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Research Paper

Assessment of various contributing factors for back pain in children while carrying school bags

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■ **ABSTRACT :** It is common today to see school children buckling from weight of their school bags, many children bear the burden of carrying school bags that are to heavy for their body frames, that might end up facing a number of health problems. The objectives were to assess the school bag weight and body weight to get the MASW(maximum acceptable school bag weight) and to investigate contributing factors of back pain felt by children carrying school bags. The study was conducted on a sample of 120 school children from middle class (*i.e.* from vi to viii) and on their mothers. Respondents were randomly selected from five government and five private schools of Ludhiana city form the age group of 11-14 years. A pre structured interview schedule was used to get the data to achieve the objectives. Results show that only 54 respondents were following the standard value of MASW, which is >15 per cent of the body weight. Average total time was 46 min to carry school bag and standard deviation was 9.40. It was observed that half of the respondents carrying school bags with one or both strap in one shoulder. Total distance covered by the respondents from home to school and *vice versa* was 218 meter in 46 minutes.

■ **KEY WORDS:** Back pain, BMI, Height, Body weight

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Back pain in children is much more likely to have a serious underlying disorder compared with adult back pain and deserves careful attention Unfortunately the diagnosis of serious disease causing back pain in children is often made late or missed completely. Pascoe *et al.* (1997) found that the prolonged carrying of heavy backpacks could lead to symptoms of body soreness, aches, pains and tiredness in children. The effect of loads carriage on posture during stair walking was studied (Hong *et al.*, 2003) and found that when the load is 10 per cent or greater of the body weight, it induced greater trunk-forward inclination in subjects on ascending stairs.

In 2010 in Greece a study was conducted on 703 boys and girls aged 6 to 14 years and body weight, standing height and school bag weight were measured and perception regarding school bag load were obtained using reliable questionnaire (Kellis and Emmanouilidou, 2010). Study showed that, younger students were almost 5 more times more likely to carry heavier bags, the girls were twice more likely to experience fatigue when carrying school bags compared with boys. They

concluded that, younger children are in greater need for education about schoolbag weight compared with older one. And there is also evidence that girls might experience more problems when carrying their schoolbag compared with boys. Therefore the present study was undertaken with the following objectives:

– To assess the school bag weight and body weight to get the MASW (maximum acceptable school bag weight)

– To investigate contributing factors of back pain felt by children carrying school bags.

■ RESEARCH METHODS

The study was conducted in Ludhiana city. Two zones were randomly selected out of four zones; further five governments and five private schools were selected randomly from these two zones. A sample of 120 students and their mothers were taken from these selected schools from class (*i.e.* vith to viiith). The age group was 11- 14 years. To achieve all the objectives questionnaire was formulated and based on these questions information was collected from school children and their mothers.

■ RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Measurement of the school bag weight and percentage to body weight :

Body weight:

It was found from Table 1 that nearly half of respondents (50.83%) had body weight between 35-48 kg, followed by 23-35 kg (26.67%). Whereas, 22.50 per cent of respondents had body weight in a range of 48-60 kg and average body weight was 40 kg with standard deviation of 7.03.

Height:

The height of 47.50 per cent of respondents was between 1.43-1.57 meter (Table1) and 29.17 per cent of respondents were having the height in the range of 1.57-1.71 meter. Whereas, 23.33 per cent of respondents had height between 1.29-1.43 meter. The average height was 1.50 meter with standard deviation of 0.13.

BMI (Body mass index):

Table 1 shows that nearly half of the respondents (48.33%) had BMI in between 20-25 kg/m^2 followed by 11-16 kg/m^2 (26.67%). Only 25.00 per cent of respondents had BMI range of 16-20 kg/m^2 and average BMI was 18 kg/m^2 with standard deviation of 3.16.It was further observed that BMI of 42.50 per cent of respondents was according to standard BMI which is 18.5-24.9 kg/m^2.

Weight of empty school bags (g):

Table 1 revels that average weight of empty bag was 550.42 g with standard deviation of 157.43. It also shows that majority of respondents (60.00 %) had empty bag weight between 500-800 g, followed by 800-1200 g (20.83 %) and 19.17 per cent had 1200-1500 g empty bag weight.

Weight of full bag (kg):

Regarding the weight of full bag, it was found that maximum number of respondents (37.50 %) had bag weight between 7-8 kg, followed by 6-7 kg (36.67%). Only 25.83 per cent respondents had full bag weight between 8-9 kg with average bag weight of about 7 kg with standard deviation of 1.39 (Table 1). Moore *et al.* (2007) reported that heavy weight of school bag can cause shoulder, neck and back pain.

Data enfolded in Table 1 also reveal that more than half of respondents (55.00 %) were not fulfilling standard MASW which is <15 per cent of body weight. In a study conducted in India, it was found that the mean bag weight carried by urban school children is approximate 7 kg which is 17 per cent of their body weight and for rural school children it was 3.2 kg (Rageswarihariharan *et al.*, 2009).They also suggested that carrying a schoolbag weighing 15 per cent of body weight changes all the postural angles in preadolescent children. Brackley *et al.* (2009) also reported that significant changes occurred in TFL (Trunk Forward Lean) and CVA (Cranio-Vertebral Angle) when the backpack was loaded to 15 per cent body weight.

