Musculoskeletal Pain and its Association with School Bag Weight and Diet Intake: A Cross-Sectional Study among School-Going Adolescents in Delhi

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Abstract

Background: Prevalence of musculoskeletal pain is increasing in adolescent school students. This study conducted to assess the role of heavy bag packs and faulty dietary habits in the causation of musculoskeletal pain.

Methods: The study was conducted in school going 1600 adolescent school students of Delhi, India from April 2018 to March 2019. The demographic profile, symptoms of pain in neck, shoulder and back was recorded through a validated questionnaire and the simplified dietary gap assessment tool was applied to assess the dietary habits. The weight of the school bag was measured. The prevalence of musculoskeletal pain was 56.8% among adolescent school students. The musculoskeletal pain was significantly higher in those students who were carrying bag weight 10-15% of their body weight and was two times higher than those students who were carrying bag weight less than 10% of their body weight. Students having dietary gap score of less than 5 out of 10 were more prevalent to get musculoskeletal pain than those having dietary score more than 8.

Conclusions: Carrying of heavy school bag weight and gap in the diet among the school going adolescents can lead to musculoskeletal pain.

Key-words: *Musculoskeletal, Pain, Adolescent, Bag, Diet, School*

Introduction

In childhood, pain is a common presentation which becomes disabling when it persists in adolescent stage.[1] Among the types of pains, around 64% are of musculoskeletal origin.[2] The symptoms of pain in school-going adolescents are more common in girls than boys[3] and can be attributed to faulty and stationary postures[4], improper classroom furniture[4] and excessive school bags load affecting the spine.[5]

Heavy schoolbags are a potential risk for musculoskeletal problems among adolescents.[6] School bags heavier than 10% of one's own body weight may result in back and shoulder pains[7], can affect the curvature of lumbar and sacral spine[8] increases musculoskeletal injury risk and affects cardiopulmonary functions.[9]

Poorer general health is also associated with back pain in around 74.4% bag pack user adolescents.[10] The adolescents continue to have unhealthy foods because of the gap in knowledge regarding the unhealthy food ill effects and lack of time.[11]

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The present study was intended to evaluate the musculoskeletal pain association with bag weight and nutritional status.

Methods

The cross-sectional observational study approved by the Institutional Ethics Committee conducted between April 2018 to March 2019 in Government co-educational schools of south Delhi. The permission was granted by Directorate of Education, Government of Delhi in 101 schools and out of those, 23 schools were Co-educational Senior Secondary schools.

The sample size was calculated based on the referenced study which showed the prevalence of neck and back pain was in 50% of the young adolescent.[12] With the allowable error as 5% of prevalence, the sample size required was 1600. Principals of 16 schools were approached as per convenience sampling for the study out of which Principal of 10 schools with 7511 students accepted to be the part of the study. Total 3790 consent forms were distributed to the senior secondary students out of which 2083 students were eligible to participate in the study. 1600 students were randomised by the "Random number generator software -Stat Trek" to include in the study.

Data Collection

The students of class 6th to 12th standard of age group 10-19 years from both gender carrying regular school bags to school were included in the study. The students having a recent history of injuries in neck, shoulder or back were excluded from the study. The details of the procedure of the study was given and explained to all the students and written informed consents were taken indicating the voluntary participation. The pre-designed proforma was filled to capture the demographic details. The height and body weight of each student along with their school bag weight was measured. The weighing machine was calibrated and height was measured with a portable stadiometer. The questions related to the use of school bags and their type i.e. Side bags or bag backs were asked. The responses were collected in the proforma by asking the students to answer "yes" or "No" to the questions. The way of carrying the bag either in both or single shoulder or in hands, and any pain or discomfort in single, double and three sites in the neck, shoulder and back pain within 1 month due to the school bag carriage was noted.

The simplified dietary assessment tool[13] was used to collect the dietary pattern of the adolescents. The questions were asked and scores were calculated as per their response in Table 1.

