ISSN: 2476-5279; International Journal of Musculoskeletal Pain Prevention. 2019; 4(4): 249-255.

Association of Musculoskeletal Disorders with Backpack carrying among school aged adolescents

ARTICLE INFO

Article Type
Original study

Authors
Safieh Kanani,* *PhD candidate*

How to cite this article

Kanani S., Association of Musculoskeletal Disorders with Backpack carrying among school aged adolescents 2019; 4(4): 249-255.

* Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University

*** Correspondence**
Address: Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran.
Tel: +98 (21)82884506
Fax:+98(21)82884555
P.O.Box: 14115-331
Email: kanani.safieh@yahoo.com

Article History
Received: Feb 4,2020
Accepted: Feb10,2020
ePublished: Feb 22,2020

ABSTRACT

Aims: Musculoskeletal Disorders (MSDs) as one of the important multifactorial health problems among school going adolescents that might be due to back pack carrying. The aim of this study was to determine the relationship between backpack standards with MSDs among students.

Method and Instrument: This was a cross-sectional designed study. The non-probability sample consisted of 159 students from four secondary and high schools in Pars Abad city, Iran, in 2019. A combination of two Nordic and Cornell questionnaires were used to collect data. The data were about demographic charisteristics and experiencing pain or discomfort in musculoskeletal system that were obtained via the self-report.
Data analyzed by Chi-Square and Logistic Regression test using SPSS-22 software.

Findings: In total, 159 students with mean age of took part in the study. A significant difference was found between the neck, shoulder, upper back, lower back, forearm, and thigh pains with backpack carrying standards such as "way of carrying backpack", "how to put the light and heavy stationery in the backpack", and "backpack height ". the inappropriate carrying of backpack and improper placement of stationery in the backpack could cause shoulder and thigh pains was more than other MSDs respectively

Conclusion: This study indicates that there was a relationship between all of reviewed standards for using backpack with MSDs among school going adolescents. Thus, it is suggested to focus on increasing knowledge of adolescents and their parents to use the proper backpack.

Keywords: Musculoskeletal Diseases, Schools, Adolescent.

Introduction

Musculoskeletal disorders (MSDs) are injuries in the musculoskeletal system that affects the human body's movement and many different parts of the body including shoulders, arms, legs, feet, hands, neck, chest, and upper / lower back [1-3]. MSDs as one of important health problems are the most prevalent and costly disorders and have caused a lot of people visit physicians recently [2, 4, 5].

Although MSDs are multifactorial and its complaints are a common issue among school-aged adolescents [1, 2, 6], but factors associated with the incidence of these disorders in these people can be divided into three groups; a heavy schoolbag, ergonomically unsuitable furniture, and incorrect sitting posture [7]. School bags and backpacks as one of these factors are the most popular means of carrying books and supplies among students today [1].

When students are using school bags, the neck and trunk moves in forward position placing abnormal forces on the body, for this reason, adolescents aged 12–18 years undergo rapid an application of external forces by school bags may suffer from musculoskeletal injuries [1]. In addition, backpacks can also strain muscles and joints and may cause musculoskeletal pains including low back pain, shoulder pain, and neck pain if they are too heavy or are used incorrectly [6, 8].Therefore, when the musculoskeletal system may be more susceptible to injury, proper backpack and school bag use are crucial to preventing

*Corresponding Author: Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran. Tel:+98(21) 82884506; Fax +98(21)82884555; P.O.Box:14115-331; Email: kanani.safieh@yahoocom

postural deformities [3].

The average weight of adolescents' school bags reported in different countries, ranging from 2.8 kg to 9.3 kg [6, 9]. However, school bags load exceeding 10% of the body weight, not only can cause musculoskeletal disorders in adolescents [9] but increases energy consumptions and cardio-respiratory problems among them [1]. Therefore, it is recommended that school bag weight be 10-15% of body weight suggested as a maximum load for school students and should be avoided from carrying load extra [1, 3, 9].

In addition to the excess school bag weight and school bag weight relative to adolescent weight, method of carrying, and duration of school bag carrying are thought to be the main factors responsible for musculoskeletal disorders among adolescents [6]. Currently, according to the findings of researches the prevalence of these disorders among in adolescents is increasing [9].

As regards MSDs such as back pain experienced in youth is a predictor for pain in adulthood [1], so there is a need to identify risk factors associated with MSDs among adolescents and to introduce appropriate preventive measures [9]. Since most studies in this field have examined the relationship between backpack weight and MSDs, may be different correlations between MSDs with factors associated with backpack including way of carrying, and backpack standards. Hence, the purpose of current study was to determine the relationship between features and standard use of backpack with MSDs among boys and girls.

