The Role of School Backpack and Training Habits on Development of Spinal Pain among Iranian Primary Student

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ABSTRACT

In recent studies, some variables such as weight of the school backpack, how to carry it or backpack features are currently under study in relation to low back pain (LBP) among students. The present study aimed to assess the role of school backpack and training habits on the development of spinal pain among Iranian students.

A current cross-sectional study was performed between November 2015 and April 2016 on 616 primary school children with age between 11-13 years in Karaj city, Iran. We gathered information on demographic characteristics and ergonomic data on backpacks via a specific checklist. The Nordic Musculoskeletal Questionnaire (NMQ) to determine the prevalence of spinal complaints was used among the participants. To assess the ergonomic status of backpacks, the students were asked to carry with the consistent and conventional method.

Study findings showed that unfortunately, only 1.9% of students carried their bags correctly. Musculoskeletal complaints in the neck region were significantly higher among students who do their homework on the floor in compare with students that doing their homework behind the desk. Musculoskeletal complaints in the shoulder region of students had a significant association with Bag handle type, TV & game time, doing homework position, Bag use with 2 ropes and Bag weight/body weight.

Findings of the present study recommended that we need to step up public health strategies and develop a monitoring system that is both preventative and proactive.

Keywords: School backpack; Spinal pain; Children

INTRODUCTION

Carrying schoolbags is one of the daily work tasks for the student as a worker. Extensive bag weight accompanied with incorrect its handling might lead to back pain among students [1-4]. Some studies are shown that the weight of the school bag of the student must be lower than 10% of their weight [1]. Some investigators believed that back pain in childhood time might have a role in the development of chronic low back pain on adulthood [5]. According to the latest studies, the prevalence of low back pain among students aged between 10 and 15-year ranges from 25% to 55% with low intensity [5-8]. Any changes in body position or alignment among students can lead to different outcomes in other parts of their body and need to more forces to adapt or correct noted changes and these forces might lead to bad postural structure or pain in their musculoskeletal system [1, 2].

Epidemiological studies reported that children and adolescents often complain of LBP, as for an example in one study on Spanish participants aged 13–15 years, where 50.9 % of boys and 69.3 % of girls have suffered LBP at least once [3]. Due to the high LBP prevalence, there is a need to carry out school-age interventions. In the recent studies, some variables such as weight of the school backpack, how to carry it or backpack features are currently under study in relation to low back pain (LBP) among students. Our searching on the literature showed that carry backpacks exceed 10% of the schoolchildren's weight causes adverse health effects such as spinal discomfort, body balance and gait performance [4, 5]. Most of the studies in this filed showed that many of children carry their back bag with more than 10% of their weight [6, 7]. The present study aimed to assess the role of school backpack and training habits on the development of spinal pain among Iranian students.

MATERIALS AND METHODS

A current cross-sectional study was performed between November 2015 and April 2016 on primary school children with age between 11-13 years selected using cluster sampling method at Karaj city, Iran. We divided study schools into north and south areas according to the socioeconomic level of the population and then two boy's schools and two girl's school

(totally eight schools including 616 students) were randomly included in each area. Among included students, those who had a history of congenital skeletal deformity, or trauma-related deformity were excluded from the study. Study information on demographic characteristics and ergonomic data on backpacks were gathered via a specific checklist. Study checklist had two parts. In the first part, type of school, gender, age, type of bag (shoulder bags, backpacks, handbags, backpacks, or wheeled bags), the method of carrying bag (by the student or school service), feeling pain when carrying the backpack, the mean time for carrying the backpack from school to home, history of chronic disorders or diseases related to spinal cord with the last month were assessed as back pain related factors. In the secondary part; the duration of doing homework at home and its position (on the floor or desk), the duration of computer gaming or watching television at home and physical function out of the school environment that was known as training habitual. Height and weight were similarly measured using a single standard tool. We weighted students' bag with all of its equipment to determine the weight of students' bags. We repeated this work in three days of the week and the mean of these measures was recorded as the final weight of the bags. We considered the ratio of the weight of the bag to students' body weight (with the cutoff value of 0.1) as the ergonomic variable.

Nordic Musculoskeletal Questionnaire (NMQ) was used to determine the prevalence of spinal complaints among the participants. NMQ was developed from a project funded by the Nordic Council of Ministers [8]. The NMQ aim was to develop and test a standardized questionnaire methodology, allowing the comparison of low back, neck, shoulder, and general complaints to be used in epidemiological studies. The tool did not develop for clinical diagnosis. This questionnaire can be used as a questionnaire or interview devices [9]. The NMQ has been used in several studies to evaluate musculoskeletal problems including computer and call center workers [10], car drivers [11], and coopers industry [12]. Previous studies reported that the NMQ is repeatable, sensitive, and useful as a screening and surveillance tool. However, a medical examination is essential to establish a clinical diagnosis].

