Association Between Poor Sitting Posture and Neck Pain Among College Students

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Abstract

Neck pain is one of the most common causes of musculoskeletal disabilities worldwide, and college students are at a high risk due to sitting for long periods of time while also displaying poor posture. All studies in Jordan, Saudi Arabia, India, China, Ethiopia and Hong Kong have found an association between poor posture and neck pain among college students. Still, no study has been conducted in Dehradun or among the students who attend Uttaranchal University to date. This study tested whether there was a relationship between poor posture and neck pain among college students. We used structured self-report surveys to gather data from 304 college students; these surveys asked about their self-reported slouch posture when seated and how much they felt their pain increased when they were seated. We also used two Likert-scale questions: the first asked them to rate the degree of stiffness after they finished sitting down, and the second asked how much they believed neck pain was caused by poor posture. We used descriptive statistics, Spearman rank-order correlations, Chi-Square Tests of association with Cramer's V. Self-reported slouched posture was positively correlated with both pain measures (Spearman's $\rho = .302$ and $.465$, both $p < .001$), which provided the primary evidence for this relationship; a smaller, secondary association was also found between posture type and pain-attribution beliefs (Cramer's $V = .134$, a small effect by conventional benchmarks). Kruskal-Wallis H and Mann-Whitney U tests showed us that those postural attitudes did not differ significantly across any demographic or behavioural subgroup we tested, including sex, sitting hours, screen time, etc. This supports our findings that there is a broadly uniform pattern

amongst all of the student samples. This confirmed the alternate hypothesis, which confirms that there is a positive relationship between poor posture and neck pain among college students. This makes it clear that institution-wide ergonomic educational programs and postural correction programs will need to be developed and implemented as a prevention program for college students.

Keywords: neck pain; sitting posture; ergonomics; college students; musculoskeletal disorders

1. Introduction

1.1 Background of the Study

Neck pain is regarded as one of the most common causes of global disability. According to a recent estimate based on the findings of the most current Global Burden of Disease Study, approximately 27.0 out of every 1000 individuals suffer from neck pain; furthermore, the incidence of neck pain has demonstrated a marked increase over the past three decades, and it is anticipated to continue rising through to 2050 (GBD 2021 Neck Pain Collaborators, 2024; Kazeminasab et al., 2022; Safiri et al., 2020; Vos et al., 2012). Estimates suggest that somewhere in the range of 22%–70% of adults will experience neck pain during their lifetime. Furthermore, studies indicate that substantial variations exist in prevalence rates for various populations and regions (Côté et al., 1998; Fejer et al., 2006).

The majority of college students belong to an epidemiological subgroup that is exposed to a variety of ergonomically hazardous situations. Due to the nature of higher education requiring extended periods of sitting while maintaining suboptimal postures, the number of potential ergonomic hazards experienced by college students has grown. Additionally, due to widespread ownership of mobile phones by young adults, forward head flexion is often adopted by those utilising their phones. Biomechanical modelling demonstrates that the forces exerted on cervical spinal structures may be substantially increased when an individual assumes a forward flexed posture; for example, when an individual bends his/her head by approximately four thousand grams or eight and eight-tenths pounds, the force placed on the cervical spine can exceed twenty thousand grams or forty-four and ten-tenths pounds (Hansraj, 2014). Photographs and goniometric analyses demonstrate that many phone users habitually bend their heads to varying angles, which typically approximate thirty degrees (Lee et al., 2015; Guan et al., 2015).

As a result of sedentary behaviour becoming increasingly recognised as a risk factor for musculoskeletal and general health issues, the World Health Organisation has encouraged national governments to decrease sedentary time among all age groups, since sedentary behaviours are continually associated with unhealthy behaviours (Bull et al., 2020). As such, research previously conducted among student populations established that estimates of neck pain prevalence rates were anywhere from 26%–73%, and that prolonged sitting, sustained forward head posture, smartphone utilization, lack of breaks, and inadequate knowledge regarding ergonomics were the most commonly reported associations among college students (Chan et al., 2020; Kanchanomai et al., 2011; Smith et al., 2009). Accordingly, this study examines the relationship between poor sitting posture and neck pain among college students.

1.2 Problem Statement

Poor sitting posture is highly prevalent among college students; however, the relationships between poor sitting posture and neck pain have been extensively documented in student populations across multiple countries, including Hong Kong, Jordan, Saudi Arabia, India, China, and Ethiopia (see section 2.3). No prior studies have investigated this relationship specifically among students attending University; only very few prior studies have utilised both a continuous multi-item self-report measure along with a categorical posture-type assessment within the same sample; moreover, none of the comparative studies described in section 2.3 evaluated whether the posture-pain relationship is consistent across demographic and behavioural subgroups in the same sample. This study provides solutions for each of these shortcomings.

1.3 Objectives

1. To assess the prevalence and patterns of poor sitting posture among college students.

2. To determine the prevalence and perceived intensity of neck pain among college students.

3. Statistically examine whether there exists an association between the type of sitting posture and neck pain among college students.

4. Examine whether scores assessing posture-related attitudes and perception levels of pain vary significantly among different demographic and behavioural subgroups (gender, hours spent sitting

per day, screen use, number of breaks taken per hour, type of posture assumed, degree of support offered by chairs used, year in school, age category).

1.4 Hypothesis 1

H☐: There does not exist a statistically significant relationship between poor sitting posture and neck pain among college students.

H☐: A statistically significant relationship exists between poor sitting posture and neck pain among college students.

Hypothesis 2

H☐: Scores measuring posture-related attitudes and levels of perceived pain do not vary significantly among demographic and behavioural subgroups.

H☐: Scores measuring posture-related attitudes and levels of perceived pain vary significantly among demographic and behavioural subgroups.

