



# A Narrative Review on the Influential Preventable Factors of Musculoskeletal Disorders In Adolescents

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## ABSTRACT

**Aim:** Musculoskeletal pain is widespread preventive problem in adolescence and have many consequences for their working life and the future of society. This study with the aim of evaluation of evidences on preventable risk factors for musculoskeletal disorders in adolescents was performed.

**Method and Materials:** In this study, databases such as Science Direct, Web of Science, PubMed, Scopus, Magiran, and Google Scholar were examined. in the period from 2010 to 2020. Totally, 22 articles were included in the study, the selected cases were thoroughly studied and finalized.

**Findings:** This study showed that there are several preventable risk factors for musculoskeletal disorders in adolescents, such as low physical activity, psychological factors, unhealthy sleep patterns, ergonomic position at home and school, unproper posture while using digital media, smoking, unhealthy eating, and lack of awareness and appropriate training platforms that have an influential role in musculoskeletal disorders.

**Conclusion:** Considering the role of various preventable risk factors in the occurrence of musculoskeletal disorders in adolescence, it seems that the participation and common approach of all influential people in providing the desired infrastructure and conditions in the home, school, and community is essential. However, it is suggested that more research be done on other factors affecting the incidence of musculoskeletal disorders in adolescents.

**Keywords:** Prevention, Musculoskeletal Disorders, Adolescents.

## Introduction

Research shows that a large number of adolescents have musculoskeletal disorders, and younger people will be more susceptible to the disease in the future due to the impact of lifestyle on musculoskeletal health [1,2]. A large survey in Germany showed that the cost of treatment of people under the age of 25 who suffered from low back disorders was estimated at least 100 million per year [3]. It has argued that the consequences of this disease for adolescents in terms of education and future health are very wide and musculoskeletal disorders affect their future lives [4]. In this regard, it has been revealed that the physical, social, and psychological development and physiological

and biomechanical conditions of adolescents are unique, but the physical symptoms of aches and pains, swelling, tingling, reluctance to move the affected area, and stiffness are still the most common complaints of musculoskeletal disorders [5]. Because many of the risk factors for musculoskeletal disorders are preventable, in this review study, some of the most important preventable risk factors associated with musculoskeletal disorders in adolescents are discussed. Familiarity with all influential preventative factors, musculoskeletal disorders preventive behaviors in adolescence play an essential role in healthy behaviours at the right time in order to prevent the occurrence of significant disabilities in adults

hood.

### Method and Materials

The present study investigates the influential preventable factors of musculoskeletal disorders in adolescents. This study examined databases such as Science Direct, Web of Science, PubMed, Scopus, Magiran, and Google Scholar. The target studies were considered from 2010 to 2020. References of searched articles were reviewed to access other articles. According to this strategy, 215 articles were initially found. Admission of articles was based on inclusion and exclusion criteria. Inclusion criteria included articles whose keywords in the research were listed in the title or abstract. Articles that were not related to the topic, duplication of studies, lack of access to the full text of the articles were excluded from the study. After reviewing the studies which were selected based on the mentioned criteria and extracting their text, 22 articles were finally included in the study. The selected cases were thoroughly studied and finalized.

### Findings

This review study included 22 articles published between 2010 and 2020. By reviewing the studies of preventable risk factors for musculoskeletal disorders, the findings of this study were classified into seven sections.

#### I) Physical activity

In a cross-sectional study of 156 students ages 12 to 17, Sanderson found that students who were less physically active were more likely to report pain due to musculoskeletal disorders, several diseases related to sedentary behavior including cardiovascular disorders, high blood pressure, diabetes, and musculoskeletal disorders are associated with rapid growth spurts in adolescents, also called "growth spurts." These adolescents, especially suffer from scoliosis and other musculoskeletal disorders [6]. Eckhoff C

et al reported in their cohort study that physical activity during adolescence helps maintain a healthy weight, in other words, healthy weight reduces unwanted stress on the adolescent musculoskeletal system, and improves balance and coordination by reducing sudden injuries. Physical activity improves sleep and cause bone growth, which is necessary for a healthy skeleton. Physical activity also increases emotional well-being, which is directly related to musculoskeletal health [7].

A study of 104,644 adolescents in Norway found that neck and shoulder pain were the most common among participants in the study, and moderate levels of physical activity were associated with more minor neck, shoulder, and back pain. Reduction of musculoskeletal disorders in adolescents were recommended through promoting physical activity in adolescents [8].

