

Influence Of Backpack On Cervical And Shoulder Posture In Collegiate

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Abstract: Background: Most of the student uses backpack to transport their belongings to college every day. Backpack is one of the several ways of load carriage which provides flexibility and it is used by students often. Nowadays, students right from the age of kindergarten through college have to learn enormous number of technical subjects and carry heavy Backpacks. Students who carry heavy backpacks tend to get reposition on the cervical and shoulder postures. Students will get back pain much earlier than others, and usage of heavy weighted backpacks is a factor which potentially cause dangerous to their body.

Objective: The study is conducted to collect the evidences about the harmful change in posture that college students are facing because of carrying backpacks.

Study design: Non-experimental design.

Methods: 100 male students aged 17 to 23 years were selected from SRM University. To analyze postural changes, Craniohorizontal angle (CHA), Craniovertebral angle (CVA), and Sagittal shoulder posture (SSP) were measured with backpack and without backpacks. These angles were measured with help of AutoCAD software 2013 by giving student photographs as the input to it.

Results: It showed postural difference with respect to CHA, SSP with backpack and without backpack. There is a change in head forward posture while carrying heavy weighted backpack. The majority of students carry backpack with greater than 15% of body weight.

Conclusion: There is a significant change in Cervical and shoulder posture while carrying backpack than without backpack.

Keywords: Backpacks, Craniohorizontal Angle, Craniovertebral Angle, Sagittal Shoulder Posture.

I. INTRODUCTION

Backpacks are a convenient way for students to carry essential educational materials. Additionally, when purchasing a backpack, many students probably give little or no attention to backpack design, padding and overall weight. Moreover, many students are not insight about their backpack weight or contents or even how they lift it, carries or wears his/her backpack. And sometimes, they literally do like piling a lunch

box, lab or sport supplies, notes and textbooks which typically weigh huge. Therefore, the load that student carry around, could be huge and potentially dangerous to their body.

Backpacks carried by school children from kindergarten through college may be associated with some potential health consequences, including muscular aches, back strain, altered gait, bad posture and eventual discomfort (Javadivala, et al, 2012). Carrying heavy backpacks have raised concerns regarding the side effects of prolonged or habitual carriage of

heavily loaded backpacks among students (Youlian, et al, 2008).

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)[4] [5].

The Chairman of Assocham's health committee B K Rao said, As per the Children's School Bag Act 2006, a backpack should not weigh more than 10 per cent of a child's weight. The law also stipulates that nursery and kindergarten students should carry no schoolbag and the school authorities should issue guidelines on bags. "If students start getting back pains at such a young age, then there is the possibility that they will have it life long," Rao said.

A recent survey conducted by Associated Chambers of Commerce and Industry of India (ASSOCHAM) under its Healthcare Committee has found that 68 per cent of school children under the age of 13 years across India may suffer from mild back pain, which can develop into chronic pain and later into hunchback. The survey noted that over 88 per cent of children in the age group of 7-13 years carry more than 45 per cent of their weight on their backs which was conducted in ten cities including Delhi, Kolkata, Chennai, Bangalore, Mumbai, Hyderabad, Pune, Ahmedabad, Lucknow, Jaipur and Dehradun in which over 2500 students and 1,000 parents were interviewed.

Numerous studies have estimated that the maximum mean weights of backpacks in students should be 15% of the body weight. Evidences from epidemiologic, physiologic, and biomechanical studies suggest that backpack weight should be 10% to 15% of body weight by Brackley, et al., 2009[16] and Heuscher, et al, 2012[6].

According to the American Academy of Pediatrics (AAP), student's backpack shouldn't weigh more than 10 to 20 percent of their weight, but often this limit is exceeded, and it could certainly lead to strain and even injury. Jaime Quinn (DPT), Professional Physical Therapy partner and regional clinical director, NYC, "Wearing a heavy backpack for prolonged periods may cause excessive strain in one's neck, back and shoulders," she explains. "Over time, muscles may fatigue, and the wearer may fall into poor posture, which may lead to muscle imbalances, which, if long-term, may cause increased risk of injury". She recommended strengthening the back and core (abdominal) muscles in order to improve posture and ease the burden of carrying a heavy backpack for long periods of time.