Method and Instruments

The current study was cross-sectional designd research in nature, which took place from October to December 2019. The non-probability sample consisted of 162 of girls and boys students from four secondary and high schools in Pars Abad city, Iran. Of all 162 students three students were excluded from this study. However, one hundred fifty nine (159) students completed the study and filled the questionnaires. Eligibility criteria in this study included being school going adolescents and aged between 12 and 18 years, being healthy, using schoolbag, and filling the questionnaire completely. In addition, exclusion criteria were suffering from any disease to prevent them to be staudied, history of fractures or handicap, structural deformities, and lack of consent to participate in the study by themselves or their parents. Before conducting the study, the students received a demonstration on how to fill the questionnaire, and they and their mother signed an informed consent before completing the questionaire. To determine the location of musculoskeletal pain in participants, a body map was used. A combination of two Nordic questionnaire (NMQ) [10] and Cornell questionnaires (CMDQ) [11] which both their validity and reliability have been previously confirmed were used to collect data via self-reporting. The backpack weight, body weight and height were measured with a standard scale by the questioner.

The questions were about demographic characteristics and experiencing pain or discomfort in musculoskeletal system during past 12 months. The demographic data included age, height, body weight, gender, level of education (secondary or high school), way of carrying backpack (bilateral/ lateral carrying), backpack weight (<10% of body weight, >10% of body weight), put the light and heavy stationery in the front or back of the backpack with options (yes, no), backpack height from lower back with options (<10 cm below the lower back , >10 cm below the lower back), and the experiencing ache, pain or discomfort in musculoskeletal system including neck, shoulder, upper back, arm, lower back,

forearm, wrist, hip, thigh, knee, lower leg or foot with options (yes or no). Data analyses were conducted, using the SPSS-22 software. Tests were used after confirming the normality by Kolmogorov-Smirnov test. Descriptive statistics were used to summarize and organize the demographics data. Chi-square test was performed to examine the relationship between "way of carrying bag", "put the light and heavy stationery in the front and back of the backpack, respectively", and "backpack height from lower back" with musculoskeletal pains. Moreover, binary logistic regression was performed to determine which independent variable ("way of carrying bag", "put the light and heavy stationery in the front and back of the backpack, respectively", and "backpack height from lower back") has the most influence on which musculoskeletal pains. P-value <0.05 was considered significant in all analyses.

Findings

Totally 159 students with mean age of 15.00± 1.00 yeasr, mean body weight of 61.00±15.05 kg , and mean height of 172.00±9.00 cm took part in the study.. Of all students , 20% (N= 32) were female and 79.0%(N=127) were boy. In this study 33% (N=54) and 66%(N=105) of the students were in secondary and high school education level respectively.

Since the average backpack weight of all participants was 1 kg and it was less than ten percent of their body weight, hence the relationship between backpack weight and MSDs was not examined.

The results of Chi-square test showed a significant difference between the shoulder, upper back, and lower back pains with the way of carrying backpack during the past academic year. Moreover, according to the findings of current study, it was found a significant difference between how to put the light and heavy stationery in the backpack with neck, upper back, lower back, and thigh pains during the past academic year.

Moreover, a significant relationship was observed between neck, upper back, lower back, and forearm pains with backpack height from lower back during the past academic year. It should be noted that no significant difference was revealed between arm, wrist, hip, knee, lower leg, and foot pains with features and standard use of backpack (Table 1).

Multivariate regression results also indicated the inappropriate carrying of backpack and improper placement of stationery in the backpack could cause shoulder and thigh pains was more than other MSDs respectively (Tables 2).

Discussion

The purpose of current study was to determine the relationship between musculoskeletal disorders associated with backpack standards among school going adolescents.

Generally the findings of this study showed a significant difference between the neck, shoulder, upper back, lower back, forearm, and thigh pains with backpack standards including "way of carrying backpack", "how to put the light and heavy stationery in the backpack", and "backpack height from lower back" during the past academic year.