2. Literature Review

2.1 Evolution

There have been three empirically identifiable phases in the progression of knowledge regarding neck pain. During the first phase, the collection of population-level data using epidemiological surveys generated the baseline prevalence and disability estimates for all adults experiencing neck pain (e.g., Côté et al., 1998) and identified postures and occupations that increase the incidence of neck pain.

Following the first generation of epidemiological studies, later studies synthesised those findings through systematic reviews that document a considerable amount of variability in the prevalence rates of neck pain between countries. Much of this variability was attributed to differences in measurement methodologies and demographics of populations studied (Fejer et al., 2006).

During the second phase of research, researchers quantified the global burden of neck pain. Neck pain was incorporated into Standardised measures of disability and tracked over time across 195-

204 countries by each iteration of the Global Burden of Disease Study (Vos et al., 2012; Safiri et al., 2020; Kazeminasab et al., 2022).

The third phase of research was fueled by rapid technological advancements in handheld portable electronic devices, specifically mobile phones. A series of biomechanics studies was conducted to investigate the effect on the spine of forward head positioning (Hansraj, 2014). Photographic and goniometric measurements were taken to identify the amount of forward flexion present when people normally use these devices (Guan et al., 2015; Lee et al., 2015).

Evidence from these biomechanical assessments was subsequently complemented by a rapidly increasing number of cross-sectional survey studies that investigated the relationship between neck pain and smartphone use. Initially, the focus was primarily on student populations (Kanchanomai et al., 2011; Smith et al., 2009; Chan et al., 2020; Al-Hadidi et al., 2019), but subsequently expanded to other geographic locations, including the Middle East, South Asia, and East Asia.

Ultimately, this body of evidence resulted in a conclusion with a systematic review and meta-analysis examining risk factors for neck pain among college students and determining poor sitting posture as one of the most strongly evidenced risk factors for neck pain (Gao et al., 2023).

2.2 Theoretical Gap

Although the literature has grown exponentially, numerous theoretical gaps continue to exist within this burgeoning area of investigation. One major gap relates to the fact that many previous studies utilised a single-item categorical method to assess posture and pain. Consequently, it could be challenging to evaluate the association between posture and neck pain utilising such a measure instead of potentially more sensitive continuous, multi-item self-report measures that could quantify the magnitude of postural deviation from normal and subjective symptoms experienced by individuals.

Additionally, very limited information is available relating to the reliability or validity of attitude scales that have been employed in prior studies to measure students' attitudes toward posture and neck pain. Therefore, it is extremely difficult to establish a reasonable basis for confidence in the internal consistency or reliability of instruments employed in investigations.

Furthermore, although there exists a vast array of studies investigating neck pain among students in multiple countries, only a small number of studies have examined comparative relationships among students residing in geographically and economically distinct regions. Therefore, we do not have an understanding of whether the relationship between posture and perceived discomfort/neck pain differs based on context/location.

Lastly, relatively few studies have explored possible mechanisms by which posture affects subjects' self-reported ratings of pain relative to objectively measured symptom intensity. When studies were completed employing categorical and continuous statistical analyses in conjunction within a singular study.

2.3 Comparative Analysis: Case Studies

5 comparative case studies that sample student populations throughout the world were selected and compared as a way to understand the current study's results within an international context. The case studies found above have demonstrated an identical trend across all regions of the globe. Specifically, students who experience back or neck pain generally report that they are at higher risk based on whether their posture is bad while sitting for long periods of time, whether they excessively use electronic devices such as computers and phones during school hours, and whether their physical activities are limited because of academic demands.

Table 1. Comparative Summary of Case Studies on Neck Pain Among Student Populations

Country	Study (Year)	Sample	Key Finding
Hong Kong	Chan et al. (2020)	Undergraduates, large-scale	A significant correlation between extensive smartphone use and neck pain, poor posture among females, was identified as a modifiable risk factor.
Jordan	Al-Hadidi et al. (2019)	University students	A significant positive relationship between mobile phone use duration and neck pain severity (numeric rating scale).
Saudi Arabia	Elsiddig et al. (2022)	516 university students	59.1% reported neck or shoulder pain while using devices; posture during device use significantly associated with pain ($\chi^2 = 25.43$, $p < .001$).
India	Behera et al. (2020)	331 medical students	A significant association between neck pain and gadget use duration; chi-square and logistic regression confirmed posture-related risk factors.
China	Wang et al. (2023)	4,793 high school students	23.7% prevalence of neck/shoulder pain; poor posture and sedentary behaviour were significant predictors (logistic regression).
Ethiopia	Hagos (2020)	Medical students	A substantial burden of neck pain among medical students, with poor posture identified as a contributing factor.

A major focus of the meta-analytic synthesis conducted by Gao et al. (2023) was to synthesise data from numerous cross-sectional and cohort-based studies. These researchers found that improperly

positioned seating is among eleven other significant risk factors for neck pain in college students. The pooled Odds Ratio for this variable was 1.97. As such, the present study drew on both an international empirical evidence base and theory to provide support for its central hypothesis.

3. Research Methodology

3.1 Research Design

The current study employed a cross-sectional quantitative survey study design. Cross-sectional designs are commonly utilised in ergonomic epidemiology to assess exposures (e.g. posture) and outcomes (e.g. pain) at the same time.

3.2 Sampling and Participants

Study Site: This study's site of data collection was Uttaranchal University, located in Dehradun, Uttarakhand, India and involved students attending undergraduate and graduate level classes in medicine, engineering and arts/ science programs.

Population: The target population included students enrolled in a college setting who were pursuing either an undergraduate or graduate degree in any area. Eligibility for inclusion was based upon the fact that the student spent a minimum of one hour per day participating in academically related sitting activities.

Sample Size: A convenience sampling technique yielded a total of 304 participants from both undergraduate and graduate student populations. A sample size of n = 300 is considered large enough to provide statistically adequate power to identify a small-to-moderate chi-square effect (Cramér's V = 0.20) at a p-value of < .05 and is sufficient to obtain the necessary power for the Spearman correlation analyses.

