



# EVALUATING CHANGE IN CRANIO-VERTEBRAL ANGLE AND NECK PAIN IN COLLEGE STUDENTS WITH BACK PACK AND WITHOUT BACK PACK.

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**Abstract:** Regular use of heavy bags can put students at the risk of musculoskeletal problems and changes the body posture. The purpose of this study is to quantify the postural changes, particularly the head on neck angle or cranio-vertebral angle, when carrying backpack or bag in male and female university students. Total 63 participants were included in this study. Out of 63 there were 23 Male and 40 female. **Result:** The average CVA with and without back pack shows that the CVA decreases in subjects carrying back pack, with mean value of 50.27 degrees and 53.28 degrees of CVA with back pack and without back pack respectively. The average NPRS scoring with and without back pack shows that the NPRS increases in subjects carrying back pack, with mean value of 3.98 and 0.31 of NPRS score with back pack and without back pack respectively.

**IndexTerms** – Craniovertebral Angle, Neck Pain, Back Pack

## INTRODUCTION

The academic rigors placed on university students continue to evolve with the times and may have different effects compared with those in years past. The growth in technology, continual development of textbooks, and popular endeavors for holistic personal enrichment are all contributing factors to recent accounts of musculoskeletal pain and postural dysfunction in even younger populations. Many items accompany these aspects of individual growth, and are carried in a most compact and convenient form of transport, namely the backpack.<sup>(1)</sup>

Neck pain is a common disorder. Poor posture might result in muscular imbalance that causes a faulty relationship among various body parts. Forward head posture is one of the most common cervical abnormalities that predispose individuals toward pathological conditions, such as headache, neck pain, and temporomandibular disorders.<sup>(2)</sup>

The carrying of a backpack alters upright posture and results in postural responses that require a complex interaction of trunk and limb adjustments to accommodate to the new stressor and maintain upright equilibrium. The backpack is an appropriate way to load the spine closely and symmetrically, while maintaining stability. There is a widespread belief that repeated carrying of heavy loads, such as school backpacks, place additional stress on rapidly growing adolescent spinal structures, making them prone to postural change.<sup>(3)</sup> Moreover, external forces such as load carrying in the form of heavy bags may influence the normal growth, development of children and adolescents and also maintenance of alignment of their bodies.<sup>(4)</sup>

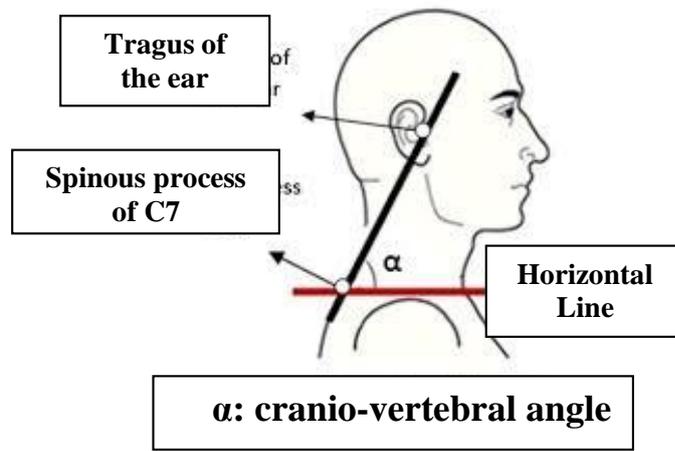
The peak rate of growth occurs during puberty and the growth of the appendicular skeletal system ceases around 16 years of age for females and 18 years for males. However secondary ossification of vertebrae is not complete until the mid-twenties.

Therefore, the spine may be susceptible to injury for a greater length of time and therefore, proper backpack use should be emphasized during these years.<sup>(5)</sup>

It is thought that adolescents or patients with neck pain have a more forward head posture, thus a smaller cranio-vertebral angle than age-matched pain-free participants.<sup>(2)</sup>

Other studies involving a young adult population were found with the United States Army Research Institute of Environmental Medicine (USARIEM). LaFiandra et al<sup>16</sup> have studied the type of backpack and the resulting biomechanics of active soldiers, but they have not focused on the CVA in particular. These researchers found that gait and muscle activity changed while carrying a posterior load. In the cervical region, increasing loads recruited more upper trapezius and erector spinae muscle activation.<sup>(1)</sup>

The cranio-vertebral angle is defined as the angle formed from a horizontal line passing through the C7 spinous process and a line passing through the tragus of the ear.



### NEED OF THE STUDY

Regular use of heavy bags can put students at the risk of musculoskeletal problems and changes the body posture.

The purpose of this study is to quantify the postural changes, particularly the head on neck angle or cranio-vertebral angle, when carrying backpack or bag in male and female university students.