The present study revealed the average of backpack weight of all participants' was less than ten percent of their body weight which is inconsistent with previous study [12]. However, Shahid G et al. in their study reported 93% of school going adolescents carrying more than 15% ratio of body to bag weight [3], and other studies also showed many students carry backpacks that exceed 15 percent of their body weight , which puts them at risk for musculoskeletal disorders including neck, shoulder, upper and lower back, arm, hand and wrist, and knee pains [13-16]. Previous

Table 1 Comparison of musculoskeletal pain with backpack standards during the past academic year (N=159)

Variables		Way of carrying backpack (bilateral carry)			Way of arranging stationery in backpack (properly)			Backpack height from lower back (<10 cm below the lower back)		
		Yes N(%)	No N(%)	P-value	Yes N(%)	No N(%)	P-value	Yes N(%)	No N(%)	P-value
Neck	**Yes**	22 (84)	4 (15)	1.000#	20 (76)	6 (23.1)	<0/001*	17 (65)	9 (34)	<0/001*
	No	112 (84)	21 (15)		106 (79)	27 (20)		75 (56)	58 (43)	
Shoulder	**Yes**	10 (62.5)	6 (37.5)	0.022#	11 (68.8)	5 (31.3)	0.328#	8 (50)	8 (50)	0.502*
	No	124 (86.7)	19 (13.3)		115 (80.4)	28 (19.6)		84 (58.7)	59 (41.3)	
Upper back	**Yes**	17 (89)	2 (10)	<0/001#	13 (68)	6 (31)	<0/001#	10 (52)	9 (47)	<0/001*
	No	117 (83)	23 (16)		113 (80)	27 (19)		82 (58)	58 (41)	
Arm	**Yes**	9 (69.2)	4 (30.8)	0.126#	9 (69.2)	4 (30.8)	0.473#	5 (38.5)	8 (61.5)	0.139*
	No	125 (85.6)	21 (14.4)		117 (80.1)	29 (19.9)		87 (59.6)	59 (40.4)	
Lower back	**Yes**	27 (81)	6 (18)	<0/001*	25 (75)	8 (24)	<0/001*	20 (60)	13 (39)	<0/001*
	No	107 (84)	19 15.1)		101 (80)	25 (19)		72 (57)	54 (42)	
Forearm	**Yes**	5 (71.4)	2 (28.6)	0.303#	6 (85.7)	1 (14.3	1.000#	1 (14.3)	6 (85.7)	0.042#
	No	129 (84.9)	23 (15.1)		120 (78.9)	32 (21.1)		91 (59.9)	61 (40.1)	
Wrist	**Yes**	16 (76.2)	5 (23.8)	0.331#	15 (71.4)	6 (28.6)	0.387#	11 (52.4)	10 (47.6)	0.585*
	No	118 (85.5)	20 (14.5)		111 (80.4)	27 (19.6)		81 (58.7)	57 (41.3)	
Hip	**Yes**	0	0	NS	0	0	NS	0	0	NS
	No	134 (84)	25 (15)		126 (79)	33 (20)		92 (57)	67 (42)	
Thigh	**Yes**	14 (87.5)	2 (12.5)	1.000#	9 (56.3)	7 (43.8)	0.025#	10 (62.5)	6 (37.5)	0.692*
	No	120 (83.9)	23 (16.1)		117 (81.8)	26 (18.2)		82 (57.3)	61 (42.7)	
Knee[1]	**Yes**	15 (78.9)	4 (21.1)	0.505#	13 (68.4)	6 (31.6)	0.232#	13 (68.4)	6 (31.6)	0.321*
	No	119 (85)	21 (15)		113 (80.7)	27 (19.3)		79 (56.4)	61 (43.6)	
Lower leg	**Yes**	14 (93.3)	1 (6.7)	0.469#	13 (86.7)	2 (13.3)	0.738#	7 (46.7)	8 (53.3)	0.356*
	No	120 (83.3)	24 (16.7)		113 (78.5)	31 (21.5)		85 (59)	59 (41)	
Foot	**Yes**	11 (84.6)	2 (15.4)	1.000#	8 (61.5)	5 (38.5)	0.146#	8 (61.5)	5 (38.5)	0.779*
	No	123 (84.2)	23 (15.8)		118 (80)	28 (19.2)		84 (57.5)	62 (42.5)	

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

Table 2 Multivariate regression analysis of musculoskeletal pain and backpack standards