3.3 Data Collection Instrument

Data were collected using a structured self-report questionnaire administered via Google Forms.

During January and February 2026. The questionnaire contained items assessing demographic and educational attributes of the participants, as well as information concerning how they sat and the postures they adopted. In addition, there were items assessing participants' experiences with pain and perceptions about posture. The five items were assessed utilizing a Likert-type scale (Strongly Disagree – 1, Neutral – 3, Strongly Agree – 5): (L1) "I frequently slouch when I study", (L2) "Prolonged sitting increases my neck pain", (L3) "Following prolonged sitting I have experienced neck stiffness", (L4) "Using my phone has led to my neck pain" and (L5) "I know what an ergonomic sitting position looks like". Posture was categorised into three groups: predominantly sitting on a bed, predominantly leaning forward and/or hunched over, or some other posture. Slouching was also documented on a continuum (the extent of slouching as reported in item L1). Neck pain was documented based upon whether the participant believed it contributed to his/her general sense of neck pain or whether it did not contribute to their general sense of neck pain. Two additional questions (L2, L3) asked the participant to report his/her thoughts regarding the connection between extended periods of sitting and neck pain symptoms. Both questions represent recognised surrogate measures of musculoskeletal symptomatology in survey-based ergonomics studies (Hoy et al., 2010). Because L1 through L5 are drawn from the same five-item self-report battery completed by each respondent in a single sitting, the correlations reported between them (Section 4.2) reflect inter-item relationships within one instrument rather than associations between independently measured constructs; this is revisited as a limitation in Section 5.3.

3.4 Data Analysis Strategy

Data analysis was conducted using IBM SPSS Statistics v. 29. To answer objectives 1 and 2, frequencies, percentiles, means, and standard deviations were calculated. To evaluate objective 3, hypotheses were tested through conducting correlation analyses (Spearman Rank Order Correlation - ρ) between the continuous variable representing poor posture (item L1) and the continuous variables representing neck pain (items L2, L3), as explained earlier. In addition, associations between posture type and posture-pain attribution belief were analysed using a Chi-Square Test of Independence (χ^2), including effect size measure Cramer's V, as described earlier. To test objective 4, Kruskal-Wallis H tests were utilised to compare Likert item responses across demographic and behavioural categories with three or more levels; whereas Mann-Whitney U tests were utilised to compare Likert item responses between male and female respondents; rank-biserial r represented the effect size measure for this comparison. Cronbach's alpha was computed using reliability analysis to estimate the internal consistency of the Likert scales, which constitute the posturalattitude-pain perception constructs. Reliability coefficients were evaluated based on standards presented by Nunnally (1978) and Tavakol & Dennick (2011); acceptable reliability ranges existed from 0.7 to 1.0. Effect sizes throughout the study were determined according to Cohen's (1988)

guidelines, and a two-tailed p-value of α = 0.05 was utilised to determine statistical significance for all tests

4. Results & Data Analysis

4.1 Descriptive Statistics

A total of 304 students completed the survey (Table 2). Females constituted 53.9% of the sample (n = 164), and 62.5% of respondents (n = 190) were aged 17–20 years. Medical students comprised 80.9% of the sample (n = 246).

Table 2. Demographic and Academic Characteristics of the Study Sample (N = 304)

Variable	Category	n	%
Gender	Female	164	53.9
	Male	140	46.1
Age group	17–20 years	190	62.5
	20–30 years	113	37.2
	≥ 30 years	1	0.3
Course of study	Medical	246	80.9
	Engineering	36	11.8
	Arts/Science	6	2.0
	Other	16	5.3
Year of study	1st year	198	65.1
	2nd year	67	22.0
	3rd year	13	4.3
	4th year	26	8.6

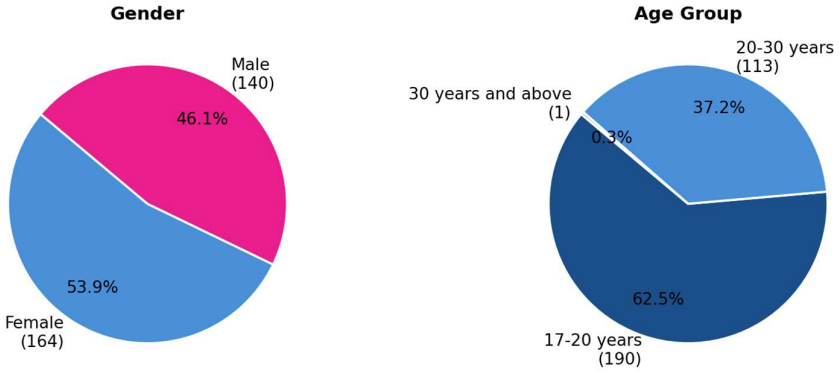

Figure 1. Demographic Profile of Study Sample (N = 304)

Table 3 presents the prevalence and pattern of poor sitting posture (Objective 1). Sitting on a bed was the most commonly reported posture (39.8%), followed by leaning forward (37.5%) and hunching (22.7%); these three non-neutral posture categories together accounted for the entire sample, as no respondent reported a neutral, fully supported sitting posture. Mean self-rated slouching frequency (L1) was 3.23 (SD = 1.02).

