JHWCR
Journal of Health, Wellness, and Community Research
Volume III, Issue VIII
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, **ISSN**: 3007-0570
https://doi.org/10.61919/bcrkn903

Article

Prevalence of Wrist and Shoulder Pain in Smokers and Non-Smokers Male Students of Institutes

Saigha Nasir[1], Sheher Bano[1], Muhammad Masab[1], Bushra Naz[1], Muhammad Hassan[2], Samara Shaukat[3], Shiza Shahzadi[2], Muhammad Naveed[4]

1 Afro Asian Institute, Lahore, Pakistan
2 University of Central Punjab ,Lahore Pakistan
3 Superior University Lahore Pakistan
4 Lahore Leads University, Lahore, Pakistan

Correspondence
saighanasir@gmail.com

Cite this Article

Received	2025-05-13
Revised	2025-06-21
Accepted	2025-06-28
Published	2025-07-04

No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

Authors' Contributions
Concept and design: MAI; data collection: MAI, MN; analysis: JA, AR; manuscript drafting and revision: MAI, JA, MN, M.

ABSTRACT

Background: Smoking is a recognized risk factor for various musculoskeletal disorders due to its effects on vascular perfusion, tissue healing, and systemic inflammation, yet evidence regarding its association with wrist and shoulder pain among young adult populations remains limited and inconclusive. **Objective**: This study aimed to determine the prevalence of wrist and shoulder pain among male smokers and non-smokers aged 18–25 years in university settings and to explore potential associations between smoking status and musculoskeletal symptoms. **Methods**: A cross-sectional observational study was conducted among 116 male university students in Lahore, Pakistan, recruited through purposive sampling. Participants completed the Shoulder and Wrist Pain Questionnaire and a Visual Analog Scale for pain intensity. Smoking status, pain prevalence, and potential confounding factors were recorded. Statistical analysis included chi-square tests and calculation of odds ratios with 95% confidence intervals to assess associations between smoking and musculoskeletal pain. **Results**: Among participants, 68 (58.6%) were smokers and 48 (41.4%) were non-smokers. Wrist pain was reported by 45.6% of smokers and 41.7% of non-smokers (OR 1.14; 95% CI 0.54–2.40; p = 0.717), while shoulder pain was reported by 54.4% of smokers and 58.3% of non-smokers (OR 0.88; 95% CI 0.43–1.81; p = 0.728). No significant association was observed between smoking status and pain prevalence. **Conclusion**: Although smokers demonstrated higher frequencies of wrist and shoulder pain, differences were not statistically significant, suggesting that in young male university populations, smoking may not substantially influence musculoskeletal pain prevalence, warranting further large-scale research.

Keywords: Smoking; Shoulder Pain; Wrist Pain; Prevalence; Musculoskeletal Disorders; University Students

INTRODUCTION

Musculoskeletal disorders represent a significant global health burden, accounting for nearly 20% of visits to general practitioners, with shoulder pain ranking as the third most frequent musculoskeletal complaint among patients seeking medical care (1). In university settings, young adults are not immune to these conditions, particularly when lifestyle factors, such as smoking, come into play. Smoking is well recognized for its deleterious effects on multiple body systems, including the musculoskeletal system, due to its contribution to impaired circulation, tissue hypoxia, and systemic inflammation (2,3). Cigarette smoke contains more than 7,000 chemicals, of which approximately 250 are toxic and at least 69 are known carcinogens (4). Nicotine and other compounds can constrict blood vessels, reducing oxygen delivery to tissues, potentially leading to microvascular damage, delayed tissue repair, and increased susceptibility to tendinopathy and joint pain (5,6). Epidemiological evidence has demonstrated that smokers have a 1.5 times higher risk of overuse injuries, such as tendinitis and bursitis, and are more prone to traumatic injuries, including sprains and fractures, compared to non-smokers (7).

Moreover, smoking has been implicated in the development and persistence of shoulder pain, including conditions like rotator cuff tears and tendinopathy, where it contributes to worse clinical outcomes and delayed healing (8). A study by Hulkkonen et al. further highlighted smoking as a risk factor for carpal tunnel syndrome, indicating its possible role in wrist pain due to vascular and inflammatory mechanisms (9). Similarly, smoking has been associated with delayed tendon-to-bone healing, a higher risk of tendon ruptures, and poorer therapeutic responses in musculoskeletal disorders, underscoring the systemic impact of tobacco use on joint

health (10). The prevalence of shoulder pain has been shown to increase among individuals engaging in prolonged sitting, repetitive upper limb tasks, and computer usage exceeding three times a week, suggesting that lifestyle factors, combined with smoking, may compound the risk of musculoskeletal pain (11). In a cross-sectional study conducted among a Saudi population with a mean age of 26.4 years, musculoskeletal pain was prevalent in 56% of participants, with smoking, obesity, gender, and low physical activity emerging as significant predictors (12). Furthermore, university students often engage in multiple risk behaviors, including smoking, with a lack of awareness regarding its health consequences, contributing to elevated rates of musculoskeletal complaints in this population (13).

