



## CONSEQUENCES OF BACKPACK LOADS ON THE PELVIC TILT ANALYSIS OF SCHOOL CHILDREN

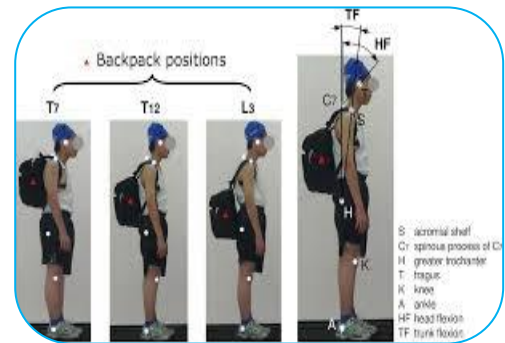
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### ABSTRACT:

School going children carry the heavy and non standard backpacks each and every day. These heavy backpacks carried by the students in the growing stage causes several postural consequences. These postural consequences can be temporary in nature or could have a long lasting effect on these children. This study aimed to investigate the differences between the unloaded condition and 15% BW load condition on the Pelvic tilt in school going children. For this purpose two categories of backpack load were selected i.e: Unloaded condition, 15% BW condition. 32 subjects after taking a due care of Inclusion and Exclusion criteria were selected from a school of Jammu and Kashmir namely "The H.K.M.C educational institute, Ganderbal. The body weight in Kg's and Height in meters was recorded at the first instance in order to find and include the subjects with a normal B.M.I. Photogrammetric method was used to collect the data from the students. The photogrammetric data was then analyzed by the APECS (All Body Posture Evaluation and Correction System). Statistics were performed on the obtained results to find out a difference between the unloaded condition and 15% BW load condition on the Pelvic tilt postural analysis. The results showed a significant difference between the unloaded condition and 15% BW load condition in the Pelvic Tilt Analysis. The significant difference found reveals that the body posture gets affected on wearing the backpack weighing up to 15% BW of the school going children. The 15% BW load condition imposed a significant pelvic tilt on the subjects.



**KEYWORDS:** BW (Body weight), Unloaded, Posture, Pelvic, analysis.

### INTRODUCTION

The backpack is one of several forms of manual load carriage that provides versatility and is often used by hikers, backpackers and soldiers, as well as school students (Knapik et al 1996). The backpack is an appropriate way to load the spine closely and symmetrically, whilst maintaining

stability (Knapik et al. 1996, Voll and Klimt, 1977). However, musculoskeletal problems associated with backpack use have become an increasing concern with school children (Troussier et al 1994). The combined effects of heavy loads, position of the load on the body, size and shape of the

load, load distribution, time spent carrying, physical characteristics and physical condition of the individual were hypothesised as factors which were associated with these problems (Haisman, 1988, Knapik et al. 1996). Past research shows numerous attempts to study the effects of

these factors on the health and safety of adult carriers. The maximal loads recommended from these early studies varied, from 25% to 40% of body weight (Haisman, 1988). The author also suggested that load requirements for adult females should be lower than adult males to account for physiological and biomechanical differences (Haisman, 1988). Most of the studies on the effect of load carriage have focused on small numbers of soldiers and hikers with the purpose of improving the techniques of load carriage.

Information derived from these studies might not apply to high school students. High school students are adolescents who experience a period of accelerated growth and development of skeletal and soft tissue (Parfitt, 1994). Their spinal structures are thus markedly different from those of adults. As growth of the spinal structures extends over a longer period of time than the other skeletal tissues, incongruities in rate of tissue development can pose a threat to postural integrity (Junghanns, 1990). Moreover, external forces such as load carrying may also influence the growth, development and maintenance of the alignment of the human body (LeVeau and Bernhardt 1984). Consequently, posture in adolescents can be affected by both internal and external influences, which may make adolescents more susceptible to injury. Few researchers have focused on the impact of load carriage on high school students. Ruscoe (1989) investigated the effects of modes of carrying the school bag, weight of bag, carriage time and year level of students on spinal asymmetry and shoulder obliquity in students aged 10 to 17 years. The lateral deviation of the spine was assessed by a scoliometer, while the inclination of the shoulders was evaluated by a goniometer. The results showed no effect on spinal asymmetry from carrying methods, school level, weight of bags and carrying time whereas the first two variables influenced shoulder posture. However, this author measured spinal posture whilst unloaded and thus spinal deviation might have been a result of habitual load carriage or other unmeasured factors. No information was provided on immediate head-on-neck postural response to loading.

