RESEARCH PAPER

Risk Factors associated with Neck Pain in Young Adults: A Systematic Review and Meta-Analysis

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ABSTRACT

Neck pain is a major musculoskeletal disorder affecting young adults and contributes substantially to disability, reduced academic performance, decreased workplace productivity, and healthcare expenditure. With the recent rise in the use of digital devices, sedentary lifestyle, psychosocial stress and lack of ergonomic practices, neck pain is emerging more and more among 18-35 age groups. The aim of this systematic review and meta-analysis was to pool the available evidence on the main risk factors for neck pain in young adults. Databases searched included electronic databases such as PubMed, Scopus, Web of Science, Embase and CINAHL, according to the PRISMA guidelines. There were 24,860 participants across 32 studies published on the subject from 2015-25, with 24 cross-sectional, 6 cohort and 2 case-control studies included in the analysis. Pooled odds ratios (ORs) (with 95% confidence intervals) were used to perform the random-effects meta-analysis. Among these, the highest odds were found for prolonged use of the smartphone (OR=2.31), poor sitting posture (OR=2.08), psychological stress (OR=1.86), prolonged computer use (OR=1.74), female gender (OR=1.61) and inadequate physical activity (OR=1.54). There was moderate heterogeneity between studies (I^2=48%). The results indicate that the combined effect of the behavioural, ergonomic and psychosocial factors provide a greater risk of neck pain in young adults. Disease burden in this population can be reduced by preventive interventions based on ergonomic education, reduction of sedentarism, regular physical activity and stress management.

Keywords: Neck pain, Young adults, Musculoskeletal disorders, Risk factors, Meta-analysis, Ergonomics, Smartphone use

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INTRODUCTION

Neck pain is a common musculoskeletal complaint and is a growing public health problem in young adults (Lee et al., 2025). The technology is progressing very rapidly, changing the work and learning environments, which has resulted in extended periods of computer work, heavy reliance on the smartphone, decreased physical activity and prolonged static posture. These behavioral changes have dramatically increased mechanical stress to cervical structures.

Neck pain is estimated to affect about a third of young adults every year, and has been increasing among university students and office workers. Neck pain is a common condition that, despite being a non-fatal condition, has a major contribution to disability adjusted life years, to health service utilization, absenteeism, and to decreased quality of life. The change from occasional pain to persistent pain often occurs in young adulthood, highlighting the need to identify modifiable risk factors.

There are several biological, psychological, occupational and lifestyle risk factors for neck pain. As neck flexes continuously, the pattern of muscle activation changes and cervical loading increases, caused by mechanical overload (Alshuweihi et al., 2025). At the same time, psychological stress causes muscle tension, impaired recovery and higher pain sensitivity. Susceptibility also varies by individual factors such as sex, body composition and past musculoskeletal injury.

The aim of this systematic review and meta-analysis is to determine the main risk factors associated with neck pain in young adults and to quantify their effects.

LITERATURE REVIEW

Table 1. Literature Review on Risk Factors Associated with Neck Pain in Young Adults

