



# A Cross-Sectional Study to Assess Effects of Schoolbag Weight and Musculoskeletal Health Problems in Primary School Students of Kolhapur

Rachhanaa S Pawaskar<sup>1</sup>, Snehdeep S Patil<sup>2</sup>, Ruchika Patel<sup>1</sup>, Puneet Kaur Dhaliwal<sup>1</sup>, Anjali V Wagh<sup>3</sup>

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#### Author's Affiliation:

<sup>1</sup>M.B.B.S; <sup>2</sup>Associate Professor; <sup>3</sup>Professor and Head, Department of Community Medicine, D Y Patil Medical College, Kolhapur

#### Correspondence

Dr. Patil Snehdeep S.  
dr.snehdeep@gmail.com

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## ABSTRACT

**Introduction:** Musculoskeletal pain in school children is becoming new topic of health concern. Government recommendation of safe load limit of schoolbag is 10% of body weight. The study aimed to determine the prevalence of musculoskeletal health problems in primary school students of Kolhapur.

**Methodology:** This school based cross sectional study included 886 primary students (age 6-10 years). Institutional Ethical Committee Consent, consent from School Authorities and parents was taken before conducting the study. Author-assisted questionnaire and a digital weighing scale were used as tools of assessment. Analysis was done using SPSS software and results were considered significant when  $p < 0.05$ .

**Results:** Of the 886 primary school students, 82.7% (n=826) carried schoolbags >10% body weight. 64% (n= 567) complained of musculoskeletal discomfort related to carrying their schoolbag.

**Conclusions:** Prevalence of musculoskeletal symptoms in students from English medium schools and Marathi medium schools was 77.4% & 36.9% respectively; prevalence of musculoskeletal symptoms is higher in CBSE (Central Board of Secondary Education) pattern schools (73%) than in SSC (Secondary School Certificate) pattern schools (55%).

The study provides practically feasible solutions to tackle the musculoskeletal health problems in primary school students and emphasizes on securing 'the health' in a healthy childhood.

**Keywords:** School children, Primary School, Body weight, Schoolbag weight, musculoskeletal health.

## INTRODUCTION

Musculoskeletal pain in school children is becoming a topic of growing health concern. Parents, school officials, and health professionals are worrisome regarding the carrying of schoolbags beyond the recommended safe load limits of 10% of body weight by school going children<sup>1</sup>. Competitive attitude of parents and society, as well as academic excellence as a parameter for future socioeconomic progression, has increased academic workload in children; which is reflected in increased schoolbag

weight. In 2009, the American Occupational Therapy Association and the American Physical Therapy Association recommended that schoolbag should not weigh more than 15% of the student's body weight; in 2012, this was changed to 10% of their body weight<sup>2</sup>. In 2015, the Government of Maharashtra recommended schoolbag weight limit of 10% of students' body weight<sup>1</sup>. The mean schoolbag weight reported in previous studies in other countries has a range between 4.7 kg- 9.3 kg<sup>3,4</sup>. The relative load carried by school children