Investigation of the method of carrying school bag:

Method of carrying school bags:

The method of carrying school bags from Fig. 1 highlighted that nearly half of respondents (54.17%) were carrying one or both straps on one shoulder and less than half respondents carrying it on both shoulders (45.83 %). Carrying a schoolbag over two shoulders is

the most efficient means of carriage, but often schoolbags are carried over one shoulder (Connolly *et al.*, 2008). Howard (2006) also reported that carrying school bag in one hand has been reported to be the most inefficient method, as it requires an energy expenditure of more than twice that of the school bag method.

Obsevations regarding total distance covered by respondents from home to school :

Distance covered from home to waiting point (meter):

Table 2 showed that half of the respondents (52.78%) covered 100-150 meters distance from home to waiting point and rest (47.22%) had travelled distance between 50-100 meters. Average distance was found 117.50 meters with standard deviation 15.50.

Method of carrying school bag at waiting point:

It was observed from Table 2 that maximum numbers of respondents (55.56%) were carrying their school bags with both straps on both shoulders and nearly 44.44 per cent were carrying school bags on one or both straps on one shoulder. Howard (2006) reported that

Table 1 : Measurement of the school bag weight and the percentage to body weight

Weight(kg)						
23-35	28	46.67	04	6.67	32	26.67
35-48	27	45.00	34	56.67	61	50.83
48-60	05	8.33	22	36.67	27	22.50
Average	35		46		40	
S.D.	±8.24		±6.29		±7.03	
Height(m)						
1.29-1.43	28	46.67	-	-	28	23.33
1.43-1.57	26	43.33	31	51.67	57	47.50
1.57-1.71	06	10.00	29	48.33	35	29.17
Average	1.44		1.56		1.50	
S.D.	±1.10		±0.15		±0.13	
BMI (Weight/Height) (kg/m^2)						
11-16	26	43.33	06	10.00	32	26.67
16-20	13	21.67	17	28.33	30	25.00
20-25	21	35.00	37	61.67	58	48.33
Average	17.87		19		18	
S.D.	±3.45		±2.44		±3.16	
BMI(Weight/height) (kg/m^2)						
18.5-24.9	19	31.67	32	53.33	51	42.50
Weight of empty school bag (g)						
500-800	37	61.67	35	58.33	72	60.00
800-1200	10	16.66	15	25.00	25	20.83
1200-1500	13	21.67	10	16.67	23	19.17
Average	559.17		541.67		550.42	
S.D	±160.10		±155.36		±157.43	
Weight of full bag(kg)						
6-7	17	28.33	27	45.00	44	36.67
7-8	20	33.33	25	41.67	45	37.50
8-9	23	38.33	08	13.33	31	25.83
Average	7.29		6.40		6.84	
S.D	±1.60		±1.17		±1.39	
Respondent fulfilling standard MASW(maximum acceptable school bag weight) (<15% of body weight)						
Yes	17	28.33	37	61.67	54	45.00
No	43	71.66	23	38.33	66	55.00

carrying school bag in one hand has been reported to be the most inefficient method, as it requires an energy expenditure of more than twice that of the school bag method.

Total distance covered from school gate to classroom (meter):

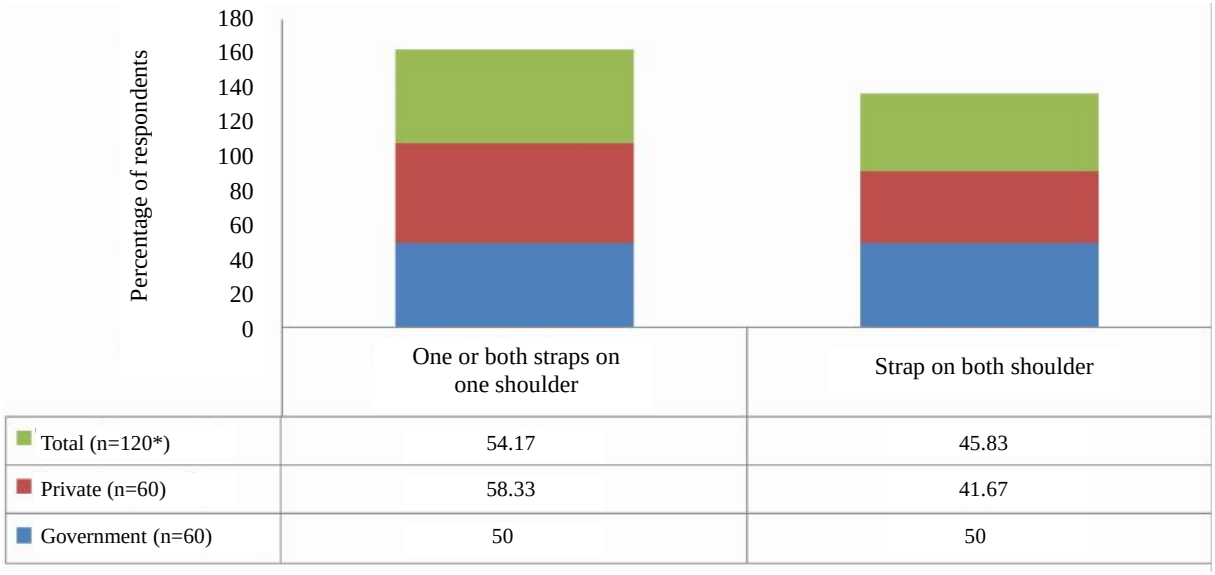
The data presented in Table 2 reveal that nearly 57.50 per cent covered 100-200 meter followed by 30.00 per cent covered 50-100 meter and 12.50 per cent covered less than 50 meter from school gate to classroom. Average distance covered was 100 meter and standard deviation was observed 20.78. Chansirinukor *et al.* (2001) examined posture of high school students under the different load condition, revealed that both school bag weight and time carried influenced cervical and shoulder posture.

