Original Article

Effect of Heavy School Bags on the Health of Children

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ABSTRACT

Objective: To evaluate how much the backpacks of elementary school children weigh and the percentage of body weight represented by them. To determine the attribute of school backpacks and key out the methods of carrying backpacks.

Study Design: Cross sectional study.

Materials and Methods: This is a cross sectional study conducted on school girls and boys of age between 5-15 years during April 2008 to Sept 2008 in Karachi. Sample of 660 students was taken. Students were interviewed with structured pre-tested questionnaire asking about: How they travel to & from school (walk/transport)? How they carry bags? If they have pain due to bag carriage? Where they feel pain (shoulder/neck/back)? Do they consult doctor for pain? How many days they remain absent from school due to pain? How they get relief from pain?

Results: School bags averaged weight is 4.9 kg. Related to body weight of the students, school bag represented an average weight of 18.00% .The maximum value for bag weight relative to body mass was 48%.About 89.1% of students carried bags weighing more than 10% of their body mass. Bag surface area ranges from 87 cm in the first grade to 2322 cm in the 7th grade. The maximal ratio of Bag surface area to student's trunk area was 266.27.The proportion of students who experienced bodily pain due to back pack carriage was 67%.Regarding intensity of pain; 40.5% students had complain of mild pain, 17.4% students had complain of moderate pain, while 10.8% had severe intensity of pain. The average bag weight of students relative to their body weight who felt pain was 19.00% of their body weight while the average bag weight of students relative to their body weight who did not felt pain was 17.21% .Our research analysis shows that 7% students were absent from school due to pain.6% of students visited doctor with complain of pain.

Conclusion: School students of Karachi 5-15 years old seem to carry substantial backpack loads, which represent more than 10 percent of children's body weight.

Key Words: school students, backpack, Karachi, pain, transport.

INTRODUCTION

Almost in registered 150,000 Elementary schools of Pakistan 27.5 million children and about 9000 registered schools of Karachi 2.5 million children carry book bags on their shoulders 5-6 days per week for the entire academic year. Though these bags weigh significant weight putting these dedicated children in discomfort, unfortunately this issue was not yet noticed. In a normal routine schedule these children carry huge piles of books and other stationary items most probably packed and fitted in an improper way. Irrespective of the maneuvers including for how long these heavy backpacks being carried by these children, design of a bag itself including number of straps its surface area whether wheeled or not, method of wearing, the books themselves contribute a considerable weight to these back packs causing bodily pains.

Keeping in mind the weight and the bodily pains caused by these heavy backpacks it is not false to say that these overloaded back packs are responsible for distortion of the posture including lost of the natural curve of the spine and rounding of the shoulders[3,4]. If such risk persists over many schooling years, it can cause chronic back problems[2,5,7] that may extend into adulthood. A research indicates that back packs loads represent a significant percentage of child's body weight[1,2]. A heavy school bag, especially when it is slung over one shoulder, can lead to muscle strain distortion of natural curve of spine and rounding of the shoulders[3,4]. In fact backpack, weight measure as a percentage of body weight was effective in predicting back pain in adolescents[7] Most of the students have a backpack big enough to hold books for 7-8 periods. Text books are not light which means they may be carrying 20-40 pounds on their back. Although this way of carrying books on shoulders by these innocent children is in front of entire society, it remained un- noticed by us it might not show any harmful aspect but we cannot ignore what our young generations is complaining about. We carried out a research by keeping in mind this statement which was revealed and later proven by the previous researches that the children should carry no more than 10% of their body weight 5,[6,8-10]. Another research reveals an alarming danger associated with children's improper backpack use and problems like LBP (lower back pain), posture deformities, decrease in growth spurt, increase number of falls, and even pulmonary dysfunction have been noticed in school going children[4]. Previous researches have been shown

that child back being damaged because of:
1)School bag that weights more than 10% of child's weight.2) Holding the bag in one hand by its strap.3) Carrying the bag over one shoulder.4) An incorrectly packed backpack. 5) An incorrectly fitted backpack.6) Carrying too many copies, books and other school supply. In Pakistan, the extent of this problem has not been yet investigated, though anecdotal evidences for the heavy loads of school bags have been surfacing in the media for some times. Therefore, the purposes of the present study were to investigate the percentage of body weight represented by school bags, to determine the size of school bags relative to trunk size, and to identify the methods of carrying book bags by elementary school children in Karachi.

