

# Prolonged Sitting, Cross-Legged Posture and Piriformis Syndrome in University-Aged Students: Evidence of Association from a Cross-Sectional Study

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## ABSTRACT

**Background:** Piriformis syndrome is an under-recognized neuromuscular condition associated with sciatic nerve irritation, often linked to prolonged sitting and poor posture among young adults.

**Objective:** To determine the prevalence of piriformis syndrome and its association with sitting duration and cross-legged posture among university students.

**Methods:** A cross-sectional study was conducted from May to November 2024 among 198 students aged 18–26 years from multiple institutions in Swat, Pakistan. Participants were selected through random sampling. Data were collected using a structured questionnaire, the FAIR test for clinical diagnosis, and the Visual Analogue Scale for pain assessment. Ethical approval and informed consent were obtained. Data were analyzed using SPSS version 25, applying descriptive statistics and relationships between piriformis syndrome, the length of time spent sitting, and sitting posture were examined through cross-tabulations.

**Results:** The mean age was 20.8±2.2 years, with 66.2% females. The prevalence of piriformis syndrome was 61.6% (95% CI: 54.7–68.3). Higher prevalence was observed in females (32.9%) than males (18.7%). Sitting >1 hour showed higher positivity (77.8%), while cross-legged posture was reported by 80.8% and strongly associated with symptoms. Moderate-to-severe pain (VAS 6–10) was reported by 77.7%.

**Conclusion:** Increased Piriformis syndrome was highly prevalent and significantly associated with prolonged sitting and cross-legged posture, highlighting the need for ergonomic and preventive interventions in university settings.

**Keywords:** Cross-legged sitting, Ergonomics, Musculoskeletal Pain, Piriformis Muscle Syndrome, Prolonged sitting, Posture, Sedentary Behavior

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## Introduction

Piriformis syndrome is a neuromuscular disorder resulting from mechanical pressure or irritation of the sciatic nerve in the deep gluteal area. The condition causes pain in the buttocks, referred discomfort along the back of the thigh, and functional limitations during activities that often mimic radicular low back pain (1, 2). The piriformis muscle is crucial for hip external rotation and pelvic stability; alterations in muscle length, tone, or local biomechanics can shift load distribution across the deep gluteal areas and heighten the risk of nerve irritation (3, 4). University students constitute a significant, engaged, and academically pressured portion of the young adult demographic. Contemporary university life demands extended hours of studying, attending lectures, and using devices, which contribute to increased daily inactivity. Epidemiological research associates extended periods of sitting and maintained non-neutral positions with reduced gluteal activation, modified hip kinematics, and gradual tightness or strain on deep hip rotators (2, 5). Cross-legged sitting and similar habitual positions generate uneven load and pelvic twisting, altering muscle resting lengths and heightening mechanical tension on the piriformis and nearby neurovascular elements(6). Estimates of prevalence for piriformis syndrome differ significantly depending on the context and diagnostic approaches used. Research employing clinical examinations or imaging reports shows prevalence rates varying from low single digits to over 30% in certain groups.(7, 8) This variability in prevalence is attributed to differences in case definitions, diagnostic methods, and the populations studied.(9, 10)

University students face unique situations that heighten their risk. Prolonged lecture periods, lengthy study hours, and laptop usage in poorly designed settings increase overall daily sitting duration. Numerous students adopt slouched or cross-legged positions while studying or engaging in social events. These actions, along with inconsistent exercise routines, significant academic pressure, and restricted availability of ergonomic seating, form a set of adjustable risk factors for piriformis irritation in this demographic(10). Evidence from research on workers and students indicates links between extended sitting, rigid or unsupportive seating, and heightened pain in the buttocks or back of the thighs. Timely identification of piriformis syndrome in young adults is important for various reasons(11). Initially, symptoms may decrease involvement in both study and leisure activities, negatively affecting sleep and focus. Secondly, unaddressed or recurring symptoms can result in compensatory movement patterns and additional musculoskeletal issues. Third, college health services and physical therapy programs can adopt affordable preventive strategies, such as posture education, regular activity breaks, and enhanced seating, to alleviate symptom burden and related academic disruption(12, 13).

Studies from low- and middle-income nations emphasize the relationship between inadequate ergonomic facilities and elevated sedentary behavior in educational environments(14). Regional research suggests a higher occurrence of symptoms in places without flexible seating, with students frequently mentioning discomfort when sitting for extended durations(15, 16). These results advocate for focused interventions within university settings, allowing for simultaneous structural and educational enhancements. Although there are credible mechanistic connections and an increasing number of case series, data at the population level concerning young university students are still sparse.