The cranio-vertebral angle is defined as the angle formed from a horizontal line passing through the C7 spinous process and a line passing through the tragus of the ear.

Thus the study, **EVALUATING CHANGE IN CRANIO-VERTEBRAL ANGLE AND NECK PAIN IN COLLEGE STUDENTS WITH BACK PACK AND WITHOUT BACK PACK** will aid in checking change in cranio-vertebral angle for better postural analysis.

### AIM AND OBJECTIVES

**AIM:** Evaluating change in cranio-vertebral angle using MB- Ruler software and neck pain on NPRS scale in college students with back pack and without back pack.

#### OBJECTIVES:

- To examine the students cranio-vertebral angle with back pack and without back pack using MB-Ruler software.
- To see the neck pain of college students with and without back pack using NPRS scale.
- To study the change of cranio-vertebral angle and neck pain in students carrying back packs.

### HYPOTHESIS

**HYPOTHESIS (H<sub>1</sub>):** There will be significant change and effect on cranio-vertebral angle and neck pain with use of back pack in college hours.

**NULL HYPOTHESIS (H<sub>0</sub>):** There will be no significant change and effect on cranio-vertebral angle and neck pain with use of back pack in college hours.

### RESEARCH METHODOLOGY

#### Population and Sample

Final year students aged 20-22 years were included, the study design is observational Cross-Sectional study, and the method of sampling was convenient sampling. The study setting was the medical college and the minimum sample size for the study was, 50 therefore the sample size in this study was taken 63. Study duration was six months. Inclusion criteria; boys and girls willing to participate, college students, students carrying back pack daily. Participants with no history of chronic or acute neurological condition affect the spine or extremities. Participants who appeared to be healthy and free of injuries, physical and/or mental disorder. Participants that are unable to stand were excluded.

### PROCEDURE

To conduct the following study permission was taken from the ethical committee. Subjects were taken as per the inclusion and exclusion criteria and the procedure was explained and a written consent was obtained from the subjects. Initially the demographic data that is name, age, gender was assessed.

The subjects were first asked to sign an informed consent document. This cross-sectional study was done on college students.

First cranio-vertebral angle of the students were measured without back pack and with back pack. Then neck pain was assessed without back pack and with back pack.

**1)Assessment of Cranio-Vertebral Angle:**

The subject was asked in a random manner to either remove his or her bag or wear it. He or she then walked 30 meters and then flex and extend his or her neck 5 times before being asked to assume a natural position looking straight ahead.

The C7 spinous process was identified and marked by palpation with active flexion and extension by the subject. Then the tragus of the ear was palpated and marked.

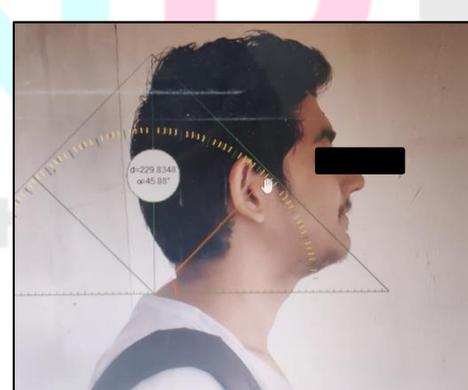
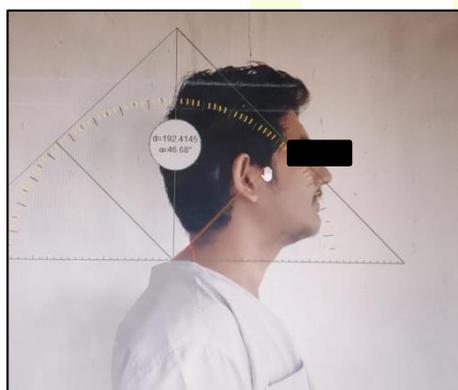
The researcher then measured the cranio-vertebral angle using the MB-Ruler App with a sagittal view.

And this cranio-vertebral angle was then compared with normal standard value.



**Measuring CVA without back pack using MB-Ruler Software**

**Measuring CVA with back pack using MB-Ruler Software**

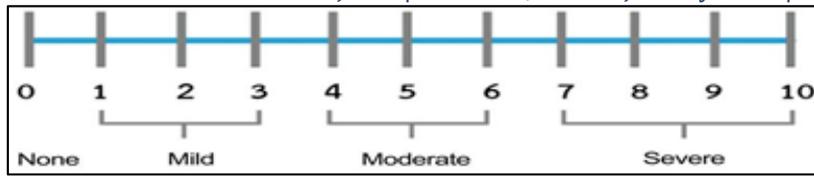


**Measuring CVA without back pack using MB-Ruler Software**

**Measuring CVA with back pack using MB-Ruler Software**

**2) Assessment of Neck Pain:**

For the assessment of Neck Pain all the subjects were given a Numerical Pain Rating Scale (NPRS). In which 0 is No pain, 5 is mild pain and 10 is worst pain. The subjects were asked to do a mark on the scale according to their level of pain.