MATERIALS AND METHODS

Type of Study: Cross sectional study by using simple random sampling technique.
Duration of Study: Three months.
Data Collection: Students were interviewed with structured pre-tested questionnaire asking about: How they travel to & from school (walk/transport)? How they carry bags? If they have pain due to bag carriage? Where they feel pain (shoulder/neck/back)?Do they consult doctor for pain? How many days they remain absent from school due to pain? How they get relief from pain?
Physical Examination: Physical examination of students was also done: Body weight was measured without shoes in kg by using bathroom scale. Standing height was measured barefooted in cms by using unstretchable measuring tape. We also measured biacromial width & trunk height in cms. Trunk area was calculated by multiplying biacromial width with trunk height.BMI was also determined.
Examination of Bag: Weight of school bags was measured in kg by bathroom scale.The height & width of school bags were measured using unstretchable measuring tape. Total area of school bags then calculated as its length multiplied by its width
Universe of Study: This is a cross sectional study conducted on school girls and boys of age between 5-15 years during April 2008 to Sept 2008 in Karachi. Convenient sampling technique was selected. Study was conducted in schools of following towns of Karachi,Bin qasim town,Baldia town,Gulshan town, Gulberg town,North Nazimabad town,Korangi town.
Sampling Technique: Our target was student's b/w grade 1 to 7.Sample of 660 students was taken and 87 from grade 1, 118 from grade 2, 99 from grade 3, 108 from grade 4, 102 from grade 5, 71 from grade 6 & 75 from grade 7. Written consent was taken from principals of selected schools.
Inclusion Criteria: Students in b/w age 5-15 years.
Exclusion Criteria: Students below 5 & above 15 year of age were excluded from the study.
Analysis: Data entry & statistical analysis were performed using SPSS Program version 10 and 16.Data were reported as mean & standard deviation or as percentages.

RESULTS

A total of 660 school students were tested spanning from 1st to 7th grade. Among them, girls were 53% and boys were 47%.

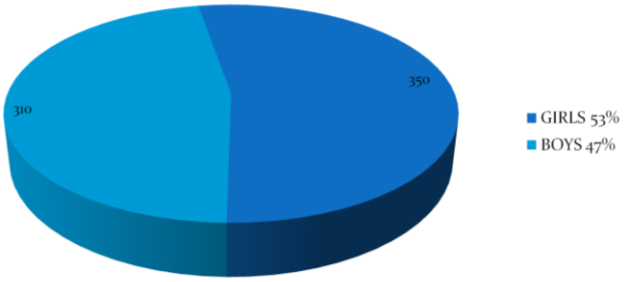

Figure No.1: Gender

We have divided the students in 3 age groups; Ist group includes 23% students of age 5-8 yrs ,2nd group includes 49.5% students of age 9-11 yrs,3rd group includes 27% students of age 12-15 yrs.

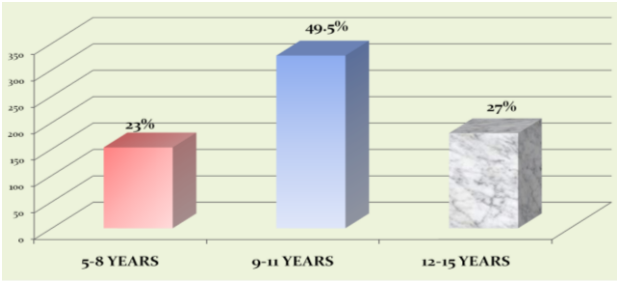

Figure No.2: Age Grouping

The study findings revealed that the majority 72.7% of the students walk to and from school and only 27.3% travel by transport.