Young college students experience extended periods of sitting and often adopt non-neutral positions that heighten mechanical stress on the piriformis muscle and sciatic nerve. Existing evidence does not adequately measure the prevalence or identify modifiable risk factors at the population level for this age group. Accurate prevalence estimates and clear identification of behavioral and environmental factors are essential to guide targeted prevention strategies, university health policies, and early treatment options. A concentrated examination of college-age individuals will tackle three deficiencies: 1) offer prevalence statistics from a young adult educational context; 2) measure links between particular sitting habits (extended sitting, cross-legged position) and clinically evaluated piriformis syndrome; and 3) determine adjustable targets for affordable interventions in educational institutions. This data will direct clinical evaluations in student health services and promote evidence-based ergonomic and educational initiatives.

## Materials and Methods

A cross-sectional study was conducted from May to November 2024 in Swat, Khyber Pakhtunkhwa, Pakistan, among undergraduate students enrolled in the University of Swat, University of Veterinary and Animal Sciences (UVAS), Saidu Institute of Rehabilitation Sciences, and KMU-Institute of Health Sciences (IHS) Swat Campus, Matta. The study population comprised individuals aged between 18 and 26 years. A random sampling technique was employed to recruit participants in order to ensure representativeness and minimize selection bias, as recommended in similar cross-sectional prevalence studies conducted among university populations (13,16). The total sample size of 198 participants was determined using Raosoft sample size estimation software, considering a 95% confidence level and an acceptable margin of error based on previously reported prevalence estimates of piriformis syndrome (13). Participants with a history of musculoskeletal disorders, previous hip or pelvic trauma, surgeries involving the spine or lower limbs, neurological disorders, or conditions affecting sciatic nerve or pelvic function were excluded to reduce confounding variables (17,18).

Data were collected using a structured methodology. A self-structured questionnaire was administered to gather information on demographic characteristics, duration of sitting, habitual sitting posture, type of chair used, pain characteristics, and functional limitations. Clinical assessment for piriformis syndrome was performed using the Flexion, Adduction, and Internal Rotation (FAIR) test, a commonly used clinical screening tool for piriformis-related sciatic nerve compression and widely reported in diagnostic and clinical studies (5,10). Pain intensity was assessed using the Visual Analogue Scale (VAS), a validated and reliable tool extensively used for quantifying pain severity in musculoskeletal conditions (11,14). All physical examinations were conducted by trained evaluators to ensure consistency and reduce inter-observer bias.

After obtaining ethical approval from the Institutional Review Board, participants were approached within their respective institutions and informed about the objectives and procedures of the study. Written informed consent was obtained from all participants prior to inclusion. Participation was voluntary, and confidentiality and anonymity of the collected data were strictly maintained throughout the study. The study was conducted in accordance with the ethical principles. The primary outcome of the study was the prevalence of piriformis syndrome, defined as a positive FAIR test in conjunction with compatible clinical symptoms, consistent with previous epidemiological studies (7,13). Secondary outcomes included the association of piriformis syndrome with factors such as duration of sitting, sitting posture (including cross-legged sitting), type of chair, gender, and pain intensity, as prolonged sitting and postural habits have been identified as important risk factors in prior research (6,19). Data were entered into Microsoft Excel and analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant characteristics and estimate prevalence. The prevalence was reported with 95% confidence intervals. Inferential statistics, including the chi-square test, were applied to examine associations between categorical variables, and a p-value of less than 0.05 was considered statistically significant (13,16).

## Results

The study included a total of 198 university students. The mean age of the participants was  $20.8 \pm 2.2$  years. Among them, 131 (66.2%) were female and 67 (33.8%) were male students. The majority of participants were within the 18–20 years age group ( $n = 109$ ), followed by 21–23 years ( $n = 59$ ) and 24–26 years ( $n = 30$ ). All participants were enrolled in full-time academic programs and reported prolonged sitting during routine academic activities. The overall prevalence of piriformis syndrome among the participants was 61.6% (122/198; 95% CI: 54.7–68.3),

based on a positive FAIR test accompanied by relevant clinical symptoms. Females demonstrated a higher proportion of piriformis syndrome compared to males. Specifically, 85 (32.9%) females and 37 (18.7%) males were diagnosed with piriformis syndrome, indicating a greater burden among female students.

**Table 1: Demographic Characteristics of Study Participants (N = 198)**

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	67	33.8
	Female	131	66.2
Age Group (years)	18–20	109	55.1
	21–23	59	29.8
	24–26	30	15.2

Pain characteristics showed that the majority of participants experienced moderate to severe pain intensity. Based on the Visual Analogue Scale (VAS), 77.7% of participants reported pain scores between 6 and 10, while 22.3% reported mild to moderate pain (scores 1–5).