**Pelvic Tilt:** Pelvic tilt (PT) is a position-dependent parameter defined as the angle created by a line running from the sacral end plate midpoint to the center of the bifemoral heads and the vertical axis.

Pelvic tilt (PT) is an important parameter in assessing spinal deformity because high PT is a compensatory mechanism that can affect and reduce the apparent extent of global sagittal malalignment. In addition to being a parameter that is highly correlated with pain and disability, PT should factor into surgical planning as well. Science direct, (2019)

### FORMS OF PELVIC TILT:-

**Anterior pelvic tilt:** - is when the front of the pelvis drops in relationship to the back of the pelvis. For example, this happens when the hip flexors shorten and the hip extensors lengthen.

**Posterior pelvic tilt:** - is the opposite, when the front of the pelvis rises and the back of the pelvis drops. For example, this happens when the hip flexors lengthen and the hip extensors shorten, particularly the gluteus maximus which is the primary extensor of the hip.

**Lateral pelvic tilt:** - describes tilting toward either right or left and is associated with scoliosis or people who have legs of different length. It can also happen when one leg is bent while the other remains straight, in that case the bent side's hip can follow the femur as knee lowers towards the ground.

**Left pelvic tilt:** - is when the right side of the pelvis is elevated higher than the left side.

**Right pelvic tilt:** - is when the left side of the pelvis is elevated higher than the right side.

### OBJECTIVES OF THE STUDY

The following objectives are related to this study:-

1. To investigate a difference between unloaded condition with 15% BW load condition in relation with Pelvic Tilt Analysis.
2. To find out the effect of 15% BW load on the posture of the school going children.
3. To examine the manipulation of the Pelvic tilt angle while comparing the result of unloaded condition with 15% BW load condition.

## **MATERIALS AND METHODS**

The researcher had made a humble effort in this chapter to shed light on the method and procedure that was used for the study like, the selection of subjects, information regarding subjects, Inclusion and exclusion criteria, Duration of the study, criterion measure, administration of test, analysis of film and collection of data, reliability of the data and. The statistical techniques and procedure used is further clarified.

### **Research Setting**

The data for the research study was collected from the students of "The H.K.M.C Educational Institute", Ganderbal, Jammu and Kashmir, India.

### **Consent and Ethical Consideration**

The detailed protocol of the research was explained and consent of every subject as well as the consent of their parents was properly taken prior to the inclusion of subjects for the study. The whole research was approved by the human subjects ethics review committee at the Punjabi University Patiala. Standards for ethical considerations were followed.

### **Population**

As many as 32 school going children aged between 10-12 years, who were regularly carrying their backpacks for an average of 30 minutes a day were targeted from a school of Jammu & Kashmir, namely "The H.K.M.C Educational Institute", Ganderbal. The subjects were selected from the rural area school of Jammu & Kashmir.

### **Sampling Method**

Convenient random sampling method was used for the study. The Subjects were included in the study as per the availability and inclusion and exclusion criteria. Data collection was done in schools on their schedule at those places so that the classes and other curriculum based activities must not get disturbed.

### **Sample Size**

32 subjects were recruited carefully for the study who were fulfilling both inclusion and exclusion criteria.

## **SAMPLING CRITERIA**

### **Inclusion Criteria:-**

- (i) Healthy school going children who were using their backpacks for at least 30 minutes a day.
- (ii) Only male school going children.
- (iii) Subjects within the age range of 10-12 years
- (iv) Subjects with normal and pain free shoulder joint and spine.
- (v) Subjects without any disability.

### **Exclusion Criteria:-**

- (i) Female school going children.
- (ii) Subjects who complain of shoulder or back surgery at the time of inclusion.
- (iii) Subjects with history of any neurological condition in an around scapular and shoulder region.
- (iv) Subjects with any active pathology in spine.
- (v) Subjects who experienced any type of fracture before taken as the subjects for this study.
- (vi) Subjects with the history of skin allergies.