TABLE 1: Simplified dietary assessment tool developed by Chacko and Ganeshan 2018

S. No	Questions (based on Indian Council Medical Research/National Institute of Nutrition recommendations)	Response Score	
		Yes =1	No=0
1	Daily do you have 3 main meals of cereals?		
2	Do you have mid-morning and evening snack daily?		
3	Do you take at least one of these items along with your meals daily? pulses/ dhal/non-vegetarian food (fish, chicken, mutton, egg) daily?		
4	Do you take 3 cups of milk/coffee/tea/flavoured milk or 2 cups with curd daily?		
5	Do you take green leafy vegetables daily?		
6	Do you take other vegetables along with your meals daily?		
7	Do you take a fruit daily?		
	General faulty dietary habits: Reverse scoring	Yes=0	No=1
8	Do you skip any meal?		
9	Do you eat junk food		
10	Do you buy eatables from the street shops?		
	Maximum possible score =10		

Data Analysis

The descriptive statistics was applied to see the prevalence of musculoskeletal pain (neck/back/shoulder) both gender-wise and across the whole samples. The prevalence of pain was analysed for the students carrying bag weight more than 15%, 10-15%, and less than 10% of their body weight. The dietary intake of participants was scrutinised with simplified dietary gap assessment tool. The data obtained was subjected to the statistical analysis using Stata (Version 14). Chi-Square test was used to evaluate the risk of musculoskeletal pain among both genders, weight of the schoolbag and simplified dietary gap assessment tool. The variables with a significant association to musculoskeletal pain in univariate analysis were then included in a multivariate model. Logistic regression was used to determine in the variables which had an independent effect on musculoskeletal pain.

Results

Sample Characteristics

There were 1600 students included in the study meeting the inclusion criteria out of which 745 (46.5%) were females and 855 (53.4%) were males. The mean age of the participants was (13.5 ± 2) years whereas the 68% (1089) students were underweight with BMI <18 kg/m^2. The mean bodyweight of the students was 41.1 ± 11.1 kg and the mean height was 151.5 ± 11.6 cm. The mean schoolbag weight for all of the adolescents was 4.3 ±1.2 kg. Total of 1591 (99%) students carried school bags on both shoulders. The characteristics of the students are described in Table 2.

TABLE 2. Sample characteristics of the students

	Total Students (n=1600)	Male (n = 855)	**Females (n =745)**
Age in years (Mean ± SD)	13.5 ± 2	13 ± 2	13.4 ± 2
Height in cm (Mean ± SD)	151.5 ± 11.6	154.5 ± 12.6	147.9 ± 9.0
Weight (Kg) (Mean ± SD)	41.1 ± 11.1	42.12± 12.45	39.4 ± 9.1
BMI (Mean ± SD)	17.7 ± 3.4	17.58 ± 3.71	17.83± 3.2
Weight of school bag (Kg) (Mean ± SD)	4.3 ± 1.2	4.3 ± 1.2	4.4 ± 1.2

Neck, Shoulder and back pain

Out of 1600 adolescent students, 909 (56.8%) had musculoskeletal pain either single site (neck, shoulder, back), two sites (neck, shoulder or neck, back or back, shoulder) or three sites (neck, back and shoulder). The shoulder pains were reported in 570 (35.6%) while back and neck pain were reported in 68 students (4.2%) and 29 students (1.8%) respectively. Among all participants, 203 (12.6%) had complaints in two different sites and 38 students (2.3%) had complaints in three sites simultaneously. An overview of the prevalence of musculoskeletal pain in different sites is presented in Figure 1

