

THE EFFECTS OF SCHOOL BAG ON PAIN PERCEPTION AMONG PRIMARY SCHOOL STUDENTS IN ERBIL- IRAQ

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ABSTRACT

Background and objectives: School bags or backpacks are bag for carrying textbooks and school supplies. The study aims to assess the pain perception among primary school student's schoolbag carriage. **Methods:** This is a descriptive cross-sectional study, which was conducted from 15th November, 2015 to 15th November, 2016. A cluster (multi-stage) probability sample of 359 students who attended public and private basic schools in Erbil city was used. A Visual Analog Scale tool was used to find level of pain. Validity and reliability of the instruments was tested through Visual Analogue Scale. P -value ≤ 0.05 was considered significant. **Results:** Students between age group of 11-12 years were taken for the experiment. Students carried two straps type school bag on two shoulders and had healthy weight, but the weight of the school bag exceeded 10% of their body weight. Students in public schools came to the school walking, but in the private schools students came to the school by the car or bus. There was a highly significant association and difference between public and private school and about the way and the weight of the school bag they carried. About 65.8% of students in both sector were carrying school bag weight more than 10% of body weight. There was a non-significant association with both genders in public and private school and pain perception. **Conclusion:** The students carrying school bag at their 10% of body weight felt moderate pain. There was no significant difference between bag weight with male and female students. The backpack weight percentile is recommended to be reduced to $\leq 10\%$ of body weight.

Keywords: *Visual Analog Scale, Schoolbag, Students, Pain Perception*

INTRODUCTION

Many systematic reviews have been conducted about school bag weight. It has been found that the weight of the school bag that the child carries to school on daily basis exceeds the percentage of the child's body weight (Dockrell, Simms & Blake, 2015). Rodríguez-Oviedo *et al.*, (2012) pointed out that 61.4% of the students reported backpacks exceeding 10% of their body weight (BWs), 50% of those carrying the heaviest backpacks had a higher risk of back pain. Researcher added that around half of students had higher risk of general back pathology (Dockrell, Simms & Blake, 2015; Ramadan & Al-Shayea, 2013). Cambridge dictionary in 2017 has defined School bags or backpacks are bag for carrying textbooks and school supplies. Backpacks are used daily by school children,

adolescent, and college students to move educational materials such as heavy books from one place to another (Ramadan & Al-Shayea, 2013). Pain perception is a process of perceiving something with the senses (Cambridge dictionary, 2017). In a study by Spain researchers found that Low back pain (LBP) or discomfort that is located between the bottom of the ribs and the top of the buttocks, with or without radiation to the lower limbs (Cuesta-Vargas *et al.*, 2008). Students who had higher body mass index (BMI) were significantly associated with lower back pain (LBP) (Chiwariidzo, 2013). In Australia, Haselgrove *et al.*, (2008) found that factors such as load and duration of carrying were associated with back pain among students. Gender has been equally considered as an important risk factor associated with reports of back pain between students (Trevelyan & Legg, 2011).

However, the literature is inconclusive on the gender. In addition, the girls represented a higher risk of pain perception compared with boys (Ramadan & Al-Shayea, 2013). Hayden *et al.*, (2012) found an increased prevalence of back pain in females to physical attributes such as poor isometric trunk musculature strength compared to males. Pain was reported by females more than males, and illustrated that lower extremity musculoskeletal symptoms were reported by females more than males, and added that school bag can cause musculoskeletal problems, and declared that bad posture, and carriage of heavy backpack is manifestly a suspected factor. Pain and discomfort occur when a student uses bad postures such as drop of the general backs, leaning forward, or using one strap (Shamsoddini, Hollisaz, & Hafezi, 2010). The visual analogue scale (VAS) is used for pain assessments among students who carry heavy school bag. Patients are asked to draw a line that intersects to indicate intensity (Haefeli & Elfering, 2006).

Based on the official statistics of the Directorate of General Education, 2016 in Erbil city - Iraq, exactly 156125 students are registered in public primary schools, and 10027 students are registered in primary private schools in Erbil city. Furthermore, there is no other study which clearly studied the effects of school bag and pain perception among primary school students in Erbil city.