To assess the ergonomic status of backpacks, the students were asked to carry with the consistent and conventional method. The checklist for assessing the ergonomic pattern of backpacks consisted of 16 items measured on a 2-point Likert Scales. The scales of this checklist ranged from 0 to 16 that higher score indicated the better ergonomic status of backpacks. Four items including correctly picking up the pack, carrying the bag using the two cords, putting the bag three inches above the waistline and also the ratio of the weight of the bag to students' body weight were the most important items of the checklist.

Statistical Analysis

For statistical analysis, results were presented as mean ± standard deviation (SD) for quantitative variables and were summarized by frequency (percentage) for categorical variables. Continuous variables were compared using a t-test or Mann-Whitney test whenever the data did not appear to have normal distribution or when the assumption of equal variances was violated across the study groups. Categorical variables were, on the other hand, compared using the chi-square test. P values of ≤ 0.05 were considered statistically significant. For the statistical analysis, the statistical software SPSS version 23.0 for Windows (*IBM*, Armonk, New York) was used.

RESULTS

General Characteristics of Study Participants

In this study, 472 students (270 boys and 202 girls) were assessed. The mean height and weight of students were 151.18 ± 7.80cm and 44.36 ± 11.38kg with body mass index 19.20 ± 3.90kg/m^2 ranged 12.20 to 40.7 kg/m^2. Most of the student (94.5%) had no history of disorders in the spinal cord. The time for watching television and computer gaming longer than two hours was revealed in 40.9%. A postural condition within homeworking was behind the desk in 36.0% and sitting on the ground in 64.0%. Near half of the students (41.9%) did not participate in other sports training. Of others, swimming was reported in 10.8%, ball sports in 32.2%, and martial arts in 15.0%.

Of total students, 97.2% carried backpacks as the school bags and thus 2.8% carried other types of bags including shoulder bag, handbag, backpacks, or wheeled bags. Only 1.9% carried their bags correctly. In this study, 91.1% carried dual-band backpacks and 8.9% carried single-band bags. The ratio of the weight of the bag to students' body weight higher than 10% was found in 66.1% of them. The mean time for carrying backpacks was 12.16 ± 13.88min that was positioned three inches above the waist in 3.8%. Of all students, 73.3% complained back pain when lifting bags as mild, moderate and severe pain in 3.8%, 22.0% and 8.0% respectively.

Among students, 60 (12.70%) had neck pain, 79 (16.7%) had shoulder pain and 85 (18%) had low back pain in a recent year .Quantitative variables had no significant differences between a student with and without neck and lumbar complaints. Mean of height among student without shoulder pain was significantly lower than students with shoulder complaints (150.1 ± 8.5 vs. 152.4 ± 7.60; P=0.02). Mean of bag handle time among student without shoulder complaints was

significantly lower than students with shoulder pain (11.13 ± 13.6 vs. 17.2 ± 16.50; P<0.001) (Table 1).

Table 1: Association of spinal region complains about quantitative study variables among students

Neck region			
Quantitative variables	**Positive**	**Negative**	**P value**
Height (cm)	152.7±7.47	151.7±7.85	0.38
Weight (kg)	42.93±9.18	44.57±11.6	0.12
BMI (kg/m²)	18.1±3.07	19.7±8.5	0.17
Mean bag weight (kg)	4.7±0.6	4.6±0.6	0.39
Bag handle time (minute)	12.17±14.2	12.16±13.8	0.99
Home work time (hour/day)	2.32±1.2	2.12±1.1	0.23
Height (cm)	152.7±7.47	151.7±7.85	0.38
Quantitative variables	**Positive**	**Negative**	**P value**
Height (cm)	150.1 ± 8.5	152.4 ± 7.60	0.02
Weight (kg)	42.58 ± 11.7	44.72 ± 11.2	0.12
BMI (kg/m²)	18.8 ± 4.7	19.6 ± 8.6	0.44
Mean bag weight (kg)	4.7 ± 0.6	4.6 ± 0.6	0.39
Bag handle time (hour)	17.2 ± 16.5	11.13 ± 13.6	<0.001
Home work time/day (hour)	2.2 ± 1.07	2.14 ± 1.18	0.66
Lumbar Region			
Quantitative variables	**Positive**	**Negative**	**P value**
Height(cm)	150.92 ± 7.39	152.15 ± 7.90	0.16
Weight (kg)	43.91 ± 11.24	44.49 ± 11.43	0.65
BMI (kg/m²)	19.19 ± 3.81	19.20 ± 3.97	0.95
Mean bag weight (kg)	4.67 ± 0.63	4.69 ± 0.63	0.72
Bag handle time (hour)	4.24 ± 13.52	11.59 ± 13.9	0.08
Home work time/day(hour)	2.28 ± 1.17	2.21 ± 1.16	0.22

Among qualitative variables, musculoskeletal complaints in neck region were significantly higher among students who perform their homework on the floor had significantly higher frequency neck pain in compare with a student that perform their homework behind the desk (OR: 1.82, CI: 1.07-3.07; P=0.02). Musculoskeletal complaints in shoulder region of students had significant association with Bag handle type (Student / car), TV & game time (>2hours/day, <2hours/day), Doing homework position (On the floor /behind desk), Bag use with 2 ropes and Bag weight / body weight (>10% / <10%). Musculoskeletal complaints in lumbar region of students had significant association with Bag handle type (Student / car), Bag weight / body weight (>10% / <10%) (Table 2).