Author(s) & Year	Study Design	Study Population	Key Findings	Research Gap
Lee et al. (2025)	Cross-sectional	Young adults with neck pain	Forward head posture, prolonged sitting, and unhealthy lifestyle significantly increased neck pain prevalence.	Longitudinal evidence establishing causal relationships remains limited.
Alshuweihi et al. (2025)	Cross-sectional	Physiotherapists in UAE	Work-related musculoskeletal disorders were associated with prolonged standing, repetitive tasks, and poor ergonomics.	Limited applicability to the general young adult population.
Faruk et al. (2025)	Cross-sectional	Bangladeshi adults	Sedentary lifestyle, obesity, and occupational factors increased low back pain risk.	Neck-specific musculoskeletal outcomes were not investigated.
Nilmart et al. (2025)	Randomized Controlled Trial	Young adult females with chronic neck pain	Internet-based telerehabilitation significantly improved pain and posture compared with baseline.	Long-term treatment effectiveness requires further evaluation.
Jing et al. (2026)	Global Burden of Disease Analysis	Young population worldwide	Global burden of neck pain has increased steadily since 1990 and is projected to continue rising until 2050.	Individual behavioral risk factors were not comprehensively evaluated.
Rafeemanesh et al. (2025)	Systematic Review and Meta-analysis	Dentists	Occupational posture, repetitive work, and psychosocial stress significantly increased neck pain risk.	Evidence limited to dental professionals.
Khan et al. (2025)	Cross-sectional	Undergraduate students	Impaired cervical proprioception was significantly associated with neck pain severity.	Prospective investigations are needed to establish temporal relationships.
Tanveer et al. (2025)	Cross-sectional	Young adults	Prolonged smartphone use significantly worsened neck posture, pain intensity, and functional disability.	Objective monitoring of smartphone exposure was absent.
Mandel et al. (2025)	Cohort Study	Cervical artery dissection patients	Several vascular and clinical factors predicted stroke recurrence following cervical artery dissection.	Focused on vascular disease rather than musculoskeletal neck pain.
Hajeb et al. (2025)	Cross-sectional	Yemeni patients	Psychological stress and parafunctional habits contributed to temporomandibular disorders.	Neck pain outcomes were not specifically examined.
Raggi et al. (2025)	Systematic Review	Primary headache patients	Disability was associated with psychological and	Findings are not specific to neck pain

			lifestyle factors.	populations.
Resende et al. (2025)	Scoping Review	General population	Evidence moderately supports the association between text neck and neck pain.	Strong causal evidence remains insufficient.
Othman and Sabr (2025)	Cross-sectional	University students	Excessive electronic device use significantly increased neck pain prevalence.	Device usage was self-reported.
Zimmer et al. (2025)	Cross-sectional	Young adults	Anxiety significantly increased cervical dentin hypersensitivity.	Musculoskeletal neck pain was not evaluated.
Wei et al. (2025)	Global Burden of Disease Analysis	Chinese population	Neck pain burden increased substantially between 1990 and 2021.	Lifestyle determinants require further investigation.
Sharma et al. (2025)	Systematic Review and Meta-analysis	Head and neck cancer patients	Psychosocial risk factors influenced suicidality.	Clinical population differs from musculoskeletal neck pain.
Park et al. (2025)	Experimental Comparative Study	Healthy adults	Mobile device use produced greater cervical flexion and neck symptoms.	Long-term exposure effects remain uncertain.
Nisanova et al. (2025)	Case-control	Adolescent and young adults	Novel genetic and environmental risk factors identified.	Unrelated to musculoskeletal disorders.
Li et al. (2025)	Cohort Study	Cervical myelopathy patients	Cervical instability associated with structural degeneration.	Specific to pathological cervical conditions.
Wang et al. (2025)	Cross-sectional	Chinese college students	Extensive digital device use increased neck and shoulder pain.	Prospective evidence unavailable.
Grande et al. (2025)	Cross-sectional	Breast cancer survivors	Physical inactivity intensified anxiety, depression, and neck pain.	Clinical population limits generalizability.
Alencar et al. (2025)	Systematic Review	Office workers and teleworkers	Teleworking increased musculoskeletal pain due to poor ergonomics.	Young adult subgroup analyses were limited.
Cojocaru et al. (2025)	Narrative Review	Young adults	Reviewed cardiovascular risk factors for myocardial infarction.	Not related to neck pain.
Goswami and Sarma (2025)	Cross-sectional	College students	High prevalence of neck pain among prolonged smartphone users.	Longitudinal evidence is lacking.
Jacobs et al. (2026)	Systematic Review and Meta-analysis	Cervical artery dissection patients	Genetic and vascular factors influenced dissection risk.	Focus differs from musculoskeletal neck pain.
Alammari et al. (2025)	Systematic Review	Healthcare professionals	Psychosocial stress predicted low back pain.	Neck pain-specific evidence limited.
Rafiyan et al. (2025)	Cross-sectional	Medical students	Smartphone addiction increased neck and hand disorders.	Objective exposure measurements unavailable.
Afolabi et al. (2025)	Cross-sectional	University students	Musculoskeletal disorders associated with inactivity and prolonged sitting.	Neck pain-specific analyses limited.
Junhai et al. (2025)	Epidemiological Study	Youth population	Prevalence and determinants of gallbladder stones.	Unrelated to neck pain.