Table 3. Prevalence and Pattern of Poor Sitting Posture

Variable	Category	n	%
Common sitting posture	Sitting on the bed	121	39.8
	Leaning forward	114	37.5
	Hunched	69	22.7
Chair back support	Yes/Always	168	55.3
	Sometimes/Maybe	79	26.0
	No/Never	57	18.8
L1: Slouched posture	Mean = 3.23, SD = 1.02	304	100.0

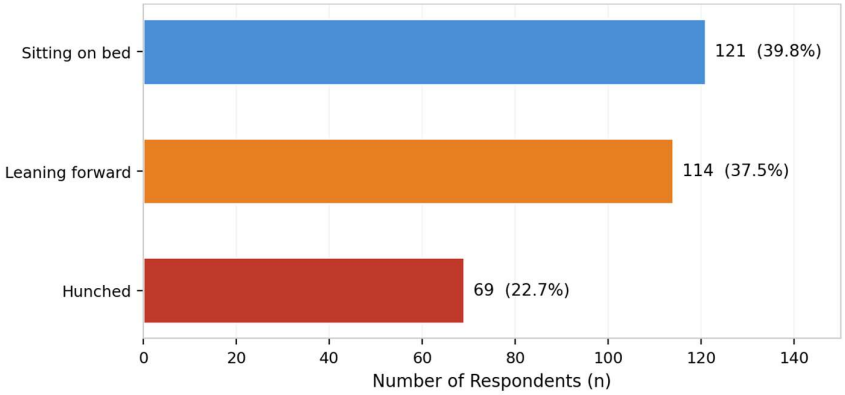

Figure 2. Prevalence of Poor Sitting Posture Types

The prevalence and perceived severity of neck pain among the respondents, 74.3% (n = 226), indicated that their sitting posture contributes to their neck pain. Mean perceived pain exacerbation from prolonged sitting (L2) was 3.37 (SD = 1.17), and mean post-sitting neck stiffness (L3) was 3.60 (SD = 1.06), the highest mean score recorded across all five Likert items.

Table 4. Prevalence and Perceived Severity of Neck Pain

Variable	Category / Statistic	n	%
Believes posture contributes to neck pain	Yes	226	74.3
	Maybe	44	14.5
	No	34	11.2
L2: Prolonged sitting increases neck pain	Mean = 3.37, SD = 1.17	304	100.0
L3: Neck stiffness after long sitting	Mean = 3.60, SD = 1.06	304	100.0

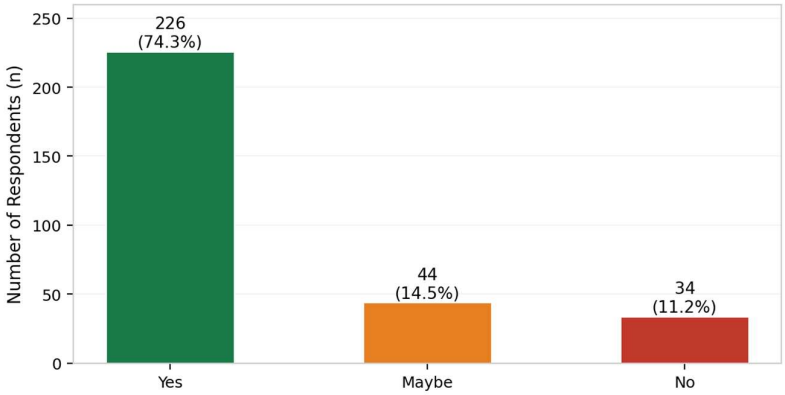

Figure 3. Belief That Sitting Posture Contributes to Neck Pain

Table 5 presents descriptive statistics for all five Likert-scale items, and Table 6 reports the reliability statistic for the scale.

Table 5. Descriptive Statistics for Five-Item Likert Scale (N = 304)

Item	Statement	Mean	SD	Median
L1	I often sit in a slouched posture while studying	3.23	1.02	3
L2	Prolonged sitting increases my neck pain	3.37	1.17	3
L3	I feel neck stiffness after	3.60	1.06	4

	long hours of sitting			
L4	Smartphone usage contributes to my neck pain	3.24	1.13	3
L5	I am aware of ergonomic sitting posture	3.37	1.05	3

Table 6. Reliability Statistics — Five-Item Postural Perception Scale

Statistic	Value
Cronbach's Alpha (α)	.798
Number of Items (k)	5
Valid Cases (N)	304

4.2 Inferential Statistics

Table 7 presents the Spearman rank-order correlations between the continuous poor-posture indicator (L1) and the continuous neck pain indicators (L2, L3).

Table 7. Spearman Correlations Between Poor Sitting Posture (L1) and Neck Pain Indicators (L2, L3)

Posture Indicator	Neck Pain Indicator	Spearman ρ	p	n
L1: Slouched posture	L2: Prolonged sitting increases neck pain	.302	< .001	304
L1: Slouched posture	L3: Neck stiffness after long sitting	.465	< .001	304

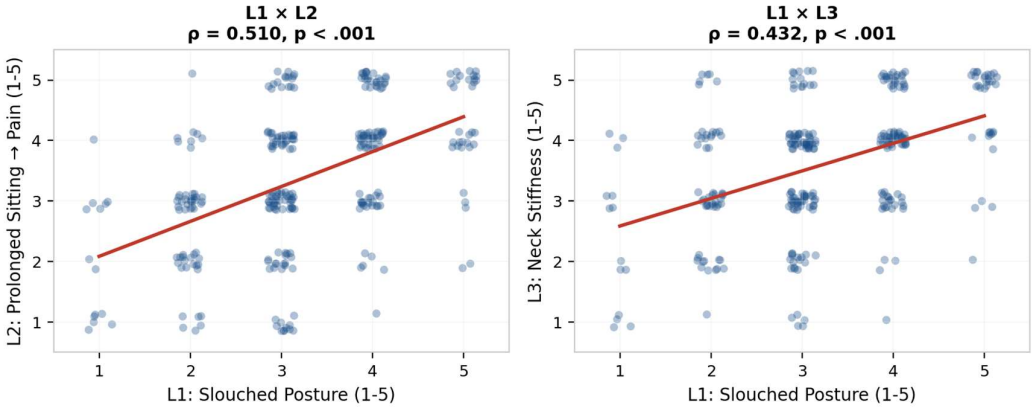

Figure 4. Spearman Correlation: Poor Sitting Posture (L1) and Neck Pain Indicators

Using Fisher's z-transformation with n = 304, the 95% confidence interval for the L1 × L2 correlation was [.196, .401], and the 95% confidence interval for the L1 × L3 correlation was [.372, .548]. Both intervals exclude zero and are consistent with a small-to-moderate true effect. A confidence interval for the chi-square association (Table 8) could not be computed from summary statistics alone; robust interval estimation for Cramér's V typically requires bootstrapping on the underlying case-level data.

