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Impact of Sitting Habits and Study Posture on Musculoskeletal Health among University Student: A Cross Sectional Study

Shehzaf Zafar
Shehzafzafar@gmail.com
DPT, Department of Allied Health Sciences, Indus University, Karachi

Paras Ayaz
paraskhalid14@gmail.com
Assistant Professor, Department of Allied Health Sciences, Indus University, Karachi

Okasha Anjum
drokashaanjumpt@gmail.com
Chairperson, Department of Allied Health Sciences, Indus University, Karachi

Corresponding Author: Shehzaf Zafar Shehzafzafar@gmail.com

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ABSTRACT

Background: *University students spend prolonged hours sitting for study and digital activities, often with poor posture. This leads to spinal strain, musculoskeletal discomfort, and potential negative effects on academic performance and well-being. However, limited research specifically examines how sitting habits impact students' musculoskeletal health, highlighting the need for further investigation.*

Objective: *To assess the impact of sitting habits and study posture on musculoskeletal health among university students.*

Methodology: *A cross-sectional study was conducted on 233 students selected through convenience sampling. Data were collected using the Nordic Musculoskeletal Questionnaire and a structured proforma on sitting time and ergonomic practices. Statistical analysis included descriptive methods, the chi square test, and linear regression modelling using SPSS version 29.*

Result: *Most participants were young females with similar demographics. Mild musculoskeletal pain and minimal-to-moderate disability were most common, and 91% showed postural deviations. Strong positive correlations ($r = 0.753–0.858$, $p < 0.05$) were found between pain, disability, and posture. Clinical variables showed significant associations, while demographic factors had limited influence. Reliability was acceptable ($\alpha = 0.81$), and non-parametric tests were appropriate.*

Conclusion: *Musculoskeletal pain, back pain disability, and postural dysfunction are strongly interconnected in university students. Poor posture and prolonged sitting are key contributing factors, while demographics play a minimal role. These findings emphasize the importance of ergonomic awareness and preventive strategies in academic settings.*

Keywords: *Repetitive strain injury, posture equilibrium, overuse syndrome*

INTRODUCTION

Entering university life often involves prolonged sitting during lectures, studying, and screen use, leading to musculoskeletal complaints such as pain and discomfort in muscles and joints [1]. University students are highly vulnerable due to sustained sedentary behavior, which disrupts normal spinal alignment and posture. Poor study positions over long durations act as a major modifiable risk factor for musculoskeletal disorders [2].

Proper sitting requires balanced spinal curvature and coordinated muscle activity to maintain stability. However, prolonged static posture reduces necessary micro-movements, leading to muscle fatigue, reduced circulation, and loss of neuromuscular control [3]. Postural deviations such as forward head and slouched posture increase mechanical stress on the spine, contributing to tissue strain and pain development [6].

The resulting build-up of inflammatory by products and pain-inducing substances like prostaglandins and bradykinin makes peripheral nerve endings in the affected muscles and tendons more sensitive. This heightened sensitivity lowers the threshold for pain, leading to the familiar sensations of soreness, stiffness, and aching that define musculoskeletal complaints during or after studying [8].

Musculoskeletal complaints are highly prevalent among university students, affecting 50–80% globally, particularly in the neck, shoulders, and lower back [9]. These conditions negatively impact academic performance, concentration, and mental well-being [13].

Assessment tools such as the Nordic Musculoskeletal Questionnaire and ergonomic methods help identify symptoms and postural risks [16]. Preventive strategies include ergonomic adjustments, posture education, regular breaks, and physical activity to reduce strain and improve function [18].

When conservative measures are insufficient, physiotherapy and supportive medication may be used, although treatment should primarily focus on correcting underlying mechanical causes [19]. Musculoskeletal pain is highly prevalent among university students (up to 87.5%), mainly affecting the neck and lower back due to prolonged sitting and poor ergonomics. Psychological stress is also a significant contributor, highlighting the combined role of physical and psychosocial factors in pain development [20].

Despite available interventions, high prevalence persists due to poor awareness and unhealthy sitting habits, emphasizing the need for further research and targeted preventive strategies in university populations [9].