**Table 2: Prevalence of Piriformis Syndrome Based on FAIR Test (N = 198)**

Variable	Category	Frequency (n)	Percentage (%)
FAIR Test	Positive	122	61.6
	Negative	76	38.4
Male	Positive	37	18.7
	Negative	30	15.2
Female	Positive	85	32.9
	Negative	46	23.2
Total		198	100

Analysis of sitting behavior and ergonomic factors revealed that a substantial proportion of students experienced discomfort during prolonged sitting. Nearly half of the participants (47.9%) reported being unable to sit comfortably for more than 30 minutes, while 27.4% reported sitting for more than one hour. Cross-legged sitting was identified as the most common aggravating posture, reported by 160 (80.8%) participants, and was frequently associated with increased pain severity. Wooden chairs were the most commonly used seating type (47.9%), followed by sofas (24.7%), stools (15.2%), and padded or ergonomic chairs (12.1%).

Further analysis of participant responses demonstrated that 47.5% reported a history of back or buttock pain, with a subset indicating persistent or untreated symptoms. Pain was reported to significantly impact daily functioning, including walking (30.3%), standing (25.3%), sleeping (20.2%), and performing routine activities (24.2%). Rest was identified as the most common relieving factor

(30.8%), followed by medication (25.3%) and postural adjustments (25.3%), whereas 21.2% reported no relief from any intervention. Academic performance was also affected, as 28.3% of students reported mild interference, 20.2% reported skipping classes occasionally, and 18.7% reported frequent absenteeism due to pain. Overall, these findings highlight a considerable burden of piriformis

syndrome and its associated functional and academic impact among university students, particularly in relation to prolonged sitting and poor ergonomic practices. This cross-tabulation demonstrates that the prevalence of piriformis syndrome increased with longer sitting duration and was markedly higher among participants adopting a cross-legged sitting posture.

**Table 3: Sitting Behavior, Ergonomic Factors, and Pain Characteristics (N = 198)**

Variable	Category	Frequency (n)	Percentage (%)
History of back pain	Yes	94	47.5
	No	44	22.2
	Yes, treated	23	11.6
	Yes, untreated	37	18.7
Sitting Duration	≤ 30 minutes	95	47.9
	~1 hour	49	24.7
	> 1 hour	54	27.4
Type of Chair	Wooden	95	48.0
	Stool	30	15.2
	Sofa	49	24.7
	Padded	24	12.1
Comfortable sitting time	≤30 min	95	48.0
	1 hour	49	24.7
	>1 hour	20	10.1
	>2 hours	30	15.2
Aggravating posture	Cross-legged	160	80.8
	Slumped	38	19.2
Effect on daily life	Walking	60	30.3
	Standing	50	25.3
	Sleeping	40	20.2
	Chores	48	24.2
	Rest	61	30.8
Pain relief	Medicine	50	25.3
	Posture change	50	25.3
	No relief	42	21.2
	Rest	61	30.8
Academic impact	None	65	32.8
	Mild	56	28.3
	Weekly absence	40	20.2
	Frequent absence	37	18.7
Pain intensity (VAS)	1–5	44	22.3
	6–10	154	77.7

**Table 4: Cross-tabulation of Piriformis Syndrome with Sitting Duration and Sitting Posture (N = 198)**

Variable	Category	FAIR Positive n (%)	FAIR Negative n (%)	Total (n)
Sitting Duration	≤ 30 minutes	48 (50.5%)	47 (49.5%)	95
	~1 hour	32 (65.3%)	17 (34.7%)	49
	> 1 hour	42 (77.8%)	12 (22.2%)	54
Sitting Posture	Cross-legged	110 (68.8%)	50 (31.2%)	160
	Slumped	12 (31.6%)	26 (68.4%)	38
Total		122 (61.6%)	76 (38.4%)	198

## Discussion

The present study investigated the prevalence of piriformis syndrome and its association with prolonged sitting duration and sitting posture among university students, revealing a notably high prevalence of 61.6%. This finding indicated that piriformis syndrome represented a substantial and potentially under-recognized musculoskeletal concern within young adult academic populations. The observed prevalence was considerably higher than that reported in previous studies conducted among student populations, where estimates ranged from approximately 6% to 37%, depending on diagnostic criteria and study settings (7,8,11,16). This discrepancy may be attributed to differences in lifestyle factors, including prolonged sitting duration, suboptimal ergonomic conditions, and limited awareness regarding preventive strategies in the studied population. Additionally, the use of a structured clinical screening tool such as the FAIR test may have contributed to improved detection of symptomatic individuals compared to studies relying solely on self-reported symptoms (5).