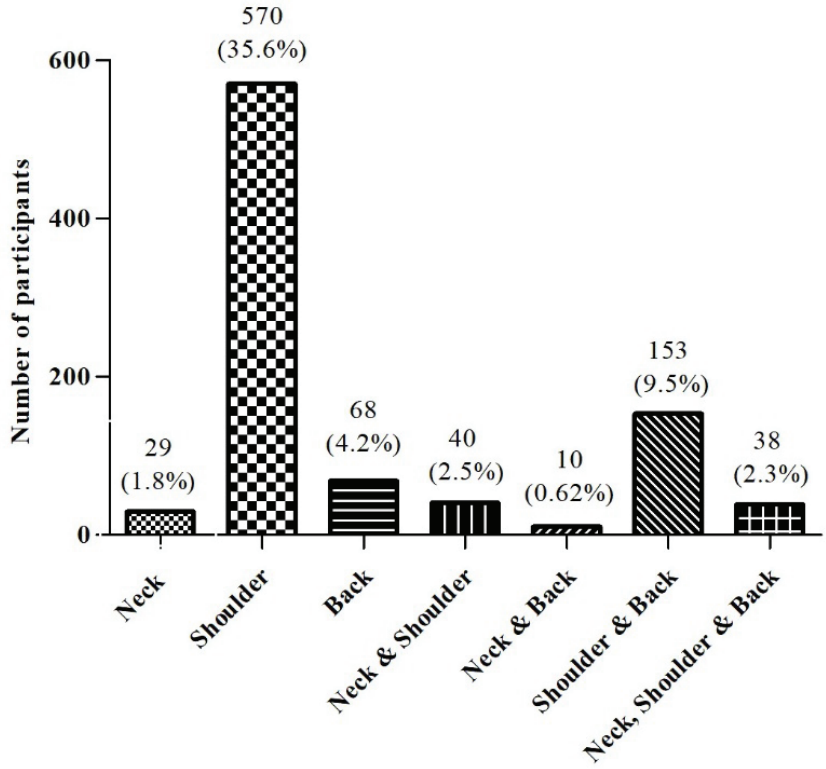

FIGURE 1. Frequency of Neck, Shoulder and Back pain as per single, two and three sites

The data analysis ($\chi 2$) shown in Table 3 suggested that females have a higher prevalence of musculoskeletal pain than males ($\chi 2$=27.41 p value= p=<0.0001). The musculoskeletal pain is more associated with the students who carry more than 10% of their body weight. ($\chi 2$=33.97 p value= p=<0.0001). The association of pain was more common in the participants having dietary scores ≥5 out of 10. ($\chi 2$= 8.4p value= 0.014*).

TABLE 3. Prevalence of musculoskeletal pain and their association with gender, bag weight and simplified dietary assessment score

Variables		Pain	No Pain	$\chi 2$ P value
Gender	Male	434(50.76%)	421(49.21 %)	$\chi 2$=27.41 p=<0.0001*
	Female	475(63.75 %)	270 (36.24%)	
Carries Bag Weight	<10 % of body weight	419 (50.79%)	406 (49.21%)	$\chi 2$=33.97 p=<0.0001*
	10-15% of body weight	283 (59.08%)	196 (40.92%)	
	>15% of body weight	207 (69.93%)	89 (30.07%)	
Simplified dietary gap assessment tool score (Total score =10)	≥ 8	173 (52.58%)	156 (47.42%)	$\chi 2$= 8.49 p = 0.014*
	6-7	484 (55.70%)	385 (44.30%)	
	≤ 5	252 (62.69%)	150 (37.31%)	

*p<0.05

The results of the univariate and multivariate logistic regressions are presented in Table 4 (Crude and adjusted odds ratios) and showed that musculoskeletal pain had a significant association with female gender, bag weight more than 10% of the body weight and Simplified dietary gap assessment tool score ≤ 5 out of 10.

TABLE 4. Risk factors associated with musculoskeletal pain among the study population using univariate and multivariate regression

Variables		Univariate Logistic Regression			Multivariate Logistic Regression		
		COR	95% CI	p	AOR	95% CI	p
Gender	Male Female	1.70	0.69-4.16	0.17	1.65	0.72-3.77	0.163
Carries Bag Weight	<10 % of body weight 10-15% of body weight > 15% of body weight	1.39 2.25	1 1.01-1.93 0.94-5.35	0.046* 0.060	1.29 2.04	1 1.05-1.58 0.90-4.62	0.025* 0.071
Simplified dietary gap assessment tool score (Total score =10)	≥ 8 6-7 ≤ 5	1.13 1.51	1 0.87-1.46 1.12- 2.03	0.33 0.006*	1.10 1.39	1 0.68-1.78 0.98-1.95	0.59 0.05*

