The Ideal School backpack: It's just a weight problem

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Abstract
Objective: *Primary school students are exposed to carrying backpack loads beyond the recommended safe load limits. The aim of this study is to assess the weight represented by school children backpacks in relation to student body weight in governmental schools in AlmadinahAlmonawara, KSA and the average weight of backpacks carried by school children.*
Methods: *A descriptive cross-sectional study was conducted by a multistage random sampling technique on 306 primary school students during their school year. The data were collected by a structured interview schedule consisting of demographic variables, height, student weight, weight of the backpack, and body mass index BMI.*
Results: *306 participants, the average weight of the students was 30.76 kg, average height 1.3 mts and mean Body Mass Index (BMI) was 17.51. Actual School backpack weight was heavier than Ideal school backpacks weight on average of 0.29 Kgs. 57.51 % of the students carry heavy school backpacks, 32% carry standard school backpacks whereas only 10.45% of the students carry light backpacks.*
Conclusion: *The primary school students in the study were exposed to heavy school backpacks which pose a risk to their physical health. For the elimination of this problem, more efforts are necessary from parents and at the school administration level.*
Keywords: *primary school; heavy backpack; backpack weight; load carriage; children.*

I.   Introduction

To increase knowledge of backpack safety and movement to do something about it. A heavy backpack can cause changes in the shape of bones, which can cause permanent damage(5).

Backs or shoulders of school children can put pressure on their joints and ligaments and may be associated with several potential health consequences including bad posture, back strain, and eventually low back pain (6)(7).

Concern regarding school backpack carriage is that the size and shape and therefore the physical capabilities of school students vary considerably. These are also different from adults as a result of their growing skeletons, the biomechanical, physiological and physical effects of load carriage on students (8). There is evidence to support the idea that backpack use and associated health problems are common among school children(9). There was an association with school children's backpack and back pain supported by many types of research (10). Regardless of whether a child carries the backpack on one shoulder or two and whether the child is a male or a female, backaches were reported by all the children(11). Also, the student who carried a backpack weighing 15% of body weight can change all the postural angles (12).

We can change the behavior of students towards carrying heavy school bags to prevent health problems resulting from this, and that is possible, according to many types of research (13).

II. Materials and Methods

This is a cross-sectional descriptive research study that includes 306 students studying in grade 1 to grade 6 in governmental school.in Al MadinahAlmnoura Saudi Arabia.

Study population:
In Al MadinahAlmnoura Saudi Arabia 306 girl students from grade first to grade six, 44 students were including from both grade first and grade second, 62 students participated from grade third, grade fourth 53 where 60 students were from grade fifth and 43 students were from grade sixth. Students were selected on convince basis

Inclusion criteria:
Students of selected schools willing to participate, age group 6 to 12 yrs. and they are in grades one to six.

Exclusion criteria:
A student who was not available at the time of data collection, who was not carrying their school backpack on their own and/or have a physical problem, students with congenital deformity and/or history of accident.

Sampling and sample size:
A non-probability convenient sampling technique was used in this study to recruit a sample of 306 students studying in grade 1 to grade 6 in the primary governmental school of girls.

Instruments:
Data instruments constructed to gather information about the backpacks. Body dimensions to measure body mass index. Then their weight was measured without shoes and jackets.

Data collection:
Structure interview schedule to assess demographic variables. The variables considered in the collection of the information were: gender, age, and assign number for the student instead of their name height, the weight of the backpack, the student weight, body mass index BMI. The grade level of each student was registered body weight and backpack weight was measured with electronic scales and body mass index calculated with WHO software 2007, to gather the required data. The weight of the backpack the students' weight and the ratio of load to body weight was measured and then was assessed with standards issues.

Data analysis:
All data were entered and analyzed by using IBM SPSS, version 25. Data was entered and analyzed by using IBM SPSS, version 25 for the distribution of school backpack weight according to the grade of the student using mean and standard deviation. The growth pattern in terms of BMI of the student was compared in acceptable and heavy backpack weight categories using a paired t-test.

Availability of data and materials:
Upon request, we can offer onsite access to external researchers to the data analyzed at Taibah University, Nursing College, Madinah, Saudi Arabia.

Source of funding
The authors declared that this article has not funded by any organization or person.

Conflict of interests
The authors have no conflict of interest to declare.

Ethics approval:
Ethical clearance for the study was obtained from the Ethical Review Committee of Faculty of Nursing at Taibah University, Madinah. Permission for data collection was obtained from the ministry of education and the principals of the relevant schools in Madinah.

Consent
The authors declared that this article has not published in any journal or conference.

III. Results

This study included a total of 306 participants (all of them were female) from primary governmental schools in Al MadinahAlmnoura Saudi Arabia. 44 students were including from both grade first and grade second, 62 students participated from grade third, grade fourth 53 students were, 60 students were from grade fifth and 43 students were from grade sixth. The average weight of the students was 30.76 kg, an average height of 1.30 mts and mean Body Mass Index (BMI) is 17.51.

