Journal of Health, Wellness and Community Research
ISSN: 3007, 0570

OPEN ACCESS

JHWCR

Type: Review Article
Published: 31 December 2025
Volume: III, **Issue:** XIX
DOI: https://doi.org/10.61919/yxbgdz06

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Received 21, 10, 25
Accepted 24, 12, 2025

Authors' Contributions
Concept: AA; Design: AA, AM; Data Collection: AK, SR, HA; Analysis: AA; Drafting: AA

Declarations
No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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Correlation of Prolonged Sitting with Low Back Pain and Level of Function Among University Students

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ABSTRACT

Background: *Low back pain (LBP) is increasingly prevalent among university students and may contribute to functional limitation and reduced academic performance, with prolonged sitting proposed as a modifiable risk factor. Objective: To assess the association between prolonged sitting duration and low back pain intensity and to evaluate its relationship with functional disability among university students. Methods: An analytical cross-sectional observational study was conducted at the University of Management and Technology, Lahore, using convenience sampling. A total of 120 students aged 20–30 years with acute or chronic LBP were assessed using the Numeric Pain Rating Scale (NPRS) and the Oswestry Disability Index (ODI). Sitting duration was categorized as 5–6, 7–8, and 8–9 hours/day. Descriptive statistics were reported as frequencies and percentages, and Pearson correlation was used to test associations between sitting duration and NPRS and ODI outcomes ($p < 0.05$). Results: Participants were predominantly female (85.8%), aged 20–25 years (98.3%), and of normal BMI (62.5%). Moderate-to-severe pain was reported by 81.6% of students. Minimal disability was observed in 53.3%, while 46.7% reported ODI ≥21%. Sitting duration showed negligible and non-significant correlations with NPRS ($r = 0.014$, $p = 0.881$) and ODI ($r = -0.012$, $p = 0.900$). Conclusion: Sitting duration was not significantly associated with pain intensity or disability; however, LBP and disability burden was substantial, suggesting multifactorial determinants beyond sitting duration alone.*

Keywords

prolonged sitting, low back pain, Oswestry Disability Index, Numeric Pain Rating Scale, university students, functional disability

INTRODUCTION

Low back pain (LBP) is among the leading causes of disability worldwide and constitutes a major contributor to functional limitation and reduced quality of life across age groups (1,2). Although traditionally emphasized in older adults and occupational cohorts, LBP has increasingly emerged as a prevalent concern in younger populations, particularly university students, due to escalating academic demands and lifestyle transitions toward sedentary behaviors (2,3). University students frequently engage in prolonged sitting during lectures, studying, screen-based learning, and leisure activities, which may promote sustained spinal loading, suboptimal postural adaptation, reduced trunk muscle variability, and impaired neuromuscular control, all of which have been proposed as potential contributors to nonspecific LBP (4–6). Epidemiological evidence indicates that a large proportion of LBP cases are nonspecific, with no identifiable structural cause, and are strongly influenced by behavioral, biomechanical, and psychosocial factors (2,5).

Sedentary behavior, particularly prolonged sitting duration, has been highlighted as a potentially modifiable risk factor for musculoskeletal pain in both adult and youth populations (7). Systematic reviews and meta-analyses have reported significant associations between sedentary time and LBP, while also noting heterogeneity in measurement approaches and inconsistent findings across different populations and study settings (7,8). In student cohorts, LBP prevalence has been documented as high, with reported consequences including absenteeism, reduced participation in physical activity, impaired academic performance, and compromised psychosocial well-being (9,10). Local and regional studies among healthcare and physiotherapy students have similarly demonstrated substantial LBP burden, but findings regarding the relationship between sitting exposure and pain or disability remain inconsistent, with some reports suggesting significant associations and others demonstrating negligible or non-significant correlations (9–12). This inconsistency may reflect differences in sitting measurement, restricted exposure ranges, unmeasured confounding (e.g., physical activity, BMI, stress, smoking), or outcome assessment methods.

Beyond pain intensity, functional disability represents a clinically meaningful outcome that captures the impact of LBP on activities of daily living and academic-life participation. Validated Patient-Reported Outcome Measures (PROMs), such as the Numeric Pain Rating Scale (NPRS) for pain intensity and the Oswestry Disability Index (ODI) for functional disability, provide standardized approaches to quantify these outcomes and facilitate comparability across studies (13). However, evidence from Pakistani university settings using standardized PROMs to evaluate both pain and disability in relation to prolonged sitting remains limited, and data are particularly scarce for mixed-gender general university cohorts rather than exclusively healthcare students. Addressing this gap is relevant for informing preventive strategies, ergonomic interventions, and early health promotion programs tailored to student populations.