RESEARCH METHODOLOGY

This is a descriptive cross-sectional study carried out at nine primary schools (six public and three private) in Erbil city. It involved 359 students (209 public school students and 150 private school students), between the period 10th of Feb to 20th of May 2016 in Erbil city, Kurdistan Region - Iraq.

Prior the data collection, the official permissions were obtained from the ethics committee at the college of Nursing/Hawler Medical University. Official approval and permission was obtained from General Director of Education/Kurdistan Region Governorate (KRG). Data were collected after obtaining oral agreement from the participants, the researchers granted the anonymity and confidentiality of the data keeping.

Multi-stage (Cluster) sampling was used to determine the study population by the following stages: In the first stage, three municipalities were randomly selected from the list of all six municipalities in Erbil

city. In the second stage: two public and one private primary school were randomly selected from the list of the primary schools, which are located within each selected municipality. Third stage: only one class between 4th to 6th grade were randomly selected in the selected school, finally all students in selected class were respectively asked to participate in the study depending on the criteria of samples. Students' aged between 10-12 years in both genders, who were functionally independent, carrying school bag, free of any disease were included. While Students who refused to participate in the study, or suffered any types of musculoskeletal disorders were excluded.

Data was collected by using a structured interview format filled out by direct face to face interview with the students for those who kindly accepted to participate in the study. Each interview took approximately 20 minutes. Data was collected on a random day; it was chosen by the researchers so that the students couldn't modify their school bag weight.

A special tool was prepared by the researchers which consisted of two parts; the first part consisted of two sections, the first section was to assess the socio-demographic characteristics of the child, which consisted of general information, such as: age, gender, school grade. The questionnaire also included questions related to school bag types (one strap backpack, two straps backpack or roller trolley), way of carrying the bag (one shoulder, two shoulders or rolling trolley). The second section of special measurements was used to assess the anthropometric measurements such as height, weight and weight of the school bag. In order to measure the body weight and school bag weight a special standard scale was used without jacket and bar foot with accepted error of 0.1 Kg, and standing height was measured through using the tape measure for children. Body mass index (BMI), Percentile Interpretation Percentile < 5: Underweight, Percentile \geq 5 and < 85: Healthy weight, Percentile \geq 85 and < 95: Overweight, Percentile \geq 95: Obesity. To determine the level of pain perception a reliable scale; Visual Analog Scale (VAS) was used as a second part of the questionnaire, which ranged between 0 (no pain) to 5 (severe pain), the students were asked to choose the level of pain they feel. The studied questionnaire was also validated through pilot and internal consistency, reliability was determined and measured through computation of Pearson product moment correlation. The correlation coefficient was $r = 0.801$.

Data prepared was organized using Statistical Package for Social Science (SPSS, version 21), frequency with percentages, Arithmetic means (x) and standard deviation (SD). Chi-square test was used to

find out the association between variables. *T*-test was used to find the difference between male and females' perception of pain. *P*-value 0.000 to 0.005 was reported as significant level.

RESULTS

Table 1: Sociodemographic Characteristics of Public and Private School

Table 1a: Distribution of Sociodemographic characteristics of public and private

		Public school No.209			Private school No.150		
		Male	Female	Total	Male	Female	Total
Items		No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Age	10	39 (10.9)	26 (7.2)	65 (18.1)	25 (7.0)	23 (6.4)	48 (13.4)
	11	32 (8.9)	33 (9.2)	65 (18.1)	25 (7.0)	33 (9.2)	58 (16.2)
	12	43 (12.0)	36 (10)	79 (22.0)	18 (5.0)	26 (7.2)	44 (12.2)
Gender		114 (54.5)	95(45.5)	209 (100)	68(45.3)	82 (54.7)	150 (100)
Bag types	One strap	19 (5.3)	17 (4.7)	36 (10)	12 (3.3)	22 (6.1)	34 (9.4)
	Two straps	88 (24.5)	74 (20.6)	162 (45.1)	40 (11.1)	39 (10.9)	79 (22.0)
	Roller trolley	7 (1.9)	4 (1.1)	11 (3)	16 (4.5)	21 (5.8)	37 (10.3)
Way of carrying	One shoulder	30 (8.4)	34 (9.5)	64 (17.9)	16 (4.5)	30 (8.4)	46 (12.9)
	Two shoulders	77 (21.4)	57 (15.9)	134 (37.3)	37 (10.3)	32 (8.9)	69 (19.2)
	Rolling trolley	7 (1.9)	4 (1.1)	11 (3.0)	15 (4.2)	20 (5.6)	35 (9.8)

