

Association between Musculoskeletal Pain and Gastrointestinal Symptoms among Medical Students in Peshawar: A Cross-Sectional Study

Syed Waqas Arshad^{1*}, Luqman Khan², Hasnain Iqbal³, Sujjad Khan⁴

¹⁻⁴ Northwest School of Medicine, Peshawar, Pakistan

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*Corresponding Author:

Email: waqasarshad0027@gmail.com

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ABSTRACT

Background: Musculoskeletal pain (MSP) is a leading cause of disability worldwide and is increasingly recognized among medical students. Prolonged sitting, intensive study hours, and poor posture place students at heightened risk of lower back, neck, and shoulder pain. Emerging evidence also suggests a link between sedentary behavior and gastrointestinal (GI) symptoms, yet data from Peshawar, Pakistan, remain scarce. This study aimed to estimate the prevalence and severity of MSP and GI symptoms among medical students and examine their association.

Methods: Research was a multi-center cross-sectional study on 346 undergraduate students in three medical colleges in Peshawar. A structured questionnaire was administered to participants, and it included the Visual Analog Scale (VAS) of back pain, The Modified Nordic Musculoskeletal Questionnaire of musculoskeletal fatigue, and self-report GI symptom scale. Cronbach alpha was used to verify reliability by adjusting it to 0.70 or above. Means and standard deviations (means) or frequencies (percentages) were used to explain descriptive statistics and chi-square, t-tests, and binary logistic regression tests were used to determine associations. Any value that was below 0.05 was counted as significant.

Findings: Mean age was 22.5 ± 2.1 years; 56.1% were female. Based on VAS, 39.9% (95% CI: 34.7–45.2) reported mild, 45.1% (95% CI: 39.8–50.4) moderate, and 15.0% (95% CI: 11.3–18.7) severe back pain. Musculoskeletal fatigue was most frequent in the lower back (67.9%; 95% CI: 62.9–72.9), shoulders (41.9%; 95% CI: 36.7–47.2), and legs (35.0%; 95% CI: 30.0–40.0). Overall, 45.1% (95% CI: 39.8–50.4) reported at least one GI symptom, most commonly bloating (30.1%; 95% CI: 25.3–35.0), constipation (25.1%; 95% CI: 20.6–29.6), and indigestion (22.0%; 95% CI: 17.6–26.4). Students with severe back pain (VAS 7–10) had higher odds of reporting GI symptoms than those with mild/moderate pain (OR = 2.1; 95% CI: 1.4–3.1; $p = 0.002$).

Conclusion: Medical students in Peshawar exhibit a high burden of MSP and GI symptoms, particularly in the lower back, shoulders, and legs. Severe back pain is significantly associated with digestive complaints, suggesting that prolonged sitting and sedentary behaviors contribute to both musculoskeletal and gastrointestinal morbidity. Integrated wellness strategies—including ergonomic interventions, physical activity promotion, movement breaks, and stress management—are recommended to mitigate these coexisting health issues.

Keywords: Musculoskeletal Pain; Gastrointestinal Diseases; Medical Students; Low Back Pain; Sedentary Behavior; Pakistan

INTRODUCTION

Musculoskeletal pain (MSP) is a leading cause of disability worldwide and represents an increasingly recognized health concern among university and medical student populations.¹ Medical education is associated with intensive academic requirements that require you to remain seated during lectures, clinical sessions, and self-directed studies, which expose students to an increased risk of getting musculoskeletal symptoms, especially lower back, neck, and shoulder.^{2,3} Recent multicenter and systematic review data indicate that the prevalence of MSP among medical students commonly exceeds 60–70%, underscoring the substantial global burden of this condition in young adults undergoing professional training.⁴ Studies from diverse regions have consistently reported high rates of MSP among medical students.⁵ In South Asia, research from India has shown that nearly three-quarters of medical students experience at least one episode of musculoskeletal pain annually, with a considerable proportion reporting symptom

within the preceding week.⁶ Similarly, investigations from the Middle East, including cohorts from Saudi Arabia, have documented that more than half of medical students report musculoskeletal discomfort, most frequently involving the lower back and cervical spine.⁷ These findings suggest that MSP is a pervasive consequence of the sedentary and ergonomically demanding nature of medical curricula across different educational and cultural settings.⁸

