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Prevalence of and Factors Associated with Chronic Pain Among Medical Students

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Abstract

Background: Chronic pain is a leading cause of disability worldwide, and is highly prevalent among university and medical students; however, data from Jordan are limited, and sleep posture as a potentially modifiable factor remains understudied. Study Design: Cross-sectional study. **Methods:** A convenience sample of 391 medical students from eight Jordanian universities offering accredited medical programs (two of which contributed only five participants in total) completed a self-administered questionnaire (online and in person) over four months, assessing demographics, lifestyle, the Brief Pittsburgh Sleep Quality Index (B-PSQI), and usual sleeping postures. Associations were tested using chi-square and logistic regression. **Results**: The prevalence of chronic pain was 57.8% (n = 226), higher among females than males (64.0% vs. 51.1%, $p = 0.009$). Regular exercise was associated with lower odds of pain (OR = 0.61, $p = 0.037$); fair (OR = 3.42, $p = 0.001$) and very bad (OR = 3.77, $p = 0.046$) sleep quality, relative to excellent, were associated with higher odds; and prone sleeping posture was associated with higher odds of pain relative to right-side sleeping (OR = 2.85, $p = 0.001$). The model was significant ($p < 0.001$) but showed modest explanatory power (Nagelkerke pseudo-$R^2 = 0.122$). **Conclusions**: Chronic pain is common among Jordanian medical students. Not engaging in regular exercise, suboptimal sleep quality, and prone sleeping posture were independently associated with chronic pain, although the model had modest explanatory power. Longitudinal studies are needed to clarify temporal and causal relationships.

Keywords: chronic pain; physical activity; sleep quality; sleeping posture

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1. Introduction

Musculoskeletal (MSK) pain is defined as acute or chronic pain affecting the musculoskeletal system, including muscles, bones, ligaments, tendons, and nerves [1]. It

is associated with significant physical, academic, and socioeconomic burden, including reduced quality of life and physical functioning, as well as increased healthcare utilization [1,2]. MSK pain is considered a major global public health concern and one of the leading causes of disability worldwide. According to the literature approximately 20–33% of the global population experiences chronic MSK pain [1], while the World Health Organization (WHO) estimates that approximately 1.71 billion people live with MSK conditions [3]. MSK pain is a highly prevalent condition among young adults, with studies reporting the lifetime prevalence of neck and lower back pain among university students from multiple countries as 30% to 70% [2]. Among university students in Jordan, neck pain was found to be the most prevalent (67.7%), followed by shoulder pain (43.5%), and then lower back pain (38.2%) [4].

Previous studies have identified prolonged static postures, repetitive activities, and psychosocial factors such as stress and high workload as key contributors to MSK pain [5]. Sleep posture has been recognized as a potentially modifiable factor that may contribute to the development and exacerbation of spinal symptoms [6]. While sleep is essential for physical and mental recovery, many individuals report waking up with new or worsened MSK pain [6,7]. Biomechanically, sustained or asymmetrical sleep positions may impose prolonged low-level stress on spinal structures, particularly viscoelastic tissues such as ligaments and joint capsules, potentially leading to inflammation and tissue changes [6]. Certain postures, such as prone sleeping, may further increase spinal loading and impair recovery [6]. Furthermore, evidence suggests a bidirectional relationship between MSK pain and sleep quality, whereby pain can impair sleep, and poor sleep may exacerbate pain symptoms [2].

Evidence on sleeping posture and pain is still limited and largely derived from non-student populations. A scoping review of adult studies reported preliminary relationships between sleep posture and non-specific spinal symptoms and called for better-designed studies [6]. A recent systematic review of sleeping posture and lower-back pain suggested that supine and supportive side-lying positions may be preferable and linked prone sleeping to pain [8], and among Serbian medical students incorrect sleeping position was independently associated with lower-back pain (OR = 1.9) [9]. These studies, however, mainly addressed lower-back or spinal pain and did not grade chronic pain using a standardized instrument; to our knowledge, no study has examined sleeping posture in relation to chronic pain among medical students.