Variables	Way of carrying backpack (bilateral carry)			Way of arranging stationery in backpack (properly)			backpack height from lower back		
	Exp (B)	95%CI	P-value*	Exp (B)	95%CI	P-value*	Exp (B)	95%CI	P-value*
Neck	1.03	(0.31 to 3.39)	0.957	0.87	(0.31 to 2.45)	0.805	1.44	(0.58 to 3.49)	0.414
Shoulder	0.28	(0.09 to 0.88)	0.030*	0.62	(0.18 to 2.05)	0.435	0.69	(0.23 to 2.02)	0.502
Upper back	1.98	(0.41 to 9.41)	0.390	0.45	(0.15 to 1.35)	0.157	0.72	(0.27 to 1.92)	0.521
Arm	0.42	(0.18 to 0.55)	0.198	0.55	(0.15 to 2.01)	0.366	0.40	(0.12 to 1.33)	0.136
Lower back	0.82	(0.29 to2.30)	0.713	0.80	(0.31 to 2.04)	0.654	1.14	(0.51 to 2.51)	0.750
Forearm	0.48	(0.08 to 2.77)	0.414	1.35	(0.15 to 12.31)	0.786	0.11	(0.01 to 1.02)	0.052
Wrist	0.59	(0.19 to 1.85)	0.372	0.63	(0.21 to 1.83)	0.401	0.75	(0.29 to 1.92)	0.554
Thigh	1.82	(0.36 to 9.06)	0.464	0.26	(0.08 to 0.79)	0.018*	1.10	(0.37 to 3.29)	0.855
Knee	0.72	(0.21 to 2.48)	0.605	0.57	(0.19 to 1.70)	0.316	1.61	(0.57 to 4.54)	0.364
Lower leg	2.76	(0.34 to 22.39)	0.341	1.54	(0.32 to 7.31)	0.586	0.59	(0.20 to 1.75)	0.350
Foot	1.27	(0.25 to 6.38)	0.771	0.37	(0.10 to 1.25)	0.109	1.08	(0.33 to 3.51)	0.898

*P-value is based on binary logestic regression.

studies also indicated shoulder pain and dropped shoulder were the most common pain associated with backpack weight [17-19]. However Michael J and co-workers showed backpack weight is not associated with neck or lower back pains [20].

Although a large percentage of students carried their backpack in 2 straps but a significant difference was observed between the shoulder, upper back, and lower back pains with way of carrying backpack during the past academic year in this study, which is in the line of existed evidences [14, 17]. Researchers argued that shoulder pain was the most common pain associated with one-sided backpack carriage reported that is consistent with the results of the present study [21]. Despite this, other researchers' findings showed this relationship for other musculoskeletal pains including neck, middle back, arm, forearm, wrist, thigh, knee, lower leg, and foot [21-24], Versus, the study by Abaraogu U.O et al. and also reported backpack carriage related factors were not associated with MSDs [16].

According to the findings of current study a significant difference between how to put the light and heavy stationery in the backpack with neck, upper back, lower back, and thigh pains was found, and also a significant relationship was observed between neck, upper back, lower back, and forearm pains with backpack height from lower back during the past academic year. As far as we have surveyed, most studies have examined the relationship between backpack weights with MSDs and there was no research in field of other backpack standards. It should be noted that some conducted studies by researchers have shown more than half of the parents reported that two-thirds of their children put additional contents in their school

backpack and complain of low back pain, shoulder or arm pain, respectively [25]; and more than half of their parents were not aware that the size of the backpack must be proportionate to the upper back region [26]. Therefore, examining these standards may be the strength point of the present study. 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 participants of this study. Finally, due to cross-sectional design and non-experimental of this study, no causal inferences can be drawn that is one of the limitation of this study. However, self-reporting is another limitation of this study.

Conclusion

On the basis of the findings of this study, it was clarified that standards for using backpack (including way of carrying backpack, backpack weight, way of putting the stationery in the front and back of the backpack, backpack height from lower back) with MSDs among school going adolescents. Furthermore, it is suggested to focus on increasing adolescents and their parents to use the backpack properly, and on design the backpacks correctly.

Acknowledgment

The author tank all students who participated in this study.

Conflicts of Interest: There is no conflicts of interest for this study.

Ethical Permission: The author alone is responsible for the study. All ethical pricipals were considered for the study. The content and writing of the article was approved by the author.

Funding: This study was financially supported by own author.