Therefore, the present study aimed to determine the association between daily prolonged sitting duration and low back pain intensity, and to evaluate whether sitting duration correlates with functional disability among university students at the University of Management and Technology (UMT), Lahore. It was hypothesized that greater sitting duration would be associated with higher pain intensity and higher disability scores (7,9,13).

MATERIALS AND METHODS

This analytical cross-sectional observational study was conducted among students enrolled at the University of Management and Technology (UMT), Lahore, Pakistan. A convenience sampling approach was used to recruit participants from the university student population. Students were

DOI: https://doi.org/10.61919/yxbgdz06

invited to participate, provided with information regarding study objectives and procedures, and those willing to participate provided written informed consent prior to inclusion. Eligibility criteria included male and female university students aged 20–30 years who reported low back pain either acute or chronic in nature and who reported daily sitting exposure within the study sitting-duration categories. Participants were excluded if they had lumbar or lower limb neurological deficits, recent surgical history, pregnancy, history of fracture, vertebral deformities, or other conditions likely to confound pain and disability reporting.

The sample size was calculated using RaoSoft sample size estimation, resulting in a final target sample of 120 participants, which was achieved. Data were collected using a structured questionnaire package comprising demographic variables (gender, age group, BMI category), clinical variables (pain duration categorized as acute or chronic), exposure variable (daily sitting hours categorized as 5–6 hours, 7–8 hours, and 8–9 hours), and outcome variables including pain intensity and functional disability. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), an 11-point scale ranging from 0 (no pain) to 10 (worst imaginable pain), widely used for evaluating pain severity and demonstrating strong reliability and validity (13). For analysis and reporting, NPRS scores were categorized as mild (1–3), moderate (4–6), and severe (7–10). Functional disability was evaluated using the Oswestry Disability Index (ODI), a validated PROM consisting of 10 items assessing pain intensity and disability across key domains including personal care, lifting, walking, sitting, standing, sleeping, social life, traveling, and employment, with total scores expressed as a percentage reflecting disability severity (13). ODI categories were classified as minimal (0–20%), moderate (21–40%), severe (41–60%), and crippled (61–80%) disability for reporting consistency.

Data were entered into SPSS version 24 and analyzed using descriptive statistics (frequencies and percentages). The relationship between sitting duration and pain intensity as well as functional disability was examined using Pearson correlation, with statistical significance set at $p < 0.05$. Ethical approval for the study was obtained from the relevant university ethics committee prior to data collection, and participant confidentiality was maintained by anonymizing study forms and restricting access to data to the research team.

RESULTS

A total of 120 university students were included in the analysis, with a predominance of females (103/120; 85.8%) compared with males (17/120; 14.2%). Most participants were aged 20–25 years (118/120; 98.3%), while only 2 participants (1.7%) were aged 26–30 years. Regarding BMI distribution, the largest proportion had normal BMI (75/120; 62.5%), followed by underweight (30/120; 25.0%), overweight (10/120; 8.3%), and obesity (5/120; 4.2%). Pain duration was reported as acute in 67 participants (55.8%) and chronic in 53 participants (44.2%).

Table 1. Participant Demographic and Clinical Characteristics (N = 120)

Variable	Category	n	%
Gender	Male	17	14.2
	Female	103	85.8
Age group (years)	20–25	118	98.3
	26–30	2	1.7
BMI category	Underweight	30	25.0
	Normal	75	62.5
	Overweight	10	8.3
	Obese	5	4.2
Pain duration	Acute	67	55.8
	Chronic	53	44.2

Table 2. Sitting Duration, Pain Intensity (NPRS), and Functional Disability (ODI) Distributions (N = 120)

Variable	Category	n	%
Daily sitting duration	5–6 hours	24	20.0
	7–8 hours	45	37.5
	8–9 hours	51	42.5
Pain intensity (NPRS category)	Mild (1–3)	22	18.3
	Moderate (4–6)	49	40.8
	Severe (7–10)	49	40.8
Functional disability (ODI category)	Minimal (0–20%)	64	53.3
	Moderate (21–40%)	44	36.7
	Severe (41–60%)	10	8.3
	Crippled (61–80%)	2	1.7