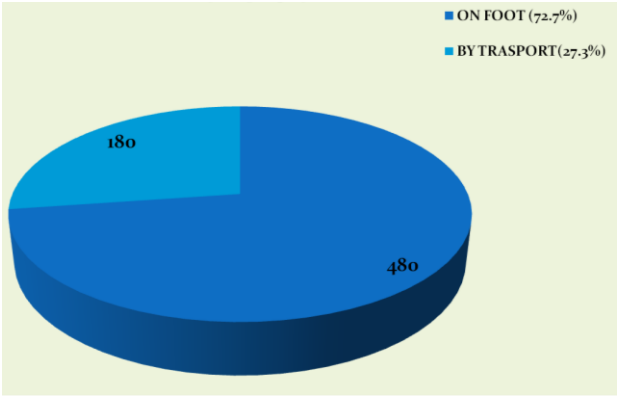

Figure No.3: Transport

School bags averaged weight is 4.9 kg. The maximum weight recorded for school bags was 13 kg. Related to

body mass of the students, school bag represented an average weight of 18% .The maximum value for bag weight relative to body mass was 48%.

Table No.1: Valid & age with standard deviation

Questions Asked	Valid % age	Standard deviation
Transport		
By transport	27.3	0.446
On foot	72.7	
Bag Type		
Single Strap	80	0.407
Double Strap	19	
Trolley bag	1	
Feeling Pain		
Yes	67	0.707
No	33	
Site of Pain		
Neck	17.2	0.499
Shoulder	96	
Lower back	9.2	
Intensity of Pain		
Mild	40.5	0.660
Moderate	17.4	
Severe	10.8	
Absent from School	7	0.626
Days Absent		
Once	3	0.498
Twice	3	
Thrice and more than thrice	1	
Frequency of Visits to Doctors Office in last Three Months		
Once	3	0.538
Twice	2	
Thrice	1	
More than thrice	1	
Pain Relieved		
By itself	56	1.136
By taking rest	35	
By taking medications	9.37	

About 89.1% of students carried bags weighing more than 10% of their body mass ,63.3% carried more than 15%,32.9% carried more than 20% ,10.8% carried more than 25% ,6.1% carried more than 30%,2.7% carried more than 35% and 1.2% carried more than 40%.

There was slight variation in bag dimensions among school graders. Bag surface area ranges from 87 cm in the first grade to 2322 cm in the 7th grade. The maximal ratio of Bag surface area to student's trunk area was 266.27.

80% of students used double strap bags, 19% of students used single strap bags and only 1% of students used trolley bags.

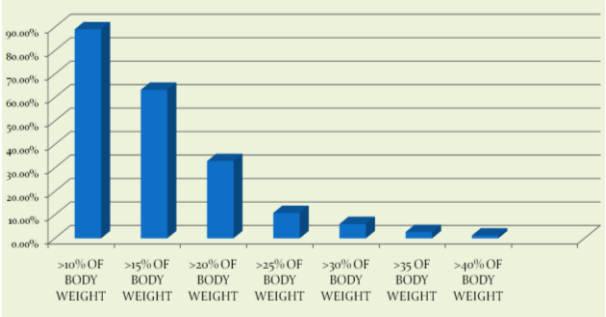

Figure No.4: Percentage of Bag weight relative to Body Weight

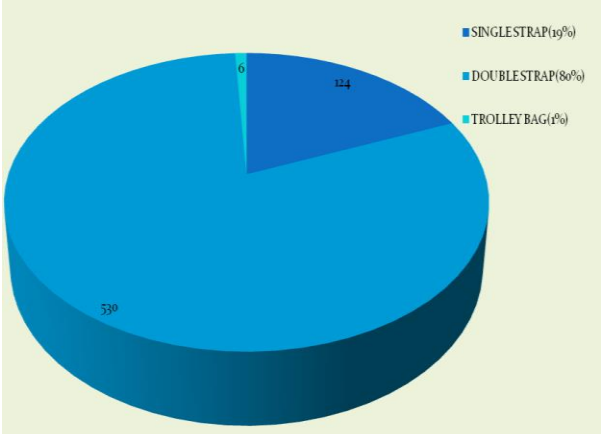

Figure No.5: Bag Type

Regarding the body weight,73% boys and 74.3% girls were normal, 24% boys and 24.3% girls were underweight and 2% boys and 1.4% girls were obese

Regarding body height, 76.5% boys and 74.1% girls were normal, 4.9% boys and 6% girls were tall and 18.6% boys and 19.8% girls were stunted.