METHODOLOGY

Study Design: This study followed an observational cross-sectional study design.

Study Setting: The study was conducted in Indus University, Bahria University, NED University and BBSUL University

Sample Size: Sample size for this will be calculated using open software. The prevalence of the study is 65% based on previously published study. Confidence interval of 95% and margin of error is 6% will be considered. The calculated minimum sample size will be 233 participants for this study.

Sampling Technique: A non-probability convenience sampling was employed to recruit eligible participants.

Inclusion Criteria: Participants were included in the study if they met the following criteria.

- Sit for <4, 4–6, or >6 hours daily during study activities
- Engage in both classroom and digital learning (online classes, gadgets)
- Agree to complete Nordic Musculoskeletal Questionnaire and posture observation
- Use digital devices like (laptops, computers, phones) for studies
- No recent muscle or bone injuries, fractures, or surgeries

Exclusion Criteria: Participants were excluded if they met any of the following criteria.

- Pre-existing muscle or spinal conditions (unrelated to sitting habits)
- Currently receiving therapy, medication, or treatment for muscle/spinal complaints
- Regularly take structured stretching or exercise breaks during academic tasks
- Declined participation or submitted incomplete questionnaires

Outcome Measure Tools: Primary Outcome Measure: The prevalence and presence of musculoskeletal discomfort linked to study posture and sitting habits, quantified using the Standardized Nordic Questionnaire (NMQ).

Data Analysis Planning: We interpreted and analyzed the obtained data using SPSS version 29 and used appropriate tests.

Ethical Considerations: Permission to conduct the study was obtained from the administrations of the selected schools before data collection. All participants were informed about the purpose and procedures of the study, and written informed consent was obtained prior to participation. Participation was voluntary, confidentiality was maintained throughout the study, and participants were free to withdraw at any stage without any consequences.

Conflicts of interest: There were no conflicts of interest declared by the authors.

RESULTS

Introduction

This chapter presents the statistical analysis of dependent and independent variables and their relationships. It includes two main aspects: data visualization for a general overview and statistical analysis comprising descriptive statistics, correlation, chi-square, and diagnostic tests. The chapter is organized into sections covering introduction, data visualization, descriptive analysis, correlation matrix, chi-square testing for hypothesis evaluation, and diagnostic analysis (reliability, normality, multicollinearity, and homogeneity). It concludes with a summary of key findings and hypothesis outcomes.

Data collection at a glance

Age-wise status of respondents:

Most participants were aged up to 20 years (n = 115, 49.4%), followed by 21–23 years (n = 90,

38.6%), while the smallest group was 24–25 years (n = 28, 12.0%). This indicates that nearly half of the sample consisted of early-age university students.

Gender-wise population:

The majority of respondents were female (n = 207, 88.8%), whereas a small proportion were male (n = 26, 11.2%), showing a highly female-dominated sample.

Marital status-wise population:

Most participants were single (n = 230, 98.7%), while only a very small fraction were married (n

= 3, 1.3%), indicating an overwhelmingly unmarried student population.

Weight-wise population:

The largest group fell in the 41–60 kg range (n = 155, 66.5%), followed by 61–80 kg (n = 43, 18.5%), and up to 40 kg (n = 35, 15.0%), showing that most participants medium tier of weight category.

University-wise population:

The majority of participants were from Indus University (n = 215, 92.3%), followed by Bahria University (n = 14, 6.0%), while both NED and BBSUL contributed minimally (n = 2 each, 0.9%).

Field-of-study-wise population:

Most respondents were from DPT (n = 163, 70.0%), followed by BSMI (n = 37, 15.9%) and BS Psychology (n = 23, 9.9%). Smaller proportions were from Textile Designing (n = 6, 2.6%), Software Engineering (n = 2, 0.9%), Architecture Engineering (n = 1, 0.4%), and Pharm-D (n = 1, 0.4%), indicating a strong dominance of physiotherapy students in the sample.