Despite the increasing attention given to sleep posture and other contributing factors in musculoskeletal pain, relatively few studies have focused specifically on chronic musculoskeletal pain among university medical students [9,10]. This group is particularly vulnerable due to prolonged sitting, high academic demands, and suboptimal lifestyle habits, as well as high dependency on technology, including computers and handheld devices [2,4]. Although two Jordanian studies have described MSK pain among students [4,11], they did not examine sleeping posture, and data on chronic pain defined using standardized instruments are lacking. Accordingly, this study aimed to estimate the prevalence of chronic pain and explore its association with multiple potential factors, especially sleeping posture, among medical students in Jordan.

2. Methodology

2.1. Study Design

This cross-sectional study was designed to investigate the association between sleeping posture and chronic pain among adult university medical students in Jordan. This study targeted students from eight Jordanian universities with accredited medical schools (participation varied widely across institutions): Hashemite University, Jordan University,

Jordan University of Science and Technology, Yarmouk University, Mu'tah University, Balqa' University, Ibn Sina University for Medical Sciences, and Aqaba University.

2.2. Setting

This study was conducted in 2025–2026, and data were collected from participants over a period of four months (October 2025–January 2026) using an online digital questionnaire. The questionnaire was distributed mainly in person, face-to-face, in the gathering areas of students within and in the periphery of the educational facilities and public spaces in the country, online through social media platforms and groups restricted to students of the previously mentioned universities, and through direct messaging.

2.3. Participants and Study Size

Any medical student currently studying in one of the eight mentioned universities was eligible to participate after providing consent. Students who refused to take part, those who were enrolled in non-medical programs, and those who had gross MSK disability (self-reported congenital/acquired deformity, amputation, or condition limiting mobility) were excluded from the study. Recruitment was performed using a convenience sampling method where researchers targeted the most accessible students in public places, educational facilities, or online in their exclusive groups or through direct messaging. Any student who met the study criteria during the data collection window was invited to participate. The sample size was determined based on the numbers provided by the Unified Admission Coordination Unit, which reported the exact number of 20,684 medical students across the different Jordanian universities. Using an estimated prevalence of 50% for this condition due to lack of research in Jordan on this specific subject, and by applying the variables to the Standard Cochran Formula ($n0 = (Z2 * P * (1 - P))/e2$), where (Z) is the z-score reflecting the desired confidence interval (1.96 for a CI of 95%), (P) is the estimated prevalence of this condition among the target population, and (e) is the accepted margin of error, we concluded that a minimum sample (n0) of 385 students was required to detect a close prevalence with a 5% margin of error and a 95% confidence level. We tried to enroll more students into the study to account for design effect and comparisons between groups; however, no more students responded in the planned timeline of the study.

2.4. Data Collection

Responses were collected using a structured, self-administered questionnaire in English, distributed electronically or in person to the participants by the researchers involved in the study using a QR code or by sending a link that redirects participants to the questionnaire on Google Forms, respectively, which used a single B-PSQI item (overall subjective sleep quality), not the global score. Responses were coded as very good, fairly good, fairly bad and very bad for the Sleep Quality Index (B-PSQI), and the usual sleeping posture of the participants, namely prone, left side, right side, supine, or fetal postures.

Demographic details included age, gender, weight, height, university name and academic level. General health and lifestyle details included posture during study time, smoking status, regular exercise (a single yes/no item: exercise exceeding 30 min per day), and chronic illness status. Sleeping environment details included mattress and pillow types, as well as cooling aids and phone usage before sleep. The Brief Pittsburgh Sleep Quality Index (B-PSQI) [12] is a validated 6-item tool that evaluates five sleep dimensions (quality, duration, efficiency, latency, and disturbance) over the past month. The last section included a question about the usual sleeping posture of the participants, where they could choose only one sleeping posture from the five available ones: prone, left side, right side, supine, and fetal. A clarification question was added where the participants chose one of the available

options or wrote their own clarification; this was to make sure all participants correctly identified their posture.