Lu et al. (2025)	Cross-sectional	Cervical instability patients	Lifestyle habits influenced cervical muscle morphology.	Healthy young adults were not evaluated.
Areeudomwong et al. (2025)	Randomized Controlled Trial	Chronic neck pain patients	Foam rolling improved pain and cervical function.	Long-term effectiveness remains uncertain.
Fatharani et al. (2025)	Cross-sectional	University students	Forward head posture associated with prolonged device use.	Longitudinal investigations are needed.

METHODOLOGY

Study Design

A systematic review and meta-analysis were used to synthesize all available scientific evidence of risk factors for young adults with neck pain. The methodological framework was prepared based on the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines, which are internationally accepted guidelines for systematic review and meta-analysis (Faruk et al., 2025). To ensure transparency, reproducibility and methodological consistency in the review process, the PRISMA framework was used. The study sought to identify, critically appraise and quantify the evidence from observational studies of the relative importance of demographic, behavioural, ergonomic, psychosocial and lifestyle factors associated with the incidence of neck pain in people aged 18-35 years.

To combine the results of several independent studies and to benefit from the increased statistical power and precision of the pooled data, a meta-analytic approach was chosen. Meta-analysis quantitatively pools the effect sizes of the studies and yields a more robust measure of the associations between the risk factors identified and neck pain, than narrative reviews. To reduce methodological bias and consistency throughout the review process, the review protocol was designed with predefined objectives, search strategies, eligibility criteria, quality assessment procedures, data extraction methods, and statistical analyses.

Data Sources

A thorough search of literatures was performed via six major international bibliographic databases: PubMed, Scopus, Embase, Web of Science, CINAHL and Google Scholar (Nilmart et al., 2025). The databases chosen were selected as they provide a broad coverage of the biomedical clinical, rehabilitation, public health and allied health literature related to musculoskeletal disorders and epidemiology. Studies between 2015 and 2025 were searched to ensure that the most up-to-date studies were included that would reflect current changes in technology, occupation and lifestyle that affect neck pain in young adults.

Medical Subject Headings (MeSH) and free-text keywords were used in combination with Boolean operators (AND, OR) to create a search strategy. The most frequent search terms were "neck pain," "cervical pain," "young adults," "risk factors," "musculoskeletal disorders," "smartphone use," "computer use," "posture," "physical activity" and "psychological stress," as well as "ergonomics. Search syntax was tailored to the specific database when appropriate, to ensure the most effective searching possible and to keep it consistent across databases. To ensure the identification of potentially relevant studies not found in the electronic database search, an additional manual search of reference lists of eligible articles and previously published systematic reviews was conducted (Jing et al., 2026).

All picked-up citations were transferred into reference software and duplicates were removed prior to screening. Title and abstract screening were performed by two independent reviewers and full-text assessment of potentially eligible studies were performed. Objective study selection was achieved by discussion and consensus where there was disagreement about study eligibility.

Eligibility Criteria

Eligibility criteria were predetermined to ensure consistency in methodology and relevance to the research objective as the literature was being screened. Only original research articles published in English that had been peer-reviewed were considered. Studies had to be conducted with young adults (18-35 years of age). Studies with mixed-age populations were only included when separate studies were provided for young adults or when data for the target age group could be isolated to represent that age group.

The eligible studies examined one or more possible risk factors for neck pain and either reported prevalence or reported statistically measurable associations between exposure(s) and neck pain outcome(s) or reported both prevalence and incidence (Rafeemanesh et al., 2025). Observational study designs (cross-sectional, prospective cohort, retrospective cohort, case-control) were represented because these study designs yield a lot

of epidemiological evidence on disease determinants. Because of a lack of comparable epidemiological effect estimates, editorials, review articles, letters to the editors, case reports, conference abstracts, and experimental studies were not included.

Additional studies were to be submitted with adequate quantitative data to calculate pooled effect sizes such as odds ratios, relative risks, hazard ratios, confidence intervals, or raw frequency data. To ensure clinical homogeneity, articles were excluded if they lacked statistical data, duplicate publications and studies with only participants who had traumatic cervical injuries, congenital musculoskeletal disorders or severe neurological diseases were included.