Hence, Heavy backpacks may cause the wearer to bend forward and increases strain on the lower back. Also, it may cause a forward head and rounded shoulder posture, which may result in tightness of muscles and excessive strain on the cervical spine (neck). When a heavy weight backpack is incorrectly placed on the shoulder, the weight of the bag can pull student backward, student may end up bend forward, which can cause the spine to compress unnaturally. They may also get backpack-related injuries because they carry loads that are heavier in proportion to their bodyweight. To determine changes in cervical and shoulder posture when carrying a backpack compared with their posture without

backpack whether 15% of body weight in a backpack carried over both shoulders produce changes in cervical and shoulder posture, compared with 'unloaded' posture.

There are so many backpack effects analyzing studies had been made, but each studies were concentrated on identifying the effects of backpack on school students. Now a days, both the school students and the college students are facing the problems of having heavy weighted backpacks There is no such approach which finds the effect of heavy weighted backpack on college students. So there is a need for such study to accurately identify the effects of backpacks on college students.

II. METHODOLOGY

Ethical approval was obtained from SRM College of Physiotherapy, SRM University. The study was performed in various departments in SRM University, Kattankulathur. Procedure was explained to the students clearly obtained. A total 170 are participated and of these, 100 students are fulfilled this study.

The Normal male students aged between 17 to 23 years. A student who carries bags on both the shoulders and the BMI Ratio (18.5 to 22.9) are included in this study.

Exclusions are the female students, Obesity individuals. Students with history of back and neck pain. Students with any congenital deformity and scoliosis. Students with any respiratory disorder.

Materials used are measuring tape, adhesive marker, electronic weighing machine, camera (16mp, 8x zoom), data collection: students photograph in lateral view, and the (AutoCAD Software 2013) is a computer Aided Drafting program. It is a 3 dimensional software and widely used in Architecture, Civil engineering, Mechanical engineering, Structural engineering, Technical illustration, Land management, Graphics, Electrical Engineering, interior decoration, or even clothing design and Arts. Also it is used as a drafting tool provides us an electronic drawing sheet. Inside the drawing area one vertical and horizontal line present called Graphic cursor or Crosshairs. On command these Graphic cursor will join the anatomical markers. It will give us the degree of that angle.

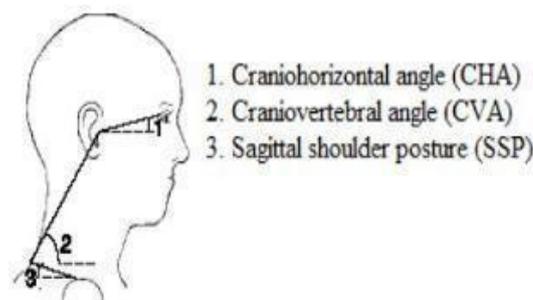


Figure 1: Angle Measurements

A. CRANIOHORIZONTAL ANGLE

The angle formed at the intersection of a horizontal line through the tragus of ear and the external canthus of the eye, will be measured. It is believed to provide an estimation of

head on neck angle or position of upper cervical spine (Raine and Twomey1994).

B. CRANIOVERTEBRAL ANGLE

This angle was defined by Wickens and Kipath (1937). The angle termed at the intersection of a horizontal line through the tragus of the ear and a line to the spinous process of C7. It gives the estimation of neck on upper trunk positioning. This small angle indicates more headed forward posture.

C. SAGITTAL SHOULDER POSTURE

The intersection of a horizontal line through C7 and a line between the mid- point of the greater tuberosity of the humerus and posterior aspect of the acromion, will be measured. This angle gives the measurements of shoulder forward position. The smaller angle indicates that the shoulder is further forward in relation to C7 (or more rounded shoulder, Raine and Twomey1994). It is commonly used to estimate the response of the human body to its environment is accurately measured by photograph.