2.5. Statistical Analysis

Responses were collected from participants, whether in person or online, using Google Forms, and data were extracted, cleaned, and analyzed using IBM SPSS software 25. Descriptive statistics were used to report participants' demographic characteristics. The normality of quantitative data was assessed visually using Q-Q plots and statistically using the Shapiro–Wilk test (W test). Association between categorical variables was tested using the Chi-square of independence. A p-value of less than 0.05 was considered significant. Variables significantly associated with pain in bivariate analysis ($p < 0.05$) were entered simultaneously (forced entry) and binary logistic regression was performed to determine the association between explanatory variables—gender, regular exercise, Brief Pittsburg Sleep Quality Index (B-PSQI), and sleeping posture—and the dependent variable, which is chronic musculoskeletal pain status. A p-value of less than 0.05 was considered significant. Missing data were handled by available case analysis, and the number of valid responses is reported for each variable (BMI n = 7 and academic level n = 10 missing). Model fit was summarized with omnibus likelihood-ratio test Nagelkerke Pseudo-R^2. Results are reported as associations, not causal effects.

2.6. Ethical Considerations

The study protocol received ethical approval from the Hashemite University Institutional Review Board (IRB) on 23 September 2025 (Approval No. 20/5/2024/2025). Participation in the study was entirely voluntary. Participants were informed of the study's purpose in the invitation and on the first page of the questionnaire, and consent was implied by their voluntarily proceeding to complete it. Strict measures were used to maintain the confidentiality and anonymity of all information provided by participants; these measures included not asking for specific personal information that could identify participants, as well as de-identification of data by removing all direct identifiers, in this case, the emails of the participants. Participants' information was not shared with people not involved in the study.

3. Results

3.1. Participant Characteristics

A total of 391 participants were recruited from eight universities across Jordan. The largest proportion of participants was from Hashemite University of Jordan (20.5%, n = 80), followed by Al-Balqa Applied University (20.2%, n = 79), Jordan University (18.7%, n = 73), Jordan University of Science and Technology (17.1%, n = 67). Mutah University (11.8%, n = 46), Yarmouk University (10.5%, n = 41), Ibn Sina University (1%, n = 4), and Aqaba University (0.3%, n = 1). Participants from Ibn Sina and Aqaba Universities were minimal (five students in total); the sample therefore largely reflects students from six universities.

The mean body mass index (BMI) was 24.3 ± 4.8 kg/m^2 (range: 16.6–57.8), with more than half of the participants classified as having normal weight (57.6%). Mean weight was 71 ± 18 kg and mean height was 169.9 ± 10.7 cm. Most participants were non-smokers (88.2%), and the majority did not engage in regular exercise exceeding 30 min per day (66.2%). The overall prevalence of chronic musculoskeletal pain was 57.8% (n = 226), while 42.2% (n = 165) reported no pain. Full demographic details are presented in Table 1.

Table 1. Sociodemographic and anthropometric characteristics of the study participants (N = 391).

Variable	n (%)	Mean ± SD	Range
Age (years)	391	21.72 ± 1.59	18–27
Gender			
Male	188 (48.1%)		
Female	203 (51.9%)		
BMI (kg/m^2)		24.3 ± 4.8	16.6–57.8
Underweight (<18.5)	21 (5.5%)		
Normal (18.5–24.9)	221 (57.6%)		
Overweight (25–29.9)	104 (27.1%)		
Obese (≥30)	38 (9.9%)		
Weight (kg)		71 ± 18	40–173
Height (cm)		169.9 ± 10.7	98–199
Smoking Status			
Non-smoker	345 (88.2%)		
Smoker	46 (11.8%)		
Regular Exercise (>30 min/day)			
Yes	132 (33.8%)		
No	259 (66.2%)		
University			
Al-Balqa Applied University	79 (20.2%)		
Hashemite University	80 (20.5%)		
Mutah University	46 (11.8%)		
Jordan University	73 (18.7%)		
Ibn Sina University	4 (1.0%)		
Jordan University of Science and Technology	67 (17.1%)		
Yarmouk University	41(10.5%)		
Aqaba University	1(0.3%)		
Academic Level			
First year	24 (6.3%)		
Second year	45 (11.8%)		
Third year	40 (10.5%)		
Fourth year	107 (28.1%)		
Fifth year	125 (32.8%)		
Sixth year	40 (10.5%)		

BMI = body mass index; SD = standard deviation. BMI categories are based on 384 participants and academic level on 381 participants (7 and 10 missing, respectively); percentages for these variables are valid percentages.