Descriptive Statistics:

Descriptive statistics included all 233 participants and indicated a predominantly young sample (Mean age = 1.63 ± 0.69), with most respondents aged ≤20 years. The sample showed minimal variability in gender and marital status, being largely female (88.8%) and single (98.7%). Most participants fell within the 41–60 kg weight range (Mean = 2.03 ± 0.58). Greater variation was observed in university affiliation and field of study, although the sample was heavily dominated by Indus University students (92.3%) and DPT students (70.0%). Overall, demographic variability was limited, with the sample largely representing young, female, single physiotherapy students.

Correlation Matrix

Correlation analysis showed strong and significant positive relationships across NMQ, SNQ, and PTA variables. NMQ items were moderately to strongly correlated with each other and highly associated with overall musculoskeletal pain, indicating good construct coherence. SNQ results demonstrated strong associations between pain intensity and functional disability, with most domains significantly interrelated, although the “sex life” item showed weak relevance. PTA findings revealed significant relationships between postural deviations and dysfunction, with upper body abnormalities (forward head and shoulder posture) showing the strongest associations. Overall, all scales demonstrated good internal consistency and construct validity, with key variables strongly contributing to pain and postural dysfunction outcomes.

Chi-Square: Here we assume hypotheses are as under to assess:

- HO_1: There is no significant association between sitting habits and study posture with musculoskeletal complaints among university students.

- HA_1: There is a significant association between sitting habits and study posture with musculoskeletal complaints among university students.

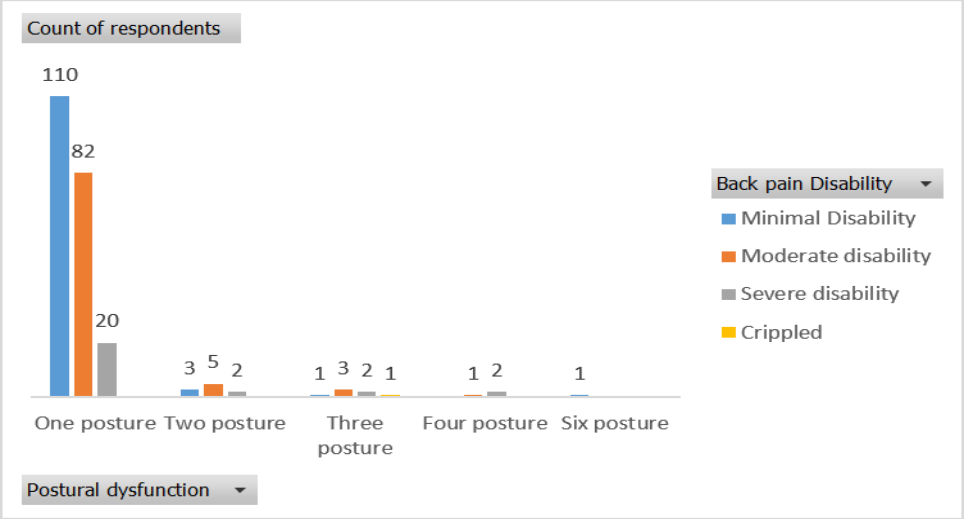
Chi-square analysis revealed significant associations among clinical variables, with musculoskeletal pain linked to back pain disability and postural dysfunction, and back pain disability also associated with postural dysfunction ($p < 0.05$). In contrast, most demographic variables showed no significant relationships with these outcomes, except for university and field of study, which were associated with postural dysfunction. Overall, clinical variables were strongly interrelated, while demographic factors had limited influence.

Diagnostic Analysis

Diagnostic analysis confirmed the suitability of statistical procedures through tests of reliability, multicollinearity, normality, and homogeneity. Reliability was strong overall ($\alpha = 0.81$), with SNQ showing high consistency, while NMQ and PTA demonstrated moderate to low reliability. No multicollinearity was detected (VIF < 10). Normality tests indicated non-normal data distribution across all variables ($p < 0.05$), supporting the use of non-parametric tests. Homogeneity of variance was largely met, with some violations in gender, weight, and university categories. Overall, assumptions were mostly satisfied, though some adjustments were required for robust analysis.