Table 1a. shows that less than quarter (22%) of the students in the public schools was at age group 12, 16.2% of students in the private schools were at age group 11. More than half (54.5%) of the students were male in the public schools, while more than half (54.7%) of the students were female in the private

schools. Less than half (45.1%) of students in the public and less than quarter (22%) of the students in the private basic schools used two straps school bag type. More than quarter (37.3%) of the students in the public and other 19.2% students in the private basics schools were carrying school bag on two shoulders.

Table 1b: Distribution of the average weight of school bag

Items	Public		Private	
	Male	Female	Male	Female
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Weight of school bag (kg)	4.5 ±1.1	4.4 ±1.0	6.1±1.3	5.6 ±1.3
Total	4.45±1.1		5.85±1.3	

The study shows that there was similarity between weight of school bag of male and female in both public and private schools. About 4.5 kg weight of bag for male and 4.4 kg weight of bag for female in public schools. While study shows that students in private schools were carrying heavier school bag than public

schools' students and found 6.1kg weight of bag for male and 5.6 kg weight of bag female in private schools, while the weight of bag differed in public and private, the mean weight of school bag in public was 4.45 kg and mean weight and SD of school bag was 5.85 kg in private schools.

Table 2: Distribution of the body mass index (BMI) of students

Items	Public school No.209			Private school No.150		
	Male	Female	Total	Male	Female	Total
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Body mass index						
Underweight	12(5.74)	13(6.22)	25(11.96)	8(5.33)	7(4.67)	15(10.00)
Healthy weight	76(36.36)	59(28.23)	135(64.59)	36(24.00)	53(35.33)	89(59.33)
Over weight	12(5.74)	14(6.70)	26(12.44)	13(8.67)	12(8.00)	25(16.67)
Obesity	14(6.7)	9(4.31)	23(11.00)	11(7.33)	10(6.67)	21(14.00)
Duration of carriage of school bag/minutes						
≤5	41(19.62)	34(16.27)	75(35.89)	7(4.67)	14(9.33)	21(14.00)
6-10	45(21.53)	32(15.31)	77(36.84)	17(11.33)	24(16.00)	41(27.33)
11-15	16(7.66)	20(9.57)	36(17.22)	15(10.00)	19(12.67)	34(22.67)
>15	12(5.74)	9(4.31)	21(10.05)	29(19.33)	25(16.67)	54(36.00)
Transportation ways to the school by						
Walking	92(44.02)	78(37.32)	170(81.34)	4(2.67)	10(6.67)	14(9.33)
Car or bus	22(10.53)	17(8.13)	39(18.66)	64(42.67)	72(48.00)	136(90.67)

In table 2 the result shows that more than half (64.59%) of the students in the public and 59.33% of the students in the primary private schools had healthy weight. More than one-third (36.84%) of the students in the public schools carried school bag for 6-10 minutes' durations away from home, and more than quarter (36%) of the students in the private schools carried school bag for >15 minutes' durations away from home. Most (81.34%) of the students came to the school on foot in the public schools, but in the private school majority of the students came to the school by the car or bus.

Table 3: Distribution of the level of pain perception using visual analog scale

Items	Public No. 209			Private No. 150		
	Male	Female	Total	Male	Female	Total
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
No pain	18(8.61)	21(10.05)	39(18.66)	18(12)	18(12)	36(24.00)
Mild pain	19(9.09)	13(6.22)	32(15.31)	7(4.67)	15(10)	22(14.67)
Moderate pain	39(18.66)	34(16.27)	73(34.93)	24(16)	22(14.67)	46(30.67)
Average pain	27(12.92)	20(9.57)	47(22.49)	12(8)	16(10.67)	28(18.67)
Acute pain	9(4.31)	6(2.87)	15(7.18)	6(4)	7(4.67)	13(8.67)
Sever pain	2(0.96)	1(0.48)	3(1.44)	1(0.67)	4(2.67)	5(3.33)

This result shows that one third (34.93%) of students, and less than one third (30.67%) had moderate pain perception in both public and private basic schools, however 1.44% and 3.33% of all students in both public and private schools had severe pain.