expressed as percentage of body weight in these studies represents a range between 10% -22% body weight. Students carried 30% to 40% of their bodyweight at least once a week<sup>5</sup>. Most of the studies reported a high prevalence of musculoskeletal symptoms<sup>4-6</sup>. This alarming prevalence was linked to the schoolbag weight carried by the students<sup>7-13</sup>. Some studies on musculoskeletal discomfort related to schoolbag carriage reported a significantly higher reporting of pain by girls than boys whereas some studies found no significant gender difference<sup>14,15</sup>. In a study conducted in Chennai, India, an alarmingly prevalence of musculoskeletal pain in primary school students was 60.6% and 65.7% in male and female respectively<sup>15</sup>. Unavailability of locker facility for all students in schools, other accessories (lunch box, sports kit, drawing sheets, etc.) needed to be carried to school, increased homework, heavy and large textbooks, has not only increased the weight of schoolbags but also has led to an increase in the of schoolbag carriage. The peak rate of growth of musculoskeletal system occurs during childhood and puberty. The growth of the appendicular skeletal system is completed by 16 years and 18 years of age, in females and males respectively. But, it is after the mid twenties, that the secondary ossification of vertebrae is completed. In these years, through the process of ossification, skeletal tissue transforms from cartilage to bone. This transformation occurs in several stages and therefore, the developing bones are most vulnerable during this period. The spine is prone to injury for a greater length of time due to carriage of heavy schoolbags, necessitating the need of establishment of standard schoolbag weight to be emphasized and implemented during the formative years<sup>16</sup>. In 2005, a study including 140 high school students (mean age 13.6 years) of New Zealand, reported a prevalence of musculoskeletal symptoms in 77.1%; in the neck, shoulder, upper back and low back, respectively<sup>17</sup>. Indian studies report that 10%-30% teenagers experience back pain, especially low back pain<sup>18</sup>. Hence, following the principle of primordial prevention, the primary school students of 6-10 years age are target for study and creating awareness. A wide range of discrepancies in literature, prevailing scenario of the physically and academically burdened small, innocent sections of our society necessitated to understand and examine the epidemiology of musculoskeletal health problems among primary school students of Kolhapur. The study was aimed to determine the prevalence of musculoskeletal health problems and their association with schoolbag use in primary school students of Kolhapur, to implicate appropriate preventive measures and create awareness about the same among the students, parents and the schools.

## METHODOLOGY

This cross-sectional school-based study was conducted in five conventional schools in the city of Kolhapur from July to September, 2015. The schools were selected based on local feasibility and positive response from the schools.

- School A: Private English Medium School, followed CBSE (Central Board of Secondary Education) pattern.
- School B: Private English Medium School, followed SSC (Secondary School Certificate) pattern.
- School C: Government Marathi Medium School, followed SSC pattern.
- School D: Private Marathi Medium School, followed SSC pattern.
- School E: Private English Medium School, followed CBSE pattern.

A written informed consent was obtained from students' parents and schools. Out of the 950 consent forms distributed, 886 were returned; thereby contributing a sample size of 886 (n) students included in the study considering that they were primary school students (Day scholars) (Class 1-4) (Age group 6-10 years) and having ability to walk and wear school bag independently.

Students were having orthopaedic problems including foot or ankle deformities and leg length discrepancy or any child on chair or Congenital and structural abnormalities or neuromuscular disorders or those suffering from any acute illness or recovered from chronic illness in past 2 months or with history of any surgery in past 2 months were excluded from the study.

Data Collection was undertaken after taking Ethical Clearance from the University Ethical Committee. A surprise visit to the school was made for data collection. Data collection was carried out at the time of commencement of the school.

A digital weighing scale (with error of margin 100 grams) was used for the objective testing. The scale will be calibrated prior to the study. Also, a pre-tested Investigator administered questionnaire (translated into appropriate language) enquired the general information of the school, student; and a Body discomfort Chart was used to record the site of discomfort. This took less than 10 minutes to complete.

Data was entered into a computer using Microsoft Excel. Responses were analyzed using frequency distributions and descriptive statistics using SPSS software. Appropriate statistical tests were applied, results were considered to be significant when the p-value < 0.05.

**RESULTS**

886 students from five schools in the city of Kolhapur were included in the study. The weights of the students and their schoolbags were recorded.

Total Schoolbag weight = Gross weight of schoolbag + weight of other accessories.

Gross weight of schoolbag = Weight of textbooks + weight of notebooks + weight of schoolbag.

**Table 1: Class-wise distribution of average schoolbag weight and other components**

Class	Weight (kg)				
	Schoolbag	Gross weight	Textbook	Notebooks	other accessories
<b>I</b>					
Frequency (n)	201	201	201	201	201
Mean	3.891	3.014	1.22	1.151	.877
Standard Deviation	1.9616	1.6304	.739	.6579	.4863
<b>II</b>					
Frequency (n)	232	232	232	232	232
Mean	1.4919	3.697	1.54	1.558	1.122
Standard Deviation	4.819	1.3660	.710	.6375	.3737
<b>III</b>					
Frequency (n)	225	225	225	225	225
Mean	5.264	4.187	1.87	1.933	1.077
Standard Deviation	1.3954	1.3287	.739	.7525	.3436
<b>IV</b>					
Frequency (n)	228	228	228	228	228
Mean	5.707	4.471	2.02	1.863	1.237
Standard Deviation	1.5478	1.4149	.705	.5531	.4720
<b>Total</b>					
Frequency (n)	886	886	886	886	886
Mean	4.950	3.866	1.68	1.639	1.085
Standard Deviation	1.7291	1.5300	.782	.7185	.4394