### ***Instruments / Materials Used***

The usage of instruments and equipments are pre-requisite to almost every study. Henceforth, this study being very experimental in nature required a lot of instruments which met its objectives. The Instruments which were used for this study are as follows:-

1. Stadiometer
2. Electronic weighing machine (Digital)
3. Digital camera
4. Tripod
5. Marker Pen
6. Backpack (UNISED, INDIA APPROVED)

### ***Measurement Protocol***

Instructions given to the subjects for data collection:-

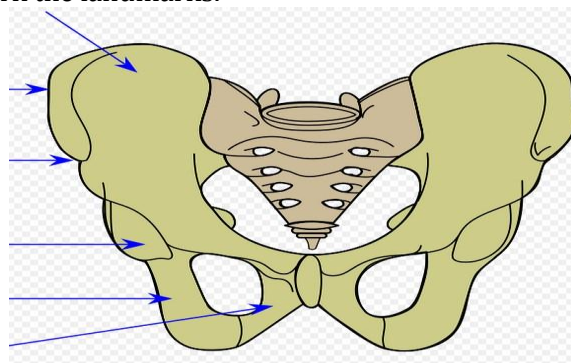
The subjects were given the following instructions before the data collection phase was initiated:-

- (i) Removal of shoes
- (ii) Keeping away all the electronic gadgets, if any.
- (iii) To remain in discipline
- (iv) To feel relaxed and calm
- (v) To look forward while weighing and height measurement process.

For this study, 32 primary school children under the age group of 10-12 years belonging to “The H.K.M.C educational Institute, Ganderbal, Jammu and Kashmir” were conveniently recruited as the subjects after taking a due care of Inclusion and Exclusion criteria adopted for this study. A formal ethical consent was taken from the human rights ethics review committee at the Punjabi University, Patiala as well as the permission from the parents / guardians of these subjects. In the first phase, the weight and height of the subjects was taken using reliable equipments. BMI was calculated with a careful procedure and In phase second of the data collection, the subjects were asked to expose their upper body so that proper marking could be done by the markers. Photographs were taken in two different planes i.e. frontal plane and sagittal plane with unloaded condition and 15% BW load condition.. The first phase of photographs was taken in an unloaded condition. After that Second phase was taken with the 15% body weight (BW) load Condition.

### ***Administration for the Collection of Data***

Clothing was rearranged to so that the upper body would be exposed or get bare. With the subjects standing white adhesive markers of size 3x3 cm dimensions were placed on the anterior superior iliac spine, landmarks. In case where it wasn't convenient to post white markers, black marking pen was used to mark the landmarks.



***Figure 1:- Anatomical view of Superior iliac spine.***

The subjects were asked to stand comfortably with arms by their side in normal standing posture. A restraining line was also drawn to help in aligning the feet symmetrically behind it. The subjects looked directly ahead while the photographs were taken to photograph the posture both in the frontal as well as the sagittal plane. The camera was placed on a tripod to stabilize it. The camera was positioned on a tripod stand as per the height of subjects at a distance of 3 meter away from the subject.

The raw data obtained from getting the assistance of all the above mentioned instruments was then analyzed through the APECS (All Posture Evaluation and Correction System). The statistical treatment was given through the SPSS (Statistical package for Social Sciences). The dependent t- test was performed on the two recorded raw data scores.