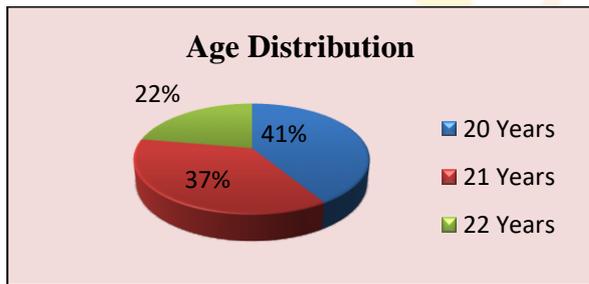
**RESULTS AND DISCUSSION**

**Table 1): The age wise distribution of study subjects**

Age In Years	Number	Percentage
20	26	41%
21	23	37%
22	14	22%
<b>Total</b>	63	100%

In study groups 26 subjects were 20 years of age, 23 subjects were 21 years of age, and 14 subjects were 22 years of age.

**Graph 1): The age wise distribution of study subjects**

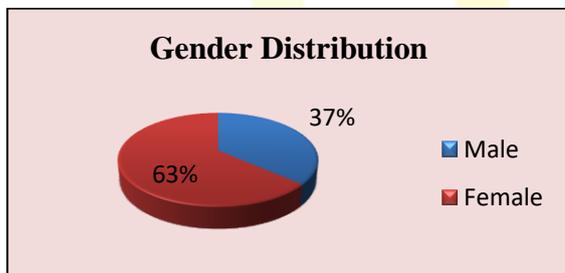


Comments: The pie diagram shows age distribution of study subjects.

**Table 2): The gender distribution of study subjects**

Gender	Number	Percentage
Male	23	37%
Female	40	63%

**Graph 2): The gender distribution of study subjects**

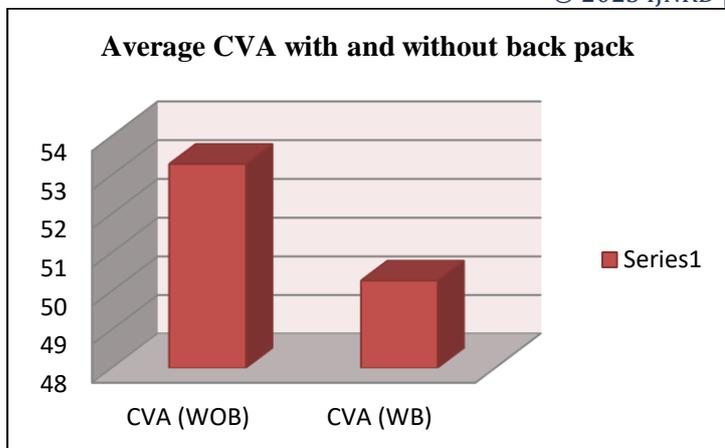


Comments: The pie diagram shows gender distribution of study subjects. There were 23 Males and 40 Females in the study.

**Table 3): Average CVA with bag and without back pack**

	CVA (WOB)	CVA (WB)
<b>Mean</b>	53.28	50.27
<b>N</b>	63	63
<b>SD</b>	4.187	4.517

**Graph 3): Average CVA with and without back pack.**

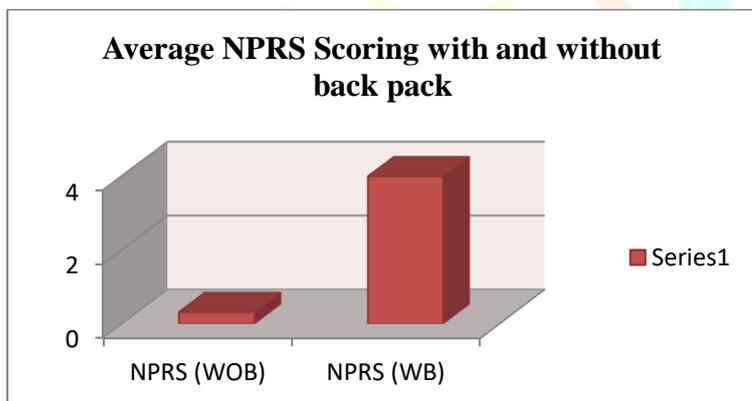


Comments: The above graph shows the average CVA with and without back pack. Cranio-vertebral angle (CVA) decreased as the subject carried a back pack.