The Procedure of this research is properly taken by measure and records the student’s height in cm, weight in kg and weight of backpack in kg. Clothing of students will be adjusted or rearranged so that the neck and the shoulders are exposed for correct measurement.

The student will be marked on 4 anatomical points comprising

- ✓ External canthus of right eye.
- ✓ Right tragus.
- ✓ Spinous process of C7.
- ✓ A midpoint between greater tuberosity of humerus & Posterior aspect of acromion process of right shoulder.

Students will be asked to stand comfortable with arms by their side in normal standing posture. They will be asked to place their weight evenly on both feet. Camera will be placed at subject's right side.

Two photographs will be taken from lateral view at same time.

- ✓ Without Backpack.
- ✓ Carrying backpack over both shoulders.

To evaluate posture of the cervical and shoulder region, 3 angle measurements done on, Craniohorizontal angle, Craniovertebral angle, Sagittal shoulder posture.

These angles are measured by AutoCAD (Aided Drafting Program).



Figure 2: Image Assessment using CAD

III. DATA ANALYSIS

The collected data were tabulated and analyzed using Descriptive Statistics by IBM Statistical Package for Social Science (SPSS) version24. Mean and Standard Deviation were used to assess all the parameters of the data.

The statistical tools used in the study are unpaired “t” test and student independent “t” test.

STUDENTS SCREENING TEST FOR 170 STUDENTS FROM VARIOUS DEPARTMENTS IN SRM UNIVERSITY

NUMBER OF STUDENTS	DEPT	ELIGIBLE STUDENTS	ELIGIBILITY %
52	BOT	33	63%
108	BPT	78	72%
10	BE	6	60%

Table 1

The total number of students in this study was 170. The number of students from SRM Engineering College was 10 and 160 students from medical science departments. 31% of the students (ie., 52 students) were not selected in screening test due to some criteria like they already have back pain problem, obese problem etc. 69% of the student passed in screening test. ie., (118 students from the total student). Among these 69% of the selected student, only 85% students (i.e., 100 students) cooperated for this research work.

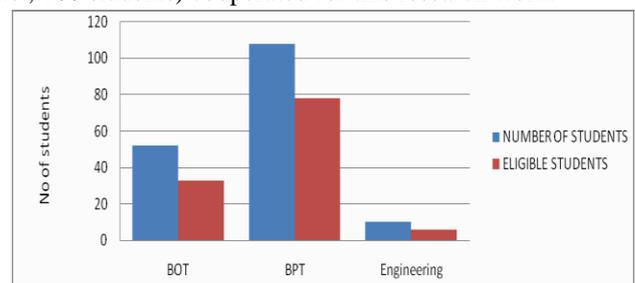
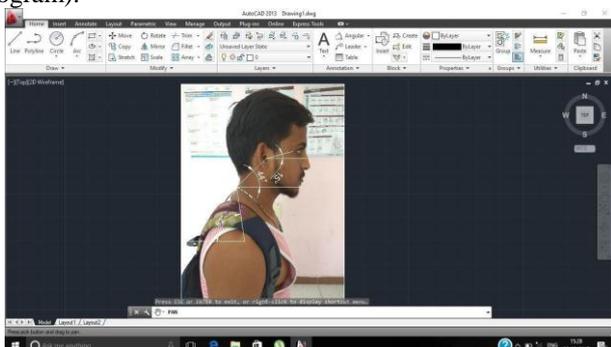