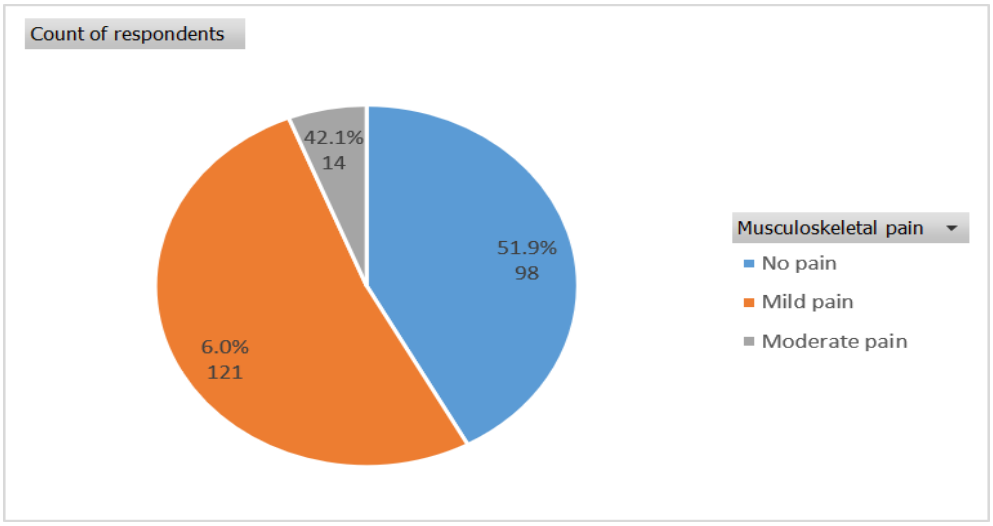
Results

Results showed that participants with fewer postural deviations mostly had minimal to moderate disability, while increasing deviations were associated with higher levels of disability. Mild pain was the most commonly reported outcome across all posture groups, with its prevalence increasing as postural deviations increased. Additionally, individuals with minimal disability predominantly reported no or mild pain, indicating a clear trend between postural deviation, pain intensity, and disability severity.



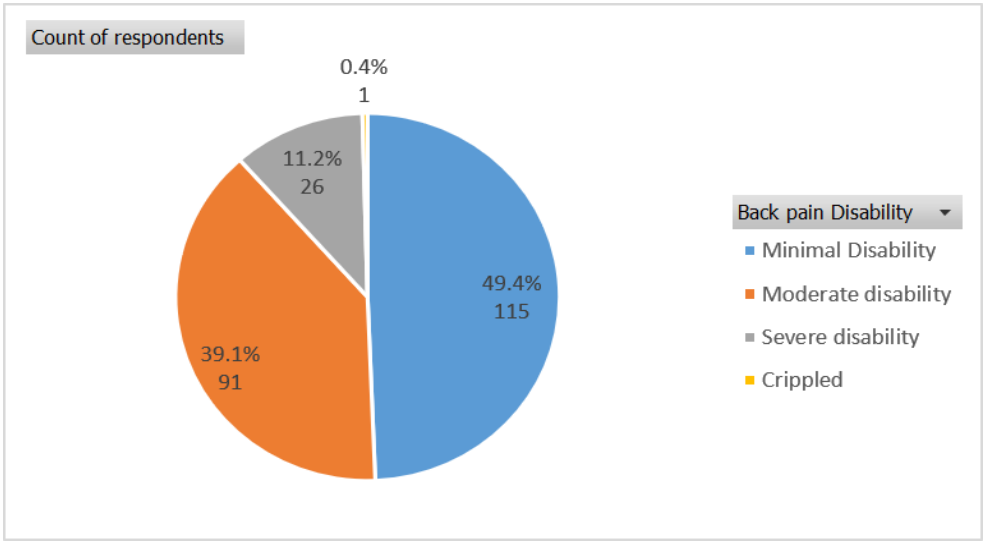
Musculoskeletal Pain

Among all respondents, 98 (51.9%) reported no pain, 121 (6.0%) reported mild pain, and 14 (42.1%) reported moderate pain, indicating that mild musculoskeletal pain was the most common complaint in the sample. In participants aged up to 20 years, 53 (46.1%) reported no pain, 56 (48.7%) mild pain, and 6 (5.2%) moderate pain. Among the 21–23 years group, 36 (40.0%) had no pain, 48 (53.3%) mild pain, and 6 (6.7%) moderate pain. In the 24–25 years group, 9 (32.1%) reported no pain, 17 (60.7%) mild pain, and 2 (7.1%) moderate pain, showing slightly higher mild pain in older groups. Among females, 88 (42.5%) reported no pain, 105 (50.7%) mild pain, and 14 (6.8%) moderate pain. In males, 10 (38.5%) had no pain, 16 (61.5%) mild pain, and none reported moderate pain (0%), indicating mild pain dominance in both genders.