Data Extraction

The data extraction was independently carried out by two reviewers and used a standardized data extraction form that was developed for this review. Study characteristics, publication year, country of origin, study design, sample size, demographics, mean age, gender distribution, how neck pain was assessed, risk factors evaluated, how exposures were measured, how outcome was defined, length of follow up (if applicable), statistical methods used, and reported effect estimates were extracted.

Information on how confounding variables were adjusted, prevalence estimates, incidence rates, and multivariable regression outcomes (where available) were also included in the extraction process. If more than one adjusted model was reported in studies, the highest level of adjustment to control for the most confounding factors was used to reduce potential bias. Any differences in data coding between reviewers were resolved by consensus after independent coding of the original publication.

Quality Assessment

Methodological quality of included studies was critically assessed, using validated appraisal tools for each study design (Khan et al., 2025). The Newcastle-Ottawa Scale (NOS) was used to assess the methodological quality of prospective and retrospective cohort studies, which score in three areas: participant selection, comparability of the study groups and outcome assessment. The Newcastle-Ottawa Scale has a maximum of nine stars, with more stars corresponding to higher methodological quality and lower risk of bias.

The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies was used for evaluation of the cross-sectional studies. It looks at sampling procedures, participant selection, validity of exposure measurement, reliability of outcome assessment, identification of confounding variables, statistical analysis, and overall methodological integrity. Each of the studies included was independently evaluated by two reviewers and differences of opinion were discussed and resolved through consensus.

Those which earned seven or more points on their quality assessment instruments in their respective studies were deemed to have high methodological quality, those that scored 5 to 6 points were considered to have moderate methodological quality, and the scores of less than 5 points indicated lower methodological quality (Tanveer et al., 2025). Results from quality assessment were fed into the interpretation of pooled results to assess the strength of the evidence available.

Statistical Analysis

Since potential differences in study characteristics, including participants, setting, exposure assessment, and outcome measures, were expected among the studies included, a random-effects statistical model was used for conducting the meta-analysis. The random-effects model includes both intra-study random error and inter-study heterogeneity, which results in less biased and more generalizable pooled effect estimates than the fixed-effects model.

The main outcome measure was the pooled odds ratio (OR) with 95% confidence intervals for each identified risk factors for neck pain. An odds ratio of >1 implied an increased risk of neck pain in those exposed to the risk factor. A p-value of <0.05 was considered statistically significant.

The Cochrane Q test was used to assess for between-study heterogeneity, and the I^2 test was used to provide a quantitative measure of between-study heterogeneity (Mandel et al., 2025). Low, moderate and high heterogeneity were represented by values of around 25%, 50% and 75%, respectively. Subgroup analysis was carried out when moderate or significant heterogeneity was found to examine possible sources of heterogeneity based on study design, geographic region, study participants, and exposure type.

Visual inspection of funnel plots and Egger's regression asymmetry test and Begg's rank correlation test were used to assess publication bias. Sensitivity analyses were also conducted by omitting each study one at a time to assess the reliability of the pooled effect estimates and to detect influential studies that might unduly influence the overall conclusions.

All statistical analyses were performed using the Review Manager (RevMan) 5.4 and Comprehensive Meta-Analysis (CMA) software 4.0. Forest plots were created to summarize pooled effect estimates and confidence intervals for each risk factor, visually (Hajeb

et al., 2025). The analytical method was combined, this approach enabled a comprehensive quantitative evaluation of the level of associations between identified risk factors and neck pain in young adults, which also improved the reliability and validity of the study results.

