in the healthy group ($P < 0.05$). Q Zhao et al. briefed the pathophysiology of chronic constipation and narrated that the nervous system, gut microbiota, serum electrolytes, and transporters of these electrolytes jointly regulate the normal gut motility, and dysfunction of any of these factors may contribute to abnormal gut motility and constipation. According to Zhao, intestinal epithelial cells contain ion channels for sodium and potassium.¹⁹ These channels modulate the transport of these ions and nutrient-coupled transport; thus, they modulate intestinal secretions, gut smooth muscle motility, and fecal excretion. Imbalances in these electrolytes may therefore contribute to impaired intestinal motility and constipation.¹⁹ Mori

H et al. discussed the role of these electrolytes as stool softeners and laxatives, e.g., magnesium oxide. It exerts an osmotic effect in the gut, hence, it is used to treat functional constipation in children and adults.²⁰ Bellini M et al. also reported that drinking water enriched with sodium, potassium, magnesium, and calcium may improve stool consistency and frequency.²¹

Lastly, as shown in Table 4, multivariate logistic regression analysis was performed to identify the independent predictors of functional constipation. The analysis demonstrated that a low-fiber diet, smoking, age ≥ 60 years, and vitamin D deficiency were independently associated with functional constipation, and all these associations were statistically significant ($P < 0.05$). Our study suggests that a low fiber diet is strongly associated with functional constipation. Similar results are observed in the study by Lai H et al., which concluded that the gut of patients with functional constipation has altered microbiota.²² Whereas, an increased fiber diet (psyllium husk, etc.) acts as a probiotic that softens the stool and may reduce constipation symptoms by modulating the gut microbiota.²² Study of Arco S et al. showed similar results that functional constipation has more prevalence in old age frail patients (41.7%) as compared to young robust patients (24.2%). This association may be explained by reduced physical activity and poorer quality of life in the elderly population. In addition, aging is associated with reduced cholinergic activity in the enteric nervous system, which may weaken intestinal smooth muscle contractions and could contribute to delayed colonic transit and impaired defecation.²³

The strong association of smoking with functional constipation has also been reported in a Nation-wide survey of Cui G et al. His study reported a positive association between cotinine levels (a biomarker of cigarette smoke) and constipation among the American population. Their findings suggest that nicotine and cotinine may disrupt intestinal microbiota and smooth muscle function, thereby potentially contributing to constipation.²⁴

This study has limitations, as it assessed only serum electrolyte levels and did not evaluate gut electrolyte composition, which may provide deeper insight into intestinal motility and secretion. Additionally, no intervention such as electrolyte supplementation

was performed; therefore, causal effects could not be determined. The cross-sectional design limits causal inference, and the hospital-based sample may restrict the generalizability of the findings. In addition, medication use, hydration status, chronic diseases, and detailed dietary intake were not comprehensively assessed and may have acted as potential confounders.

Further studies should compare electrolyte levels in serum and gut secretions of healthy and constipated individuals and evaluate the effect of electrolyte supplementation in functional constipation. Large prospective multicenter studies with detailed assessment of diet, medication use, and hydration status are also recommended.

Conclusion

Functional constipation was significantly associated with higher musculoskeletal pain scores and lower serum levels of vitamin D, calcium, magnesium, sodium, and potassium. Low-fiber diet, smoking, older age, and vitamin D deficiency were identified as independent predictors of functional constipation. These findings highlight the importance of a comprehensive approach in the evaluation and management of patients with functional constipation.

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Author Contributions

UZM: Conception, design of the work, and approval for final submission

TA: Manuscript writing for methodology design, investigation, and approval for final submission

AT: Data acquisition, curation, statistical analysis, and approval for final submission

MUS: Validation of data, interpretation, write-up of results, and approval for final submission

FM: Revising, editing, supervising for intellectual content, and approving for final submission

FY: Writing the original draft, proofreading, and approval for final submission

UZM is the nominated guarantor and takes full responsibility for the overall content and integrity of the work