In a study of 1,435 male and female adolescents, Smith et al. found that adolescents who exercised less, watched more television, had a higher body mass index, sat in a more bent torso position, and had less physical activity suffered from low bone health, and low self-esteem [9].

#### II) Use of digital media

Frequent use of digital media forces users to adopt an awkward position that increases the risk of musculoskeletal disorders and pain. Falkenberg et al. conducted a study to examine musculoskeletal symptoms in adolescents and their relationship with the use of tablets and smartphones. Their research showed that the use of digital media is associated with musculoskeletal pain in adolescents. Researchers reported that pain symptoms in the neck area is related with increased digital media use, shorter vision distances, and reduced participation in sports activities. In fact, according to their study, even healthy adolescents with good eyesight may experience visual acuity

symptoms and musculoskeletal pain with increased use of digital media <sup>[10]</sup>.

The results of a study of 1884 Singaporean adolescents showed that, in general, the use of digital technologies was high among students, and among them, the long duration of using a smartphone was so prevalent. Among these adolescents, there was an increased risk of discomfort in the neck/shoulders, upper back, arms, and wrists/hands of adolescents <sup>[11]</sup>.

Findings from a study of 961 adolescents aged 14 to 19 years showed that the prevalence of musculoskeletal pain in adolescents was high and excessive use of electronic devices was shown to be an essential risk factor for neck and back pain <sup>[12]</sup>.

A study of 632 Portuguese teens found that nearly half of teens had experienced musculoskeletal disorders in the past three months, and the disease was more common in female teens and among those who spent more time watching TV and using new technologies. Researchers suggested that preventive behaviors and regenerative measures are necessary to promote better musculoskeletal function in adolescents <sup>[13]</sup>

### III) Psychological factors and sleep pattern

A Finnish study found that recurrent neck, shoulder and back pain, along with mental health problems and daytime drowsiness, were common at age 10 and increased sharply between the ages of 12 and 15. Daytime drowsiness at all ages was associated with an increase in skeletal disorders. Daily drowsiness at age ten can cause neck and shoulder pain in the future. Due to the influential role of sleep problems in the development of adolescent musculoskeletal pain, researchers need to pay attention to this issue <sup>[14]</sup>.

A meta-analysis in 2020 identified several factors associated with the risks and stimuli of adolescent low back pain, including headache, abdominal pain, anxiety, and

tension, and psychological characteristics were considered the most likely risk factors for low back pain in adolescents and young adults <sup>[15]</sup>

In a study of 4,481 Norwegian adolescents, researchers reported a strong association between musculoskeletal pain areas and mental health problems, anxiety, depression, adverse life events. In this regard, school-related stress was the most important factors associated with musculoskeletal pain. It was particularly prevalent in adolescents who reported pain-related dysfunction <sup>[16]</sup>.

Two-thirds of adolescents with chronic musculoskeletal pain reported a concomitant sleep problem. The results of the cohort study showed that sleep problems were associated with more symptoms associated with musculoskeletal pain. Thus, sleep problems may be an important modifiable risk factor for anxiety in adolescents with musculoskeletal pain <sup>[17]</sup>.

### IV) Healthy diet

In a study of 4,246, Merder et al. found that adolescent unhealthy diet was a predictor of obesity in adulthood and that increasing body mass index in adolescents increased the risk of musculoskeletal disorders in adulthood. Increased body mass index was associated with decreased balance and emotional unfunction. The researchers suggested that interventions that reduce body mass index may protect overweight and obese adolescents from musculoskeletal severe disorders. <sup>[18]</sup>

A Polish study of 2,732 overweight girls and boys found that overweight and obesity were a risk factors for some of the most common postural errors in this age group. It effectively assesses incorrect physical conditions and may be used to determine body condition during screening tests and preventive measures at school <sup>[19]</sup>.

In a study by Perry et al. examining the nutritional status of 1424 adolescents and its association with spinal pain, six

macronutrients (five cereals, vegetables, fruits, dairy products, meat, and meat substitutes) were identified. Total fat, saturated fat, protein, fiber, iron, calcium) and additives (which were sweet and savory snacks, including sweets, biscuits and chips) were created by creating quality categories of the diet and certain aspects of the possible diet which was associated with spinal pain in adolescence [20].