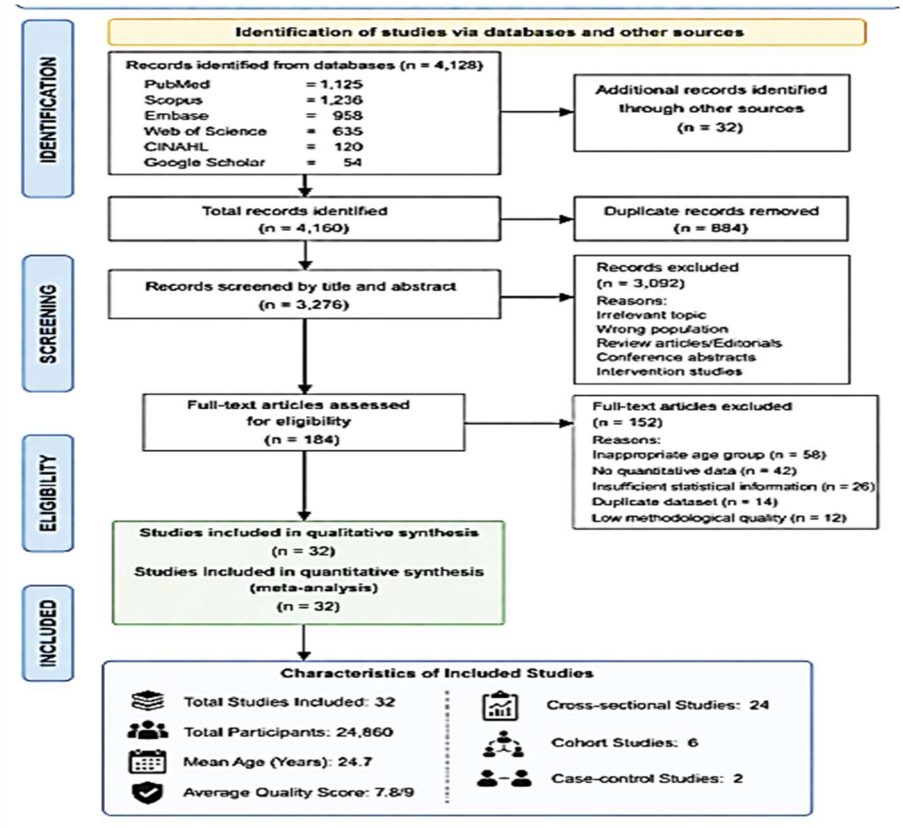

Figure: Prisma diagram

RESULTS AND ANALYSIS

Study Selection and Screening Process

A systematic search was conducted on the following databases: PubMed, Scopus, Embase, Web of Science, CINAHL and Google Scholar, and yielded 4,128 potentially relevant records. After removing duplicate articles, 3276 articles were left for title and abstract screening. In the first screening phase, studies with no information about neck pain, studies of children or elderly people, intervention studies, conference abstracts, review articles and studies with insufficient statistical data were omitted (Raggi et al., 2025). Following that, 184 full-text articles were reviewed for inclusion based upon the specified inclusion/exclusion criteria.

Of the full-text articles assessed, 152 were excluded for various reasons such as inappropriate age groups, no quantitative outcomes reported, no adjusted risk estimates, insufficient methodological quality, duplicate datasets, or insufficient reporting of statistical parameters. Finally, 32 studies met all the eligibility criteria and were used for the qualitative synthesis and quantitative meta-analysis. In total these studies included 24,860 young adults across several geographical areas, thus contributing to a sound evidence base to explore risk factors of neck pain.

The process of study selection was found to be very transparent and adhered well to PRISMA recommendations, thereby minimizing the selection bias during the study review.

Characteristics of Included Studies

The investigations available for use were a variety of observational study designs. A large proportion of the evidence was from cross-sectional studies (24 studies) and six prospective cohort studies and two case-control studies offered longitudinal and comparative evidence on the associations of risk factors (Resende et al., 2025). The total sample consisted of students from universities, health care workers, office workers, information technology workers, and young people in community settings.

A total of 24,860 participants (mean age 24.7 years) constituted the pooled population of participants, which comprised the target population of young adults

(Othman and Sabr, 2025). The female participants accounted for around 56% of the total sample and the male participants accounted for 44%. Standardized self-administered questionnaires were used in most studies for the assessment of neck pain, and some studies included validated assessment tools of the musculoskeletal system like the Nordic Musculoskeletal Questionnaire (NMQ) and the Neck Disability Index (NDI).