**Table 2: Co-relation of socio-demographic variables and musculoskeletal symptoms**

Sociodemographic variables	Musculoskeletal symptoms		'p' value
	Present (n=567) (%)	Absent (n=319) (%)	
<b>Gender</b>			
Female (n=369)	238 (42)	131 (41)	0.792
Male (n=517)	329 (58)	188 (58.9)	
<b>Standard</b>			
I (n=201)	106 (18.7)	95 (29.7)	0.001
II (n=232)	153 (27)	79 (24.7)	
III (n=225)	158 (27.9)	67 (21)	
IV (n=228)	150 (26.5)	78 (24.4)	
<b>School Administration</b>			
Govt (n=87)	44 (7.76)	43 (13.47)	0.006
Private (n=799)	523 (92.23)	276 (86.52)	
<b>School Board</b>			
CBSE (n=444)	324 (57.14)	120 (37.61)	0
SSC (n=442)	243 (42.85)	199 (62.38)	
<b>School Medium</b>			
English (n=593)	459 (80.9)	134 (42)	0
Marathi (n=293)	108 (19)	185 (57.9)	

p value <0.05 indicate statistical significant

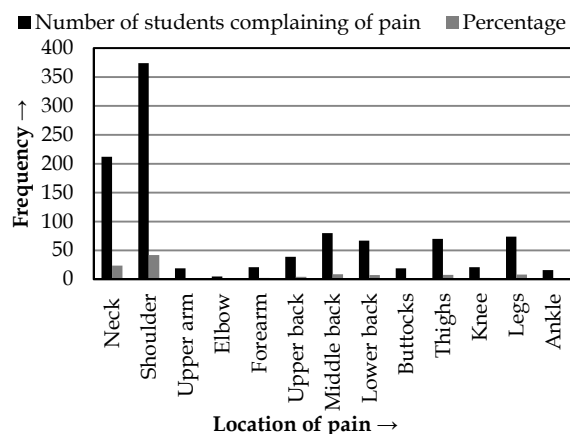
**Table 3: Association of musculoskeletal symptoms with schoolbag weight**

Schoolbag weight	Musculoskeletal symptoms		Total (n=886)
	Present (n=567) (%)	Absent (n=319) (%)	
10% of bodywt	16 (26.7)	44 (73.3)	60
>10% bodywt	551 (66.7)	275 (33.3)	826

Chi-square 38.921, df 1; p <0.001, Statistically significant

Total Schoolbag weight ranged from 0.6 - 10.3kg. Average total school bag weight carried by students was 4.95 kg. Average gross weight of schoolbag was 3.87 kg. Table 1 gives the class-wise distribution of average schoolbag weight and its components. Average total schoolbag weight was highest in students of class 4. The mean schoolbag weight as a percentage of mean body weight carried by the students was 22.4% (Standard Deviation = 8.94). Percentage body weight carried in schoolbags ranged from 3.85%-66.39% body weight. Out of the total students under study, 7.2% (n=60) students carried schoolbags which were less than or equal 10% of their body weight, 92.8% (n=826) students carried schoolbags which weighed more than 10% of their body weight. Average percentage of the weight contributed by textbooks, notebooks and other accessories was 55%, 27%, 18% respectively. 64% (n= 567) students complained of musculoskeletal discomfort related to carrying their schoolbag. Table 2 gives the co-relation of socio-demographic variables and musculoskeletal symptoms. Prevalence of musculoskeletal symptoms in Class I students is less than students studying in higher classes. Prevalence of musculoskeletal symptoms in students from CBSE schools is less than students from SSC schools. Prevalence of musculoskeletal symptoms in students from English medium schools is less than students from Marathi medium schools. Statisti-

cally significant relationship was found between the schoolbag weight carried and the discomfort complained by the student.



