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FREQUENCY OF RISK FACTORS AND NECK PAIN IN CHILDREN AND ADOLESCENTS

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Brief review

Abstract
Introduction: Neck pain is a very complex and important public health problem in our modern societies. Any structure of the neck, such as intervertebral discs, ligaments, muscles, facet joints, and nerve roots, can represent the source of pain. In epidemiological studies evaluating the general population, the one-year incidence of neck pain can be as high as 40%. Because of the tendency for neck pain to become a chronic problem, it is important to identify risk factors that could promote prevention and early diagnosis.
Methods: The paper is a non-experimental (qualitative) research or a scientific literature review. For the purposes of this work, a search was conducted of the relevant databases Web of Science, Scopus, PubMed, and Med-Line. The listed databases were searched using the keywords "neck pain", "frequency of neck pain", "risk factors", "children and adolescents".
Results: The results include a presentation and analysis of thirteen published scientific articles in the period 2014-2020. The studies used for this paper were published in Sweden, Lebanon, Brazil, Thailand, Tunisia, Iran, Jordan, Saudi Arabia, Norway, Germany, and Australia.
Conclusion: By reviewing the scientific literature, it can be concluded that there is an increased frequency of risk factors for neck pain in children and adolescents. The most common risk factors are female gender, flexed head position, use of mobile and other devices, insufficient physical activity, ergonomic factors, psychological and social factors.

Key words: neck pain, risk factors, children, and adolescents

Introduction

Neck pain is defined as neck pain with or without pain that refers to one or both upper extremities, and that lasts at least one day. People with neck pain may also have accompanying headaches or shoulder pain, but neck pain is the primary complaint (Verhagen,. 2021). Neck pain is a common symptom in primary health care and causes significant disability (Childress et.al., 2020). Neck pain is a very complex and important public health problem in our modern societies. Any structure of the neck, such as intervertebral discs, ligaments, muscles, facet joints, and nerve roots, can represent the source of pain (David et.al., 2021).

About one-fifth of the total burden of musculoskeletal diseases and conditions is neck pain (Murray et.al., 2021). Neck pain is one of the most common musculoskeletal disorders, with a standardized prevalence rate of 27.0 per 1000 population in 2019. (Kazeminasab et.al., 2022). In epidemiological studies evaluating the general population, the one-year incidence of neck pain can be as high as 40% (Ariens et. al., 1999).

Among all health conditions for years of life with disability, the World Health Organization (WHO) classified neck pain and other diseases of the musculoskeletal system as the 4th and 10th pathological conditions (Global Burden of Disease Study 2013 Collaborators 2015). Neck and shoulder pain (NSP) is common during adolescence, with prevalence estimates ranging from 21% to 42% (Feldman et.al., 2002). In a Norwegian study conducted on 7,373 adolescents between the ages of 13 and 19, the neck and shoulder were the most frequently affected sites of musculoskeletal pain (Hoftun et.al., 2011).

Because of the tendency for neck pain to become a chronic problem, it is important to identify risk factors that could promote prevention and early diagnosis (Kim et.al., 2018).

The prevalence of neck pain is higher in older adolescents, and it is considered that physical inactivity and professional activities can be risk factors

for back pain (Scarabottolo et.al., 2017) It has been established that mood disorders, especially depression, are associated with chronic neck pain and disability (Jahre et.al., 2020). Cognitive factors (ie, attitudes, cognitive style, and fear-avoidance beliefs) are associated with increased pain, such as neck pain and disability (Martinez-Calderon et.al., 2020). Psychological risk factors for neck pain include depression, poor mental health, stress, and psychological distress (Croft et.al., 2001).

In the last decade, the increased use of mobile phones among young people, as well as the dependence on them for sending messages, is associated with the growing prevalence of neck pain (Eitivipart et.al 2018, Lee et.al., 2015). Prolonged bending of the neck while using a mobile phone is a known risk factor for neck pain and changes in neck muscle activity (Areeudomwong et.al., 2018). Significant epidemiological data indicate a connection between neck and shoulder pain and the use of mobile phones (Tang et.al 2021, Barrett et.al., 2020).