Figure 3

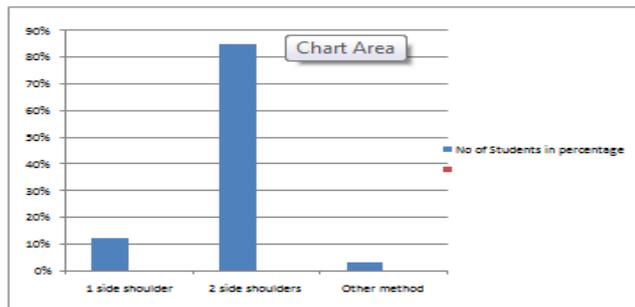
PERCENTAGE OF STUDENTS CARRYING BAGS IN DIFFERENT METHODS

Way of Carrying Bag	1 side shoulder	2 side shoulders	Other method
No of Students (Percentage)	12%	85%	3%

Table 2



Total number of students considered for this study after screening test is 100. Out of which 12 % of the student carry bag on one side of their shoulder. 85% of student carries their bags on both the shoulders. And remaining 3% carry their



bags on different methods.

Figure 5

DIFFERENCE OF CRANIOHORIZONTAL, CRANIOVERTEBRAL ANGLES AND SAGITTAL SHOULDER POSTURE BETWEEN SUBJECTS WITH AND WITHOUT BACKPACK

No. of Samples = 100		Mean	SD	T Value	P Value	Criteria	Result
CRANIO HORIZONTAL ANGLE	Without backpack	18.22	6.240	3.87157	0.00073	P<0.01	Significant
	With backpack	21.43	5.449				
CRANIO VERTIBRAL ANGLE	Without backpack	50.1	6.107	0.74386	0.4578	P<0.01	Not Significant
	With Backpack	49.43	6.619				
SAGITTAL SHOULDER POSTURE	Without backpack	72.3	6.487	2.52794	0.00612	P<0.01	Significant
	With backpack	74.49	5.741				

Table 3

There is significant change in craniohorizontal and shoulder sagittal posture. Since the value obtained by those angles are less than the threshold value 0.01. So these two angles have greater impact on backpack wearing. And there is no such significant result found in craniovertebral angle.

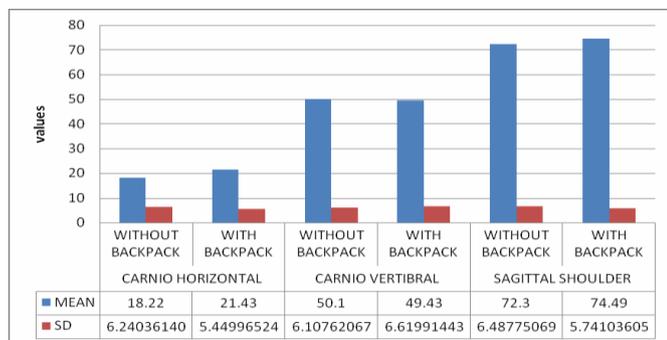


Figure 6

IV. RESULTS

Results were analyzed by using both manual and IBM SPSS version 24.0 software. Un Paired t- test was applied to

assess all the three angles such as Craniohorizontal angle, Craniovertebral angle and Sagittal shoulder posture.

The screening test has been done for 170 students from various departments in SRM University. Out of which, 118 students has been selected under eligibility criteria. From those 118, only 100 students for the study.

Students considered for this study after screening test is 100. Out of which 12 % of the student carry bag on one side of their shoulder. 85% of student carries their bags on both the shoulders. And remaining 3% carry their bags on different ways.

According to the statistical report, the mean value of craniohorizontal angle got increased from 18.22 to 21.43. The mean value of cranio vertebral angle got decreased from 50.1 to 49.43. The mean value of sagittal shoulder posture got increased from 72.3 to 74.49. Also there is highly significant result found in craniohorizontal angle ($t= 3.8715, p<0.01$), this angle increased after carrying backpack which indicates the extension of upper cervical spine. There is also a highly significant result found in sagittal shoulder posture ($t=2.5279, p<0.01$), which denotes the change in curvature of the spine. There is no such significant result found in craniovertebral angle ($t=0.7438, p<0.01$).

The results of this study showed that, there is some change in postures of student after wearing backpack is significantly associated. On the other hand, the results were also significant at $p<0.01$ stating that there is a change in the postural alignment of the student due to carrying of the backpacks about 15% of their bodyweight.

