ISSN: 2476-5279; International Journal of Musculoskeletal Pain Prevention. 2020; 5(1): 293-300.

Relationship between Musculoskeletal Disorders and Backpack Carrying among Musculoskeletal Disorders and School going Students

ARTICLE INFO

Article Type
Original study

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How to cite this article

Kanani Kandeh S. Relationship between Musculoskeletal Disorders and Backpack Carrying among Musculoskeletal Disorders and School going Students. IJMPP. 2020; 5(1): 293-300

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Article History
Received: Mar 17,2020
Accepted: May 20,2020
ePublished: Jun 15,2020

ABSTRACT

Aims: Backpacks are the most popular means of carrying backpack among school going students, but long duration of backpack carrying might lead to MusculoSkeletal Disorders (MSDs) among them. The purpose of the present study was to determine if MSDs could be related to backpack carrying among school going students.

Method and Instruments: This cross-sectional study was carried out among 159 students selected by convenience sampling from four schools in Pars Abad city of Ardabil in Iran in Autumn 2019. A combination of two Nordic and Cornell questionnaires used to collect the data via self-reporting , an anatomical figure of musculoskeletal system was provided to mark the area of pain , and also the students' body weight and weight of their backpack were recorded using a digital weighting scale. Data analysis was performed using SPSS-23 software by Chi-Square test and descriptive statistics.

Findings: Lower back, neck, and wrist pains were the most common pains, respectively. Based on the results of Chi-square test, none of the musculoskeletal pains were significant association with transport ways vehicles to school such as walking, cycling, by car except for ankle pain (P-value <0.05). However, students who walked to school reported a higher prevalence of MSDs.

Conclusion: According to the study's results, there was only a significant association between "types of transport to school" with ankle pain among students who carried backpack during last 12 month. Hence, it is recommended that researchers consider other determinants of these disorders in future research.

Keywords: Musculoskeletal Diseases, School, Student.

Introduction

Backpack as one of school bags is the most popular means of carrying for books, stationeries, laptops, water bottles, lunch boxes, and other belongings among students [1-6]. On others word, schoolchildren use backpacks for transporting what they need to and from schools [5]. Over time, a large number of school children have increasingly been adapted to use backpacks [5], and carrying backpack has been a common practice of the daily work tasks among school going children [7, 8]. Although based on studies, backpack is an appropriate way for carrying loads on the spine since they can distribute the load symmetrically with maintaining stability [9, 10], but extensive bag weight (when the weight of the bag exceeds 10% of the child's body weight), improper its handling, using non-ergonomic backpack, and long duration of school bag carrying might lead to MSDs among school age children [8, 9, 11].

In general, the researchers stated that because of the peak of growth occurs during adolescent [10], students are susceptible to MSDs and it is one of the most important and common problems among them that its prevalence is increasing [5, 9, 12-14], and this rate is even higher because of the carrying of backpacks in these age groups [4]. Based on statistics provided by various studies, it has been argued that 25% of individuals who suffering from

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musculoskeletal pains are adolescents these types of pains are the second most commonly reported problem in adolescent students population [12]. Fpr example in one study in Spain, more than 50% of teenagers and children have suffered musculoskeletal pains (especially low back pain) at least once in their life [8].

Although various reasons have been mentioned in studies of different countries to explain MSDs including: physiological ,biomechanical, and psychological factors, but carrying heavy backpacks as part of these factors have a harmful impact on students body and an important role in the development their MSDs [5-7]. Therefore, it is recommended that backpack weight should be ranged from 10% to 25% of their body weight [4].

There is evidence which indicates that loading the spine with a backpack and, carrying heavy or bad designed backpack can lead to exaggerated trunk muscle activity, skeletal system damage, bone muscle pain, spinal deformity and its curvature, distance between the vertebra, nervous pains, postural abnormalities, increased fatigue, alteration in gait and body balance adverse effect on the pulmonary system[7-9, 12], head and neck pain, pressure on shoulder and its pain, and back pain among students [15]. In addition, it is important to note that lLBP in childhood may contribute to the incidence of chronic LBP in adulthood [7, 8]. Nowadays, there is an ever-increasing concern about students because their spine is at the critical stage of growth [7].

Our investigations on the literature revealed that increased complaints about MSDs among students have led to further researches in this area, but most studies have examined the relationship between weight of the school backpack, how to carry it or backpack features and MSDs [7, 8]. Therefore, considering the importance of this problem and research in this area may promote health programs and policy formulation aimed at reducing the burden of backpack-related MSDs among students [7]. Accordingly, the present study aimed to investigate its new dimension and was carried out to determine the relationship between MSDs with ways of transport to school among the students carrying backpack; to be able to explain the effect of backpack carrying time duration in different ways of transport methods on the occurrence of MSDs.