References

1. Panicker RK, Sandesh TS. Prevalence of musculoskeletal pain in school going adolescents using school bags: A co-relational research. International journal of therapies and rehabilitation research. 2014; 3(4): 1.
2. Motaqi M, Ghanjal A. Musculoskeletal disorders: definition, causes, risk factors, and prevention. International journal of musculoskeletal pain prevention. 2019; 4(1): 127-31.
3. Shahid G, Aziz K, Arif A, Fahim MF. Prevalence of musculoskeletal pain due to heavy backpacks in school going children of Karachi. Int J Phys Med Rehabil. 2018; 6(3): 2.
4. Delshad MH, Moazemi Goodarzi A, Pourhaji F. Musculoskeletal disorders among a sample of Iranian medical care professions working in Lorestan hospitals: a Descriptive study from Lorestan, Iran. International journal of musculoskeletal pain prevention. 2019; 4(1): 150-5.
5. Balamurugan J. School bags and musculoskeletal pain among elementary school children in Chennai. International journal of medical science and clinical invention. 2014; 1(6): 302-9.
6. Mandic S, Keller R, Garcia Bengoechea E, Moore A, Coppell KJ. School bag weight as a barrier to active transport to school among New Zealand adolescents. Children. 2018; 5(10): 129.
7. Martin A, Bertha OY, Hosea B, Acheampong B, Edward A, Cynthia OY. Prevalence of Musculoskeletal Pain and Body-Chair Mismatch among Junior High School Students in Ghana: A Risk Factor for the Young. Journal of advances in medicine and medical research. 2017; 23(12): 1-9.
8. Rai A, Agarawal S. Back problems due to heavy backpacks in school children. IOSR J Hum Soc Sci. 2013; 10: 1-5.
9. Dianat I, Javadivala Z, Allahverdipour H. School bag weight and the occurrence of shoulder, hand/wrist and low back symptoms among Iranian elementary schoolchildren. Health promotion perspectives. 2011; 1(1): 76.
10. Viry P, Creveuil C, Marcelli C. Nonspecific back pain in children. A search for associated factors in 14-year-old schoolchildren. Revue du rheumatism. 1999; 66(7-9): 381-8.
11. Afifehzadeh-Kashani H, Choobineh A, Bakand S, Gohari MR, Abbastabar H, Moshtaghi P. Validity and reliability of farsi version of Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). IOH. 2011; 7(4): 0-10.
12. Chansirinukor W, Wilson D, Dansie B. Effects of backpacks on students: measurement of cervical

and shoulder posture. Australian Journal of physiotherapy. 2001; 47(2): 110-20.
13. Zakeri Y, Baraz S, Gheibizadeh M, Saidkhani V. Relationship between backpack weight and prevalence of lordosis, kyphosis, scoliosis and dropped shoulders in elementary students. International journal of pediatrics. 2016; 4(6): 1859-66.
14. Ibrahim AH. Incidence of Back Pain in Egyptian School Girls: Effect of School Bag Weight and Carrying Way. World Appl Sci J. 2012; 17(11): 1526-34.
15. Shamsoddini AR, Hollisaz MT, Hafezi R. Backpack weight and musculoskeletal symptoms in secondary school students, Tehran, Iran. Iranian journal of public health. 2010; 39(4): 120-5.
16. Abaraogu U. Musculoskeletal problems and backpack carriage among students in Nigeria. Work. 2019; (Preprint):1-6.
17. Poornajaf A, Omidi L, Khodadadi I, Rahim Nejad N, Rahmani A, Akbarzadeh A, and et al . Backpack and related health problems among school students. Payesh. 2016; 15(1): 79-85.
18. Whittfield J, Legg S, Hedderley D. Schoolbag weight and musculoskeletal symptoms in New Zealand secondary schools. Applied Ergonomics. 2005; 36(2): 193-8.
19. Van Gent C, Dols J, De Rover C, Hira SR, De VetH. The weight of schoolbags and the occurrence of neck, shoulder, and back pain in young adolescents. Spine. 2003; 28 (9): 916-21.
20. Moore MJ, White GL, Moore DL. Association of relative backpack weight with reported pain, pain sites, medical utilization, and lost school time in children and adolescents. Journal of School Health. 2007; 77(5): 232-9.
21. Zamanian Z, Ghanbari A, Arghavani F, Hasanzadeh J. Determining the Relationship between carrying school bags and bascule skeletal pains in 12-15 year old students. Armaghane-danesh 2014; 19(9): 808-16.
22. Sharan D, Ajeesh PS, Jose JA, Debnath S, Manjula M. Back pack injuries in Indian school children: risk factors and clinical presentations. Work. 2012; 41(Supplement 1): 929-32.
23. Assiri A, Mahfouz AA, Awadalla NJ, Abolyazid AY, Shalaby M. Back Pain and Schoolbags among Adolescents in Abha City, Southwestern Saudi Arabia. International Journal of Environmental Research and Public Health. 2020; 17(1): 5.
24. Sharan D, Mohandoss M, R Ranganathan, Makkuva clude A, Kavoor JJ. A systematic review of risk factors for musculoskeletal pain due to heavy backpacks in school children. 19th Triennial Congress of the IEA. 2015; 9: 14.
25. El Magrabi NM, Mahmoud SR, Yousef YE. Awareness of parents about school backpack and its related musculoskeletal disorders in Assiut City. IOSR Journal of Nursing and Health Science. 2015; 4(6): 5-11.
26. Javadivala Z, Allahverdipour H, Dianat I, Bazargan M. Awareness of parents about characteristics of a healthy school backpack. Health promotion perspectives. 2012; 2(2): 166.