

# The Effect of Schoolbag Weight on School Children's Health in Zawia City-Libya

Ibrahim D A Sakal<sup>1\*</sup>, Mohamed A.M. Wadan<sup>2</sup>, Mouna Koshlaf<sup>3</sup>, Abdalhalim Suaiee<sup>4</sup>, Rwida A. Emberesh<sup>1</sup>

<sup>1</sup>Zoology Department, Science Faculty, Sebratah University, Sabratah, Libya

<sup>2</sup>Diagnostic and Therapeutic Radiology Department, Medical Technology Faculty, Al Zawia University, Az-Zāwiyah, Libya

<sup>3</sup>National Medical Research Center, Al Zawia University, Az-Zāwiyah, Libya

<sup>4</sup>Statistics Department, Science Faculty, Al Zawia University, Az-Zāwiyah, Libya

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\*Corresponding author: Ibrahim D A Sakal

## Abstract

The objective of this study is to investigate the weight of schoolbags and the factors related to schoolbag carriage on first, second, third and fourth year school students. The study was performed on 800 children aged six to eleven years at elementary school level in a government school in Zawia city - Libya. The body weight (kg), height (cm), schoolbag weight (kg), percentile of school bag weight to body weight and questionnaire included school bag type, perception of students toward school bag weight were evaluated and health effects (back pain, shoulder pain and neck pain) were recorded during the interviewing period. The data were analyzed using statistical package for social science and the significance level was considered as  $\alpha=0.05$ . A two-strap backpack without wheel that was used by (88.6%) students in the study and the weekly mean schoolbag weight was 4.27 kg. The mean schoolbag weight as a percentage of mean body weight carried by the students was  $(15.53 \pm 8.88)\%$  and 91% of students carry school bags weighing more than 10% of their body weight. For pain related to carrying schoolbag; 71% of students had shoulder pain, 63% had lower back pain, and 28.4% had neck pain. The effect of bag weight and ratio of bag weight to body weight were highly significant on back, shoulder and neck.

**Keywords:** Children, schoolbag weight, schoolbag type, discomfort, pain.

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## INTRODUCTION

In recent years, it is well-noted that a large number of children visit physicians to get treated for their musculoskeletal problems and spinal pain seems to be the most common reasons. Many studies reveal and recommend different school bag weight percentage and carrying methods to avoid bodily stress [1]. School bag loads are reported to cause many problems in children such as body pain, cardio-respiratory changes, postural changes, and balance impairment [1-4].

A general guideline of 10% body weight, initially proposed by Voll and Klimt in 1977 [5], continues to be the recommended guideline when carrying a backpack style schoolbag. The weight carried by students varies from day to day and studies have reported different results with regard to the average schoolbag weight [6-8]. Several studies have reported an association between carrying heavily loaded schoolbags and musculoskeletal pain or discomfort [9-12].

It is suggested that a weight limit of 10% to 15% of body weight has been recommended recently as a maximum load for schoolchildren [13-15] but it is not clear whether or not the limit set should be the same for both boys and girls.

Much international attention among the health – related literature has been focused on the school bag weight that heavy load may cause a problem on the developing spine.

The aim of this study was to investigate the weight of schoolbags and the effects of schoolbag carriage on first (6Y) to fourth (9Y) grade school students. The specific objectives were:

- To measure the weights of schoolbags
- To determine percentage bodyweight carried
- To determine types of bags and methods of carriage

- To record reported discomfort due to schoolbag carriage.

## METHODS

### Study Design

Eighthundred students attending first (6Y) to fourth (9Y) grade at a government schools in the city of Zawia took part in the study. Where the schools of study were determined by the education authority in Zawia. The study was conducted on healthy male and female students between January and March of 2016. Students were selected randomly from each class. The students were interviewed by the researchers during the school days (Sunday-Thursday). Subsequently, data collection was done during the interviewing period.

### Data Collection

During the initial data collection session, the child's age, gender, weight, height, school bag weight, percentile of school bag weight to body weight and questionnaire included school bag type, perception of students toward school bag weight (lighter weight, heavier weight) and health effects (back pain, shoulder

pain, neck pain) were recorded. Data were collected on random days chosen by researchers at the begins of the school daysto measure school bag weight.