Table 8. Chi-Square Test: Sitting Posture Type × Belief That Posture Causes Neck Pain

Posture Type	Believes Posture → Pain: Yes (%)	Maybe (%)	No (%)	n
Sitting on the bed	76.0	14.9	9.1	121
Leaning forward	76.3	16.7	7.0	114
Hunched	68.1	10.1	21.7	69

Table 8 presents the chi-square test of independence between predominant posture type and the categorical belief that posture contributes to neck pain.

Note. χ^2 (4) = 10.87, p = .028, Cramér's V = 0.134.

4.3 Hypothesis Testing Results

Table 9 summarises the results of hypothesis testing for the central hypothesis of this study. Figure 5 visualises the chi-square hypothesis test reported in Table 8.

Table 9. Summary of Hypothesis Testing Results

Test	Statistic	p-value	Result
Spearman correlation: L1 × L2	ρ = .302	< .001	Significant
Spearman correlation: L1 × L3	ρ = .465	< .001	Significant
Chi-square: Posture type × Pain belief	χ^2 (4) = 10.87	.028	Significant

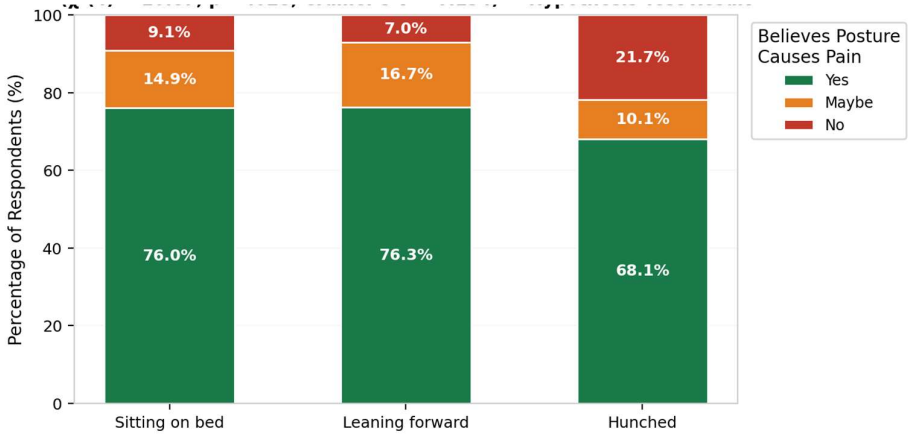

Figure 5. Sitting Posture Type × Belief That Posture Causes Neck Pain

Both the continuous Spearman correlation tests and the categorical chi-square test yielded statistically significant results (p < .05). The null hypothesis (H☐) is therefore rejected, and the alternative hypothesis (H☐) — that there is a statistically significant association between poor sitting posture and neck pain among college students — is supported by the data.

4.4 Subgroup Comparisons (Kruskal-Wallis H and Mann-Whitney U Tests)

To determine whether the five Likert items varied across demographic and behavioural subgroups, Kruskal-Wallis H tests were used to compare scores across groups with three or more levels (gender, sitting hours per day, screen time per day, break frequency, sitting posture type, chair

back support, year of study, and age group), and Mann-Whitney U tests were used to compare scores specifically between male and female respondents.

None of the fifteen Kruskal-Wallis H tests reached statistical significance (all p > .05), and none of the five Mann-Whitney U tests comparing male and female respondents reached statistical significance (all p > .05; effect sizes r ranged from -0.113 to -0.004, negligible to small by Cohen's 1988 benchmarks). Male and female students reported comparable mean scores across all five Likert items; for example, mean agreement with the item on neck stiffness after long sitting was 3.61 for males and 3.59 for females (U = 11,529, p = .947, r = -.004).

Taken together, these results indicate that postural habits and pain-perception attitudes were statistically uniform across every demographic and behavioural subgroup examined in this sample, rather than concentrated within a particular group. The secondary null hypothesis (H☐☐) is therefore retained.

Table 10. Mann-Whitney U Test Results Comparing Likert Item Scores by Gender. All p > .05.

Likert Item	Mean (Male)	Mean (Female)	U	p	r	Effect
I often sit in a slouched posture	3.26	3.21	12098	.398	-.054	Negligible

while studying						
Prolonged sitting increases my neck pain	3.39	3.36	11548	.927	-.006	Negligible
I feel neck stiffness after long hours of sitting	3.61	3.59	11529	.947	-.004	Negligible
Smartphone usage contributes to my neck pain	3.37	3.13	12777	.079	-.113	Small
I am aware of ergonomic sitting posture	3.41	3.33	12168	.349	-.060	Negligible

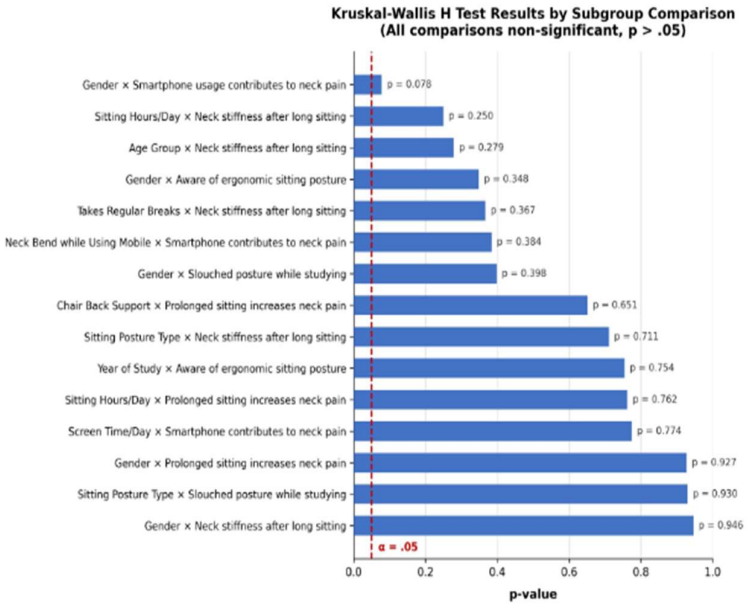

Figure 6. Kruskal-Wallis H Test Results by Subgroup Comparison.

