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Review Article

The Relationship between Schoolbag Carriage with Musculoskeletal Pain and Posture in Iranian Students: A Systematic Review Study

Rahman Sheikhhoseini[1,*], Parisa Sayyadi[2], Hashem Piri[1]

[1] Associate Professor, Department of Corrective Exercise and Sport Injury, School of Physical Education and Sport Sciences, Allameh Tabataba'i University, Tehran, Iran
[2] PhD Candidate, Department of Health and Sports Medicine, School of Physical Education and Sports Sciences, University of Tehran, Tehran, Iran

[*]Corresponding author: Rahman Sheikhhoseini; Department of Corrective Exercise and Sport Injury, School of Physical Education and Sport Sciences, Allameh Tabataba'i University, Tehran, Iran. Tel: +98-2148394134, Email: rahman.pt82@gmail.com

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Abstract

Background: Students in different levels use schoolbags to carry books and other educational tools. Various studies showed that schoolbag affects musculoskeletal system and posture in children and adolescents. This systematic review study aimed to examine the relationship between schoolbag characteristics with musculoskeletal pain syndromes and posture in Iranian students.
Methods: The search strategy was run in PubMed, Scopus, Web of Science (WoS), Magiran, and SID databases. The Persian or English-written original papers that were published in peer-reviewed journals were selected without any time limit. The eligible studies were classified based on pain location and postural alignment.
Results: A total number of 2426 records were found in the databases. Thirteen studies were eligible for this study. The results showed that musculoskeletal disorders and postural abnormalities had a relatively high prevalence among Iranian students, and their prevalence was significantly higher in girls. Generally, it seems that carrying a schoolbag, carrying time, type of bag, and weight have a significant effect on the low back, wrist, shoulder, upper back, and neck pain. However, the carrying time and relative weight of the bag have a significant effect on thoracic kyphosis, lumbar lordosis, and forward head posture.
Conclusion: The factors such as weight of bag or backpack, carrying time, unilateral bag carrying, female gender, location of the schoolbag, and walking to school with a bag can affect musculoskeletal pain and posture in Iranian students.

Keywords: Schools; Musculoskeletal Pain; Posture; Students

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Background

Most people carry loads during their daily life. Schoolbag is one of the most common forms of carrying loads by students. The students use schoolbags to bring their books and other teaching aids (1). The previous studies showed that most students used schoolbags with greater weight than standards limits (2), and most students carried schoolbags by more than 10 percent of body weight (3).

It has been demonstrated that carrying heavy schoolbags may put excessive loads on the student's spinal structures, predisposing them to develop spinal deformities (4) and musculoskeletal pain syndromes (5). Moreover, carrying heavy loads may alter muscular activity pattern (6) and spinal loading causes more energy expenditure and fatigue in the students (7). In addition to schoolbag weight, it has been suggested that the schoolbag placement can change students' posture (8) and biomechanics (9) while performing daily activities. Therefore, carrying schoolbags with heavy weight or improper position can predispose students to musculoskeletal disorders such as the low back, neck, lower leg, or shoulder girdle pain (10).

On the other hand, previous epidemiologic studies showed that musculoskeletal pain disorders were prevalent among children (11) and adolescents (12). However, the critical point is that suffering from musculoskeletal pain disorders in early life may predispose people to develop more musculoskeletal disorders in the future life (13). Therefore, identifying and eliminating possible risk factors of developing musculoskeletal pain disorders is suggested t10 promote societies' health conditions (14).

Given that usage of schoolbag is common among students and considering the fact that improper use of schoolbags may predispose students to develop some musculoskeletal pain disorders, studying the possible effects of schoolbags on musculoskeletal pain disorders has been noticed by researchers. In this regard, several studies are conducted to examine these issues in Iranian students. Therefore, this study aimed to summarize and review the current literature on the effects of schoolbag carriage on the musculoskeletal health of Iranian students.

Methods

In this systematic review study, the title and abstracts of English and Persian records in PubMed, Scopus, Web of Science (WoS), SID, and Magiran databases were searched without a time limit. The search strategy was: (Posture OR Musculoskeletal OR Pain OR Disorder OR Malalignment OR Syndrome) AND (Student OR Children OR Child OR Adolescent OR Juvenile OR Teenager OR Pediatrics) AND (Iran OR Persian OR Farsi) AND (Backpack OR Bag OR Load OR Carriage OR Carrying OR Carried OR Knapsack OR Rucksack OR Pack).

A total of 2426 records were found in the mentioned databases. All records were exported to the EndNote software (version 7). Then 69 records were found as duplication and deleted with the software. The rest of the records were examined for eligibility independently by the first two authors. At first, the title and abstracts were assessed by two authors. The consensus method was used for any possible disagreements. Fifty-three studies were extracted as possibly eligible. Then by reviewing the full text, 13 studies were eligible to include in the review (Figure 1).