Table 2: Association of spinal region complains of students with study variables

Neck region			
Qualitative variables	**OR**	**CI**	**P value**
Bag handle type student	0.79	(0.45 - 1.37)	0.42
TV & game time >2hours/day, <2hours/day	0.82	(0.47 - 1.42)	0.48
Doing homework position On the floor / behind desk	1.82	(1.07 - 3.07)	0.02
Bag lifting False / true	1.74	(0.3 - 8.60)	0.41
Bag use with 2 ropes	1.42	(0.48 - 4.1)	0.51
Bag weight / body weight >10% / <10%	0.61	(0.33 - 1.1)	0.11
Shoulder region			
Qualitative variables	OR	CI	P value
Bag handle type Student / car	1.9	(1.10 – 3.28)	0.02
TV & game time >2hours/day, <2hours/day	2.15	(1.25 – 3.67)	0.005
Doing homework position On the floor / behind desk	2.53	(1.41 – 4.5)	0.001
Bag lifting False / true	2.54	(0.62 – 10.4)	0.17
Bag use with 2 ropes	3.1	(1.60 – 6.3)	0.001
Bag weight / body weight >10% / <10%	1.2	(0.75 – 2.04)	0.4
Lumbar Region			
Qualitative variables	OR	CI	P value
Bag handle type Student / car	1.69	(1.04 – 2.74)	0.03
TV & game time >2hours/day, <2hours/day	2.47	(0.93 – 2.34)	0.09
Doing homework position On the floor / behind desk	0.79	(0.49 – 1.26)	0.33
Bag lifting False / true	1.05	(0.21 – 5.13)	0.95
Bag use with 2 ropes	1.70	(0.69 – 4.15)	0.23
Bag weight / body weight >10% / <10%	1.23	(1.5 – 2.5)	0.048

DISCUSSION

Study findings showed that unfortunately, only 1.9% of students carried their bags correctly. Mean of bag handle time among students with shoulder pain was significantly higher than students without shoulder complaints. Musculoskeletal complaints in the neck region were significantly higher among students who do their homework on the floor in compare with students that doing their homework behind the desk.

Musculoskeletal complaints in shoulder region of students had significant association with Bag handle type (Student / car), TV & game time (>2hours/day, <2hours/day), Doing homework position (On the floor /behind desk), Bag use with 2 ropes and Bag weight / body weight (>10% / <10%).

Musculoskeletal complaints in lumbar region of students had significant association with their bag handle type (Student / car), Bag weight / body weight (>10% / <10%). Our study is one of the pioneer studies which looked into the effect of bag weight on the back complaint in of sample of schoolchildren in Iran. We found that bag weight contributes towards musculoskeletal complaints in the spinal region in children, together with bag handle, doing homework position. Study findings were similar with previous studies and both of them took into consideration pain in all the spine (15). The study highlights the multi-factorial nature of spinal complaints in schoolchildren. The final statistical model confirms the previous literature that there is a gender difference in the prevalence of back complaints in schoolchildren (16-18) BMI was also found to be a risk factor towards the development of back complaints in children (16, 19). In the final model, bag weight to body weight ratio was analyzed as a continuous variable instead of using the recommended 10% bag weight to body weight ratio (20). The model shows that there is an increased risk of developing back pain with every 1% increase in bag weight to body weight ratio.

Study findings highlight a strong link between the prevalence of low back pain and the lifting of heavy schoolbags in Iran. The prevalence of spinal complaints in children merits public health action and attempts to prevent that at a young age could help decrease the burden in older age groups (21). We need to some strategies to help children and their support network to identify those factors that could predispose children of this age to spinal complaints and to empower them with the necessary skills to independently monitor the weight of their schoolbags on a daily basis. This initiative could be further supported by physiotherapists, as specialists in movement and exercise in schools (22).

CONCLUSION

Findings of the present study recommended that we need to step up public health strategies and develop a monitoring system that is both preventative and proactive.

ETHICAL ISSUES

The study protocol was approved in ethical research committee of Iran University of medical sciences.

CONFLICT OF INTEREST

The authors had not any conflict of interest in this study

AUTHORS CONTRIBUTIONS

Mashaallah Aghilinejad: Study design and supervision

Saber Mohammadi: Supervision and finalizing the final draft of the manuscript

Amir Bahrami-Ahmadi: Statistical analysis and drafting the manuscript

Shahrbanoo Moslemi: Data gathering

Marjan Amini: Data gathering

Elaheh Kabir-Mokamelkhah: Study design and supervision

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