As seen in (Table1), the mean of actual school bag weight of the student was 4.90 Kg which is 6.5 % heavier than the ideal school bag weight (4.61 Kg). The heaviest bag weighed 11 kg and the lightest bag weighs

Table 1:Difference between Ideal school bag weight and actual school bag weight (N = 306)

Table 1: Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Actual Bag Weight in Kgs	306	1.80	11.00	4.9034	1.90853
Ideal Bag Weight in Kgs	306	2.25	13.35	4.6136	1.80182
Valid N (listwise)	306				

Table 2:Paired Sample t-test as both Actual Bag weight and Ideal bag weight are continuous paired data(N = 306)

Table 2: Paired Samples Test			Pair 1 Bag Weight – Ideal Bag Weight
Paired Differences	Mean		.28979
	Std. Deviation		1.85469
	Std. Error Mean		.10603
	95% Confidence Interval of the Difference	Lower	.08115
		Upper	.49842
t			2.733
df			305
Sig. (2-tailed)			.007

In (Table 2) we have used the paired sample t-test as both Actual Bag weight and Ideal bag weight are continuous paired data. The significant value of the paired t-test is 0.007 which is less than 0.05 at a 95% confidence level. Hence it is concluded that there was a significant difference between ideal school bag weight and actual school bag weight. The actual school bag weight was heavier than Ideal school bag weight on an average of 0.29 Kgs.

Table 3: Post Hoc Tests Multiple Comparisons(N = 306)

(I) Grade	(J) Grade	P value	95% Confidence Interval	
			Lower Bound	Upper Bound
First Grade	Second Grade	.406	-1.2586	.2563
	Third Grade	.130	-1.3082	.0924
	Fourth Grade	.000	-2.4406	-.9915
	Fifth Grade	.000	-3.8819	-2.4716
	Sixth Grade	.000	-4.8994	-3.3758
Second Grade	First Grade	.406	-.2563	1.2586
	Third Grade	.998	-.8071	.5935
	Fourth Grade	.000	-1.9395	-.4904
	Fifth Grade	.000	-3.3807	-1.9705
	Sixth Grade	.000	-4.3983	-2.8746
Third Grade	First Grade	.130	-.0924	1.3082
	Second Grade	.998	-.5935	.8071
	Fourth Grade	.000	-1.7727	-.4435
	Fifth Grade	.000	-3.2122	-1.9254
	Sixth Grade	.000	-4.2347	-2.8246
Fourth Grade	First Grade	.000	.9915	2.4406
	Second Grade	.000	.4904	1.9395
	Third Grade	.000	.4435	1.7727
	Fifth Grade	.000	-2.1304	-.7910
	Sixth Grade	.000	-3.1507	-1.6924
Fifth Grade	First Grade	.000	2.4716	3.8819
	Second Grade	.000	1.9705	3.3807
	Third Grade	.000	1.9254	3.2122
	Fourth Grade	.000	.7910	2.1304
	Sixth Grade	.002	-1.6707	-.2510
Sixth Grade	First Grade	.000	3.3758	4.8994
	Second Grade	.000	2.8746	4.3983

Third Grade	.000	2.8246	4.2347	
Fourth Grade	.000	1.6924	3.1507	
Fifth Grade	.002	.2510	1.6707	