The average bag weight of students relative to their body weight who felt pain was 19.00% of their body weight while the average bag weight of students relative to their body weight who did not felt pain was 17.21%

Our research analysis shows that 7% students were absent from school due to pain. Among them 3% students were absent once, 3% for 2 times and 1% for 3 times and more than 3 times in last 3 months. Pain in 56% students relieved by itself, in 35% relieved by rest and in 9.37% relieved by taking medication.

Table No.2: T-test for equality of means

Bag weight related to body weight	T-test for equality of means			
	T	DF	Sig.(2 tailed)	Mean Difference
Equal variances assumed	2.628	652	0.009	1.5661
Equal variances not assumed	2.653	429.491	0.008	1.5661

Table No.3: T-Test for Std. deviation and Std. error mean

Feeling of Pain	Total no of students	mean	Std. deviation	Std. error mean
Bag wt relative to body wt ;				
Yes	441	19	7.2041	0.3431
No	213	18	7.0118	0.4804

6% of students visited doctor with complain of pain. Among those students who visited doctors in last 3 months 3% visited once, 2% twice,1% thrice and 1% more than thrice.

Table No.4: Independence Sample Test

Bag wt relative to body wt	Levene's test for equality of variances	
Equal variances assumed	F	Sig.
Equal variances not assumed	0.141	0.707

DISCUSSION

The research has revealed some interesting findings of school children of age 5-15 years carry loads on their shoulders averaging nearly 18.23% of their body mass. Moreover, school bags, relative to the student's trunk area, were shown to be oversized, especially for the younger students. The American Chiropractic Association (ACA) recommends limiting the back packs weight to no more than 10% of the child's body mass. The present investigation showed that about 67% students were experiencing bodily pain. Pain was felt more frequently by girls 71.1% and less frequently by boys 61.3% and those carry bag on one shoulder 18.8%.Findings from Puckree et al who reported more pain in children carrying bags on 2 shoulders. Other researchers found that time spent carrying the back pack is associated with back pain the most.Our findings indicate that 80% of the students carried their backpacks on two shoulders. Moreover, Approximately 1% of the students in our study used wheeled bags. Present report demonstrated that 27.3% of the children travel to and from the school by transport. School students of Karachi 5-15 years old seem to carry substantial backpack loads, which represent a significant percentage of children's body mass. Almost 89.1% of the students in this study carried backpack weighing more than 10% of their body mass. Majority of the students carry their bags on 2 shoulders. 2/3rd of the student's experienced bodily pain; mostly on shoulders due to school bag carriage.81 visits were paid to Doctors because of these complains in last 3 months meaning 324 visits/year only by these 660 students. We will extrapolate these findings it will become 1.2 million visits by students of Karachi only & 13.5 million visits by students of Pakistan to doctor/year. If we estimate the financial implication of these visits, estimating an expense of Rs: 50/= per visit. It comes about Rs. 675 million per year. If we estimate that only 1/4th of this amount are being expensed on import of medicines, it comes to about Rs.169 million per year.

Recommendations

Backpack weight is limited to no more than 10% of child's body mass.Students should avoid carrying their bags on single shoulder and have backpacks properly packed and fitted.It was further noticed in our study that percentage of underweight students are significantly high (24% students weight fall less than 5th percentile in growth chart) as well as percentage of stunted students were also high (19% boys & 20% girls fall below 5th percentile in growth chart.)Keeping in mind that all these students were from private schools meaning poverty/under nutrition is not the major contributor. This high percentage of underweight and stunted students indicate a major mismatch b/w the standard weight and height of our children as compared standards given to the growth charts of Harvard.We recommend a broader study to compare these standards.

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