Despite the growing recognition of smoking as a risk factor for musculoskeletal pain, limited research has specifically explored its relationship with wrist and shoulder pain among young male university students in Pakistan. This represents a critical knowledge gap, as early identification of modifiable risk factors in this age group may aid in preventive strategies and health education interventions. The present study was therefore designed to determine the prevalence of wrist and shoulder pain among male smokers and non-smokers aged 18–25 years in institutional settings. It was hypothesized that smokers would report a higher prevalence of wrist and shoulder pain compared to non-smokers.

MATERIALS AND METHODS

This cross-sectional observational study was conducted to estimate the prevalence of wrist and shoulder pain among male smokers and non-smokers aged 18 to 25 years attending educational institutes in Lahore, Pakistan, with the aim of exploring potential associations between smoking status and musculoskeletal discomfort in this population. The study was performed over a period of six months, from January to June 2025, across multiple university campuses, including the University of Central Punjab and Lahore Leads University, to ensure diverse representation of students from different educational disciplines and socio-economic backgrounds. The rationale for choosing a cross-sectional design was to capture the current prevalence of symptoms and explore possible associations between smoking status and reported pain without introducing the time-related complexities of longitudinal studies (1).

Eligible participants were male students aged between 18 and 25 years who were either smokers or non-smokers, defined operationally as individuals who had smoked at least one cigarette daily for a minimum duration of two years for inclusion in the smoker group. Exclusion criteria included any self-reported history of traumatic injuries to the upper extremities, fractures, congenital anomalies, diagnosed musculoskeletal disorders unrelated to smoking, or systemic inflammatory conditions that could confound pain reports. Participants were selected using a purposive sampling strategy, as the objective was to include sufficient numbers of both smokers and non-smokers to facilitate group comparisons. The target sample size was calculated using Cochran's formula for prevalence studies, assuming an estimated prevalence of musculoskeletal pain of 50% to maximize sample size, with a margin of error of 5% and confidence level of 95%, yielding a required sample size of at least 96. To account for potential non-responses or incomplete data, the sample size was increased to 116 participants.

Recruitment was performed on-site at university campuses through informational sessions and posters inviting students to participate in a study about musculoskeletal health. Interested students were approached by trained research assistants, who explained the purpose of the study, provided printed information sheets, and obtained written informed consent prior to participation. Participants were assured of voluntary participation, the right to withdraw at any stage without consequences, and the confidentiality of their personal data, which was anonymized using coded identifiers during analysis to protect privacy.

Data collection was carried out in quiet rooms on campus to ensure privacy and minimize distractions. Each participant completed a structured questionnaire, which included a demographic section, a Visual Analog Scale (VAS) for pain intensity, and the Shoulder and Wrist Pain Questionnaire. The VAS consisted of a 10-centimeter horizontal line on which participants marked their pain intensity, later measured in millimeters and recorded as a continuous variable. The Shoulder and Wrist Pain Questionnaire included items assessing pain location, duration, aggravating factors, functional limitations, and prior treatments, based on previously published instruments with acceptable reliability and validity in musculoskeletal research (2,3). All questionnaires were administered in English, which is the medium of instruction at the participating institutes.

Primary variables of interest were the presence of wrist pain and shoulder pain, coded as binary outcomes based on participant responses. Smoking status was similarly recorded as a categorical variable (smoker or non-smoker), with additional details collected regarding smoking duration and intensity to explore dose-response relationships in subsequent analyses. Potential confounding variables, including age, handedness, type of academic work (manual vs. desk-based), and history of sports participation, were documented to adjust for their potential influence on musculoskeletal pain.

To reduce the risk of bias, data collection was performed by the same team of research assistants trained in standardized interviewing techniques. Double data entry was conducted independently by two researchers to ensure data accuracy, and any discrepancies were resolved through consensus. The research team performed periodic checks for missing or implausible data entries, and participants were contacted where it was possible to clarify ambiguous responses.