### Statistical Analysis

Descriptive and inferential statistics were used to analyze the data including mean, standard deviation, odds ratio and Wald's Chi-Square test. The significance level ( $\alpha$ ) for the analyses was sat at (0.05; 95%) confidence intervals were presented. The Statistical Package for Social Sciences (SPSS, 21) was used for the analyses.

## RESULTS

### The Study Sample

The number of students in this study was 800, out of which 377 (47.12%) were male and 423 (52.88%) female. Total number of students according to educational stage was 294 (36.8%) in first grade, 183 (22.9%) in second grade, 193 (24.1%) in third grade and 130 (16.3%) in fourth grade (Table-1). Means of student weight, height, bag weight and bag weight to student weight ratio are presented in Table-1 by grade.

**Table-1: Means±SD of students grade, weight, height, bag weight, and bag weight to student weight ratio**

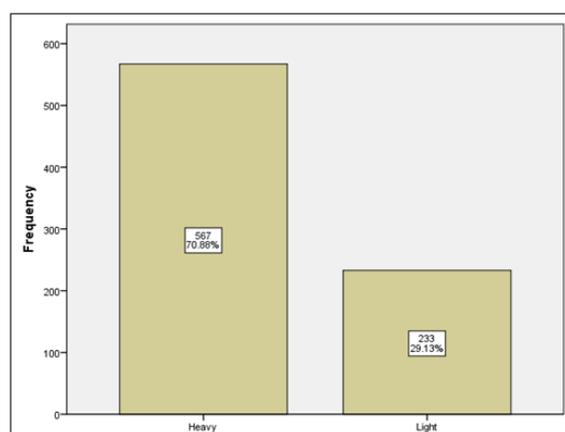
| Grade           | # of Students(N) (%) | Student weight ( $\bar{X} \pm SD$ ) (Kg) | Height of student ( $\bar{X} \pm SD$ ) (cm) | Bag weight ( $\bar{X} \pm SD$ ) (Kg) | School bag weigh/ Student weight (Ratio)* ( $\bar{X} \pm SD$ ) |
|-----------------|----------------------|--|---|--------------------------------------|--|
| 1 <sup>st</sup> | 294 (36.80 %)        | 23.24 ±8.36                              | 121.40 ±5.81                                | 3.62±0.90                            | 15.58 ± 3.70   |
| 2 <sup>nd</sup> | 183 (22.90 %)        | 25.50 ± 5.17                             | 131.66 ± 8.30                               | 3.92 ± 0.98                          | 15.37 ± 3.93   |
| 3 <sup>rd</sup> | 193 (24.10 %)        | 29.76 ±5.11                              | 137.80 ± 8.42                               | 4.75± 1.11                           | 15.96 ±5.26  |
| 4 <sup>th</sup> | 130 (16.30 %)        | 31.52 ±5.67                              | 137.20 ±6.82                                | 4.79 ± 1.09                          | 15.20 ± 3.29   |
| Total           | 800 (100.0%)         | 27.50 ±10.32                             | 130.27 ±11.77                               | 4.27± 1.13                           | 15.53± 8.88  |

\* School bag weight / Student weight = Result × %

### Weight of Schoolbag

The weight of schoolbag ranged from (1.10 kg) to (8.20kg) over the 5 days. The weekly mean schoolbag weight was (4.27kg) (Table-1). In addition, 29.10% of the sampled students felt that school bag was

light, while (70.90%) felt their school bag was heavy and complained of always getting tiered while carrying their school bag. This indicates that the majority of students spend intensive energy to carry the school bag (Fig-1).

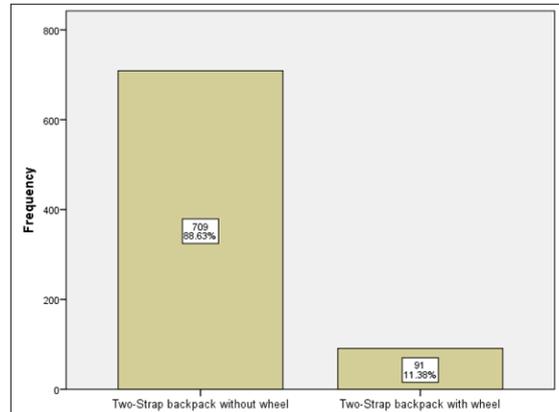


**Fig-1: Perception of students toward schoolbag weight**

**Types of Schoolbags**

A two-strap backpack without wheel that was used by most students in the study 709 (88.6%), but only 91 (11.40%) carried their schoolbags on their

backs using two strap backpack with wheel (Fig-2). The backpack was carried on both shoulders, placed on the trunk but did not fixed at waist level.