In Pakistan, available cross-sectional studies have also highlighted a high prevalence of back and neck pain among medical trainees, with prolonged sitting time, inadequate posture, and limited physical activity identified as important contributing factors.^{9,10} However, most national studies have focused primarily on isolated musculoskeletal outcomes, and data from Khyber Pakhtunkhwa province, particularly from Peshawar, remain scarce. The absence of region-specific evidence limits the development of targeted preventive strategies for this population.

The pathophysiological mechanisms linking prolonged



sedentary behavior to musculoskeletal symptoms is multifactorial.¹¹ Sustained sitting without adequate ergonomic support increases mechanical loading of the lumbar spine and paraspinal musculature, leading to muscle fatigue, postural strain, and pain.¹² Recent meta-analyses have demonstrated a significant association between prolonged sedentary time and an increased risk of low back pain in both adolescents and adults. Among medical students, extended study hours, reduced physical activity, and sustained static postures may synergistically exacerbate the risk of musculoskeletal fatigue and chronic discomfort.¹³

Beyond musculoskeletal effects, growing evidence suggests that sedentary lifestyles and academic stress may also adversely affect gastrointestinal (GI) health.¹⁴ Prolonged sitting and physical inactivity have been associated with an increased risk of gastroesophageal reflux disease, functional bowel disorders, and other digestive symptoms in adult populations.¹⁵ Occupational and student-based studies further indicate that sedentary behavior and psychosocial stress independently predict greater severity of gastrointestinal complaints.¹⁵ In medical students, irregular meal patterns, high stress levels, and prolonged study sessions may contribute to symptoms such as bloating, constipation, and indigestion, suggesting a potential interaction between musculoskeletal strain, lifestyle factors, and digestive disturbances.¹⁶

Despite the high prevalence of MSP and emerging evidence linking sedentary behavior to gastrointestinal symptoms, there is a notable lack of studies that have concurrently evaluated musculoskeletal fatigue and gastrointestinal complaints within medical student populations.^{17,18} Moreover, no published data are currently available from Peshawar or the broader Khyber Pakhtunkhwa region examining the coexistence and potential interrelationship of these conditions using validated assessment tools. This represents an important knowledge gap, as understanding the combined burden of musculoskeletal and gastrointestinal symptoms is essential for designing holistic preventive and supportive interventions for future healthcare professionals.

To this end, the current cross-sectional research was intended to provide the estimate of the prevalence and severity of low back pain, musculoskeletal fatigue and gastrointestinal symptoms among medical students in Peshawar, Pakistan and to determine the relationship between the severity of musculoskeletal pain and digestive symptoms using reliable assessment tools.

METHODOLOGY

It was tri-centric cross-sectional research carried out in three institutions of Peshawar, Northwest School of Medicine, Rehman Medical College, and Pak International Medical College.

The size of the sample was computed based on Cochran formula of the cross-sectional studies in the OpenEpi online sample size calculator. A margin of error of 5 percent, 95 percent confidence level, and an assumed population prevalence of 50 percent were susceptible to generate a 384-participant minimum required sample. Incomplete response was taken care of by issuing more questionnaires, and a final response rate of 90% was obtained after the exclusion of incomplete form.

A convenience sampling method was used to select participants among the undergraduate medical students in the participating institutions. Students that agreed to participate in the study and were in during the data collection period were eligible participants. Students who had not filled the form were excluded in the final analysis.

Data were collected using a structured, blended questionnaire

comprising three components:

1. The Visual Analog Scale (VAS) in order to determine the intensity of back pain utilizing a 0–10 scale.
2. Nordic Musculoskeletal Questionnaire- the questionnaire is a valid questionnaire that is frequently used to measure musculoskeletal fatigue and musculoskeletal discomfort in various body parts (such as the back, shoulders, and legs) in relation to symptoms reported over the last 12 months.
3. Self-report gastrointestinal symptom scale based on the standard clinical symptom checklists to document the complaints of bloating, constipation, indigestion, and other gastrointestinal symptoms linked to prolonged sitting.