**Chart 1: Body Discomfort Chart Findings**

Table 3 shows relationship of schoolbag weight carried expressed in terms of percentage body weight (10% of body weight) to the musculoskeletal symptoms complained. Majority of the students (42.2%) reported discomfort in the shoulder region, followed by 23.9% reported in the neck with negligible percentages reported elsewhere. Chart 1 gives the findings of the body discomfort chart.

## DISCUSSION

Of the 950 consent forms issued, 93.2% (N=886) were returned and were eligible for inclusion in the study. The mean weight of schoolbags in the study was 4.95kg. The mean weight in this study is lighter than a study<sup>4</sup> which measured both third (7kg) and sixth formers (6.3kg). The wide range of schoolbag weights in this study, (0.6kg - 10.3kg) may be explained by the fact that some school children brought more books to school each day than others. In addition, some empty schoolbags may have been heavier than others. The weight of schoolbags ranged from 3.85%-66.39% body weights. This wide range may be attributed to the observation made regarding carriage of excess notebooks, textbooks to the school by the students. It was found that most of the students did not pack their schoolbags according to the school timetable regularly. In a study carried out in Italy<sup>19</sup>, mean schoolbag weight as a percentage of body weight carried by the students was 8.94, and reported a considerably lower percentage of 22% body weight carried. This discrepancy is mainly because Indian students are compelled to carry more schoolbag weight<sup>18</sup>. 64% of primary school students of Kolhapur reported discomfort due to carrying their schoolbag, parallel to a finding in most of the stud-

ies carried out internationally<sup>3</sup>. Prevalence of musculoskeletal symptoms in girls (64.5%) and boys (63.6%) was almost similar, since the age group under consideration was 6-10 years and the growth of musculoskeletal system isn't gender dependent in this age group. It was found that, the 65.5% students from private schools included study complained of musculoskeletal symptoms whereas 50.6% students from government school complained of musculoskeletal symptoms, suggesting need to create awareness regarding effects of schoolbag weight carriage in students studying in private as well as government schools. Students from English medium schools reported higher prevalence of musculoskeletal symptoms (77.4%) than those studying in the Marathi medium schools (36.9%). Students from schools following CBSE pattern reported a higher prevalence of musculoskeletal symptoms (73%) than those following SSC pattern (55%) one of the attributing factor for which may be heavy textbook, notebook weight. Thus, efforts need to be directed towards reducing the net textbook and notebook weight. In this study, 42.2% students had reported discomfort in the shoulder and 23.9% in the neck, whereas, higher levels of discomfort were reported in other studies<sup>13,17</sup>. Despite guidelines of the Maharashtra Government, regarding carriage of schoolbag weight of 10% of body weight of students, the musculoskeletal health problems in primary school students of Kolhapur continue to exist, suggesting strict implementation of the law, collective efforts of the school authorities and parents to create awareness in the students to help secure 'health' in their healthy childhood.

## CONCLUSIONS

The prevalence of musculoskeletal health problems is alarming in primary school students in Kolhapur. Majority of the students carry schoolbags more than the recommended safe load limits. The textbooks constituted for the maximum component of the schoolbag weight carried by the student followed by weight of notebooks and other accessories. Prevalence of musculoskeletal symptoms is higher in students from private schools, studying in English Medium schools and those studying in CBSE schools than those who studied in government school, Marathi medium schools and following SSC pattern. Musculoskeletal health problems mostly reported in the shoulder and neck region.

## RECOMMENDATIONS

Students should be encouraged to use schoolbags, and other accessories (lunch box, water bottle) which are made of durable but light-weight mate-



rials. Students should pack their schoolbags regularly according to the school timetable. They should not carry extra notebooks/textbooks to the school.

Parents should be urged to select schoolbags and other accessories (lunch box, water bottle) which are made of light-weight materials. Parents should keep a regular check on their ward's schoolbag, and make sure that he/she packs the schoolbag according to the school timetable and that no extra notebooks/textbooks are carried to the school.

In selecting textbooks, schools should take the weight of textbook into account.

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### Abbreviations:

CBSE: Central Board of Secondary Education  
SSC: Secondary School Certificate

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