Back-Pain disability

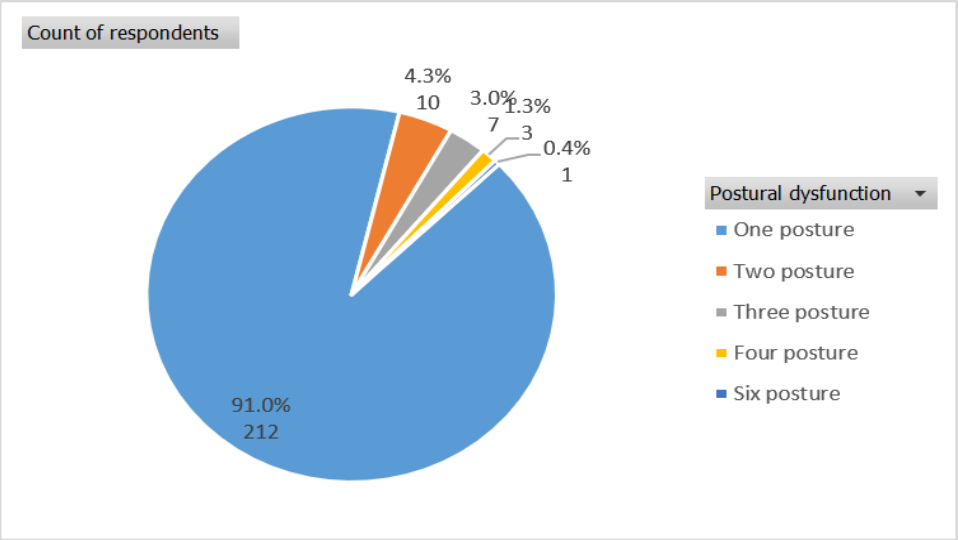
Among all respondents, 115 (49.4%) had minimal disability, 91 (39.1%) had moderate disability, 26 (11.2%) had severe disability, and 1 (0.4%) was crippled. This indicates that most participants experienced low to moderate levels of back pain-related disability. In the up to 20 years group, 56 (48.7%) had minimal disability, 46 (40.0%) moderate disability, 12 (10.4%) severe disability, and 1 (0.9%) crippled. In the 21–23 years group, 44 (48.9%) had minimal disability, 33 (36.7%) moderate disability, and 13 (14.4%) severe disability. In the 24–25 years group, 15 (53.6%) had minimal disability, 12 (42.9%) moderate disability, and 1 (3.6%) severe disability.



Among females, 102 (49.3%) had minimal disability, 79 (38.2%) moderate disability, 25 (12.1%) severe disability, and 1 (0.5%) crippled. Among males, 13 (50.0%) had minimal disability, 12 (46.2%) moderate disability, and 1 (3.8%) severe disability.

Postural dysfunction

Most respondents had one postural deviation (n = 212, 91.0%), followed by two postures (n = 10, 4.3%), three postures (n = 7, 3.0%), four postures (n = 3, 1.3%), and six postures (n = 1, 0.4%), indicating that single-posture deviations were overwhelmingly dominant in the sample.