Post Hoc Multiple comparison table was used as shown in (Table 3) and we can conclude that, the confidence interval for the difference between the means of grade fourth and grade first is 0.9915 to 2.4406.
Table (3):
This range does not include zero, which indicates that the difference is statistically significant. The highest difference is observed between grade sixth and grade first 3.3758 to 4.2347. Since Significant (p-value) is less than 0.05 for maximum factors, there is a significant difference between the weight of the school bag depends on the grade. To support
the above statement, we have a bar chart as follows in Figure 1.
Figure (1):
The Anova test was used to assess if there is any difference between Body Weight Levels and the school bag weight, Significant value is 0.000 which is less than 0.05 at 95% confidence level So, we can conclude that there is a significant difference between Body Weight Levels and the school bag weight students carry as shown.
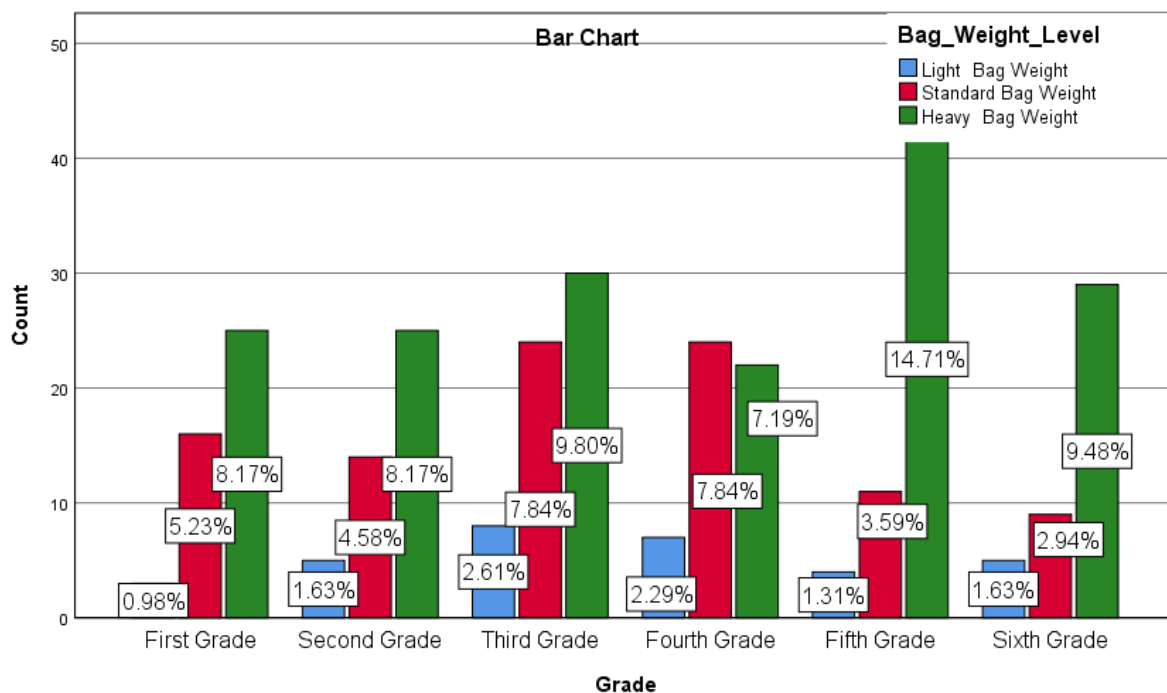
From the above figure it is clear that 14.71 % students from grade fifth carry heavy school bags whereas only 1.31 % students carry light bags. Holistic picture says that 57.51 % of the students carry heavy school bags where as 32% carry standard school bag whereas only 10.45% of the students carry light bags.

Table 4: difference between Body Weight Levels and the school bag weight(N = 306)

ANOVA					
Bag Weight					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	315.737	4	78.934	29.878	.000
Within Groups	795.218	301	2.642		
Total	1110.955	305			

in (Table 4). Pearson correlation test was used to find the correlation between student's BMI and Bag weight, the Sig value was less than 0.05, there is a significant positive correlation of 0.274 between student's BMI and Bag weight.

IV. Discussion

This descriptive, cross-sectional study was conducted to assess weight represented by school backpack in relation to student body weight in governmental schools in Al MadinahAlmnoura Saudi Arabia. The findings demonstrated that the actual school bag weight of the student was heavier than the ideal school bag weight, was moderate, similar to(14)(15)(16). Usually, students are carrying a heavy backpack when compared with their

body weight and it will be up to 15% of body weight (17)(18)(19).was visible in this study there was a significant difference between Body Weight Levels and the school bag weight students carrying Significant value is 0.000 which is less than 0.05 at 95% confidence level. A review by Mackenzie et al. in 2003 of backpack loads carried by school students during a school day identified that children were carrying as much as 30% to 40% of their body weight, this review while acknowledging that no critical maximal load had been established to address back pain, recommended around 10% of the child's body weight as a maximum limit (20). Brackley and Stevenson stated that the majority of work considered the loads carried by children to be above recommended limits, likewise recommending a maximal load of between 10 to 15% of the child's body weight (18). Saudi primary school students, similar to other primary school students worldwide, In a study by Mohammadi et al. (2012) on elementary school students in Tehran, only 28.3% of backpacks had a weight of less than 10% body weight(21). while in the present study Actual school bag weight is heavier than Ideal school bag weight on an average of 0.29 Kgs.

The finding of this study showed that students carrying school bag more than the ideal weigh which was similar to Israeli study state that 54% of students carried more than 15% of their body weight (22)

The finding of this study was found out that grade has a maximum effect on the weight of the backpack and it was also observed that height also influences the weight of the backpack along with weight.

Limitations

This study used convenience sampling and limited data collection to 306 students studying in grade one to grade six in governmental schools.in Al MadinahAlmnoura Saudi Arabia. which condensed the scope to generalize the result. Data were collected in the lecture theater, so students absent from that lecture might have had different responses to the study instrument.

V. Conclusion and Recommendations

The primary school students in the study were exposed to heavy school backpacks which pose a risk to their physical health. For the lighting of school backpack, more efforts are necessary from parents and at the school administration level. We recommend that all parents and teachers take precautions and cautions in school backpack weights for students to prevent complications resulting from the extra weight of the school backpack.

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