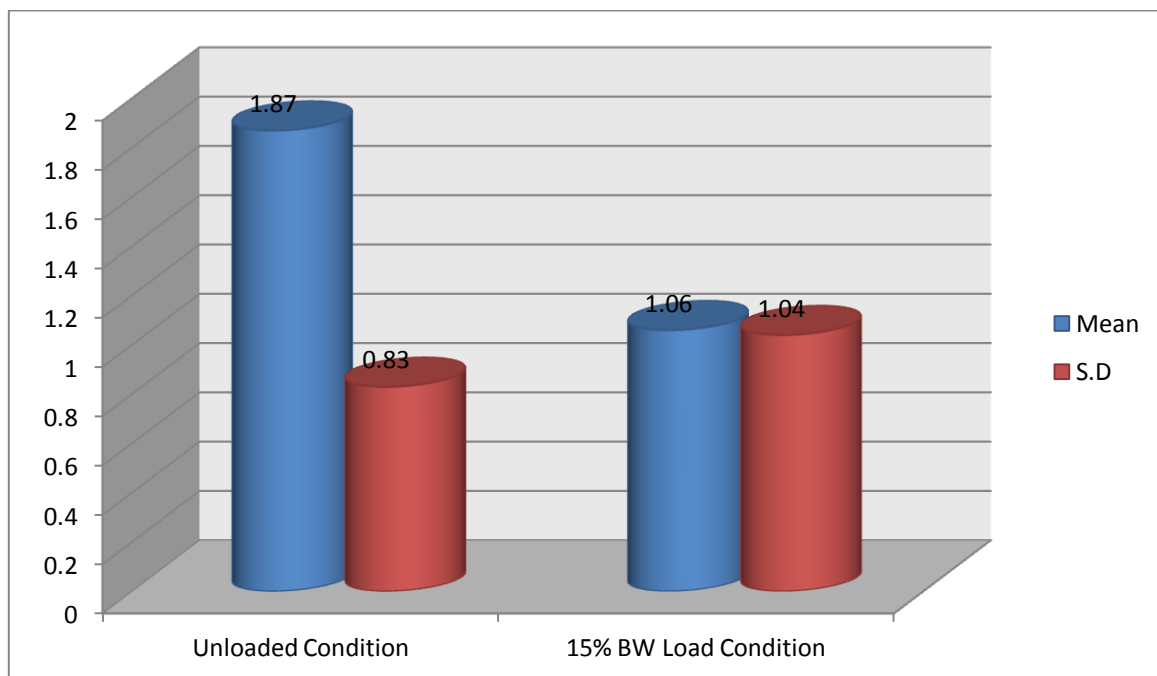
**Results**

The results of this study reported a significant difference between unloaded condition and 15%BW load condition, which is statistically shown below:-

Variable	N	Mean	S.D	t- value	p-value
Unloaded Condition	32	1.87	0.83	-4.76	.00004
15% BW load condition	32	1.06	1.04		

**Table 1:- Mean S.D distribution with the calculated p-value and t-value.**

The table shows the mean, standard deviation, t value and p value of the unloaded condition and 15% BW load condition. The table evidently indicates that the mean for the unloaded condition is M = 1.87 and S.D = 0.83, whereas M= 1.06 and S.D = 1.04 for 15% BW load condition. It is also evident that the p- value (.00004) is lower than the .05 level of significance. Consequently, it can be said that there is a significant difference between the unloaded condition and 15% BW load condition in relation to Pelvic tilt.



**Figure 2: Mean and S.D Distribution of Pelvic Tilt Analysis. (Unloaded condition and 15% BW load condition).**

## DISCUSSION

A significant difference was found between the unloaded condition and 15% BW condition after the careful analysis of the posture in connection with the pelvic tilt. The reason may be that a double strapped backpack by UNISED (INDIA), used for the study, which weighs 1.20 kg empty, may be promoting a pelvic tilt in the subjects as the musculoskeletal system of the subjects in the age group of 10-12 years is normally in the developmental phase. The load of the backpacks may have put a tilted impact on the pelvic region of the subjects which resulted in showing a significant difference between the results of unloaded condition and 15% BW condition. In the agreement of this finding, Smith et al., (2006), reported that a significant difference was found in the pelvic tilt angles between the unloaded condition and 15% BW load condition. This conclusion and finding of him fully supports the finding of this study.

## CONCLUSION

The data analysis platform showed a significant difference between the unloaded and 15% BW load condition in relation with Pelvic tilt. The school bag with 15% BW load was reported as non standard load for the school going children. It was investigated in this study that 15% BW load puts a significant effect on the Pelvic region of the children. The children in their schooling age experience various growth and development phases, and if they would be exposed to this inhuman and non standard backpack weight for about 180 minutes a week, it would then cast a very devastating effect on their overall posture. Therefore, it is recommended that students should avoid the 15% BW load and other fellow researchers may conduct some relevant studies which can possibly define a standard backpack load limit for the school going children.

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