All comparisons were non-significant (p > .05); df = degrees of freedom; η^2 = eta-squared effect size.

Figure 6. Kruskal-Wallis H Test Summary Across Demographic and Behavioural Subgroups. All p > .05; df = degrees of freedom; η^2 = eta-squared effect size.

5. Discussion

5.1 Interpretation of Findings

The primary conclusion of this study is that there exists strong evidence to reject the null hypothesis. Specifically, poor sitting posture is positively related to neck pain among college students. These relationships were most robustly demonstrated through the use of both continuous measures of posture and pain. For example, a moderate association existed between an individual's perception of how much they slouch while sitting and their belief that prolonged sitting increases their neck pain (ρ = .302, p < .001). A stronger relationship was found between slouched posture and reported neck stiffness after long periods of sitting (ρ = .465, p < .001), the largest of the two inter-item relationships examined. The strength of this latter relationship supported the pooled odds ratio of 1.97 found by Gao et al. (2023) for inappropriate sitting posture and the biomechanical models showing that

slouched, forward-flexed postures have greater cervical spinal load than postures in neutral alignment (Hansraj, 2014).

Categorical support for the hypothesis was provided by the significant chi-square associations between posture type and beliefs about pain attribution [$\chi^2(4) = 10.87$, $p = .028$, $V = 0.134$]. However, the size of these relationships was smaller than the corresponding continuous relationships. A larger range of values can be captured in a continuous variable, whereas a categorical variable collapses all values into discrete categories and loses information contained in differences within each category. By Cohen's (1988) benchmarks, a Cramér's V of .134 falls in the small-effect range. The categorical result should therefore be read as confirming that an association exists, rather than as evidence of a strong link between posture type and pain attribution; the continuous correlations ($\rho = .302$, $\rho = .465$) are the more informative estimates of the strength of this relationship.

One possible exception to this is the fact that proportionally more students who habitually hunched denied any connection between their posture and their pain, compared to those who habitually leaned forward, even though the two postures would likely place similar mechanical demands upon the cervical spine. Such a result could be considered representative of a normalisation effect seen in patients suffering from "text-neck," where patients who habitually assume a particular posture will eventually normalise their perception of that posture and cease to associate discomfort experienced in response to that posture with that posture (Damasceno et al., 2018).

In terms of comparison with other studies reviewed in section 2.3, el-Siddig et al. (2022) found a similar significant chi-square association between device-use posture and neck/shoulder pain among Saudi university students, and Behera et al. (2020) found similar posture-related risk factors among Indian medical students using analogous chi-square and logistic regression methodologies.

The presence of such similarity between the current findings and this international body of evidence provides additional support for the idea that the observed relationships between posture and pain in this study reflect a generally applicable phenomenon, rather than a specific context-dependent artefact. An additional supporting factor for this interpretation is that there exists clinical biomechanical evidence demonstrating that postural deviation in the cervical and thoracic regions of the spine is directly correlated with the severity of neck pain and the degree of functional impairment (Lau et al., 2010). Therefore, a physiologically based explanation exists for the relationship between slouching and increased reports of neck pain, as shown in section 4.2.

A further finding of this study, not reported by the comparator studies in Section 2.3, was the absence of significant subgroup differences (Section 4.4). Postural and pain-perception attitudes did not differ significantly by gender, sitting hours, screen time, break frequency, posture type, chair support, year of study, or age. This suggests that poor postural habits and their associated attitudes are broadly distributed across this student population rather than concentrated in an identifiable subgroup, which has a direct bearing on how an intervention should be designed (see Section 5.2).

5.2 Implications

The results provide immediate implications for promoting the health of college students. Because poor sitting posture is significantly associated with neck pain among college students, institutions should implement ergonomics education programs to correct poor sitting posture among college students. World Health Organisation recommendations also include reducing sedentary behaviour over long periods (Bull et al., 2020). The high internal consistency of the five-item attitudinal scale ($\alpha = .798$; Tavakol & Dennick, 2011) indicates that the scale may serve as an effective tool to screen for potential problems in institutional ergonomic surveys. Because Section 4.4 found no significant differences in postural attitudes across gender, year of study, sitting hours, or any other subgroup examined, these programs are better designed as population-wide initiatives delivered to the entire student body rather than as interventions targeted at a specific demographic segment.

5.3 Limitations

Several challenges and limitations were experienced during the course of conducting this study. Since the study used a cross-sectional design, it does not allow researchers to make claims about cause-and-effect relationships concerning whether poor sitting posture causes neck pain or vice versa. Longitudinal designs like that used by Kanchanomai et al. (2011) would be necessary to show that poor sitting posture precedes the development of neck pain.

All data collected during this study were based solely on self-reports. Therefore, this study is susceptible to biases stemming from individuals' recollections of events and/or desires to appear socially desirable. Additionally, this study did not utilise standardised clinical instruments to assess the nature of participants' pain. However, the questions asked in this study are theoretically similar to those previously employed in survey-based approaches to assessing symptoms (Hoy et al., 2010). The sampling frame utilised in this study consisted exclusively of one institutional setting characterised by an overwhelmingly large number (80.9%) of medical students. Furthermore, this

study included undergraduate and graduate students together without separately analysing responses according to academic level. Therefore, these findings cannot be generalised beyond students attending colleges with similar demographic characteristics.