3.2. Bivariate Association with Pain Prevalence

Chi-square tests of independence were performed to examine the association between each candidate variable and the presence of chronic pain, as shown in Table 2.

As shown in Table 2, statistically significant associations were identified for gender ($\chi^2(1) = 6.737$, $p = 0.009$), sleep quality ($\chi^2(3) = 13.001$, $p = 0.005$), regular exercise ($\chi^2(1) = 7.090$, $p = 0.008$), and sleeping posture ($\chi^2(5) = 15.436$, $p = 0.009$).

Female participants reported a significantly higher prevalence of pain (64.0%) than males (51.1%). Poorer sleep quality was significantly associated with higher pain prevalence: 42.6% among those with excellent sleep quality, rising to 55.4%, 70.3%, and 73.3% among those with very good, fairly good, fairly bad and very bad sleep quality, respectively. Students who did not exercise regularly had a significantly higher pain prevalence (62.5%) compared to those who exercised regularly (48.5%). Looking at sleeping posture, prone (stomach) sleepers had the highest pain prevalence (72.2%), while right-side sleepers had the lowest (47.3%).

Table 2. Chi-square analysis of associations between lifestyle and sleep-related factors, and chronic pain.

Variable	No Pain n (%)	Pain n (%)	χ^2	df	*p*-Value
Gender	92 (48.9%)	96 (51.1%) *	6.737	1	0.009
Sleep Quality (single B-PSQI item)			13.001	3	0.005 *
Very good	31 (57.4%)	23 (42.6%)			
Fairly good	103 (44.6%)	128 (55.4%)			
Fairly bad	27 (29.7%)	64 (70.3%)			
Very bad	4 (26.7%)	11 (73.3%)			
Smoking Status	148 (42.9%)	197 (57.1%)	0.588	1	0.443
Regular Exercise (Gym)	97 (37.5%)	162 (62.5%) *	7.090	1	0.008
Phone Usage	8–70 (varied)	9–83 (varied)	1.993	4	0.737
Sleeping Aid Use	47–57 (varied)	60–77 (varied)	3.349	4	0.501
Time to Fall Asleep	70 (46.4%)	81 (53.6%)	6.072	4	0.194
Mattress Type	36–80 (varied)	51–100 (varied)	3.250	8	0.918
Pillow Type	113 (43.1%)	149 (56.9%)	8.539	8	0.383
Sleeping Posture	22–58 (varied)	52–57	15.436	5	0.009 *
Right-side sleeper	57 (52.3%)	52 (47.7%)			
Supine (back) sleeper	38 (48.1%)	41 (51.9%)			
Prone (stomach) sleeper	22 (28.6%)	55 (71.4%)			
Left-side sleeper	23 (44.2%)	29 (55.8%)			
Fetal position	22 (33.8%)	43 (66.2%)			
Variable	3 (33.3%)	6 (66.7%)			

* Statistically significant at $p < 0.05$. χ^2 = Pearson chi-square statistic; df = degrees of freedom.

No statistically significant associations were found between pain prevalence and smoking status ($p = 0.443$), phone usage duration ($p = 0.737$), sleeping aid use ($p = 0.501$), time taken to fall asleep ($p = 0.194$), mattress type ($p = 0.918$), or pillow type ($p = 0.383$).

3.3. Multivariate Logistic Regression Analysis

A binary logistic regression model (forced entry) method was constructed to identify factors independently associated with chronic musculoskeletal pain. The model included the following explanatory variables: regular exercise, gender, sleep quality, and sleeping posture. The overall model was statistically significant ($\chi^2(10) = 37.283$, $p < 0.001$), with a Nagelkerke pseudo-R^2 of 0.122, indicating modest model fit (pseudo-R^2 values are not interpretable as the proportion of variance explained, as in linear regression). Reference categories were no regular exercise, male gender, excellent sleep quality, and right-side sleeping (the posture with the lowest observed pain prevalence); the "variable" posture category comprised students without a single usual posture. The model's −2 log-likelihood was 495.202.

The results of the model are presented in Table 3.