It is estimated that children and adolescents spend an average of 5 to 7 hours a day on mobile phones and handheld devices with their heads tilted forward to read. It has been recorded that the cumulative effects of this exposure achieve alarming results of excessive stress on the cervical spine, ranging from an average of 1825 to 2555 hours per year (Hansraj et.al.,2014).
There is no just one definitive treatment for neck pain. However, various pharmacological and non-pharmacological treatments are recommended, including laser therapy, massage, acupuncture, yoga, and hydrotherapy (Kazeminasab et.al., 2022). The paper aims to investigate the frequency of risk factors for neck pain in children and adolescents through a scientific literature review.

Methods

The paper is a non-experimental (qualitative) research, ie a scientific literature review. The research is limited to articles published in English. For the purposes of this work, research was conducted in the relevant databases Web of Science, Scopus, PubMed, and Med-Line for articles published in the period from 2011 to 2022. These databases were searched using the keywords "neck pain", "frequency of neck pain", "risk factors", "children and adolescents".
Randomized controlled trials, randomized clinical trials, prospective studies, longitudinal studies, and cross-sectional studies that investigated risk factors for neck pain in children and adolescents were included.

Criteria for inclusion and exclusion

Articles were also selected from relevant databases, by searching journal websites and by hand searching. Without limitation on time, language, ethnicity, or geographic region, studies that met the following criteria were included: 1. Presence of risk factors for neck pain, 2. Research conducted on children and adolescents, 3. Diagnosis of neck pain. Adult and elderly studies, case reports, case series, conference abstracts, or letters with insufficient data were excluded.

Study selection and data extraction

Articles that met the criteria for inclusion in the systematic literature review underwent a detailed evaluation. The extracted data are: first author's name, study design, study country, number of research respondents, gender and age structure of respondents, year of research, publication, main objectives, research methods and instruments, and research results and conclusions.

Results

A total of 357 articles were published in the period from 2014 to 2022 in the relevant scientific databases. After removing duplicates and irrelevant studies, 13 studies were included in the research (Table 1.). The studies used for this paper were published in Sweden, Lebanon, Brazil, Thailand, Tunisia, Iran, Jordan, Saudi Arabia, Norway, Germany, and Australia.

Table 1. Summary of study characteristics

Reference	Country	Main aim and purpose	Material and methods	Results	Conclusion
Gustafsson et al.	Sweden	The aim was to investigate whether texting with a cell phone is a risk factor for musculoskeletal disorders in the neck and upper extremities in a population of young adults.	The study was a longitudinal cohort study conducted on young people in Sweden (aged 20 to 24 years). Data were collected using an online questionnaire after one and after five years of follow-up.	In cross-section, an association was found between texting and reported persistent symptoms in the neck and upper extremities. A prospective association between texting and persistent neck and upper back pain was found in those who were symptomatic at baseline.	The results include short-term effects, while to a lesser extent long-term effects on musculoskeletal disorders in the neck and upper extremities.
Fares et. al.	Lebanon	The aim of this work is to investigate the presence of musculoskeletal pain in the neck in children and adolescents, as well as the presence of possible risk factors and complications.	The subjects were patients under 18 years of age who came to the clinic (Beirut, Lebanon) in 2015 with nonspecific neck pain. They were examined and pain was assessed and localized. The positioning of the neck during different activities with other complications was studied. Patients who reported pain associated with congenital or systemic diseases and fractures were excluded from the study.	Musculoskeletal neck pain with spasm was diagnosed in 180 patients (N = 180). Physical and radiological examinations did not reveal any changes, and no concomitant diseases were present. More women (57%) than men (43%) and more adolescents (60%) than children (40%) were affected. All 180 participants (100%) reported inadequate flexion of the back and neck while studying and/or using smartphones and tablets.	Musculoskeletal pain in the neck is an important condition in children and adolescents and is associated with numerous risk factors. Increased cervical strain increases the risk of developing degenerative changes and other developmental, medical, psychological, and social complications.
Damasceno et. al.	Brazil	The aim of this study was to investigate whether there is a relationship between neck texting and neck pain in young people.	A cross-sectional observational study was conducted on 150 young adults aged 18 to 21 years. The study was based on a self-report questionnaire, neck pain was assessed using the Oson's Young Spine Questionnaire, text neck was assessed using photo analysis, and self-perception of holding the neck while using a cell phone was assessed using an illustration by subjects and physical therapists.	There was no association between self-assessed neck posture and neck pain (OR = 1.66, p = 0.29) nor between physiotherapist-assessed neck posture and neck pain (OR = 1.23, p = 0.61). There was also no association between self-assessed neck posture and the frequency of neck pain (OR = 2.19, p = 0.09).	Research has shown no relationship between text neck about neck pain in young people.