A further limitation concerns common-method variance. Items L1 through L5 were drawn from a single five-item Likert battery completed by the same respondent in one sitting, and the two correlations underpinning the central hypothesis (L1 × L2, L1 × L3) are therefore inter-item correlations within that same instrument rather than correlations between independently measured constructs. Some portion of the observed association may reflect shared method variance, such as a general tendency toward agreement or heightened body awareness, rather than a purely posture-specific effect. Future studies could address this by pairing the self-report scale with an independent, non-self-report measure of posture or pain.

Finally, this study conducted 42 significance tests in total across the chi-square, Kruskal-Wallis, Mann-Whitney U, and Spearman analyses (Sections 4.2–4.4), without applying a correction for multiple comparisons. At an uncorrected $\alpha = .05$, roughly two false positives would be expected by chance alone across these many tests. No correction (e.g., Bonferroni) was applied because the analyses were organised around a single pre-specified hypothesis (Spearman and chi-square) plus a set of exploratory subgroup checks (Kruskal-Wallis and Mann-Whitney), and applying a family-wise correction across all 42 tests indiscriminately would be overly conservative for the exploratory component. Readers should nonetheless treat the single significant chi-square result (Table 8) with some caution, given the number of categorical comparisons tested.

Objective measurements of posture (such as using photogrammetry to measure craniovertebral angles) were not used in this study. However, objective measures are available (Mylonas et al., 2022) and can provide useful comparisons to self-report data for future studies.

6. Conclusion & Suggestions

6.1 Conclusion of This Study

In an effort to examine the relationship between poor sitting posture and neck pain among university students, the prevalence of poor sitting posture among 304 undergraduate and graduate-level university students was examined using a cross-sectional survey. The results showed a very high incidence of poor sitting posture; all participants reported one of three non-neutral postures (39.8% on a bed, 37.5% leaning forward, 22.7% hunched). Poor sitting posture was also shown to be significantly correlated to neck pain via both continuous correlational analyses ($\rho = .302$ and $\rho = .465$, both $p < .001$) and categorical chi-square analyses [$\chi^2(4) = 10.87$, $p = .028$]. Thus, the null hypothesis was rejected, and the alternative hypothesis was confirmed. The results of this study, which show that there exists a significant association between posture and pain among university students, are similar to previous studies conducted in Hong Kong, Jordan, Saudi Arabia, India, China, and Ethiopia. These similarities suggest that the posture-pain relationship is a widespread occurrence among university student populations. This study extends that evidence base to a population not previously examined in the published literature, students at Uttaranchal University, and, to our knowledge, is the first to apply both a continuous, multi-item self-report scale and a categorical posture-type analysis within a single sample from this setting.

6.2 Suggestions

Providing colleges and universities with structured programs to educate students about proper sitting ergonomics beginning at the start of their first semester or year, and continuing throughout the duration of their attendance;

Equipping university libraries, classrooms, and dormitory rooms with furniture having ergonomic design features such as lumbar supports;

Including educational programs focused on reducing "text neck" resulting from prolonged use of smartphones while studying/typing to raise awareness about this issue in student wellness programs;

Utilising a valid, short instrument to assess attitudes toward posture awareness, such as the 5-item instrument developed by researchers to track changes in students' postural awareness over time.

6.3 Future Research

Future research should utilise long-term follow-up designs to identify whether posture influences chronic pain as suggested in the current study.

Additional future research may wish to utilise standardised clinical pain assessments (e.g., Neck Disability Index) rather than just self-assessment scales so that findings can be compared directly to those in the larger clinical pain literature.

Incorporate objective measures of posture (photographic-based measurements of craniovertebral angles) along with subjective assessments. Additionally, other universities/institutions and different

disciplines within higher education should be sampled to increase generalizability beyond just medical students.