Table 4: Association between the school bag types and level of the pain perception

Items	School bag type				χ^2 -value (p-value)
	One strap	Two straps	Roller trolley	Total	
	No. (%)	No. (%)	No. (%)	No. (%)	
Visual analog scale					
No pain	7(1.95)	49(13.65)	19(5.29)	75(20.89)	27.208 (0.002)
Mild pain	6(1.67)	41(11.42)	7(1.95)	54(15.04)	
Moderate pain	35(9.75)	71(19.78)	13(3.62)	119(33.15)	
Average pain	14(3.90)	53(14.76)	8(2.23)	75(20.89)	
Acute pain	6(3.90)	22(6.13)	0(0.00)	28(7.80)	
Sever pain	2(0.56)	5(1.39)	1(0.28)	8(2.23)	
Total	70(19.50)	241(67.13)	48(13.37)	359(100)	

Current study reveals the highly significant association between public and private school and school bag type and visual analog pain scale (VAS) at p -value 0.002 (Table 4).

Table 5: Association between way of carrying the bag and level of the pain perception and way of carrying the bag

Items	One shoulder	Two shoulders	Rolling trolley	Total	χ^2 -value (p-value)
	No. (%)	No. (%)	No. (%)	No. (%)	
Visual analog scale					
No pain	13(3.62)	43(11.98)	19(5.29)	75(20.89)	29.532(0.001)
Mild pain	11(3.06)	36(10.03)	7(1.95)	54(15.04)	
Moderate pain	49(13.65)	58(16.16)	12(3.34)	119(33.15)	
Average pain	22(6.13)	45(12.53)	8(2.23)	75(20.89)	
Acute pain	11(3.06)	17(4.74)	0(0.00)	28(7.80)	
Sever pain	4(1.11)	4(1.11)	0(0.00)	8(2.23)	
Total	110(30.64)	203(56.55)	46(12.81)	359(100)	

There is a highly significant association between public and private school and about the ways of carrying the bag and visual analog pain scale (VAS) at p -value 0.001(Table 5).

Table 6: Association of the level of pain between male and female students

Items	Public school			Private school		
	Male	Female	Total	Male	Female	Total
No pain	18(5)	21(5.8)	39(10.9)	18(5)	18(5)	36(10)
Mild pain	19 (5.3)	13 (3.6)	32 (8.9)	7 (1.9)	15 (4.2)	22 (6.1)
Moderate pain	39(10.9)	34 (9.5)	73 (20.3)	24 (6.7)	22 (6.1)	46 (12.8)
Average pain	27 (7.5)	20(5.6)	47 (13.1)	12 (3.3)	16 (4.5)	28 (7.8)
Acute pain	9 (2.5)	6 (1.7)	15 (4.2)	6 (1.7)	7 (1.9)	13 (3.6)
Sever pain	2 (0.6)	1 (0.3)	3 (0.8)	1 (0.3)	4 (1.1)	5 (1.4)
Total	114(31.8)	95(26.5)	209(58.2)	68(18.9)	82(22.8)	150(41.8)
			Chi-Square Public=1.963, $df=5$, P -Value= 0.854 (NS)	Chi-Square Private=4.174, $df=5$, P -Value = 0.525 (NS)		
Chi-Square between Public & Private=1.299, $df=5$, P -Value= 0.935 (NS)						

Current study shows that there was non-significant association between both genders in public and private school and pain perception according to visual analog pain scale (VAS). However, the study found that less than quarter (20.3%) of students in the public and 12.8% of the students in the private basic schools had moderate pain (Table 6).