**Fig-2: Distribution of students according to the type of schoolbag**

**Schoolbag weight as a percentage of body weight**

The mean schoolbag weight as a percentage of mean body weight carried by the students was (15.52%). The results showed that (9%) of students usually carry school bag weighing less than (10%) of

their body weight, (91%) of students carry school bags weighing (10%) or more of their body weight (48.1% carry bags more than 15% of their body weight). The loads carried with regard to % body weight guideline are shown in Table-2.

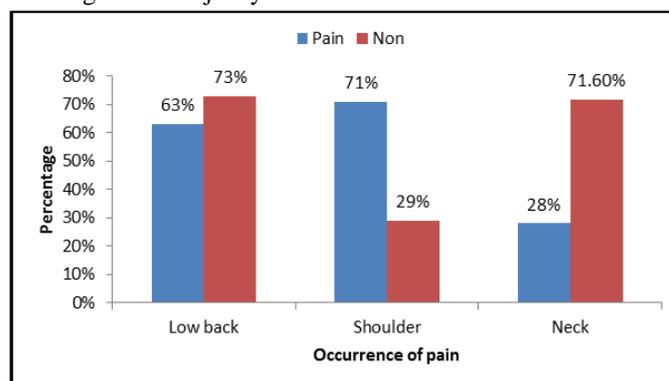
**Table-2: Distribution of students according to the ratio of school bag weight to body weight**

| Ratio of school bag to student weight | Number of Students | Percentage, % |
|---------------------------------------|--------------------|---------------|
| ≤ 10%                                 | 72                 | 9.00 %        |
| >10% and ≤ 15%                        | 343                | 42.90 %       |
| > 15%                                 | 385                | 48.10 %       |
| Total                                 | 800                | 100.00        |

**Schoolbag Related Musculoskeletal Discomfort**

Fig-3 shows percentages of students who complained of pain (neck, shoulder and lower back) while or after carrying school bag. The majority of

discomfort (71%) was reported in the shoulder region, followed by (63%) reported in the lower back and (28.4%) reported in the neck.



**Fig-3: Distribution of students based on percentage of occurrence of musculoskeletal pain due to carrying school bag**

**DISCUSSION**

The health of students is a priority subject and the prevention of back pain and other musculoskeletal injuries is important for students. The result of this study reported that the age of children was between 6 to

9 years, carrying school bags weight with mean (4.27±1.13), that is lower than found by [7, 11] who reported (6.6±2.2) and (8.3±2.1) respectively. Negrini and Carabalona [10] measured students with a mean age of 11.6 years and found that their mean schoolbag weight was (9.06kg).

In this study the weight of schoolbags varied from one student to another and the weight of schoolbag ranged from (1.10kg) to (8.20kg) over the 5 days. In addition, (29.10%) of the sampled students felt that school bag was light, while (70.90%) felt their school bag was heavy may be explained by the fact that some school children bring more books to school each day than others.

A two-strap backpack without wheel that was used by most students in the study 709 (88.6%) similar to that found by [7], but only 91 (11.40%) carried their schoolbags on their backs using two strap backpack with wheel. The backpack was carried on both shoulders, placed on the trunk but did not fixed at waist level. It is encouraging that the majority of the students in the study opted to use the backpack for school since it has been shown to be the most appropriate design for use.

The study showed that, the mean schoolbag weight as a percentage of mean body weight carried by the students was (15.52%). This finding is in agreement with others [7-9], while [6] found a lesser percentage (8.2%). It is of some concern that, the majority of students (91%) carry school bags weighing 10% or more of their body weight (48.1% carry bags more than 15% of their body weight) over the course of the five days of weighing.

From the questionnaire it was found that (70.90%) of students felt their school bag was heavy and complained of always getting tired due to carrying their school bag. This high proportion of reported discomfort is similar to the (74.4%) finding of [11]. The highest reporting of discomfort was recorded in shoulder region (71%), followed by (63%) and (28.4%) reported in the lower back and the neck respectively. These findings differ from the study of [8] how found the high level of discomfort in neck. In other words, the effect of bag weight and ratio of bag weight to body weight were highly significant on back, shoulder and neck.

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