A pilot-testing of the questionnaire using 30 students in the similar population was done before the main study to determine its clarity, relevance, and internal consistency. Based on feedback, minor modifications were made. The resulting final version had a reasonable reliability of 0.70 and above Cronbach alpha coefficient.

Participants were approached in the classrooms and clinical settings after receiving institutional permission. Before administration of the questionnaires, the aim of the study was explained, and the informed consent was provided in written form. The people involved were volunteers, and anonymity was maintained by coding the questionnaires and removing personal identifiers.

The ethics boards of Northwest School of Medicine, Rehman Medical College, and Pak International Medical College were approached regarding the study to provide an ethical approval (Approval No.: ERC/2024/PM/017). All participants were approached to provide informed consent in writing before joining the study. The study was conducted with strict adherence to the principles of the Declaration of Helsinki, in reference to confidentiality and privacy.

Data processing, statistical computation, and initial analysis were executed using OpenAI's ChatGPT (Model: GPT-4o) via the Advanced Data Analysis environment, with all AI-generated outputs manually audited and verified by the authors to ensure analytical accuracy. Descriptive statistics were computed, expressing continuous variables as means $\pm$ standard deviations and categorical variables as frequencies and percentages. Inferential statistics included the Chi-square test for categorical associations and the independent samples t-test for continuous variables to evaluate relationships between demographic factors, gastrointestinal symptoms, and musculoskeletal fatigue. To identify independent predictors of musculoskeletal fatigue and gastrointestinal signs, variables demonstrating significance in univariate analyses were entered into a binary logistic regression model. Statistical significance was defined a priori at a p-value less than 0.05.

RESULTS

A population of 384 medical students was contacted and a response rate of 90.1 resulted in the completion of 346 students filling in the questionnaire. The average age of the respondents was 22.5 years with a standard deviation of 2.1. The number of respondents was 56.1% female and 43.9% male (Table 1).

According to the Visual Analog Scale (VAS), slight back pain (score 03) was noted in 39.9% (95% CI: 34.745.2), moderate pain (score 46) was found on 45.1% (95% CI: 39.850.4) and severe pain (score 710) was detected in 15.0% (95% CI: 11.318.7). The mean VAS score was 4.6 ± 2.2 (Table 2).

Based on the Modified Nordic Musculoskeletal Questionnaire, lower back (67.9; 95% CI: 62.9–72.9) was the site of most musculoskeletal fatigue experienced during the last year, then shoulders (41.9; 95% CI: 36.7372.2), and legs (35.0; 95% CI:

30.036).

Overall, 45.1% (95% CI: 39.8–50.4) of participants reported at least one gastrointestinal symptom. The most frequently reported symptoms were bloating (30.1%; 95% CI: 25.3–35.0), constipation (25.1%; 95% CI: 20.6–29.6), and indigestion (22.0%; 95% CI: 17.6–26.4) (Table 3).

Participants with severe back pain (VAS 7–10) had higher odds of reporting at least one gastrointestinal symptom compared with those reporting mild or moderate pain (OR = 2.1; 95% CI: 1.4–3.1; $p = 0.002$) (Table 3).

Table 1: Demographic Characteristics of Participants (n = 346)

Characteristic	n (%)	95% CI
Age (years), mean $\pm$ SD	22.5 $\pm$ 2.1	—
Male	152 (43.9%)	38.7–49.1
Female	194 (56.1%)	50.9–61.3
Characteristic	n (%)	95% CI

Table 2: Distribution of Back Pain and Musculoskeletal Fatigue (n = 346)

Variable	n (%)	95% CI
VAS Back Pain		
Mild (0–3)	138 (39.9%)	34.7–45.2
Moderate (4–6)	156 (45.1%)	39.8–50.4
Severe (7–10)	52 (15.0%)	11.3–18.7
Mean VAS score $\pm$ SD	4.6 $\pm$ 2.2	—
Musculoskeletal Fatigue (past year)		
Lower back	235 (67.9%)	62.9–72.9
Shoulders	145 (41.9%)	36.7–47.2
Legs	121 (35.0%)	30.0–40.0