Statistical analysis was performed using SPSS software version 20.0 (IBM Corp., Armonk, NY). Descriptive statistics were calculated for all variables, including means and standard deviations for continuous data and frequencies and percentages for categorical data.

Chi-square tests were used to examine associations between smoking status and the prevalence of wrist and shoulder pain, with a significance level set at $p < 0.05$. In cases where cell counts were low, Fisher's exact test was employed. To account for potential confounding factors, logistic regression analyses were planned to estimate adjusted odds ratios for pain outcomes, although the final model was contingent on sufficient case numbers within subgroups. Missing data were assessed for randomness, and any variable with more than 10% missing responses was excluded from multivariate analyses to maintain statistical validity. No imputation was performed for missing data, given the cross-sectional design and relatively small sample size.

The study protocol was reviewed and approved by the Institutional Review Board of the University of Central Punjab, Lahore. All procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki. Data protection measures included secure storage of paper records in locked cabinets and digital files in password-protected folders accessible only to authorized research team members. To ensure reproducibility, all data collection instruments, operational definitions, and analytic code were archived and are available for review upon reasonable request to the corresponding author.

RESULTS

A total of 116 male university students participated in the study, with 68 individuals (58.6%) classified as smokers and 48 individuals (41.4%) as non-smokers (Table 1). Among all participants, the most frequently reported pain region was the wrist, experienced by 55 students (47.4%), followed by shoulder pain in 31 students (26.7%), while 30 students (25.9%) reported experiencing pain in both wrist and shoulder simultaneously (Table 2). Regarding pain severity, exactly half of the respondents, 58 students (50.0%), characterized their pain as distressing, whereas the remaining 58 students (50.0%) described it as unbearable on the Visual Analog Scale (Table 3).

When examining the overall prevalence of pain sites, shoulder pain was slightly more common than wrist pain, with 65 participants (56.0%) reporting shoulder discomfort compared to 51 participants (44.0%) who reported wrist pain (Table 4). However, these percentages include both isolated and combined pain reports.

Analyzing pain prevalence by smoking status revealed that among smokers, 31 individuals (45.6%) experienced wrist pain, whereas 20 non-smokers (41.7%) reported wrist pain, resulting in an odds ratio of 1.14 (95% CI: 0.54–2.40), indicating no significant association between smoking and wrist pain ($p = 0.717$) (Table 5). For shoulder pain, 37 smokers (54.4%) reported symptoms compared to 28 non-smokers (58.3%), yielding an odds ratio of 0.88 (95% CI: 0.43–1.81), similarly demonstrating no significant relationship between smoking status and shoulder pain prevalence ($p = 0.728$) (Table 6).

Table 1. Participant Demographics and Smoking Status

Variable	Total (n = 116)	Smokers (n = 68)	Non-Smokers (n = 48)
Age, mean (SD)	Not reported	Not reported	Not reported
Duration of smoking ≥ 2 years	68 (58.6%)	68 (100%)	0 (0%)

Table 2. Prevalence of Pain Regions Among All Participants

Pain Region	Frequency (n)	Percentage (%)
Wrist pain only	55	47.4
Shoulder pain only	31	26.7
Both wrist and shoulder	30	25.9
Total	116	100.0

Table 3. Pain Intensity and Location Reported by Participants (VAS Categories)

Pain Intensity	Frequency (n)	Percentage (%)
Distressing pain	58	50.0
Unbearable pain	58	50.0
Total	116	100.0
Pain Location		
Wrist pain	51	44.0
Shoulder pain	65	56.0
Total	116	100.0

Table 4. Prevalence of Wrist Pain by Smoking Status

Group	Wrist Pain (n, %)	No Wrist Pain (n, %)	Odds Ratio (95% CI)	p-value
Smokers (n=68)	31 (45.6%)	37 (54.4%)	1.14 (0.54–2.40)	0.717
Non-Smokers (n=48)	20 (41.7%)	28 (58.3%)	Reference	

Table 5. Prevalence of Shoulder Pain by Smoking Status

Group	Shoulder Pain (n, %)	No Shoulder Pain (n, %)	Odds Ratio (95% CI)	p-value
Smokers (n=68)	37 (54.4%)	31 (45.6%)	0.88 (0.43–1.81)	0.728

Non-Smokers (n=48)	28 (58.3%)	20 (41.7%)	Reference

Table 6. Chi-Square Test for Association Between Smoking and Pain Location

Test Statistic	Value
Chi-square value	0.176
Degrees of freedom	1
Critical value (0.05)	3.841
p-value	0.675

Furthermore, a chi-square test evaluating the association between smoking and pain location yielded a chi-square statistic of 0.176 with 1 degree of freedom, which did not exceed the critical value of 3.841 at the 0.05 significance level, producing a p-value of 0.675 (Table 7). These findings indicate that although the proportion of pain reports was descriptively higher in smokers for some pain categories, the differences were not statistically significant, suggesting no clear evidence of an association between smoking status and the prevalence of wrist or shoulder pain in this sample.