References

- Al-Hadidi, F., Bsisu, I., AlRyalat, S. A., Al-Zu'bi, B., Bsisu, R., Hamdan, M., Kanaan, T., Yasin, M., & Samarah, O. (2019). Association between mobile phone use and neck pain in university students: A cross-sectional study using a numeric rating scale for evaluation of neck pain. PLOS ONE, 14(5), e0217231. https://doi.org/10.1371/journal.pone.0217231
- Behera, P., Majumdar, A., Revadi, G., Santoshi, J. A., Nagar, V., & Mishra, N. (2020). Neck pain among undergraduate medical students in a premier institute of central India: A cross-sectional study of prevalence and associated factors. Journal of Family Medicine and Primary Care, 9(7), 3574–3581. https://doi.org/10.4103/jfmpc.jfmpc_206_20
- Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J.-P., Chastin, S., Chou, R., Dempsey, P. C., DiPietro, L., Ekelund, U., Firth, J., Friedenreich, C. M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, P. T., Lambert, E., Leitzmann, M., Milton, K., Ortega, F. B., Ranasinghe, C., Stamatakis, E., Tiedemann, A., Troiano, R. P., van der Ploeg, H. P., Wari, V., & Willumsen, J. F. (2020). World Health Organisation 2020 guidelines on physical activity and sedentary behaviour. British Journal of Sports Medicine, 54(24), 1451–1462. https://doi.org/10.1136/bjsports-2020-102955
- Chan, L. L. Y., Wong, A. Y. L., Wang, M. H., Cheung, K., & Samartzis, D. (2020). The prevalence of neck pain and associated risk factors among undergraduate students: A large-scale cross-sectional study. International Journal of Industrial Ergonomics, 76, Article 102934. https://doi.org/10.1016/j.ergon.2020.102934
- Cohen, J. (1988). Statistical power analysis for the behavioural sciences (2nd ed.). Lawrence Erlbaum Associates.
- Côté, P., Cassidy, J. D., & Carroll, L. (1998). The Saskatchewan Health and Back Pain Survey: The prevalence of neck pain and related disability in Saskatchewan adults. Spine, 23(15), 1689–1698. https://doi.org/10.1097/00007632-199808010-00015
- Damasceno, G. M., Ferreira, A. S., Nogueira, L. A. C., Reis, F. J. J., Andrade, I. C. S., & Meziat-Filho, N. (2018). Text neck and neck pain in 18–21-year-old young adults. European Spine Journal, 27(6), 1249–1254. https://doi.org/10.1007/s00586-017-5444-5
- Elsiddig, A. I., Altalhi, I. A., Althobaiti, M. E., Alwethainani, M. T., & Alzahrani, A. M. (2022). Prevalence of neck and shoulder pain among Saudi university students who are using smartphones and computers. Journal of Family Medicine and Primary Care, 11(1), 194–200. https://doi.org/10.4103/jfmpc.jfmpc_1138_21
- Fejer, R., Kyvik, K. O., & Hartvigsen, J. (2006). The prevalence of neck pain in the world population: A systematic critical review of the literature. European Spine Journal, 15(6), 834–848. https://doi.org/10.1007/s00586-004-0864-4
- Gao, Y., Chen, Z., Chen, S., Wang, S., & Lin, J. (2023). Risk factors for neck pain in college students: A systematic review and meta-analysis. BMC Public Health, 23, Article 1502. https://doi.org/10.1186/s12889-023-16212-7
- GBD 2021 Neck Pain Collaborators. (2024). Global, regional, and national burden of neck pain, 1990–2020, and projections to 2050: A systematic analysis of the Global Burden of Disease Study 2021. The Lancet Rheumatology, 6(3), e142–e155. https://doi.org/10.1016/S2665-9913(23)00321-1
- Guan, X., Fan, G., Wu, X., Zeng, Y., Su, H., Gu, G., & He, S. (2015). Photographic measurement of head and cervical posture when viewing a mobile phone: A pilot study. European Spine Journal, 24(12), 2892–2898. https://doi.org/10.1007/s00586-015-4143-3
- Hansraj, K. K. (2014). Assessment of stresses in the cervical spine caused by posture and position of the head. Surgical Technology International, 25, 277–279.
- Hoy, D. G., Protani, M., De, R., & Buchbinder, R. (2010). The epidemiology of neck pain. Best Practice & Research Clinical Rheumatology, 24(6), 783–792.

https://doi.org/10.1016/j.berh.2011.01.019

- Kanchanomai, S., Janwantanakul, P., Pensri, P., & Jiamjarasrangsi, W. (2011). Risk factors for the onset and persistence of neck pain in undergraduate students: 1-year prospective cohort study. BMC Public Health, 11, Article 566. https://doi.org/10.1186/1471-2458-11-566
- Kazeminasab, S., Nejadghaderi, S. A., Amiri, P., Pourfathi, H., Araj-Khodaei, M., Sullman, M. J. M., Kolahi, A. A., & Safiri, S. (2022). Neck pain: Global epidemiology, trends and risk factors. BMC Musculoskeletal Disorders, 23, Article 26. https://doi.org/10.1186/s12891-021-04957-4

- Lau, K. T., Cheung, K. Y., Chan, K. B., Chan, M. H., Lo, K. Y., & Chiu, T. T. (2010). Relationships between sagittal postures of thoracic and cervical spine, presence of neck pain, neck pain severity and disability. Manual Therapy, 15(5), 457–462.

https://doi.org/10.1016/j.math.2010.03.009

- Lee, S., Kang, H., & Shin, G. (2015). Head flexion angle while using a smartphone. Ergonomics, 58(2), 220–226. https://doi.org/10.1080/00140139.2014.967311
- Mylonas, K., Tsekoura, M., Billis, E., Aggelopoulos, P., Tsepis, E., & Fousekis, K. (2022). Reliability and validity of non-radiographic methods of forward head posture measurement: A systematic review. Cureus, 14(8), e27696. https://doi.org/10.7759/cureus.27696
- Nunnally, J. C. (1978). Psychometric theory (2nd ed.). McGraw-Hill.
- Safiri, S., Kolahi, A. A., Hoy, D., Buchbinder, R., Mansournia, M. A., Bettampadi, D., Ashrafi-Asgarabad, A., Almasi-Hashiani, A., Smith, E., Sepidarkish, M., Cross, M., Qorbani, M., Moradi-Lakeh, M., Woolf, A. D., March, L., Collins, G., & Ferreira, M. L. (2020). Global, regional, and national burden of neck pain in the general population, 1990–2017: Systematic analysis of the Global Burden of Disease Study 2017. BMJ, 368, Article m791. https://doi.org/10.1136/bmj.m791
- Smith, L., Louw, Q., Crous, L., & Grimmer-Somers, K. (2009). Prevalence of neck pain and headaches: Impact of computer use and other associated factors. Cephalalgia, 29(2), 250–257. https://doi.org/10.1111/j.1468-2982.2008.01714.x
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. International Journal of Medical Education, 2, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd
- Vos, T., Flaxman, A. D., Naghavi, M., Lozano, R., Michaud, C., Ezzati, M., Shibuya, K., Salomon, J. A., Abdalla, S., Aboyans, V., Abraham, J., & Murray, C. J. L. (2012). Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. The Lancet, 380(9859), 2163–2196. https://doi.org/10.1016/S0140-6736(12)61729-2
- Wang, R., Yin, Y., Zhang, H., Pan, L., Zhu, Y., Wang, M., Huang, Z., Wang, W., & Deng, G. (2023). Risk factors associated with the prevalence of neck and shoulder pain among high school students: A cross-sectional survey in China. BMC Musculoskeletal Disorders, 24, Article 641. https://doi.org/10.1186/s12891-023-06656-8
- Weleslassie, G. G., Meles, H. G., Haile, T. G., & Hagos, G. K. (2020). Burden of neck pain among medical students in Ethiopia. BMC Musculoskeletal Disorders, 21, Article 14. https://doi.org/10.1186/s12891-019-3018-x