Regular exercise was independently associated with chronic musculoskeletal pain (Table 3). Students who exercised regularly had significantly lower odds of reporting chronic musculoskeletal pain compared with those who did not exercise (OR = 0.610, 95% CI: 0.38–0.97, $p = 0.037$), indicating that regular exercise is associated with 39% lower odds of pain.

Sleep quality was significantly associated with pain overall (Wald = 12.426, df = 3, $p = 0.006$). Specifically, students reporting fair sleep quality had more than three times the odds of pain compared to those with excellent sleep quality (OR = 3.42, 95% CI: 1.64–7.14, $p = 0.001$). Those reporting very poor sleeping quality also had significantly higher odds (OR =3.77, 95% CI: 1.02–13.89, $p = 0.046$), although the wide confidence interval indicates an imprecise estimate, likely reflecting the small number of students in this category. The

association for poor sleep quality approached but did not reach conventional statistical significance (OR = 1.78, 95% CI: 0.95–3.32, $p = 0.071$).

Table 3. Binary logistic regression analysis: factors associated with chronic musculoskeletal pain among medical students.

Variable	B	S.E.	Wald	df	*p*	OR	95% CI
Regular exercise (yes vs. no)	−0.494	0.236	4.367	1	0.037	0.61	0.38–0.97
Gender (female vs. male)	0.324	0.228	2.022	1	0.155	1.38	0.89–2.16
Sleep Quality							
Fairly good (vs. excellent)	0.575	0.318	3.268	1	0.071	1.78	0.95–3.32
Fairly bad (vs. excellent)	1.231	0.376	10.730	1	0.001	3.42	1.64–7.15
Very bad (vs. excellent)	1.326	0.666	3.972	1	0.046	3.767	1.02–13.89
Sleeping Posture (reference: right-side sleeper)							
Back sleeper (right-side sleeper)	0.229	0.307	0.554	1	0.457	1.26	0.69–2.30
Stomach sleeper (right-side sleeper)	1.046	0.325	10.364	1	0.001	2.85	1.51–5.38
Left side sleeper (right-side sleeper)	0.140	0.351	0.159	1	0.690	1.15	0.58–2.29
Fetal sleeper (right-side sleeper)	0.613	0.338	3.303	1	0.069	1.85	0.95–3.58
Variable (right-side sleeper)	1.207	0.912	1.752	1	0.186	3.34	0.56–19.96

B = regression coefficient; S.E. = standard error; Wald = Wald chi-square statistic; df = degrees of freedom; p = probability value; OR = odds ratio; CI = confidence interval. ORs and CIs are rounded to two decimals. Reference categories: no regular exercise, excellent sleep quality, right-side sleeper; gender reference: male. Model: $\chi^2(10) = 37.283$, $p < 0.001$; Nagelkerke pseudo-$R^2 = 0.122$; −2 Log-likelihood = 495.202.

Sleeping posture was also significantly associated with pain (Wald = 13.066, df = 5, $p = 0.023$). Stomach sleepers (prone) were associated with nearly three times the odds of pain relative to the reference posture (right-side posture) (OR = 2.85, 95% CI: 1.51–5.38, $p = 0.001$). Gender did not reach statistical significance after adjustment for other variables (OR = 1.38, 95% CI: 0.89–2.16, $p = 0.155$), although the direction of association was consistent with the bivariate findings (females had higher odds of pain).

4. Discussion

In this cross-sectional study of 391 medical students across eight Jordanian universities, more than half of the participants (57.8%) reported chronic musculoskeletal (MSK) pain, and three potentially modifiable factors were independently associated with pain after adjustment: not engaging in regular exercise, fair or very poor (rather than excellent) sleep quality, and prone (stomach) sleeping posture. Female sex and poor sleep quality were associated with pain in unadjusted analyses but were longer significantly associated with pain once other lifestyle factors were accounted for. Surprisingly, factors often assumed to matter, like smoking status, mattress type, and pillow type, did not show any significant association with pain in this study.