Daily sitting duration was high across the cohort, with 51/120 students (42.5%) reporting 8–9 hours/day, 45/120 (37.5%) reporting 7–8 hours/day, and 24/120 (20.0%) reporting 5–6 hours/day. Pain intensity was predominantly moderate-to-severe, with 49/120 (40.8%) reporting moderate pain and an equal proportion 49/120 (40.8%) reporting severe pain, while only 22/120 (18.3%) reported mild pain. Functional disability assessed by ODI demonstrated that most participants had minimal disability (64/120; 53.3%), whereas 44/120 (36.7%) had moderate disability, 10/120 (8.3%) had severe disability, and 2/120 (1.7%) were categorized as crippled disability. Overall, while disability severity was predominantly minimal-to-moderate, a clinically relevant subgroup (12/120; 10.0%) reported severe-to-crippled disability.

Table 3. Association Between Sitting Duration and Pain/Disability Outcomes (Pearson Correlation, N = 120)

Exposure	Outcome	Pearson r	p-value (2-tailed)	Interpretation
Sitting duration	NPRS pain intensity	0.014	0.881	Negligible, not significant
Sitting duration	ODI disability score	−0.012	0.900	Negligible, not significant

Pearson correlation analysis demonstrated a negligible and non-significant association between sitting duration and pain intensity measured by NPRS ($r = 0.014$, $p = 0.881$). Similarly, sitting duration showed an almost zero correlation with functional disability assessed by ODI ($r = -0.012$, $p = 0.900$). These findings indicate that within this cohort of university students, increased daily sitting duration (within the reported categories of 5–9 hours/day) did not demonstrate a statistically significant relationship with either pain intensity or functional disability.

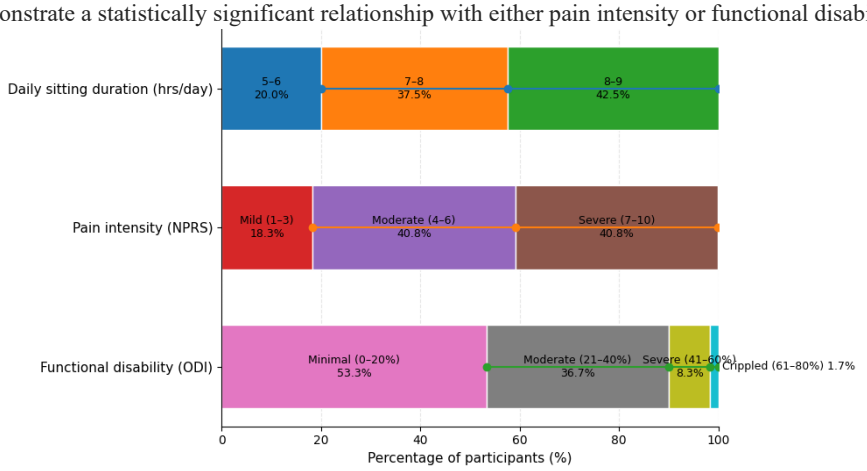

Figure 1 Distribution of Sitting Exposure, Pain Severity, and Functional Disability (N = 120)

The distribution profile demonstrates that prolonged sitting exposure was common, with 42.5% of students sitting 8–9 hours/day, followed by 37.5% sitting 7–8 hours/day, and only 20.0% sitting 5–6 hours/day. Pain intensity showed a marked shift toward higher severity, as 81.6% of participants reported moderate-to-severe pain (NPRS 4–10), with 40.8% reporting moderate pain and an equal proportion (40.8%) reporting severe pain, whereas only 18.3% reported mild pain. Functional disability was predominantly low-to-moderate, with 53.3% categorized as minimal disability, but a substantial proportion (46.7%) reported ODI ≥21% (moderate-to-crippled disability), including 36.7% moderate, 8.3% severe, and 1.7% crippled disability. Collectively, the visualization highlights that despite predominantly minimal disability, a clinically relevant subgroup demonstrates substantial disability alongside a high prevalence of moderate-to-severe pain.