DISCUSSION

The mean and SD of the participants were 11.03±0.81years old. A cross-sectional study on 240 randomly selected students from 20 primary schools, indicated that the mean age was 8.55 ± 2 years (ranges: 5–12 years) (Ogana, 2016 ; Olmedo - Buenrostro *et al.*, 2016). But the current results are agreed with a study by Aundhakar *et al.*, (2015) who recruited 626 students and found that most of the students were at age 12-16 mean and SD was 14±2. Also this study is contrary with the finding of Scoffers who recruited 546 of ninths grade students between 14-16 years old.

More than half of the students were male in the public schools and more than half (54.7%) of the students were female in the private schools. Current study is agreed by a cross-sectional study by Skoffer, (2007) who conducted a study on students in public school and found that more than half (53.3%) of students were male; and less than half (46.7%) were female.

While disagreement with a cross-sectional study done by Kellis & Emmanouilidou, (2010) conducted a study on 703 students in public school and found that 49.07% of participants were male and 50.93% of participants were female and with the study by Puckree, Silal & Lin, (2004) found that the majority of the children carried backpacks over two shoulders. The type of bag carried was significantly related to pain experienced (0.00).

Less than half of students in the public and less than quarter of the students in the private primary schools used two straps school bag type. Researchers confirmed that students used two straps school bag (Pau et al., 2011). In the study by Hong, Fong & Li, (2017) found that one strap school bag causes a greater trunk range of motion than the two strap school bag during stair descent. Comparing the model of transport backpacks of school supplies, the present study, the dorsal attachment design, was the most used by people among samples.

The result shows that one-third of the students in the public and other sixty-nine students in the private primary schools were carrying school bag on two shoulders. The studies in United States of American and in Greece were found that most of the students were carrying their school bag on their two shoulders and emphasized that the students carry their schoolbag on their two shoulders (Talbot *et al.*, 2009; Korovessis, Koureas, Papazisis, 2004). Most of the respondents were using both shoulders for carrying school bag (Nor Azlin, Asfarina & Chee, 2010). This could be attributed to the fact that unilateral loading causes more postural deviation than bilateral loading on shoulders. Almost all of Ugandan students used backpack style school bags, but only 65% carried their schoolbag on their backs using two straps (Dockrell, Simms & Blake, 2015). In a Malaysian study which was concluded, that students from all the three mediums primary school, in particular Chinese medium school carry school bag heavier than that generally recommended, with unnecessary materials weigh up to 2kg. Back pain is high and mainly associate with the types of school (Nor Azlin, Asfarina & Chee, 2010). This model therefore takes into account the impacts of physical strain in carrying backpacks, and biomechanical strains resulting from method of bag carriage, duration of carriage among others, as well as individual factors such as body weight, age and gender on musculoskeletal outcomes

(Ogana, 2016).

Most of the students in the public and the private primary schools had healthy weight (normal weight). The mean weight of school bag in public was 4.45 kg and 5.58 kg, and most of students carrying school bag weight more than 10% of body weight. The result agreed with a study conducted on measuring height and weight in 2011 and found that 72% of participants had health weight (Bowring *et al.*, 2012). A study by Dockrell, and colleagues, who found that most (75.4%) of the students being a healthy weight. one-third of the students in the public schools were carriage school bag for 6-10 minutes 'durations away from the home, while only one-third of the students in the private schools were carriage school bag for more than 15 minutes' durations away from the home.

The mean and SD duration of the school bag carriage of public school students were 10.17 ± 5.734 minutes per each trail, while the mean and SD duration of the private school students was 16.48 ± 9.463 minutes (by bus). This is because the students in public schools arrives school on foot and carry bags on their shoulders, while students in non-government schools arrive at the school by car or Bus. This finding is agreed by a study by Yuing Hu & Jacobs, (2008) who presented that the more than quarter i.e. 30% of the respondents spent 10-20 minutes carrying their school bags per day while 8.4% spent more than 60 minutes. The load has two physical characteristics which influences the efficiency of transport of the weight and shape of the load. The transported object design implies directly the way of transporting it and so is the energy expenditure and biomechanical changes (Al-Saleem *et al.*, 2016).

The result is contrary with other studies which emphasized that carriage of school bag is about 20 minutes. Primary school students often stay in the same classroom for the day and so do not need to carry their school bags during school hours (Talbot *et al.*, 2009; Adeyemi Rohani, & Abdul Rani, 2014; Dianat *et al.*, 2013). In contrast, secondary school students are more likely to move from one classroom to another between classes, according to their timetable, putting on and taking off their school bag as required and carrying them for longer periods of time (Mackie & Legg, 2008).