These results suggest that chronic pain among medical students is not simply an unavoidable byproduct of their academic life, but is associated with daily habits that are potentially modifiable. This has practical relevance for three audiences. For students, this offers an preliminary rationale (pending longitudinal confirmation) for prioritizing regular physical activity and attention to sleep posture, even amid demanding academic schedules. For medical schools and student health services, the results may support incorporating musculoskeletal health screenings and posture education into wellness programming, rather than treating chronic pain as a purely occupational concern for practicing clinicians. And for future researchers, our findings reinforce sleep posture as an understudied factor worthy of further study, distinct from more commonly studied sleep environment factors such as mattress or pillow choice, which were not associated with pain here.

We believe the modest fit of the multivariate model (Nagelkerke pseudo-$R^2 = 0.122$) is in itself informative, suggesting that while sleep quality, posture, and exercise are associated with pain, MSK pain in this population is likely multifactorial, and other unmeasured or unanalyzed variables, such as psychological distress, study posture and ergonomics, or academic workload, may account for a substantial share of the unexplained variation. We would caution against overinterpreting any single modifiable factor identified here as a complete explanation for MSK pain risk.

The overall prevalence of chronic MSK pain observed in this study (57.8%) is within the wide range reported internationally for chronic MSK pain among university and medical students, but the variability across studies is striking and worth studying carefully. Our figure is considerably higher than the 20.8% point prevalence of lower-back pain reported among Serbian medical students [9], yet clearly lower than the (80.6–82%) reported among Saudi medical student cohorts [10,13]. Specifically, within Jordan, our findings are broadly consistent with a recent national study linking high rates of MSK pain among Jordanian medical students to psychosomatic symptoms, prolonged study hours, and poor ergonomics [1,4]. This cross-national variability likely reflects differences in pain definitions and assessment instruments, academic culture, and ergonomic norms across different world regions, rather than being a true underlying difference in biological risk, and we present this as our interpretation rather than an established fact.

Regarding sex differences, our bivariate finding of higher pain prevalence among females (64.0% vs. 51.1%) mirrors previous reports attributing sex disparities in pain partly to biopsychosocial differences in pain perception [2]. However, consistent with the more nuanced findings of Ilic et al. [8], the sex effect in our data was substantially decreased after adjusting for exercise, sleep quality, and posture, suggesting that part of the unadjusted sex difference may overlap with differences in exercise, sleep quality and posture; however, this mediation was not formally tested, and this should be interpreted with caution. The role of sleeping posture deserves particular comment because prone sleepers had both the highest unadjusted pain prevalence (72.2%) and the highest adjusted odds of pain relative to right-side sleepers (OR = 2.85), in line with a systematic review linking prone sleeping to pain [14]. Because pain site was not assessed, we cannot attribute this association to a specific spinal region; it is, however, consistent with the biomechanical literature suggesting that prolonged, unsupported prone positioning may increase lumbosacral loading and impose sustained shear stress on the cervical, lumbar, and shoulder regions [6,15,16]. Our finding that mattress and pillow type were not significantly associated with pain contrasts with meta-analytic evidence that pillow design influences neck pain and spinal alignment [17]; this discrepancy may reflect the limitations of self-reported bedding characteristics [14], or may indicate that body posture itself is a stronger determinant of spinal loading than passive bedding support.

The association between sleep quality and MSK pain in our data was nonlinear, as fair and very poor sleepers had significantly higher odds of pain than excellent sleepers, while the poor sleep category only approached significance, which differs from the more linear dose response relationships reported elsewhere [7,18]. This should be interpreted with caution, since self-reported sleep quality categories may not consistently reflect the same underlying concept across respondents. Additionally, because pain and sleep have a well-established bidirectional relationship [2], this cross-sectional study design does not allow for the direction of this causality to be established.

The association observed in this study between regular exercise and lower odds of pain (OR = 0.61) is compatible with the existing literature showing that exercise can reduce the risk of lower-back pain [19], including evidence that physical activity mediates the relationship between sleep quality and neck/shoulder disability [7], and an exploratory

study in physically active older adults suggested that modifying sleeping position may reduce back pain [20]. However, exercise was measured with a single yes/no item, and students with pain may have reduced their physical activity because of their symptoms (reverse causation); the association should therefore not be interpreted as evidence of a protective effect.