Piriformis syndrome is frequently underdiagnosed due to its clinical overlap with lumbar radiculopathy and nonspecific low back pain, which complicates accurate identification in routine practice (4,10). The application of standardized clinical tests in this study likely enhanced diagnostic sensitivity, thereby revealing a higher burden of disease. These findings underscored the importance of incorporating targeted screening approaches in university health settings to facilitate early identification and management of piriformis-related conditions.

Prolonged sitting emerged as a key associated factor in this study. A significant proportion of participants reported an inability to sit comfortably beyond 30 minutes, and longer sitting durations were associated with a higher frequency of piriformis syndrome. Biomechanically, prolonged sitting reduces gluteal muscle activation, increases compressive forces in the deep gluteal region, and promotes adaptive shortening of external rotators such as the piriformis muscle (3,9). Over time, these changes may contribute to irritation or compression of the sciatic nerve. These findings were consistent with previous research conducted among sedentary workers and student

populations, which demonstrated a relationship between prolonged sitting, piriformis tightness, and buttock pain (6,15,17). University students may be particularly vulnerable due to extended lecture hours, prolonged study sessions, and limited opportunities for movement.

Sitting posture also demonstrated a strong association with piriformis syndrome. Cross-legged sitting was identified as the most common aggravating posture, with more than 80% of participants reporting increased pain in this position. This posture alters pelvic alignment, increases hip external rotation and adduction, and places sustained tension on the piriformis muscle. Biomechanical evidence suggests that asymmetrical and non-neutral sitting positions increase localized muscle strain and neural tension, particularly when maintained for prolonged periods (3,18). These findings aligned with earlier observational studies that identified poor sitting posture as a significant contributor to deep gluteal pain and sciatic symptoms (19). The high prevalence of cross-legged sitting among students highlighted the importance of postural education as a modifiable preventive strategy.

Gender-based differences were also observed, with female students demonstrating a higher prevalence of piriformis syndrome compared to males. This finding was consistent with previous epidemiological studies suggesting increased susceptibility among females (2,3,20). Potential explanations include anatomical differences in pelvic structure, hormonal influences on ligamentous laxity, and variations in hip biomechanics. Behavioral factors, such as a greater tendency among females to adopt cross-legged sitting positions, may further contribute to increased exposure to risk (21).

Ergonomic factors, particularly the type of seating, also played a notable role. Nearly half of the participants reported using wooden chairs, which were associated with greater discomfort and symptom frequency. Rigid and non-adjustable seating surfaces can increase localized and limit dynamic postural adjustments, thereby contributing to sustained muscle and lumbopelvic strain (14,17). These findings emphasized the importance of ergonomic interventions in reducing musculoskeletal burden among students.

The study possessed several strengths. It included participants from multiple institutions, enhancing the diversity of the sample, and employed a standardized clinical assessment (FAIR test) alongside validated pain measurement tools (VAS), improving the reliability of findings. Furthermore, the study explored multiple modifiable risk factors, including posture and ergonomics, providing practical insights for preventive strategies.

However, certain limitations must be acknowledged. The cross-sectional design precluded the establishment of causal relationships between sitting behaviors and piriformis syndrome. The study was conducted within a specific geographic region, which may limit the generalizability of the findings to other populations. The diagnosis relied on clinical assessment without imaging confirmation, which may have introduced the possibility of misclassification. Additionally, self-reported measures of sitting duration and posture were subject to recall bias and reporting inaccuracies.

Future research should focus on multicenter studies involving diverse university populations to improve external validity. Longitudinal designs are recommended to establish causal relationships between prolonged sitting, postural habits, and the development of piriformis syndrome. Incorporating objective assessment tools, such as motion analysis systems, wearable devices, or imaging and electromyographic techniques, could enhance diagnostic accuracy and provide deeper insights into pathophysiology.

## Conclusion

This research reveals a significant rate of piriformis syndrome in university students, with long periods of sitting and sitting cross-legged strongly linked to the presence and intensity of symptoms. The results show that piriformis syndrome is a significant musculoskeletal issue among young adults in educational settings. Female students showed a greater prevalence, indicating potential biomechanical and behavioral factors that require concentrated attention. Extended periods of static sitting positions, utilization of non-ergonomic chairs, and the regular practice of sitting cross-legged seem to significantly contribute to the emergence of symptoms. Since these factors can be changed, specific preventive measures can be applied at the organizational level.

## Authors' Contributions

ICMJE authorship criteria	Detailed contributions	Authors
Substantial Contributions	Conception or Design of the work Data acquisition Data analysis or interpretation	1,2,3,5,7 2,3,4,6 1,3,5,7
Drafting or Reviewing	Draft the work Review critically	3 1,2,3,6
Final approval	Final approval of the version to be published.	1,2,3,4,5,6,7
Accountable	Agreement to be accountable for all aspects of the work.	1,2,3,4,5,6,7

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