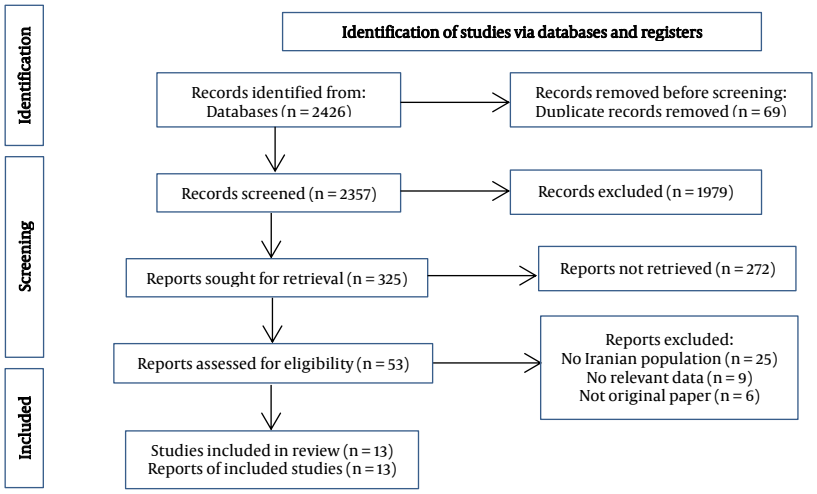

Figure 1. Flow diagram for eligible studies

Only the original articles published in English or Persian languages were included. The studies should be published in full-text format and journals with a peer-review process. Only the articles were eligible that aimed to investigate the relationship between musculoskeletal pain disorders and posture with schoolbag carriage in Iranian students. The results presented are based on the region of pain and postural deviation as below.

Results

From 2426 primary searched records, 13 studies were eligible to be included in the review. The results were classified based on the region of experienced pain and postural variables. Existing heterogeneity between the study's methodology and design precludes meta-analysis. The results were as below:

Prevalence of Musculoskeletal Pain

Four studies were eligible when reporting an association between carrying schoolbags and musculoskeletal pain disorders among Iranian students. Dianat et al. found that 59.6% of Iranian children suffered from neck, shoulder, or back pain (15). In addition, they reported that approximately 86% of musculoskeletal symptoms might be associated with schoolbag carriage (16). The other study found that 85.7% of Iranian children had musculoskeletal disorders in one or more body segments associated with schoolbag carriage (17). Moreover, Shamsoddini et al. showed significant differences between schoolbag weight in students with and without musculoskeletal pain disorders (18). Therefore, it can be concluded that musculoskeletal pain disorders are prevalent among Iranian students. It seems that the weight of schoolbag has a significant correlation with the prevalence of musculoskeletal pain disorders.

Neck Pain

Four studies were found to be eligible when reporting the possible effects of schoolbags on neck pain. In this regard, Dianat et al. showed that neck pain was prevalent among Iranian students and more in girls (41.5%) compared to boys (26.7%). Further, they found the higher prevalence of neck pain in the students that carried schoolbags weighted more than 10% of body weight and those who walked to school (15). Moreover, other studies reported a high prevalence of neck pain among Iranian students (18) and more prevalence in students who carried unilaterally rather than bilaterally (19). Other studies found higher neck pain prevalence in students who carried schoolbags versus students who did not carry schoolbag (20) and those who carried tarpaulin bags (21). It can be concluded that the neck pain prevalence is higher in Iranian girls and is associated with the schoolbag weight, using of schoolbags or backpacks unilaterally, and walking to school.

Low Back Pain

Seven studies were eligible on low back pain. Dianat et al. showed that the low back pain prevalence was higher in girls (39.9%) than boys (29.5%). Moreover, they found that back pain prevalence was higher in boys who carried briefcases/satchels rather than backpacks (15). Another study reported that carrying schoolbags on one shoulder and carriage time more than 60 minutes had a significant correlation with low back pain (22). Still, there were no correlations between schoolbag type or weight with back pain (16, 19, 22). However, other studies showed significant correlations between the weight (18, 23) and type (21) of schoolbag and low back pain development in Iranian students. In conclusion, it seems that carrying a schoolbag on one shoulder, carrying time more than 60 minutes, female gender, heavy schoolbags, and schoolbag's type may affect low back pain in Iranian students.

Shoulder Pain

Five studies were found to be eligible reporting the possible correlation between schoolbag carriage and shoulder joint pain among Iranian students. Three studies showed significant association between the weight of schoolbags (more than 10% of body weight) (15, 18) and carrying schoolbag unilaterally (17) with shoulder pain complaint (15). One study found no association between shoulder pain complaint and the weight of schoolbags (16). Moreover, Poursadeghiyan et al. found that students who carried tarpaulin bags had more shoulder symptoms (21). Thus, it seems that the weight of schoolbags (higher than 10% of body weight), carrying schoolbag unilaterally, and female gender may have a significant effect on shoulder pain in Iranian students.