Finally, we found no association between smoking and MSK pain, which contrasts with longitudinal occupational data linking nonsmoking to more favorable long-term back and neck pain outcomes [21]. We believe this is most plausibly explained by the young age of our sample (mean 21.7 years), in whom cumulative smoking exposure is likely too limited to produce the vascular- and disk-degenerative changes implicated in smoking-related MSK pain in older and longer-exposed populations.

5. Strengths, Limitations, and Recommendations

This study benefits from a multi-institutional sample drawn from eight medical schools in Jordan (although two contributed only five students in total), the use of validated instruments (B-PSQI, GCPS-R), and the inclusion of sleep posture as a candidate associated factor that is rarely examined in this population. Several limitations should also be acknowledged. First, the cross-sectional design hinders causal inference; it cannot be determined whether poor sleep, posture, or inactivity cause pain or result from it, and reverse causation is plausible. Second, sleep posture, sleep quality, and physical activity were self-reported and therefore susceptible to recall bias and subjective interpretation; this was partly mitigated by including a clarifying follow-up question asking participants to describe their usual posture in their own words, but future studies should consider objective measures, such as inertial sensor-based posture monitoring [18]. Third, a risk of selection bias is introduced due to convenience sampling, which was necessitated by time constraints and variable access across institutions; this limits generalizability to the broader population of Jordanian medical students. Students with pain may have been more motivated to participate, which could overestimate prevalence; the number of students approached was not recorded so a response rate could not be calculated and non-responders are unknown. Participation was also highly uneven across universities. Fourth, the GCPS-R does not record pain location, so pain could not be confirmed as musculoskeletal in origin or attributed to an anatomical site, and the biomechanical explanations above remain speculative. Fifth, physical activity was assessed with a single yes/no item that does not capture the frequency, intensity or type of activity, sleeping posture was a single self-reported usual posture, and the single-item response provides a coarser measure of sleep quality than the B-PSQI global score and does not support the validated cut-off. Sixth, the adjusted model included only variables significant in bivariate analysis, so residual confounding by age, BMI, academic year, smoking, chronic illness and study posture cannot be excluded, and the exclusion of students with gross MSK disability may have underestimated prevalence. Based on these associations, and pending confirmation in longitudinal studies, we suggest that medical schools consider integrating brief musculoskeletal health screening and education into existing student wellness initiatives, with a particular emphasis on encouraging regular physical activity and discouraging prolonged prone sleeping. For future research, longitudinal designs are needed to clarify the direction of the relationships identified here, and studies employing objective posture monitoring technology would help address the recall bias limitations inherent to questionnaire-based assessments. Larger, randomly sampled, multi-country studies would also help clarify how much of the cross-national variability in prevalence reflects true differences in risk versus differences in measurement.

6. Conclusions

Chronic musculoskeletal pain is common among medical students in Jordan. Not engaging in regular exercise, suboptimal sleep quality, and prone sleeping posture were independently associated with chronic pain in this cross-sectional sample, although the explanatory power of the model was modest. Longitudinal studies are needed to establish temporal relationships and causality before targeted, low-cost interventions in medical education settings can be recommended with confidence.

Author Contributions: L.K. and M.R. conceptualized and supervised the study. The data collection and manuscript preparation were conducted by M.A. (Mais Alqoudah), M.M., M.O., S.A.-D.Z.A.-I., M.S., I.A., A.S., D.A.-H. and M.A. (Mohammad Awadallah), and they provided clinical and methodological input. Data cleaning, coding, and statistical analysis were performed by W.A.D., A.A., S.A. and M.R. The study employed a cross-sectional design. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board State: This study was approved by the Hashemite University Institutional Review Board (IRB) on 23 September 2025 (Approval No. 20/5/2024/2025). All procedures involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent Statement: By completing the questionnaire after reading the study information, participants provided their implied consent to take part in the research. The study purpose was clearly explained in the invitation, and participants were informed that their responses would remain confidential and used solely for academic purposes. Informed consent was obtained from all participants involved in the study, and no identifiable personal data or images of participants are included in the publication. All participants were informed about the purpose of the study, and their participation was voluntary. The confidentiality and anonymity of participant data were strictly maintained.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to privacy and ethical restrictions and confidentiality.

Conflicts of Interest: The authors declare no conflicts of interest.

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