Present study shows that most of the students came to the school on foot in the public schools, but the

students in the private schools came to the schools by the car or bus. It is because private school students have higher family income. Prolonged time or/and transporting the heavy school bag from home to school and from school to home (Talbot *et al.*, 2009) caused severe back pain. These results were agreed by Dockrell, Simms & Blake, (2015) who found that less than half of students came to the school on foot and more than half of students in private school was using car or bus for transportation. Also, it was contrary with the finding of Al-Hazzaa, (2006) who revealed that the most of the students travels to and from schools by cars, and only 28.8% walk to and from schools. This result shows that one-third of students and less than one-third had moderate pain perception in both public and private primary schools. While only 3.33% of all students in both public and private schools had severe pain. Four out of every five school students presented with backpack overload, exposing them to a potential health problem (Olmedo-Buenrostro *et al.*, 2016). The result is disagreement with the finding of the study by Mwaka *et al.*, (2014) found that the greatest (88.2%) of pupils complained of pain.

Current study shows that there was highly significant association between public and private school and school bag types and VAS for pain assessment at p -value 0.002. Skoffer, (2007) reported that pain positively associated with school bag type. The result is disagreement with the finding of the study which by Mwaka *et al.*, (2014) found that the greatest of pupils complained of pain.

Current study shows that there were highly significant associations between public and private school and school bag types and VAS for pain assessment at p -value 0.002. This finding is agreed by Skoffer, (2007) reported that pain positively associated with school bag type. The students carry heavers than their body weight in Kuala Lumpur (Nor Azlin *et al.*, 2010).

Current study finding shows that there were highly significant association between public and private school of way of carrying the bag and VAS at p -value 0.001. Researchers found a significant association between the way of school bag carriage and occurrence of discomforts in the body regions at $P = 0.002$ (Mwaka *et al.*, 2014). Skoffer, (2007) confirmed the significant association between pain and the way of school bag

carrying.

There was a significant association between backpack weight to schoolchild body weight and the presence of musculoskeletal pain. The results also revealed that most pupils did not take a break from carrying their backpacks (Ogana, 2016). Puckree *et al.*, (2004) emphasized that there were significant associations between school bag weight and pain perception. The weight of the school bag was not definitely associated with pain (Skoffer, 2007).

The study found that there was non-significant association between both genders in public and private school between VAS. Gender has been equally considered as an important risk reason associated with reports of back pain between students Trevelyan & Legg, (2011). 41.1% of female students and 31.2% of male students were carrying school bags of >15% of their body weight (Al-Saleem *et al.*, 2016).

There was no significant association between gender in Nairobi students and pain perception at $p > 0.05$ (Ogana, 2016). However, the literature is inconclusive on the gender most affected. in addition, the girls represented a higher risk of pain perception compared with boys (Dockler *et al.*, 2015 and Ramadan & Al-Shayea, 2013). Hayden *et al.*, (2012) found an increased prevalence of back pain in females to physical attributes such as poor isometric trunk musculature strength compared to males (Hayden *et al.*, 2012). In another study highlighted pain and being confused with pain emanating from menses in females (Chiwaridzo, 2013). Al-Saleem *et al.*, 2016 noticed that there was a significant difference in gender as 1057 (41.1%) of female children were carrying bags >15% of their body weight as compared with 801 (31.2%) of male children carrying bag weight of >15% of their body weight. However, the literature is inconclusive on the gender most affected. in addition, the girls represented a higher risk of pain perception compared with boys (Dockler *et al.*, 2015; Ramadan & Al-Shayea, 2013). with the proportion of pupils carrying school bag weighing more than 15% of their body weight being 28% (Ogana, 2016).

CONCLUSION

The study found that most of the student carrying the school bag more than their body weight and above of standard, and most of the samples complain of

moderate pain in their shoulders, and reveals to significant association between public and private school about way of carrying the bag and VAS. While

no significant difference between the male and female of school bag weight, duration of carrying school bag were found in this experiment.

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