Among participants aged up to 20 years, 106 (92.2%) had one posture, 5 (4.3%) two postures, 3 (2.6%) three postures, and 1 (0.9%) four postures. In the 21–23 years group, 81 (90.0%) had one posture, 3 (3.3%) two postures, 4 (4.4%) three postures, and 2 (2.2%) four postures. In the 24–25 years group, 25 (89.3%) had one posture, 2 (7.1%) two postures, and 1 (3.6%) six postures. Among females, 188 (90.8%) had one posture, 10 (4.8%) two postures, 6 (2.9%) three postures, and 3 (1.4%) four postures. Among males, 24 (92.3%) had one posture, 1 (3.8%) three postures, and 1 (3.8%) six postures All married participants had one posture (n = 3, 100%). Among single participants, 209 (90.9%) had one posture, 10 (4.3%) two postures, 7 (3.0%) three postures, 3 (1.3%) four postures, and 1(0.4%) six postures. In the up to 40 kg group, 33 (94.3%) had one posture, 1 (2.9%) two postures, and 1 (2.9%) three postures. In the 41–60 kg group, 144 (92.9%) had one posture, 4 (2.6%) two postures, 4 (2.6%) three postures, 2 (1.3%) four postures, and 1 (0.6%) six postures. In the 61–80 kg group, 35 (81.4%) had one posture, 5 (11.6%) two postures, 2 (4.7%) three postures, and 1 (2.3%) four postures. At Indus University, 197 (91.6%) had one posture, 9 (4.2%) two postures, 6 (2.8%) three postures, 2 (0.9%) four postures, and 1 (0.5%) six postures. At Bahria University, 13 (92.9%) had one posture and 1 (7.1%) four postures. At BBSUL, both respondents (100%) had one posture, while at NED, 1 (50%) had two postures and 1 (50%) had three postures. Among DPT students, 152 (93.3%) had one posture, 5 (3.1%) two postures, 4 (2.5%) three postures, 1 (0.6%) four postures, and 1 (0.6%) six postures. In BSMI, 31 (83.8%) had one posture, 4 (10.8%) two postures, 1 (2.7%) three postures, and 1 (2.7%) four postures. In BS Psychology, 22 (95.7%) had one posture and 1 (4.3%) four postures. Other disciplines showed minimal representation, mostly with single-posture deviations.

Research at a Glance:

This chapter presents the statistical analysis and interpretation of data related to musculoskeletal pain, back pain disability, and postural dysfunction among university students. It is organized into seven sections, including introduction, data visualization, descriptive statistics, correlation analysis, chi-square analysis, diagnostic testing, and overall results summary. The study examines relationships between dependent and independent variables using both descriptive and inferential statistics. Data visualization shows that most participants were young (49.4% aged up to 20 years), predominantly female (88.8%), and single (98.7%). The majority belonged to the 41–60 kg weight category (66.5%), with most respondents from Indus University (92.3%) and primarily enrolled in DPT programs (70.0%). This indicates a highly homogeneous academic and demographic profile. Descriptive statistics confirmed limited variability in key demographic variables, with mean values indicating concentration in younger age groups, female gender, and moderate weight categories. Field of study showed relatively higher dispersion, reflecting diversity in academic disciplines. Correlation analysis of NMQ items demonstrated strong positive relationships among musculoskeletal pain indicators, with ―trouble during last 12 months‖ showing a very strong correlation with overall pain ($r = 0.858$). SNQ results also revealed strong associations between pain intensity and functional disability domains, particularly back pain disability ($r = 0.753$), while PTA analysis showed strong inter-item relationships, especially between forward head posture and shoulder posture ($r > 0.80$), indicating good construct validity. Chi-square analysis revealed significant associations among clinical variables. Musculoskeletal pain, back pain disability, and postural dysfunction were strongly interrelated ($p < 0.05$). However, most demographic variables including age, gender, marital status, weight, and field of study showed no significant associations with clinical outcomes. Exceptions included university and field of study, which were significantly associated with postural dysfunction. Diagnostic analysis confirmed that the data met several statistical assumptions. Reliability testing showed acceptable internal consistency for NMQ ($\alpha = 0.64$), good reliability for SNQ ($\alpha = 0.84$), and lower reliability for PTA ($\alpha = 0.59$), while overall reliability was strong ($\alpha = 0.81$). Multicollinearity analysis indicated no serious collinearity issues, with all VIF values below 10. Shapiro-Wilk tests confirmed non-normal distribution of all major variables ($p < 0.05$), suggesting the use of non-parametric tests. Levene‘s test showed mixed results, with some violations in homogeneity for weight, gender, and university variables.