Over all time to carry school bag from home to classroom/day by respondents (minutes):

Data enfolds in Table 2 indicate that half of respondents (50.00 %) carried school bags for 20-25 minutes per day from home to classroom followed by 15-20 minutes (28.33%) and 10-15 min per day (21.67%). It was also observed that average time to carry school bag was 21 min per day and standard deviation

Table 2 : Observation regarding total distance covered by respondents from home to school

Distance covered from home to waiting point while carrying school bags (meter)	Government (n=13)		Private (n=23)		Total (n=36)	
	Number	Percentage	Number	Percentage	Number	Percentage
50-100	06	46.15	11	47.83	17	47.22
100-150	07	53.85	12	52.17	19	52.78
Average	125		110		117.50	
S.D.	±12.20		±17.20		±15.50	
Method of carrying school bag at waiting point						
Strap on both shoulder	11	84.62	09	39.13	20	55.56
One or both strap on one shoulder	2	15.38	14	60.87	16	44.44
Total distance covered from school gate to classroom while carrying school bags (meter)						
<50	10	16.67	05	8.33	15	12.50
50-100	16	26.67	20	33.33	36	30.00
100-200	34	56.67	35	58.33	69	57.50
Average	100		100		100	
S.D.	±20.43		±21.50		±20.78	
Over all time to carry school bag from home to classroom/day(minutes)						
10-15	17	28.33	09	5.00	26	21.67
15-20	19	31.67	15	25.00	34	28.33
20-25	24	40.00	36	60.00	60	50.00
Average	22		20		21	
S.D.	±5.33		±3.40		± 4.67	
Over all time to carry school bags while returning from school to home/day(minutes)						
10-15	05	8.33	04	6.67	09	7.50
15-20	28	46.67	28	46.67	56	46.67
20-25	27	45.00	28	46.67	55	45.83
Average	26		24		25	
S.D.	± 6.09		± 4.36		± 5.39	
Total time to carry school bags/day(minutes)						
20-30	14	23.34	04	6.67	18	15.00
30-40	17	28.33	26	43.33	43	35.83
40-50	29	48.33	30	50.00	59	49.16
Average	48		44		46	
S.D.	± 7.09		±4.70		±9.40	



	One or both straps on one shoulder	Strap on both shoulder
Total (n=120*)	54.17	45.83
Private (n=60)	58.33	41.67
Government (n=60)	50	50

Fig. 1 : Investigation of the method of carrying school bag

was 4.67.

Over all time to carry school bag returning from school to home/day by respondents (minutes):

Table 2 shows that nearly 46.67 per cent respondents carried 15-20 min per day while returning from school to home followed by 20 -25 min per day (45.83%) and 10-15 min per day (7.50%). The average time while returning home from school while carrying school bag was 25 min per day with standard deviation was 5.39.

Total time to carry school bags/day by respondents (minutes):

Table 2 highlight that half of the respondents (49.16 %) took 40-50 min per day to carry school bags followed by 30-40 min (35.83%) per day to carry school bags, whereas 15.00 per cent of the respondents had taken 20-30 min to carry school bag/day. Average total time was 46 min to carry school bag and standard deviation was 9.40. Grimmer *et al.* (2000) also found positive association between longer periods spent carrying backpacks and Low back pain. Haselgrove *et al.* (2008), observed that Almost half of participants carried their school bag for more than 30 minutes per day with 85 per cent carrying their bag over both shoulders. School bags were felt to be heavy by 54 per cent and to cause fatigue by 51 per cent. They concluded that, neck pain is also very common as back pain between adolescents. The school bag load, duration of carriage and method of transport to school are associated with back and neck pain.

Conclusion :

Results revealed that BMI of most of the school children was 42.50 kg/m^2 and weight of school children was 6.84 kg. Results further show that only 54 respondents were following the standard value of MASW, which is >15 per cent of the body weight. Average total time was 46 min to carry school bag and standard deviation was 9.40. It was observed that half of the respondents carrying school bags with one or both strap in one shoulder. Total distance covered by the respondents from home to school and *vice versa* was 218 meter in 46 minutes.

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