Wrist/Hand Pain

Four studies were eligible on this issue. These studies showed that carrying schoolbags weighing more than 10% of body weight (16-18), schoolbag carriage for more

than 20 minutes per day (17), and unilateral schoolbag carriage (19) had significant correlations with experiencing wrist/hand pain in Iranian students.

Upper Back Pain

One study was eligible when examining the possible association between carrying a schoolbag and upper back pain. Dianat et al. demonstrated that the upper back pain prevalence was 13.6% in elementary school students. Moreover, they reported that schoolbag carriage for more than 20 minutes per day was significantly correlated with the prevalence of upper back pain and significantly higher prevalence in girls (18.9%) than boys (8.4%) (17).

Elbow Pain

One eligible study was found reporting that the prevalence of elbow pain was higher in students who carried handbag compared to the unilateral and bilateral carriage of schoolbags (19).

Posture

Four studies were found eligible when reporting the possible association between carrying schoolbags and postural deviations. In this regard, Zakeri et al. demonstrated that carrying schoolbags weighing more than 10% of body weight was significantly correlated with the prevalence of thoracic hyper-kyphosis, lumbar lordosis, and dropped shoulder abnormalities (24). In addition, Moslemi et al. showed that carrying schoolbags weighing more than 10% of body weight was significantly correlated with thoracic kyphosis angle, while the time of schoolbag carriage was significantly associated with forward head, forward neck, spinal scoliosis, thoracic kyphosis, and lumbar lordosis angles (25). Moreover, the other study found that carrying schoolbags weighing more than 3.5 kg for 16 minutes might significantly increase lumbar lordosis and thoracic kyphosis angles, but not forward head posture angle (26). Besides, Naderi et al. showed that carrying backpacks weighing more than 15% of body weight and the time of carrying backpack might change thoracic, craniovertebral, and head angles. While, in comparison with putting the backpack on the L3 vertebrae, putting it at the T7-T12 segment of the thoracic can significantly change the thoracic and craniovertebral angles (27). Finally, it can be concluded that schoolbag carrying time, weight, and location may affect spinal postural deviations in Iranian students.

Discussion

This study aimed to review the current evidence on a possible association between carrying a schoolbag with musculoskeletal pain disorders and posture in Iranian students. The eligible studies were classified based on the body segments. Generally, the results showed that several factors associated with student's schoolbags might affect musculoskeletal health and posture in Iranian students. Moreover, some controversies exist between evidence that may arise from heterogeneity among studies, including differences in age, gender, and sample size. The schoolbag-related factors that can affect musculoskeletal and posture in Iranian students can be listed as below:

Neck Pain: Schoolbag or backpack unilateral carriage, school bags weighing more than 10% of body weight, and walking to school

Low Back Pain: Carrying time more than 60 minutes, carrying schoolbag on one shoulder, heavy schoolbags, female gender, and type of schoolbags

Shoulder Pain: Unilateral schoolbag carrying, the weight of schoolbag more than 10% of body weight, and female gender

Hand/Wrist Pain: Daily carrying time more than 20 minutes, carrying schoolbags weighing more than 10% of body weight, and unilateral schoolbag carrying

Upper Back Pain: Carrying schoolbag for more than 20 minutes per day

Elbow Pain: Carrying handbag instead of carrying schoolbags

Posture: Weight, carrying time, and location of schoolbags

Therefore, keeping in mind that the improper use or excessive weight of schoolbags may negatively affect Iranian students' musculoskeletal health and posture, the parents should select appropriate schoolbags and inform and educate the students to use their schoolbags correctly. Postural changes due to heavy loading may dramatically lead to changes in spinal curves. Furthermore, these loads may affect the intervertebral disks and spinal ligaments and may increase tensile and compressive stresses on some structures, causing spinal injuries or pain (28). For instant, while using a backpack, the center of gravity inclines posteriorly. As a result, the people will activate their pectoral muscles and lean the thoracic spine forward to realign the center of gravity and maintain balance. These compensatory movements may predispose the thoracic spine for hyperkyphosis development (29). Knowing that the improper use of schoolbags may be harmful to students, using the best ergonomic schoolbag and the best using method should be considered.

Several issues may criticize this study: firstly, most of the studies were focused on the schoolbag weight; therefore, further studies are needed about the type of schoolbags, methods of carrying, and ergonomically-designed ones. Secondly, most of the studies were conducted in elementary schools; thus, more studies are needed to clarify the issue in secondary schools. Thirdly, all eligible studies were cross-sectional; hence, conducting longitudinal cohort studies to examine the actual effects of carrying schoolbags on musculoskeletal health and posture is needed.

Conclusion

The factors such as weight of bag or backpack, schoolbag carrying time, unilateral bag carriage, female gender, location of the schoolbag, and walking to school with a bag can affect musculoskeletal pain and posture in Iranian students.

Conflict of Interest

The authors declare no conflict of interest in this study.

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