### V) Smoking

Niu et al. reported in their study that five out of 10 surgeries among patients who referred to the hospital for orthopedic surgery involved the musculoskeletal system. Smoking is one of the most common and preventable risk factors for musculoskeletal disorders and complications of orthopedic surgery [21].

A meta-analysis showed that smoking may have detrimental effects on the skeletal system, causing imbalances in bone rotation mechanisms, decreasing bone mass and density, making bones vulnerable to osteoporosis and fractures [22].

### VI) Ergonomics

In many cases, musculoskeletal disorders begin during adolescence when poor posture is combined with poor exercise. Odunaiya et al., in a study of 240 students, found that seat height was 80.4% inappropriate. Seat depth was inappropriate for 76.7% of participants [23]. A Bangladeshi study of 375 female students found that 90% of girls used chairs that did not fit their anthropometric dimensions [24].

### VII) Education

A study of 159 adolescent students showed that the high weight of students' backpacks is due to the lack of knowledge of students and their parents about standard weight and healthy backpack conditions [25].

In a study of 616 parents, Alsiddiky et al. found that their awareness of the serious consequences of school bags and their proper use were limited, and researchers suggested that parent training sessions and

awareness campaigns might reduce the prevalence of musculoskeletal problems among these teenagers [26].

### Discussion

The present study investigated the influential factors preventing healthy musculoskeletal system in adolescents. In this study, one of the influential factors was lack of physical activity among adolescent that seems the use of interventional strategies can be optimal in this regard, strategies such as increasing the duration and type of exercise for adolescents, sports and dynamic activities in school environment, proposing and promoting after-school clubs and social activities with the aim of increasing girls' participation in activities, promoting safe active travel, creating social infrastructure to support adolescent physical activity in the community. Creating well-maintained recreational, social spaces such as playgrounds and open areas help encourage active families and encourage teens to participate in a variety of sports instead of one [27].

Among the effective intervention strategies in psychological factors, a healthy sleep guide for adolescents and their families can be shared [28]. Furthermore, providing in-school support for children and youth, reputable external support organizations that work with parents / carers and families are so helpful [29].

Due to the effective role of nutrition in the prevention of musculoskeletal disorders in adolescents, including effective intervention strategies can promote and encourage adolescents to have a healthy weight and body mass index, ensure healthy nutrition in schools which included packed lunch, cooking education, breeding vegetables to increase the perception of healthy food in their diet and parents' participation in healthy eating and family cooking workshops. Ensure children and young people are aware of their calcium and vitamin D needs by identifying calcium-rich foods and encouraging hydration during

attendance in school through frequent drinking of safe drinking water [30].

Due to the effective role of ergonomics in the prevention of musculoskeletal disorders, effective interventions in this field can be such as preparing school bags with 10% of student bodyweight, considering school furniture in proportion to the height of students, and activities in schools facilitate. Also, set up healthy workstations in schools when using the screen so that raise it to fit the upper part at eye level [31].

The use of digital technology is growing among teens and young adults, with the latest findings from a recent US study reporting that 46% of smartphone users believe their phone is something they cannot live without it [32]. It seems necessary to conduct educational interventions aimed at improving the skills of adolescents on how to maintain the correct posture while using these media and also increase self-control and self-management in order to make optimal use of digital media.

The school environment provides an opportunity to provide preventive interventions to a large number of children and has been used to address a wide range of public health problems [33]. Education and awareness of students and their parents play an effective role in preventing skeletal disorders. Other studies have found that educational interventions are effective in raising awareness and reducing the incidence of musculoskeletal disorders [36-34]. It seems that holding training sessions to improve the awareness and skills of students and their parents is essential.

### Conclusion

Considering the many preventable risk factors in the development of musculoskeletal disorders in adolescence, it seems that having a healthy lifestyle in all aspects can help in the prevention of this

disease and according to the preventive factors in this study, interventions such as increasing physical activity and reduce obesity, healthy eating, ergonomic standards and continuing education in the home and school environment as a common and integrated approach at the level of families, school principals, educators, occupational safety and health counselors and community providers to make more impact and combined required.

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**Authors Contribution:** ZSH was the main investigator and conducted the searching studies, collected information and performed the reviewing the studies. SST was advisor and reviewed and edited the manuscript Both authors read the manuscript and approved it.

**Conflicts of Interests:** The authors declare that they have no competing interests.

**Ethical approval:** This study is a mini review and there is no intervention. All studies were inserted in the manuscript with the real meaning.

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