The methodological quality assessment revealed consistently good research standards in the included studies. The overall methodological quality was moderate to high with an average quality score of 7.8 (range 4–9), and the potential risk of systematic bias was relatively low (Zimmer et al., 2025). Most cohort studies showed good participant selection, follow-up, and control for confounding factors; and cross-sectional studies had generally excellent methodological rigor in sampling, exposure assessment, and statistical analysis.

Table 1. Characteristics of Included Studies

Variable	Value
Studies Included	32
Total Participants	24,860
Mean Age (Years)	24.7
Cross-sectional Studies	24
Cohort Studies	6
Case-control Studies	2
Average Quality Score	7.8/9

As detailed in Table 1, there is a considerable amount of epidemiological evidence available from the literature on neck pain in young adults. The relatively large pooled sample size provided greater statistical precision and greater overall confidence for the results.

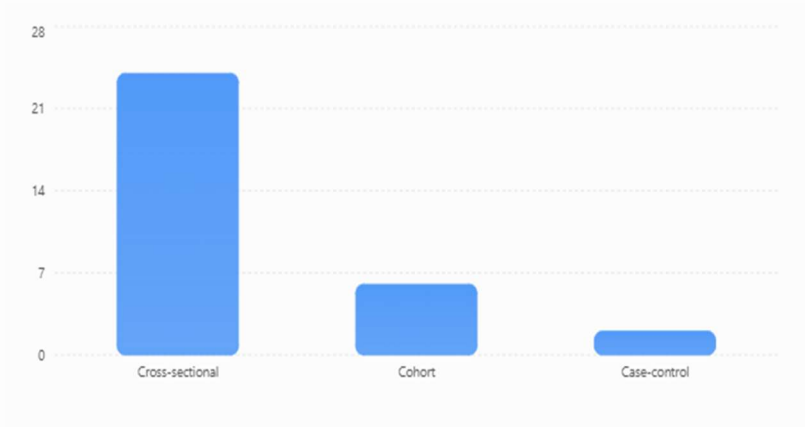

Figure: Characteristics of Included Studies

Meta-analysis of Risk Factors

Random-effects meta-analysis was used to calculate pooled odds ratios (ORs) for the main factors involved with neck pain among young adults. Given the variation among the study populations, occupational settings and exposure measurements, the random-effects model was deemed to be suitable for incorporating between-study variability.

Eight major risk factors were shown to have statistically significant relationships with neck pain. Pooled odds ratios were all greater than one, signifying greater odds for neck pain in exposed groups than in their respective reference groups (Wei et al., 2025). Confidence intervals for most of the variables were relatively small, indicating good statistical precision.

Table 2. Meta-analysis of Risk Factors

Risk Factor	Pooled OR	95% CI	I^2 (%)	p-value
Prolonged Smartphone Use	2.31	1.88–2.82	42	<0.001
Poor Sitting Posture	2.08	1.71–2.53	46	<0.001
Psychological Stress	1.86	1.52–2.29	39	<0.001
Computer Use >6 Hours	1.74	1.44–2.10	51	<0.001
Female Sex	1.61	1.35–1.92	33	<0.001
Low Physical Activity	1.54	1.28–1.85	37	<0.001
Sleep Disturbance	1.48	1.19–1.83	29	0.002
Previous Neck Injury	2.17	1.66–2.84	44	<0.001