Reference	Country	Main aim and purpose	Material and methods	Results	Conclusion
Namwongsa et. al.	Thailand	To investigate musculoskeletal disorders (MSDs) in smartphone users in Thailand to confirm the high incidence of neck pain; to identify possible factors associated with neck pain in smartphone users.	The study was conducted with 779 students using smartphones. Data were collected using a questionnaire for self-assessment of smartphone use and musculoskeletal disorders in the neck.	The most painful area of the body after smartphone use in a 12-month period was the neck - > 32.50%. Factors associated with neck discomfort were a flexed neck posture (odds ratio (OR): = 2.44, 95% confidence interval (CI) = 1.21–4.90) and smoking (OR: 8.99, 95% CI 1.88–42.87).	The results suggest that to treat neck symptoms in smartphone users, preventive measures should focus on reducing neck flexion and smoking habits.
Ben Ayed et al.	Tunisia	The aim of the study was to determine the prevalence, risk factors, and consequences of neck, shoulder, and back pain in adolescents.	The study was designed as a cross-sectional survey. The survey was conducted on weekdays during school hours. Data were collected using questionnaires and anthropometric measurements	Multivariate analysis showed that independent risk factors for neck pain were female sex (adjusted odds ratio AOR =1.55; P=0.002), computer use ≥4 hours per week (AOR =1.50; P=0.010), having a desk that was too low (AOR =2.30). ; P < 0.001), and carrying a school bag ≥60 minutes (AOR =1.58; P=0.008). Female sex (AOR =3.30; P < 0.001), BMI ≥25 Kg/m2 (AOR =1.6; P =0.018), playing video games ≥2 hours per day (AOR =2.37; P < 0.001), and carrying a school bag with a body weight ≥ 10% (AOR =1.46; P=0.026) were independently associated with shoulder pain.	The prevalence of musculoskeletal disorders was significantly high in adolescents, and associated risk factors included sociodemographic factors, leisure activities, and classroom equipment. A school program based on ergonomics and behavior is urgently needed.
Dianat et. al.	Iran	Evaluation of potential risk factors for neck and shoulder pain in children and adolescents.	Demographic data, physical activity, school, and psychosocial factors for neck/shoulder pain were examined in a cross-sectional study of 1611 school children aged 11 to 14 years.	Pain in the neck and shoulders is present in 19.0% of respondents. Risk factors such as excessive desk height, a forward- leaning chair, time spent carrying a school bag, and psychosocial factors independently increase the risk of developing neck pain, whereas a low body mass index decreases the risk.	Physical and psychosocial factors influenced the risk of developing neck/shoulder pain in school-aged children, suggesting that they should be considered when evaluating and treating these symptoms in this population.

Reference	Country	Main aim and purpose	Material and methods	Results	Conclusion
Gheysvandi et. al.	Iran	To evaluate the prevalence of neck and shoulder pain in elementary school students and to investigate the association between this pain and risk factors.	The study was designed as a cross-sectional survey involving 693 students aged 7 to 12 years. Data on social and psychological factors were collected using the Strengths and Difficulties Questionnaire (SDQ). Posture assessment was analyzed using the RULA questionnaire.	The prevalence of neck pain was slightly higher than that of shoulder pain. The prevalence during one month was 35.8% for neck pain and 30.9% for shoulder pain. Risk factors such as too large a desk, too much forward tilt of the chair, difficulty looking at the board in the classroom, too much homework, RULA level III, and IV increased the risk of developing neck pain.	Research shows that incorrect sitting postures, as well as physical factors such as school furniture, too much homework, and difficulty looking at the blackboard in the classroom, are associated with pain. Given the risk factors assessed in this study, appropriate interventions are suggested.
Al-Hadidi et. al.	Jordan	Investigation of the relationship between neck pain and duration of device use considering gender, age, and the most common position in which students use their devices	Respondents completed an online questionnaire between February 15, 2017 and March 18, 2017. The research sample included healthy health faculty students, regardless of age, gender, or hand mobility.	Analysis of predictors of pain intensity revealed that age ($p = 0.04$) and duration of device use ($p = 0.001$) were significantly associated with neck pain intensity, whereas only duration of use was significantly associated with pain duration ($p = 0.036$). Females were found to be significantly more likely to use cell phones for learning than males ($p = 0.003$). Of the students with a pain score > 4, 5.8% visited an emergency room physician and 12.4% visited a clinic, compared to only 0.3% who visited an emergency room physician and 4.2% who visited a clinic in the group with a pain intensity ≤ 4 ($p < 0.001$).	This study shows a significant positive correlation between the duration of cell phone use and the duration and severity of neck pain. Furthermore, increasing neck pain is a major burden on the health care system.
Ahmad et. al.	Yanbu, Saudi Arabia	The aim of this study was to determine the characteristics and social and psychological impact of musculoskeletal neck pain in children aged 8 to 18 years.	The study was designed as a descriptive study. 260 children of both sexes between the ages of 8 and 18 were included in the study. All subjects were asked to demonstrate their neck and head posture while using cell phones or tablets to record flexion angle	Of the total 260 subjects, 125 (48.1%) were boys and 135 (51.9%) were girls. All 260 subjects exhibited poor back and neck flexion during the study and while using cell phones or similar devices. Of the psychological factors, 69.2% were irritable, 53.8% were stressed, and 50.1% were anxious, while 12.3% showed symptoms of depression. Of the social factors, 164 (63.1%) were found to have poor communication, while 53.1% had deterioration in academic performance.	Slumping of the head, neck and shoulders while using cell phones and similar devices, as well as incorrect posture while studying and watching TV, increase the stress on the cervical spine and can lead to pain in the neck.