DISCUSSION

This analytical cross-sectional study evaluated whether daily prolonged sitting duration was associated with low back pain intensity and functional disability among university students at UMT Lahore using validated PROMs (NPRS and ODI). The principal finding was that sitting duration demonstrated negligible and non-significant correlations with both NPRS pain intensity ($r = 0.014$; $p = 0.881$) and ODI functional disability ($r = -0.012$; $p = 0.900$). Although prolonged sitting is frequently discussed as a risk factor for nonspecific LBP, the present data did not demonstrate evidence of a linear association within the observed sitting range (5–9 hours/day). Importantly, while the correlation analysis did not support a dose–response relationship between sitting duration and pain or disability, the cohort still exhibited a clinically meaningful burden of symptoms, with 81.6% reporting moderate-to-severe pain (NPRS 4–10) and 46.7% reporting moderate-to-crippled disability (ODI ≥21%). These findings suggest that LBP and disability are prevalent among students with prolonged sitting exposure, but the contribution of sitting duration alone may be limited or masked by other factors, emphasizing the multifactorial nature of nonspecific LBP (1,2,14).

The lack of association between sitting duration and outcomes may be explained by several methodological and clinical considerations. First, a restricted exposure range may reduce detectable variability and attenuate correlations; the present sample comprised students sitting predominantly ≥7 hours/day (80%), leaving fewer participants in lower exposure categories, which can reduce statistical power to detect gradients. Second, sitting duration is only one dimension of sedentary behavior; factors such as sitting posture, frequency of breaks, lumbar support, workstation ergonomics, psychosocial stress, physical activity level, and sleep quality may influence pain development and disability more strongly than total sitting time (4,7,15). Third, both sitting duration and pain outcomes were based on self-reported measures, which may introduce misclassification and measurement error that typically biases associations toward the null (7,8). Finally, nonspecific LBP reflects complex interactions between biomechanical loading, central pain processing, and psychosocial influences; therefore, a simple linear relationship between sitting hours and pain may not capture the dynamic mechanisms underlying symptom persistence (2,5,14).

When compared with prior literature, the present results align with studies reporting null or negligible relationships between sitting posture or sitting exposure and nonspecific LBP. For example, observational work among weavers and ergonomic posture assessments have also reported non-significant associations between sitting posture risk categories and nonspecific LBP symptoms (16). A recent cross-sectional study among nursing students similarly concluded that sitting posture was not significantly related to LBP complaints, although prolonged sitting exposure was emphasized as a behavioral factor requiring management (17). In contrast, other studies have reported significant associations between prolonged sitting and LBP, particularly in medical students and occupational cohorts. A study among medical students in Lahore reported a high prevalence of LBP with associations attributed to prolonged sitting and insufficient physical activity (9). Likewise, office-based studies have reported lower back pain complaints among staff with extended sitting duration, underscoring the importance of occupational exposure and ergonomic conditions (18). These mixed findings are consistent with systematic reviews indicating that sedentary behavior is associated with LBP risk at a population level, while the magnitude and consistency of associations vary by measurement methods, population characteristics, and adjustment for confounders (7,8). Therefore, the current findings do not refute the role of sedentary behavior but rather indicate that, within this cohort and measurement approach, sitting duration alone was not a statistically explanatory predictor of pain intensity or disability.

Despite the null correlation, the descriptive burden observed in this cohort remains clinically relevant. The predominance of female participants (85.8%) and the high proportion reporting moderate-to-severe pain suggests that LBP may be a significant health concern among university students and may negatively influence academic function and overall wellbeing. Prior studies among physiotherapy and healthcare students have similarly reported high prevalence of LBP with impacts on daily activities and absenteeism, suggesting that student populations are vulnerable due

DOI: https://doi.org/10.61919/yxbgdz06

to prolonged sitting, learning-related stress, and limited activity breaks (10,11,19). From a prevention standpoint, university-based interventions may need to focus beyond sitting duration and address ergonomic optimization, structured breaks, graded activity, core conditioning, and education in pain neuroscience and self-management strategies, as supported by evidence emphasizing multi-component approaches to reduce sedentary-related musculoskeletal burden (15,20). Given the cross-sectional design, these findings should be interpreted as associative and not causal; longitudinal studies with objective sedentary tracking and adjustment for physical activity, psychosocial factors, and ergonomic variables are required to clarify temporal pathways and determine predictors of disability in student LBP (7,8,14).

CONCLUSION

In this cross-sectional study of university students with prolonged daily sitting exposure, sitting duration demonstrated negligible and non-significant correlations with low back pain intensity (NPRS) and functional disability (ODI), indicating that within the observed sitting range (5–9 hours/day), increased sitting time was not statistically associated with higher pain or disability; however, the high prevalence of moderate-to-severe pain and moderate-to-crippled disability suggests that low back pain remains a substantial clinical burden in this population and likely reflects multifactorial determinants beyond sitting duration alone.

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