Method and Instruments

This cross-sectional descriptive study was carried out among 159 students selected by convenience sampling as participation from four secondary and high schools in Pars Abad city, Ardabil, Iran, in Autumn 2019.

Participants were included in the sample frame only if they were healthy student, used backpack, had personal informed consent to participate in the study, filled the questionnaire completely, had no history of fractures or handicap and MSDs; otherwise they were excluded from this study.

After students received the details about procedure and the purpose of the current research clearly, they were provided with informed consent from to be signed. Then, they received explanation about how to complet the questionnaire. .

A questionnaire was developed from a combination of two Nordic [16] and Cornell questionnaires [17] plus a demographic questionnaire were used to collect the data, which their validity and reliability were verified previously[18]. Moreover, an anatomical figure of musculoskeletal system was provided to mark the area of pain on it by participants; and the students' body weight and weight of their backpack were recorded using a digital weighing scale by the researcher. Subsequently, questionnaire was self-completed by students in the classroom at

a time previously scheduled with the course directors.

The questionnaire comprised three parts with eighteen closed questions. The first part assessed participants' demographic characteristics, including age, body weight, gender (boy or girl), level of education (elementary, secondary, high school), backpack weight (<10% of body weight, >10% of body weight), and ways of transport to school (walking, cycling, with car). The second part contained questions that evaluated the presence of pain/discomfort in the previous 12 months in body areas (neck, shoulder, upper back, arm, lower back, forearm, wrist, hip, thigh, knee, lower leg or ankle, and foot) with options (yes or no). The third part determined area of pain on anatomical figure.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 23 was used for data analyses. Tests were used after confirmed the normality by Kolmogorov-Smirnov test. Descriptive statistics were used to summarize participants' demographics; mean ± standard deviation for quantitative variables and frequencies and percentages for categorical variables. Furthermore, Pearson's Chi-Square test was employed to explore the association between " ways of transport to school" and MSDs. P values of 0.05 or less were considered statistically significant.

Finding

In current study, a total of 159 students (127 boys and 32 girls) within the age range of 12 to 18 years were assessed. Majority of the students had a high school education; the frequency of participants according to the academic level was: no participants in elementary level, 56 participants in middle level, and 104 participants in high level.

Mean their body weight and the average of backpack weight of all participants were 61 and 1kg, respectively. According to the student's body weight and their bag weight, it was observed that none of the students carried backpacks weight more than 10% of their body weight.

Prevalence of MSDs

Of all studied students 33 students suffered from lower back pain(20. 8%), neck pain (N= 26; 16.4%), and wrist (N=21; 13.2%) pains that were the most common pains in a recent years, respectively; whereas the forearm (N=7; 4%) pain was the least that was reported in a recent year . There was no case of hip pain among the participants. The remaining students had pain in other body areas. The details is seen in Table 1.

Based on the results of Chi-square test, none of the musculoskeletal pains were significant association with "ways of transport to school" (walking, cycling, with car) except for ankle pain. It should be noted that students who walked to school, reported a higher prevalence of MSDs compared to those who went by cycling or car (Table 2).

Discussion

The aim of this study was to determine the relationship between MSDs and ways of transport to school among school going students. The findings of current study revealed lower back, neck, and wrist pains were the most common pains among students, respectively. Moreover, there was only a significant difference between ankle pain regarding ways of transport to school" (walking, cycling, with car) during the past academic year.

Although some of studies showed many students carry backpacks that exceed 10-15 percent of their body weight which

Table 1) Prevalence of MSDs among studied Students at 12 months (N=159)

Suffering from pain in past12 months		
Different parts of body	**No N(%)**	**Yes N(%)**
Neck	133 (83.6)	26 (16.4)
Shoulder	143 (89.9)	16 (10.1)
Upper back	140 (88.1)	19 (11.9)
Arm	146 (91.8)	13 (8.2)
Lower back	126 (79.2)	33 (20.8)
Forearm	152 (95.6)	7 (4.4)
Wrist	138 (86.8)	21 (13.2)
Hip	159 (100.0)	0
Thigh	143 (89.9)	16 (10.1)
Knee	140 (88.1)	19 (11.9)
Lower leg	144 (90.6)	15 (9.4)
Foot	146 (91.8)	13 (8.2)

exposes students to MSDs [1, 14, 15, 19, 20], but in this study was observed that none of the students carried backpacks weight more than 10% of all students' body weight which Chansirinukor and co-workers in their study found the same result, too [21].