Overall results indicate that mild musculoskeletal pain and minimal to moderate disability were most prevalent. Most participants had a single postural deviation (91.0%), while increasing postural deviations were associated with higher pain and disability levels. Across all analyses, clinical variables showed strong interrelationships, whereas demographic variables had limited influence. These findings suggest that musculoskeletal complaints and postural dysfunction are more strongly linked to functional and clinical factors than demographic characteristics in the studied population.

DISCUSSION

The present study highlights a strong association between postural dysfunction, musculoskeletal pain, and back pain disability among university students. The findings are consistent with existing literature, which identifies prolonged sitting, poor ergonomics, and increased screen exposure as major contributors to musculoskeletal disorders in young adults. The high prevalence of mild pain and minimal disability observed in this study suggests that although symptoms are common, they may initially present at a subclinical level, with the potential to progress if preventive measures are not implemented.

One of the key findings of this study is the significant positive correlation between musculoskeletal pain and disability, as well as between postural deviations and pain intensity. This indicates that poor posture, particularly forward head posture and rounded shoulders, plays a critical role in increasing mechanical stress on the spine and surrounding soft tissues. Sustained abnormal posture leads to muscle imbalance, ligament strain, and reduced neuromuscular control, which collectively contribute

to pain development and functional limitations. These findings align with biomechanical theories that emphasize the impact of prolonged static loading on spinal structures.

The study also demonstrated statistically significant associations between pain, disability, and postural dysfunction, reinforcing the concept that these variables are interdependent. Interestingly, most demographic variables did not show significant associations, suggesting that lifestyle-related factors, rather than inherent demographic characteristics, are the primary drivers of musculoskeletal problems in this population. However, the significant association of postural dysfunction with the field of study and university may reflect differences in academic demands, workload, and ergonomic environments.

Despite the availability of preventive strategies such as ergonomic adjustments, posture correction, and physical activity, the persistence of a high prevalence of musculoskeletal complaints indicates a gap between knowledge and practice. Many students remain unaware of proper sitting posture or fail to implement healthy habits during prolonged study sessions. This highlights the need for targeted educational interventions and institutional policies to promote ergonomic awareness and behavioral change.

Overall, the findings of this study emphasize that postural dysfunction is a significant and modifiable risk factor for musculoskeletal pain and disability among university students. Early identification and intervention are essential to prevent the progression of symptoms into chronic conditions, which can negatively impact academic performance, quality of life, and long-term health outcomes.

Implications

Musculoskeletal disorders in students are largely preventable. The results support implementing ergonomic education, posture correction programs, routine screening, and early physiotherapy interventions in universities. Improving learning environments and promoting active sitting can reduce long-term disability risks.

Limitations

The cross-sectional design limits causal inference. Convenience sampling reduces generalizability, and self-reported data may introduce recall and reporting bias. Lack of control for confounding factors such as physical activity, BMI, and ergonomic setup may affect accuracy.

Recommendations

Future research should adopt longitudinal designs, probability sampling, and larger diverse populations. Objective posture assessment tools and inclusion of key confounders are recommended. Advanced statistical models and standardized data collection methods will improve validity and applicability of findings.

CONCLUSION:

This study highlights a strong association between musculoskeletal complaints, back pain disability, and postural dysfunction among university students. Findings indicate that mild musculoskeletal pain (51.9%) and minimal to moderate disability (88.5%) were most prevalent, while 91.0% of participants had a single postural deviation. Correlation results showed significant positive relationships among clinical variables, with musculoskeletal pain strongly linked to overall symptom burden ($r=0.858$) and disability ($r=0.753$). Chi-square analysis further confirmed significant associations between pain, disability, and postural dysfunction ($p<0.05$), whereas most demographic variables showed no significant effect. These results suggest that functional and postural factors play a greater role than demographic characteristics in musculoskeletal outcomes. Reliability testing supported acceptable internal consistency ($\alpha=0.81$ overall),

though PTA reliability was relatively low (α=0.59). Non-normal distribution and limited homogeneity in some variables indicate cautious interpretation. Overall, poor sitting posture and prolonged study habits appear to be key contributors, emphasizing the need for ergonomic interventions and preventive strategies in university settings

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