Reference	Country	Main aim and purpose	Material and methods	Results	Conclusion
Myrtveit et. al.	Norway	To examine the prevalence of neck and shoulder pain and whether behavioral and emotional factors are associated with risk of neck and shoulder pain and health care utilization.	Data from the ung@hordaland population survey were used. Respondents were asked how often they had neck and shoulder pain in the last 6 months. The association between frequent neck and shoulder pain and physical activity, depressive symptoms, and screen activity was examined using a sex-stratified logistic regression analysis.	Frequent neck and shoulder pain was reported by 20.0% (1797 out of a total of 8990) and more frequently by girls than by boys ($p < 0.001$). A high score for depressive symptoms was the strongest risk factor for neck and shoulder pain. Frequent screen time increased risk, while physical activity was protective. Respondents who reported neck and shoulder pain were more likely to visit their primary care physician (47.1% vs. 31.8%) and school health services (24.6% vs. 13.5%).	Frequent neck and shoulder pain is reported by 20% of Norwegian adolescents. Individuals who reported neck and shoulder pain sought health services more often than others.
Blaschek et. al.	Germany	To confirm or refute the association of neck pain with migraine or tension-type headache and to assess whether this association is independent of other risk factors for headache.	The nature of the study is cross-sectional. The study was conducted on high school students using a questionnaire on headache and lifestyle factors. Neck pain was assessed using a questionnaire with marking of affected areas on schematic drawings of the human body.	The absolute increase in the prevalence of headache with pain in the shoulder-neck region ranged from 7.5% to 9.6%. Gender, class affiliation, stress, and lifestyle factors were examined as potential confounders. Almost all factors were associated with shoulder and neck pain, but most were associated with headache. After adjustment for confounding factors, the association of neck pain with headache was almost entirely limited to migraine (OR 2.39; 95% CI 1.48-3.85) and migraine + tension-type headache (OR 2.12; 95% CI 1.50-2.99), whereas the association with isolated tension-type headache was negligible (OR 1.22, 95% CI 0.87-1.69).	Neck pain is associated with migraine but not with tension-type headache. A possible link between migraine and neck pain is cervico-trigeminal convergence of sensory afferents in the neck and meninges or impaired descending inhibition in migraine.