**Table 4): Average NPRS scoring with back pack and without back pack.**

	NPRS (WOB)	NPRS (WB)
Mean	0.31	3.98
N	63	63
SD	0.59	1.651

**Graph 4): Average NPRS scoring with back pack and without back pack.**



Comments: The above graph shows the average NPRS scoring with and without back pack. NPRS score increases in subjects carrying back pack.

## RESULT

1. Total 63 subjects were included in the study. Out of 63 subjects, 26 subjects were 20 years of age, 23 subjects were 21 years of age, and 14 subjects were 22 years of age.
2. Total 63 participants were included in this study. Out of 63 there were 23 Male and 40 female.
3. The average CVA with and without back pack shows that the CVA decreases in subjects carrying back pack, with mean value of 50.27 degrees and 53.28 degrees of CVA with back pack and without back pack respectively.
4. The average NPRS scoring with and without back pack shows that the NPRS increases in subjects carrying back pack, with mean value of 3.98 and 0.31 of NPRS score with back pack and without back pack respectively.

## DISCUSSION

The main purpose of the study is evaluating changes in cranio-vertebral angle and neck pain in college students with back pack and without back pack. This is a cross sectional study performed on 63 college students of age group 20 to 22, out of which 40 participants are female and 23 are male.

The chief objective is to study the change of cranio-vertebral angle and musculoskeletal pain in students carrying bag packs.

Outcome measure in the study showed the following results:

The result shows there is a extremely significant change in cranio-vertebral angle ( $p < 0.0001$ ) and musculoskeletal pain ( $p = 0.0001$ )

A study conducted by Christine T. San Agustin and Mary Ann Wilmarth on the Amount and Variation of Cranio-vertebral Angle Changes in College-aged Students Using One-strapped and Two-strapped Backpacks and Bags, in which they found that the average

CVA among the students measured  $49.23^{\circ} \pm 5.02^{\circ}$  without carrying the bag (CVASANS), and  $47.56^{\circ} \pm 5.48^{\circ}$  with the bag on (CVAWITH), a difference of  $1.67^{\circ}$ . The decrease in CVA is observed as more forward head posture and it also supports the current study that there is a change in CVA with and without bag, the values are larger without bag and less with bag.

In a study by Wunpen Chansirinukor on Effects of backpacks on students: Measurement of cervical and shoulder posture found that both backpack weight and time carried influenced cervical and shoulder posture. Forward head posture increased when carrying a backpack, especially one with a heavy load. Significant differences were found in the cranio-vertebral angle between the unloaded condition and carrying the backpack weighing 15% of body weight ( $p = 0.04$ ), and after a 5min walk ( $p = 0.001$ ) with the angle increasing in the loaded conditions. This reflects subjects' heads positioned more forward which is very similar to present study.

The findings of the study done by Mr. Janakiraman Balamurugan indicates the higher prevalence of musculoskeletal pain among younger children and carrying heavy school supplies with further analyses showing association of school bag weight and spinal pain is a worrying fact shows alarmingly the prevalence of musculoskeletal pain was 60.6% (180) and 65.7% (140) in male and female respectively, it supports the current study that there is increase in musculoskeletal pain with bag.

All of the preceding research supports and demonstrates that long term use of back pack causes forward head posture and musculoskeletal pain. The use of back pack for an extended period of time decreases the cranio-vertebral angle, resulting in forward head posture. Since the back pack is a necessary component, we cannot just remove it. Instead, we advise students to maintain and work on their posture correction to strengthen their neck and shoulder muscles.

### CONCLUSION

The study entitled evaluating changes in cranio-vertebral angle and neck pain in college students with back pack and without back pack is extremely significant. The study found that students carrying back pack have a significant change in CVA. The average result shows that there is a decrease in CVA with back pack which causes postural changes, as well as an increase in musculoskeletal pain. Over time, forward head posture can cause muscle imbalances as the body attempts to adapt and find efficient ways to hold the head up for straight ahead vision. Some muscles grow longer and weaker, while others grow shorter and tighter. Muscle imbalances can result from forward head posture.

As a result, subjects must concentrate on their muscle strength and posture in order to avoid forward head.

### STATISTICAL ANALYSIS

Statistically methods use,

The entire data of the study was entered and cleaned in MS Excel before it was statistically analysed in "GraphPad Instat version 3.05 of MS Windows.

All the results are shown in tabular as well as graphical format to visualize the statistically significant difference more clearly.

The data on qualitative characteristics was presented as n (% of cases).

The data on quantitative characteristics was presented as Mean  $\pm$  Standard Deviation (SD) across study group.

The statistical significance of change in cranio-vertebral angle and musculoskeletal pain carried out using paired t test.

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