# **Original Research Article**

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# Schoolbag weight limit: should there be a cut off?

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### **ABSTRACT**

**Background:** School children are at a development age and it is important that they do not carry excessive loads. Heavy school bags can change the body posture and the musculoskeletal system must react appropriately in order to compensate for this stress. There is still no consensus about a guideline for weight of school bags. The objective of the present study was to asses the bag weight in school going children, Compare the bag weight with the whole-body weight of children, Percentage of bag weight to whole body weight at different age groups.

**Methods:** 727 children (413 males and 314 girls) were examined from different schools in Davangere. Descriptive analyses and measures of central tendency were performed on the demographic data to describe the sample.

**Results:** Overall 21.7% of children carry a bag which is >25% of their body weight, 46.5% children are carrying a bag >20% of their body weight and 74.7% of children carry a bag of >15% of their body weight. 40.9% children between 8-10 years carry bag of >25% and 39.8% of them between 11 -13 years carry bag of >20% and this is statistically significant (p = 0.000).

**Conclusions:** The weight of schoolbags of school children were higher than the internationally acceptable standards in majority of school children. The school authorities and ministry of health should further evaluate and take the necessary steps to rectify the situation. Early intervention and good regulation can prevent long term complication.

Keywords: Bag weight, Regulations, School bag, School children

### **INTRODUCTION**

The majority of children on a daily basis use a backpack to transport their belongings to and from school. School children are at a development age and it is very important that they do not carry excessive loads. Heavy school bags can lead to change in the body posture and the musculoskeletal system in order to compensate for this stress must react appropriately.

There is still no consensus about a guideline for weight of school bags.<sup>1</sup> A report from Ireland mentions that it is

reasonable for school children to carry 10% of body weight.<sup>2</sup> Heavy school bags are one of the major factors that influence the incidence of musculoskeletal pain in school children.<sup>3</sup> Wearing a backpack or school bag heavier than 10% of one's body weight may cause shallowing of the lumbar lordosis and have a tendency towards a vertical position of the sacrum.<sup>4</sup>

There were no significant differences in FEV1 and FVC between free standing and the person with backpack of 10% body weight load. But, both FEV1 and FVC is reduced significantly when the student adopted the

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kyphotic posture and also when the load in the backpack was increased to 20% and 30% of body weight.<sup>5</sup> In order to promote safer staircase, use a symmetrical backpack with a load not more than 20% or not exceeding 10% in an asymmetrical single-strap athletic bag should be recommended for school children.<sup>6</sup> A Canadian literature review in 2004, has concluded that a limit of 10-15% of body weight is acceptable. The American Occupational Therapy recommends a limit of 15% of body weight.<sup>7</sup>

We conducted this study to see the weight of the backpack or the school bag of different age groups in different schools in Davangere, Karnataka. Later we analyzed the bag weight in percentage of whole-body weight in corresponding age group. The objective of the present study was to assess the bag weight in school going children. Compare the bag weight with the whole-body weight of children. Percentage of bag weight to whole body weight at different age groups

### **METHODS**

This is a descriptive cross section observational study conducted in different schools of Davangere district, Karnataka. Data was collected from different schools in Davangere. 727 children (413 males and 314 girls) were examined from different schools in Davangere. Proper consent was taken from the parents, school authorities before starting the study. Age was taken as per the completed years as on the school records. The children were subjected to full clinical assessment. The anthropometric measurements taken were height and

weight. Weight was measured in kilograms (kgs) using standard weighing machine. Weight was taken without footwear and with light clothes. Weighing machine was kept on absolutely flat surface and was calibrated before taking measurements.

Accuracy of the weighing machine was up to 100 grams. Any fraction of weight thus measured was corrected to the nearest kilogram. Standing height was measured by making the child to stand against a fixed calibrated rod with adjustable headrest. Height was measured without foot wear, with the children standing erect, looking forward with feet closed, back of head and body touching the rod. The measured height was then corrected to the nearest centimeter. Bag weight was also measured in the weighing machine.

Details were entered in the Excel sheet and later analyzed. Descriptive analyses and measures of central tendency were performed on the demographic data to describe the sample characteristics.

## **RESULTS**

727 children were examined and the age wise distribution. In Table 1, it can be noticed that there was a significant difference in the percentage of bag weight to body weight at different age groups.

Overall 22.5% of girls were carrying a bag of >25% of body weight and its maximum at 8 years of age where 50.8% of children carry bag >25% of body weight.

Table 1: Students carrying bags <10%, 11-15%, 16-20%, 21-25% and >25% of body weight.

Variable		Upto 10% of body weight	11-15% of body weight	16-20% of body	20-25% of body weight	>25% of body weight	Total
		n (%)	n (%)	Weight n (%)	n (%)	n (%)	
Gender	Male	42 (10.2)	64 (15.5)	126 (30.5)	95 (23)	86 (20.8)	413
	Female	23 (7.3)	54 (17.2)	75 (23.9)	82 (26.1)	80 (25.5)	314
Age	5	30 (66.7)	11 (24.4)	3 (6.7)	1 (2.2)	0	45
	6	0	4 (7.1)	14 (25)	23 (41.1)	15 (26.8)	56
	7	0	10 (13.9)	20 (27.8)	25 (34.7)	17 (23.6)	72
	8	1 (1.7)	2 (3.4)	10 (16.9)	16 (27.1)	30 (50.8)	59
	9	1 (1.2)	6 (7.5)	21 (26.2)	21 (26.2)	31 (38.8)	80
	10	0 (0)	5 (7.2)	15 (21.7)	22 (31.9)	27 (39.1)	69
	11	1 (1.8)	6 (10.7)	23 (41.1)	10 (17.9)	16 (28.6)	56
	12	2 (1.9)	16 (15.2)	32 (10.5)	34 (32.4)	21 (20)	105
	13	6 (6.1)	28 (28.6)	40 (40.8)	16 (16.3)	8 (8.2)	98
	14	18 (25)	26 (36.1)	19 (26.4)	8 (11.1)	1 (1.4)	72
	15	6 (40)	4 (26.7)	4 (26.7)	1 (6.7)	0	15
	Total	65 (8.9)	118 (16.2)	201 (27.6)	177 (24.3)	166 (22.6)	727