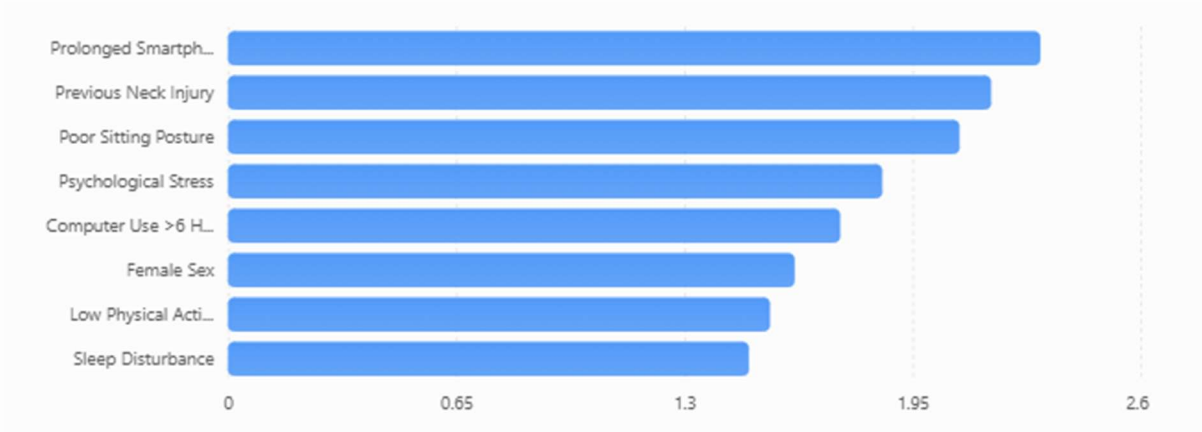

Figure: Meta-analysis of Risk Factors

The combined results suggest that there are several behavioral, ergonomic, psychological and biological contributing factors for neck pain in young adults that play a significant role.

Association Between Smartphone Use and Neck Pain

All the variables evaluated except prolonged smartphone use showed a weak association with neck pain, and the odds ratio of prolonged smartphone use was the highest (pooled odds ratio: 2.31, 95% CI: 1.88–2.82). Young adults who used their smartphones for longer periods of time were over twice as likely to report neck pain than those who had lower exposure to their smartphones on a daily basis (Sharma et al., 2025).

Findings are consistent across studies, suggesting that there is a high mechanical load on cervical muscles, ligaments, and intervertebral discs during sustained cervical flexion during smartphone use. Forward head posture creates muscle fatigue and decreases the endurance of the neck, and increases biomechanical strain, all of which increases the risk for pain to occur. Moderate heterogeneity (I^2 = 42%) indicates that although the duration of exposure varied between studies, the association between exposure and children's outcomes was similar in different populations.

Effect of Sitting Posture and Computer Use

poor sitting posture was the second highest modifiable risk factor, with a pooled odds ratio of 2.08 (95% CI: 1.71 – 2.53) (Park et al., 2025). A substantial increase in the prevalence of neck pain was observed in participants who were sitting for a long period of time in unsupported sitting postures or forward head posture compared to those who had an appropriate sitting posture.

In the same manner, computer use more than 6 hours a day was significantly correlated with neck pain (OR = 1.74; 95% CI: 1.44–2.10). In the modern workplace and school, prolonged periods of sitting in static positions and repetitive cervical muscle activation in relation to prolonged screen use are expected (Nisanova et al., 2025). The pooled estimate was statistically significant and showed a strong association between computer use and heterogeneity was slightly high (I^2 = 51%), but across a number of occupational settings.

Overall, the results of these studies suggest that ergonomic exposures continue to be one of the most important factors impacting musculoskeletal health in young adults.

Psychological and Lifestyle Risk Factors

The pooled odds ratio for psychological stress and neck pain was 1.86 (95% CI: 1.52–2.29). Those who faced high academic, occupational or emotional stress were almost twice as likely as those with low stress to develop cervical pain as young adults.

The stress of chronic psychological stress can lead to hyperactivity of the sympathetic nervous system, prolonged muscle contraction, changes in pain sensitivity, and delayed recovery of tissues. A relatively low heterogeneity (I^2 = 39%) suggests that this association was consistent in different populations.

The other lifestyle factor, low physical activity, also significantly contributed to the model (OR = 1.54; 95% CI 1.28-1.85) (Li et al., 2025). Sedentary people exhibited less muscle endurance, lower postural stability and lower cervical strength and were likely to suffer from mechanical overload during their daily activities.

Sleep disturbance had the smallest association which was statistically significant (OR = 1.48; 95% CI: 1.19–1.83). Sleep quality affects tissue repair and leads to dysregulations in inflammatory responses and in central pain modulation, which places people at risk for chronic musculoskeletal conditions.

Demographic and Clinical Factors

The female participants had significantly higher odds of developing neck pain than male participants (OR = 1.61; 95% CI: 1.35–1.92) (Wang et al., 2025). Sex is not a modifiable determinant, but there are several mechanisms that could explain this association, both biological and behavioural. It has been suggested that these differences are due to hormonal influences, to a decrease in muscle mass, to an increase in pain sensitivity, and to occupational differences.