Table 3: Gastrointestinal Symptoms and Association with Severe Back Pain (n = 346)

Variable	n (%) / OR (95% CI)	p-value
Bloating	104 (30.1%)	—
Constipation	87 (25.1%)	—
Indigestion	76 (22.0%)	—
At least one GI symptom	156 (45.1%)	—
Severe back pain & any GI symptom	OR = 2.1 (1.4–3.1)	$p = 0.002$

DISCUSSION

In this cross-sectional study of medical students, musculoskeletal pain (MSP) and fatigue were prevalent, particularly in the lower back, shoulders, and legs.¹⁹ These findings indicate that prolonged sitting and sedentary behaviors are commonly associated with discomfort among health care trainees, consistent with the research question.²⁰

Comparatively, studies in Pakistan have shown that prolonged sitting is significantly linked to lower back pain among medical students.²¹ Internationally, research from Saudi Arabia reported that over half of medical students experienced musculoskeletal pain, with lower back and neck being the most frequent sites, while a study in Sikkim, India, found that 73% of students reported musculoskeletal pain within the past year. Similar symptom burdens have also been reported in Chinese and Malaysian student populations, suggesting that these issues are prevalent across diverse educational and cultural contexts.⁶

The observed association between musculoskeletal pain and gastrointestinal (GI) symptoms may be explained through physiological mechanisms such as the Brain-Gut axis, stress-induced cortisol elevation, and autonomic dysregulation, which can alter visceral function and contribute to digestive disturbances.²² Chronic pain and sedentary behavior may exacerbate GI complaints through these systemic pathways.²³ Although psychological stress was not directly measured in this study, prior research indicates that higher stress levels among students with musculoskeletal pain may mediate or amplify gastrointestinal symptoms.

These findings have practical implications. They highlight the importance of ergonomic interventions, posture awareness, regular movement breaks, and physical activity promotion to mitigate musculoskeletal discomfort. Additionally, the association with GI symptoms suggests that student wellness programs should integrate physical health, digestive health, and stress management strategies.²⁴

Lastly, the limitations of the study should be mentioned. The cross-sectional study makes causal conclusions impossible and the use of self-report data can result in recall bias. Future research ought to employ objective measurements of posture, activity and stress and longitudinal study designs to explain these relationships.

CONCLUSION

This research records that the musculoskeletal pain and gastrointestinal symptoms burden is high among the medical students in Peshawar, especially among the lower back, shoulders and legs. Digestive problems like bloating, constipation and indigestion were found to be significantly linked with lower back pain and fatigue. These findings indicate that chronic sitting, bad posture, and other sedentary habits are not only possibly associated with specific local musculoskeletal pain, but also general systemic symptoms. The status of musculoskeletal and gastrointestinal symptoms highlights the necessity of comprehensive wellness programs in the health sector, such as ergonomic measures, physical exercise, consistency of movement, and stress management courses. Future longitudinal research that includes objective measures of activity and psychosocial techniques is necessary to get a clearer picture of these associations and to implement specific intervention strategies into medical student preventive and wellness programs.

Ethical Approval

The study was approved by the Institutional Review Board/Ethics Committee of [Northwest School of Medicine, Peshawar, Pakistan] (approval [Approval No.:

ERC/2024/PM/017).

Ethical approval was not required for this study as it did not involve human or animal participants.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

Conceptualization: Syed Waqas Arshad, Luqman Khan

Methodology: Syed Waqas Arshad, Luqman Khan, Hasnain Iqbal

Data Collection: Luqman Khan, Hasnain Iqbal, Sujjad Khan

Formal Analysis: Syed Waqas Arshad, Hasnain Iqbal

Writing – Original Draft: Syed Waqas Arshad

Writing – Review & Editing: Luqman Khan, Hasnain Iqbal, Sujjad Khan

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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Conflict of Interest

The authors declare that they have no competing interests.

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