74% of children carry a bay weight of >15% of body weight. 46.9% of children carry >20% of body weight. Only 5 and 15 years of age group carry 66.7% and 40%

of body weight respectively. This explains that 21.7% of children carry a bag which is >25% of their body weight, 46.5% children are carrying a bag >20% of their body

weight and 74.7% of children carry a bag of >15% of their body weight, which is too high than the internationally accepted or recommended bag weight.

These are the children who will be prone to long term side effects of heavy bag pack.

Table 2: Students of different group carrying bags <10%, 11-15%, 16-20%, 21-25% and >25% of body weight.

Age (in years)	Bag weight percentage					Total	p value
	<10	10-15	15-20	20-25	>25		
5-7	30	26	36	51	30	173	
	17.3%	15.0%	20.8%	29.5%	17.3%	100.0%	
8-10	2	13	49	59	85	208	
	1.0%	6.3%	23.6%	28.4%	40.9%	100.0%	
11-13	9	50	97	61	42	259	0.000
	3.5%	19.3%	37.5%	23.6%	16.2%	100.0%	0.000
14-15	24	30	23	9	1	87	
	27.6%	34.5%	26.4%	10.3%	1.1%	100.0%	
Total	65	119	205	180	158	727	
	8.9%	16.4%	28.2%	24.8%	21.7%	100.0%	

Among children those between 8-10 years 40.9% of them carry bag of >25% and those between 11 -13 years 39.8% of them carry bag of >20% and this is statistically significant (p=0.000). This tells us that children in the middle school are most affected from the heavy school bags. The difference in bag weight percentage between male and female and it is not statistically significant (p=0.109). This tells that both the sexes are equally affected. Table 3 shows the mean body weight and mean bag weight at different age group with min and max bag weight of corresponding age. The overall min bag weight is 0.7 Kgs at 5 years of age and Max bag weight is 15.7 at 11 years of age.

Table 3: Mean body weight and mean bag weight at different age group.

Age	Mean weight	Mean bag weight	Min bag weight	Max bag weight
5	17.61	1.56	0.7	5
6	19.07	4.14	2.8	6.2
7	22.93	4.85	3.2	8.9
8	26.16	6.36	1.8	9
9	30.53	6.60	1.8	9.1
10	33.40	7.57	3.4	12.7
11	35.75	7.24	2.3	15.7
12	37.67	7.40	0.5	11.7
13	44.39	7.33	2	10.8
14	46.79	6.18	3	10.4
15	50.41	6.05	2	9.9

### **DISCUSSION**

Heavy school bags has been one of the prime causes of musculoskeletal system abnormalities in school going children, and it has been published in several article.<sup>3,4</sup>

Many studies have found that backpacks alter posture and gait significantly, produce modifications in the headneck angle, shoulder asymmetry and even lumbar lordosis. These biomechanical alterations could induce the appearance of chronic pain and back pathologies in the long term. The surge in the incidence of kyphosis and related respiratory difficulties in children has raised an alarm for ensuring strict guidelines on capping of the weight of schoolbags which our children are routinely carrying has been cited in international article.<sup>5</sup>

A school backpack weight exceeding 10% is associated with higher incidence of back pain and back pathology published in BMJ journals Grimmer et al observed that girls were more prone to have changes in the craniovertebral angle when carrying a backpack and this association became stronger with age. 8.9 A study performed in Northeast England in 2002 showed a low back pain prevalence of 24%, with girls posing a higher prevalence compared with boys. 10 Another study performed in Italy by Negrini and Negrini found that 11-year-old children carried backpacks as heavy as 20% of their body weight, and also that 58.4% had experienced back pain more than once in their lifetime. 3,11 Experts recommend that school children should not carry loads exceeding 10% of their body weight. 12

A cross sectional descriptive observational study was performed in Davengere, Karnataka. The results were analyzed and compared it with several studies done in other countries to bring out the consensus over guidelines for schoolbags weight restriction in order to prevent long term effects on children. Some studies have shown that an individual with back pain in adolescence is more likely to develop low back pain in adult life or that heavy backpacks can cause neck, shoulders and back muscular problems, such as scoliosis.<sup>13</sup>

### **CONCLUSION**

The weight of schoolbags of school children were higher than the internationally acceptable standards in majority of school children. The school authorities and ministry of health should further evaluate and take the necessary steps to rectify the situation. Early intervention and good regulation can prevent long term complication.

### Recommendations

We should have a school bag policy, set by the education board/ health authorities. Parents and teachers should frequently check the contents of school bag, to avoid un necessary luggage. School time table should be modified to reduce the bag weight. Two strap bags should be used instead of single strap bag.

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Institutional Ethics Committee

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