V. DISCUSSIONS

The interest of carrying backpacks, particularly with regards to students, has dramatically increased in recent years. The aim of the present study is to find the influence of backpack on college students. Girls and Obesity people were not considered for the study. The results of this study showed that change in postures of student after wearing backpack is significantly associated ($P < 0.01$). On the other hand, the results showed that carrying backpack as 15% of body weight had significant effect on student in cranio horizontal and shoulder sagittal angle and it had no significant relationships with cranio vertebral angle. There is a significant change in the posture after carrying the backpack was also noticed. There was flexion in lower neck, extension in upper neck and stooped posture of the spine.

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In [1], there were highly significant results found from all the three angles. The study was focused on school students (ie., children). But in our study, the effects of backpack on college students (ie., adolescents) have got no significant change in craniovertebral angle. Occurrence of such result in this study may be due to the age groups of students being considered.

The mean weight of backpacks in the study was 15% of student's body weight. Although the age range is not comparable, yet another study on students aged 12-18 years reported that the mean of bag weight was 8.3 kg [10]. In other studies, students with mean age of 11.6 years had bag weights averaging about 9 kg [11] [20]. The range of bag weight in our study was 15% –16% of the body weight of the student. The larger bag weight found in this study may be explained by the fact that some students bring more books, sports item, laptops, and heavy lunch boxes in some days than other days. The mean of college bag weight differed slightly according to the weight they carry. As previously explained, the difference in bag weights on a day to day basis was found to be a factor in determining the average bag weight. Also, the number of additional materials carried by the student is a factor. Students carrying bags exceeding 15% of their body weight had some risk of pain compared to students who carry less than 15% of their body weight. Dr. Shivananda et al., (2013) conducted a analysis of this same study in school children using back pack and concluded that forward head posture increased when carrying backpacks especially one with a heavy load carrying backpacks weighing 15% of body weight appeared to be too heavy to maintain standing posture.

Carrying a backpack weighing 15% of the body weight appeared to be too heavy to maintain standing posture for adolescents[19]. The 15% load condition induced a significant increase in trunk forward lean and prolonged blood pressure recovery time [18]. Another study by Ramprasad et al., (2010) indicated that significant changes occurred in TFL and CVA when the backpack was loaded to 15% body weight[17]. Also, little change in temporal-spatial gait parameters was noted during backpack use with loads limited to 15% body weight[16].

VI. CONCLUSION

The study involved a large cross-sectional sample of students who studies in SRM University, Kattankulathur. The study can be concluded by stating that there is a small but significant differences were found when comparing posture while carrying a backpack in the Craniohorizontal angle, Craniovertebral angle and Sagittal shoulder posture. A significant reduction in the craniovertebral angle was found while carrying a backpack weighing about 15% of body weight over both the shoulders indicating an increase in the forward head posture. Also there was significant increase in the Craniohorizontal angle and the Sagittal shoulder posture with the loading.

Thus it implies that the weight of the backpack has an adverse effect on changes in the cervical and shoulder posture, suggesting that carrying a backpack weighing 15% of body weight would be too heavy for students to maintain their

normal postural alignment, in other words, carrying a backpack of less than 15% of body weight could be recommended. Also results revealed that, almost half of the sampled students (50.6%) declared that backpack felt heavy sometimes.

VII. LIMITATIONS

College students in the age group of 17-23 were considered in this study. Also the male students were included in this study since it was difficult to take photographs of female students. Asia's scale BMI range had taken for this study. Due to time constraint, only 15% of bag weight to that of body weight of students was examined in this study.

VIII. RECOMMENDATIONS

Further research is needed to investigate the effect of backpack carriage in static and dynamic conditions on cervical and shoulder posture changes. May be not concentrating generic effects of backpacks, the work might be done like particularly concentrating on effects of backpack on muscular skeletal, spinal curvature etc.,

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