According to this study results lower back, neck, and wrist pains were the most common pains in a recent year, respectively among the participants. Since these pains were not related with backpack weight in some studies [22], so this seems to be a multifactorial issue as various studies have reported other factors including psychological physiological, and biomechanical factors in incidence of MSDs [6, 23, 24].

Based on findings of current study only a significant relationship between ways of transport to school" (walking, cycling, with car) and ankle pain during the past academic year was seenHoweverm researches conducted by Mwaka and other researchers showed a large percentage of students that transferred their school bag had musculoskeletal pains especially lower back pain and it was found a significant association between LBP with long duration of walking and between MSDs with mode of transport [24-26]; which this was not consistent with our study results. Additionally, the evidence has shown that fatigue during backpack transport and its transport time were the factors associated directly with MSDs and also with increased risk of injury [23, 27].

Generally, in our study it was observed that the student who walked to school, reported a higher prevalence of MSDs compared to

Table 2) Comparison of MSDs with ways of transport to school during the Past academic Year (N=159)

Pain in different parts of body		Transportation vehicle to school			P-value*#
		with car N(%)	Cycling N(%)	walking N(%)	
Neck	No	47 (83.9)	3 (100.0)	83 (83.0)	1.000#
	Yes	9 (16.1)	0	17 (17.0)	
Shoulder	No	48 (85.7)	3 (100.0)	92 (92.0)	0.472#
	Yes	8 (14.3)	0	8 (8.0)	
Upper back	No	48 (85.7)	3 (100.0)	89 (89.0)	0.736#
	Yes	8(14.3)	0	11 (11.0)	
Arm	No	49 (87.5)	3(100.0)	94 (94.0)	0.402#
	Yes	7 (12.5)	0	6 (6.0)	
Lower back	No	47 (83.0)	3(100.0)	76 (76.0)	0.424#
	Yes	9 (16.1)	0	24 (24.0)	
Forearm	No	52 (92.9)	3(100.0)	97 (97.0)	0.346#
	Yes	4 (7.1)	0	3 (3.0)	
Wrist	No	50 (89.3)	3(100.0)	85 (85.0)	0.756#
	Yes	6 (10.7)	0	15 (15.0)	
Hip	No	56 (100)	3(100.0)	100 (100.0)	NS
	Yes	0	0	0	
Thigh	No	49 (87.5)	3(100.0)	91 (91.0)	0.698#
	Yes	7 (12.5)	0	9 (9.0)	
Knee	No	48 (85.7)	3(100.0)	89 (89.0)	0.736#
	Yes	8 (14.3)	0	11 (11.0)	
Lower leg	No	44 (78.6)	3(100.0)	97 (97.0)	0.001#
	Yes	12 (21.4)	0	3 (3.0)	
Foot	No	51 (91.1)	3(100.0)	92 (92.8)	1.000#
	Yes	5 (8.9)	0	8 (8.2)	

*P-value is based on Chi-square Test.

P-value is based on Fisher's Exact Test.

those who went by cycling or car, which Delele and et al study findings also were similar of this finding[28].

Some conducted studies by researchers have shown that it is not enough to make a right choice of the backpack, but using a backpack with 2 straps properly attached to the student's body can help reduce MSDs [23]. Therefore, different factors may affect the development of MSDs in backpack transportation, apart from the weight of it and mode of transportation.

It should be noted that parents, students, and school staff should to be aware about these issues and there should be appropriately informed on the purchase and use of backpack [23]. As far as we have surveyed, there were few studies in field of backpack transportation and it was found that the mode of transport to schoolis effective in the development of MSDs among students with backpacks.

The study's limitations must be acknowledged. First, self-reporting was used to collect the data which relied on the recollection of past events; thus, recall bias cannot be ruled out. Second, due to the non-probability nature of sampling, external validity was limited to the study's participants. Finally, due to cross-sectional design and non-experimental of this study, no causal inferences can be drawn.

Conclusion

According to the study's results, it can be concluded that there was only a significant association between ways of transport to school with ankle pain among students who carried backpack during last 12 month. We should not forget that students spend more time in schools during the critical development stages of their lives, therefore needed to protect this age group and conduct interventions to properly transportation of students to school. Hence, it is recommended that researchers could consider other determinants of these disorders in future research and get help from parents as best supporters of promoting student's health.

Confilicts of Interest

The author declares no conflicts of interest. The author alone is responsible for the content and writing of the article.

Acknowledgement

The author would like to thank all of participants for participating in the current study.

Funding: There ws no funding for this study.

Ethics Permission: All ethical principals were considered in this study. All participants were satisfied to be studied and signed the consent form.

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