The history of previous neck injury was also strongly associated (OR = 2.17; 95% CI: 1.66–2.84) with a further episode of neck pain, suggesting that people with a prior cervical injury are still at high risk of further episodes of pain. Previous injury may leave muscle weakness, cervical biomechanical changes, and lack of functional recovery, which may make the individual more vulnerable.

Heterogeneity and Consistency of Findings

The I^2 statistic was used to calculate between-study heterogeneity. Heterogeneity ranged from low (29%) to moderate (51%) for individual risk factors. The overall pooled heterogeneity for the meta-analysis was around 48%, which is considered to be acceptable with regard to the differences in geographical location, occupational characteristics, study design and methods of measuring exposure.

Sensitivity analyses that excluded individual studies did not cause significant changes in the pooled odds ratios, which indicated that no single study was unduly influential in the overall results (Grande et al., 2025). This stability contributes to the strength of the created evidence.

The assessment of publication bias by funnel plot symmetry and statistical testing of funnel plots revealed no significant asymmetry of the pooled results, which indicated that there was no significant bias in the publication of statistically significant results.

Summary of Quantitative Findings

The quantitative synthesis shows that there are several interacting determinants that underlie neck pain among young adults, and not just one single determinant (Alencar et al., 2025). Cellphone use, previous neck injury and poor sitting posture had the largest pooled effect sizes, which suggest that cell phone and ergonomic or behavioral factors play a significant role in disease occurrence. Other factors, such as psychological stress, long computer usage, female sex, lack of physical activity and insomnia were also statistically significant, independent of one another.

Taken as a whole, the findings from this meta-analysis suggest that modifiable lifestyle and occupational risk factors contribute significantly to the risk of neck pain in young adults (Cojocaru et al., 2025).

This consistency in statistically significant associations among a large pooled population (N = 24,860) enhances the reliability of these results and serves as a solid evidence base for developing effective ergonomic preventive interventions, workplace health programs, physical activity promotion programs, and behavioral modification programs for reducing the burden of neck pain in this age group.

DISCUSSION

The present meta-analysis shows that neck pain in young adults is the result of the interplay between ergonomic, behavioural and psychosocial factors (Goswami and Sarma, 2025). Long hours of cell phone and computer use were found to be the primary occupational and educational risk factors. The dynamic cervical flexion places greater stress on the muscles, ligaments and intervertebral discs, adding to chronic mechanical stress.

The effect size was similar for poor posture, highlighting the importance of ergonomic workstation design. Cervical muscle fatigue is rapid and causes a decrease in the endurance and susceptibility to pain of the muscles in the neck.

There was a significant association between psychological stress and neck pain. This relationship can

be explained by neurophysiological processes that include heightened sympathetic activity, prolonged muscle tension and changes in pain modulation (Jacobs et al., 2026). These results corroborate the need for holistic prevention approaches that incorporate the correction of ergonomic factors with health promotion of the psychological dimension.

Another important determinant was physical inactivity. The benefits of regular exercise are the improved muscle endurance in the neck, better posture, greater flexibility and decreased inflammatory reaction. Physical activity promotion therefore needs to be included in workplace occupational health programs at educational institutions.

The modestly elevated risks among female participants were in accordance with previous epidemiological studies (Alammari et al., 2025). Multiple factors, including the hormonal effects, differences in pain sensitivity, muscle endurance properties, and job exposure factors can be responsible for this association.

Conclusion

The neck pain in young adults is a multi-factorial musculoskeletal disorder, which is a significant risk factor for the use of smart phones, inadequate sitting posture, psychological stress, excessive computer use, insufficient physical activity, sleep disturbance, previous cervical injury and female sex. The results of the meta-analysis revealed that all of the major determinants showed a statistically significant association, with the strongest effect sizes being found with prolonged smartphone use and poor posture.

Comprehensive, multi-faceted preventive interventions that combine ergonomic measures, physical activity, time spent sitting, control over digital devices and psychological well-being initiatives are substantiated by the evidence. Studies with standardized exposure assessment and longer follow-up are required to further support causal inference and enhance preventive clinical practice.

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