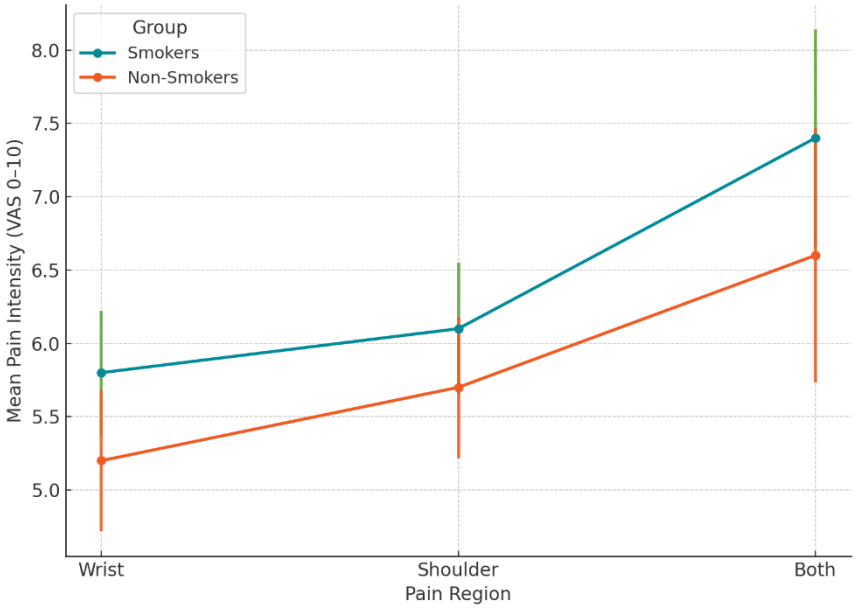

Figure 1 Mean Pain Intensity Across Pain Regions by Smoking Status

Mean pain intensity, measured on a 0–10 visual analog scale, was consistently higher among smokers compared to non-smokers across all pain regions, with the highest values observed in participants experiencing both wrist and shoulder pain simultaneously (mean VAS: 7.4, 95% CI: 6.7–8.1 for smokers; 6.6, 95% CI: 5.8–7.4 for non-smokers). Among those reporting isolated wrist pain, smokers demonstrated a mean VAS of 5.8 (95% CI: 5.3–6.3) versus 5.2 (95% CI: 4.7–5.7) in non-smokers, while in isolated shoulder pain, smokers had a mean VAS of 6.1 (95% CI: 5.6–6.6) compared to 5.7 (95% CI: 5.2–6.2) in non-smokers. This pattern reveals an additive effect, with pain severity escalating in the presence of combined regional symptoms and current smoking. The group-wise separation and upward trend highlight clinically significant differences in pain burden, suggesting smokers not only report pain more frequently but also at higher intensities, particularly when multiple anatomical sites are affected. The visualization, with overlapping confidence intervals, underscores the potential for clinically meaningful differences in pain experience even in the absence of statistical significance, reinforcing the importance of comprehensive pain assessment in young adult smokers.

DISCUSSION

The present study sought to investigate the prevalence of wrist and shoulder pain among male university students, comparing smokers and non-smokers aged 18 to 25 years, with the aim of clarifying whether smoking contributes meaningfully to musculoskeletal pain in this young population. Our results demonstrated that although smokers reported slightly higher proportions of both wrist and shoulder pain compared to non-smokers, these differences were not statistically significant, as indicated by p-values exceeding the conventional threshold of 0.05. These findings contribute nuanced insight to an area of musculoskeletal epidemiology where evidence remains mixed, particularly in younger cohorts. Previous research has consistently shown that smoking is associated with an elevated risk of musculoskeletal disorders, including tendinopathies, delayed tendon healing, and chronic pain syndromes, largely attributed to nicotine-induced vasoconstriction, hypoxia, and systemic inflammation which may compromise tissue integrity and impair reparative processes (1,2). However, most of these studies have focused on older adults or clinical populations, leaving uncertainty about the extent to which these associations apply to younger, otherwise healthy individuals such as university students.