*p<0.05

Discussion

The prevalence of musculoskeletal pain was 56.8% among the school going students of age between 10 to 19 years. In one study done in New Zealand, the musculoskeletal symptoms were reported by 77.1% of adolescent school students.[14] The cross-sectional descriptive study involving 532 pupils from six primary schools with a mean age of 13.6 years suggested that about 35.4% of the children reported that carrying the schoolbag was the cause of their musculoskeletal pain.[15]

The present study revealed that there is a significant association of pain among female participants in the $\chi 2$ analysis ($p < 0.0001$). 63% of females reported musculoskeletal pain as compared to 50% males. However, with the multivariate regression model the gender-wise difference was not found to be significant ($p=0.163$; OR1.65; 95%CI 0.72-3.77). In a community-based study in Maharashtra (India) conducted in children from various schools of the age group of 11 to 14 years, the musculoskeletal problems related to use of backpacks was more in females (66.53%) as compared to that of males (55.02%).[16] Females tend to have a higher prevalence of back pain (30%) and neck pain (33.9%) compared to that of males (25.7% and 23.8%) respectively.[17]

In the present study, it was observed that only 51% of students were carrying bag weight less than 10% of their body weight. As per the recommendation of The National Commission for Protection of Child Rights, measures should be taken to reduce the weight of school bags which the children carry. The suggestions for the junior classes included making month-wise

books with relevant chapters of all the subjects that will be taught in a particular month. It also suggested making changes in the Right to Education Act, 2009, so that children can avoid carrying more than 10 per cent of their body weight as their daily school bag.[18] A study involving Malta school students (aged 8–13 years), over 70% exceeded the recommended 10% bag weight to body ratio and out of which 32% complained of back pain, which was related to gender, body mass index and bag weight.[19]

The current study revealed that 29.9% students carried the bag weighing between 10-15% of their body weight have significant association of musculoskeletal pain than those students carrying less than 10% of their body weight in multivariate analysis. (p =0.025 OR 1.29 95% CI 1.05-1.58). The risk of getting musculoskeletal pain in the students carrying more than 15% of their body weight had two times higher than students carrying less than 10% of their body weight (p =0.071 OR 2.04 95% CI 0.90-4.62). This finding can be correlated with a similar study conducted in preadolescent children in Mangalore, India suggesting that bag pack weighing 15% of the bodyweight has an impact in the craniovertebral angle especially the head on neck angle, and head and neck on trunk angles affecting the posture.[4]

The overall data from the current study suggests that in single-site pain the shoulder pain 35.6% (570) was more prevalent whereas, in the two site pain complaints, shoulder and back 9.5% (153) was prevalent. Around 2.3% (38) participants complained of three site pains in neck, shoulder and back. The findings of single-site pain were similar with the studies conducted among children which also highlighted mostly the single-site such as most on shoulders (57.9%), followed by neck (44.3%), upper back (36.4%), lower back (35.0%), and rest arms, legs, knee and hip.[14]

In the present study, the dietary gap assessment tool[13] effectively overcame the challenge among the adolescents to understand the complex concept of portion size and frequency of food intake. It was found that the students having more dietary gap tend to develop musculoskeletal pain. In our study, the students having dietary gap score ≤5 have more prevalence of musculoskeletal pain from those students who had dietary gap ≥ 8 (p=0.05; OR 1.39; 95%CI 0.98-1.95). Similar Questionnaire-based studies in the form of Food frequency questionnaire is being used in one study conducted in Greece to assess the dietary calcium intake in common population.[20] Dietary gap analysis was conducted in Cameroon which can be of help in the development of strategies for both the supply and demand to achieve a healthy diet.[21]

Conclusion

The findings of the present study emphasised that the weight of the school bags needs to be restricted ≥10% of the bodyweight of the student. The dietary modification may be made in the daily intake of the food items so that the nutrient gap in the daily diet of adolescents can be minimised.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: The study was approved by:

· Institutional Ethics Committee of All India Institute of Medical Sciences, New Delhi, India bearing number IEC/555/9/dated 22/11/2017

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