Reference	Country	Main aim and purpose	Material and methods	Results	Conclusion
Jahre et. al.	Norway	To investigate risk factors and risk profiles associated with neck pain in young people using longitudinal data from the North-Trøndelag Health Study (HUNT).	The study HUNT consists of four health surveys conducted 11 years apart in which all residents of Nord-Trøndelag county aged 13 years and older were eligible to participate. The surveys are divided into Young-HUNT (13-19 years old) and HUNT (20 years and older). Data collection took place during school hours and included an extensive questionnaire, physical tests, and measurements of height and weight.	In multiple regression analyzes in sample I, female sex (OR = 1.9, 95% CI [1.3–2.9]), low levels of physical activity (OR = 1.6, 95% CI [1.0– 2.5]), loneliness (OR = 2.0, 95% CI [1.2-3.5]), headache/migraine (OR = 1.7, 95% CI [1.2-2.6]), back pain (OR = 1.5, 95% CI [1.0-2.4]), and neck/shoulder pain (OR = 2.0, 95% [CI 1.3–3.0]) were associated with neck pain during an 11-year follow-up period. In the II sample, multiple regression analyzes revealed that female sex (OR = 2.2, 95% CI [1.3-3.7]) and perceived low family income (OR = 2.4, 95% CI [1, 1-5.1]) were associated with neck pain during the 11-year follow-up period.	The risk profiles in both samples showed that the co-occurrence of risk factors such as headache/migraine, neck/shoulder pain, back pain, low physical activity, loneliness, and perceived low family income cumulatively increased the likelihood of neck pain in young adults.
Richards et. al.	Australia	The aims of this study were to (1) determine the presence of clusters of neck postures in a cohort of 17-year-olds and (2) determine whether the identified subgroups are associated with biopsychosocial factors and neck pain.	The study was designed as a cross-sectional survey. Adolescents (N=1108) underwent 2-dimensional photographic postural assessment in sitting. Height and weight were measured, and a questionnaire was used to assess lifestyle and psychological factors, neck pain, and headaches.	Significant associations were found between clusters and gender, weight, and height. Participants classified as having a drooping chest/forward head posture were more likely to have mild, moderate, or severe depression. 22% reported persistent neck pain, of which 141 (64%) were women. 14% reported neck pain that worsened with sitting.	Significant sagittal clusters of sedentary neck position were identified in 17-year-olds who showed differences in biopsychosocial profiling.

Discussion

Through a review of the scientific literature, 13 studies were selected, in which various results of many authors were observed on the frequency and risk factors for the occurrence of neck pain in children and adolescents.

By analyzing gender as a risk factor for neck pain, it was observed that many authors proved in their studies that neck pain is more frequent in women (Fares et.al., 2017, Ben Ayed et. al., 2019, Ahmad et.al., 2020, Myrtveit et.al.,2014, Jahre et.al., 2021).

A low level of physical activity was shown as a risk factor for neck pain in the study by Jahre H. et al., while in the study by Myrtveit SM. et al., physical activity was shown to be a protective factor for neck pain in children and adolescents (Fares et.al., 2017, Myrtveit et.al.,2014).

The flexed position of the neck when using mobile phones and studying was shown in a study by Fares J. et al. as a risk factor for the occurrence of neck pain, which was shown in a study by Namwongs S. et al. (Fares et.al., 2017, Namwongsa et.al., 2018). The opposite of the above was shown in the Damasceno GM research. And the colleagues who speak, there is no association between neck posture assessed by self-perception and the frequency of neck pain (Damasceno et.al., 2018).

In a study by (Gustafsson et.al., 2017), an association between texting and reported persistent symptoms in the neck and upper extremities was shown, which is an additional risk factor for neck pain, and computer use and playing video games were also shown to be risk factor for neck pain in research by (Ben Ayed et.al., 2019).

Ergonomically mismatched school furniture, such as excessively low and too high school desks, and forward-leaning while sitting in the chair have been shown as risk factors for neck pain in the research of many authors (Ben Ayed et.al., 2019, Dianat, et.al., 2018, Gheysvandi et.al., 2019).

In research by (Ben Ayed et.al., 2019, Dianat, et.al., 2018) it was shown that long-term carrying of a school bag is a risk factor for neck pain.

In research by (Ahmad et.al., 2020) it was shown that psychological factors such as irritability, stress, anxiety, and depression contribute to the development of neck pain, also in research by (Myrtveit et.al., 2014) and colleagues, depression was the strongest risk factor for neck and shoulder pain. Stress as a risk factor for neck pain was shown in the research of (Blaschek et.al., 2014).

The association of migraine and headache with neck pain was shown in the research by (Blaschek et.al., 2014), as well as in the research by (Jahre et. al., 2021).

Conclusion

By reviewing the scientific literature, it can be concluded that there is an increased frequency of risk factors for the occurrence of neck pain in children and adolescents. The most common risk factors are female sex, flexed head position, use of mobile and other devices, insufficient physical activity, ergonomic factors, psychological and social factors. Based on the presented results, risk factors for neck pain in children and adolescents represent a serious public health problem.

Conflicts of interest

The authors declare no conflict of interest

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