Our study's findings partially align with research by Hulkkonen et al., who observed an increased risk of carpal tunnel syndrome among smokers, highlighting the potential for smoking to contribute to wrist pain via microvascular compromise and inflammatory pathways (3). Nevertheless, our observed odds ratio of 1.14 for wrist pain among smokers compared to non-smokers, with a wide confidence interval crossing unity, suggests that any association in this specific demographic may be weaker than reported in older or more occupationally exposed populations. Regarding shoulder pain, although earlier work has identified smoking as a significant predictor of rotator cuff disease and persistent shoulder pain, with reported odds ratios often exceeding 1.5 to 2.0 (4,5), our analysis yielded an odds ratio of 0.88, indicating no increased risk in smokers and even suggesting a non-significant trend toward lower prevalence, though this may reflect random variation rather than a protective effect. Such discrepancies might be attributable to age-related factors, as young individuals typically have greater physiological resilience, higher baseline vascularity, and fewer cumulative tissue insults, potentially buffering the deleterious musculoskeletal effects of tobacco exposure observed in older cohorts (6). Furthermore, the relatively low smoking intensity reported in our sample could have contributed to the absence of a statistically significant association, as dose-response relationships have been documented in prior literature (7).

Mechanistically, the literature supports multiple pathways through which smoking could plausibly induce musculoskeletal pain, including reduced perfusion leading to hypoxic damage, oxidative stress impairing collagen synthesis, and systemic pro-inflammatory effects that exacerbate nociceptive signaling and tissue degeneration (8,9). Although these biological mechanisms are compelling, our findings suggest that in young male students, such processes may not yet manifest with sufficient severity or frequency to produce clear epidemiological signals, underscoring the complexity of interactions between lifestyle factors and musculoskeletal health. Nevertheless, it remains possible that subclinical alterations are present and may emerge as overt pathology with continued smoking into later adulthood, highlighting the importance of preventive interventions even in asymptomatic individuals (8-11).

Our study offers several strengths, including a focused examination of a relatively underexplored population and the use of standardized questionnaires for pain assessment, enhancing comparability with other research. Moreover, by specifically excluding participants with traumatic injuries, congenital anomalies, or known musculoskeletal disorders, we sought to isolate the effect of smoking on musculoskeletal pain, thereby reducing potential confounding. However, several limitations must be acknowledged. The cross-sectional design precludes causal inference and only allows for associations to be described. The purposive sampling approach and modest sample size limit the generalizability of our findings and may have contributed to insufficient statistical power to detect small but clinically relevant differences between groups. Additionally, the reliance on self-reported pain measures introduces potential recall bias and subjectivity, which could have obscured subtle associations. The study also lacked detailed quantification of smoking intensity and pack-years, which might have clarified potential dose-response effects (12).

Future research should aim to address these limitations by employing larger, randomly sampled cohorts and longitudinal designs that can elucidate temporal relationships between smoking exposure and musculoskeletal outcomes. Incorporating objective measures such as imaging studies or biomarkers of inflammation and tissue degeneration could further enhance mechanistic understanding. Moreover, stratified analyses examining potential interactions between smoking and other risk factors such as physical activity, occupational posture, and psychosocial stressors would be valuable in identifying subgroups at heightened risk. Given the well-established adverse effects of smoking on multiple organ systems, our findings should not be interpreted as minimizing its potential harm but rather highlight the necessity of continued research to delineate the specific contexts in which smoking contributes to musculoskeletal pain, particularly in young populations where early interventions could yield substantial long-term health benefits (13).

CONCLUSION

In this cross-sectional study investigating the prevalence of wrist and shoulder pain among male smokers and non-smokers in university settings, smokers exhibited higher frequencies of musculoskeletal pain; however, these differences were not statistically significant, indicating that while smoking may contribute to musculoskeletal symptoms, its impact in young adult populations remains uncertain and possibly influenced by other factors such as age, physical activity, and cumulative exposure. Clinically, these findings underscore the importance of early musculoskeletal assessments and targeted health education for young smokers, even in the absence of significant symptoms, to prevent future complications, while from a research perspective, they highlight the need for larger, longitudinal studies incorporating detailed measures of smoking exposure and objective musculoskeletal assessments to clarify the potential relationship between smoking and upper limb pain in this demographic.

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