



**ORIGINAL RESEARCH PAPER**

**Physiotherapy**

**TO COMPARE THE EFFICACY OF VARIATION OF CARRYING ANGLE IN NORMAL COLLEGE STUDENTS VS SPORTSMEN USING HAND ACTIVITIES**

**KEY WORDS:** Carrying Angle, Fulcrum, Measurements, Manual Goniometer, Dominant.

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**ABSTRACT**

**BACKGROUND:** The carrying angle is defined as the acute angle made by the median axis of arm and median axis of forearm in full extension and supination. This angle allows your forearms to clear your hips when you swing your arms, such as during walking. It acts as a lever arm when positioning the hand and functions as a fulcrum for forearm lever.  
**OBJECTIVE:** The aim of the study is to find the variation of carrying angle in both gender according to age group in relationship with height and special reference to side.  
**PROCEDURE:** To find carrying angle in normal adults between 18-25 years by using a Manual Goniometer, Measurements were performed with elbow in full extension and forearm in supination. Carrying angle was measured on right and left upper limbs to find out the difference on both the limbs. Their height, age and sex was noted.  
**RESULTS:** The carrying angle is greater in dominant arm than in non-dominant arm and is not inversely related to the height of person.

**INTRODUCTION**

The carrying angle is described as acute angle made by the median axis of arm and forearm in full extension and supination<sup>1</sup>. If the forearm is pronated or flexed from extension or in supinated position this angle is neutralized<sup>2</sup>. It plays an vital role in carrying objects and this angle allows the forearm to clear the hips in swaying movements in the midst of walking<sup>3</sup>. In the treatment of elbow fractures and in the diagnosis of the disease of lateral and medial epicondyles the value of carrying angle and its pathological variations is necessary<sup>4</sup>. It is commonly said that this angle is greater in females than males due to secondary sex characteristics.

The angle is plotted in such a manner that trochlear groove being vertical anteriorly however in posterior aspect it runs obliquely distally & laterally. In extension the carrying angle is formed when posterior aspect of the oblique groove forms connection with the trochlear notch of ulna & the angle is noted during flexion when trochlear notch lies on the vertical groove in the anterior aspect.

The average value of the carrying angle is 12.5 ±0.57 degrees in male and 15.26 ±0.45 degrees in females. Females had higher values than males except in 3-5 years age group in whom the carrying angle is greater in males. The finding of carrying angle and its value is vital in finding elbow problems and in the assessment of lateral and medial epicondyle deformities. In both the gender carrying angle increases i.e 0.42 to 0.60 every year. Elevation in this angle may lead to pain during some exercise, elbow instability, and in throwing activities during sports, it may decrease elbow flexion function, has risk for elbow dislocation or fracture when falling with outstretched hand.

In some studies it is said that left hand had more carrying angle than right hand (P<0.05). It is concluded that difference may be due to ligamentous laxity at the medial elbow or due to asymmetrical bone growth. Women in common have smaller shoulder and wider hips compared to men which may be a cause for acute carrying angle. The olecranon- coronoid angle is one of the causes of sexual difference noted in carrying angle.

The idea of carrying angle and its variation in dominant and non-dominant limb important for decrease in complications of elbow fracture, dislocation or in deformities and for designing prosthesis in elbow. So, the present study is to find the difference in dominant and non-dominant limb with relationship to height and whether a correlation existed between them.

**AIM FOR THE STUDY**

The aim of the study is to find the efficacy of variation of carrying angle in normal healthy students versus sports men using hand activities.

**NEED FOR THE STUDY**

To find the result of hand dominance over the carrying angle among healthy college students. To understand the variation of carrying angle in dominant limb and non-dominant limb for both the gender. More studies have noticed only the formation of carrying angle, difference in gender and age but only little attention has been paid to the dominancy between both the limbs.

**HYPOTHESIS**

**Null Hypothesis:-** There is no significant difference between the carrying angle of dominant and non-dominant limb in healthy adults.

**Alternate Hypothesis:-** There is significant difference between the carrying angle of dominant and non-dominant limb in healthy adults.

**REVIEW OF THE LITERATURE**

**Vichard Lim , Natasha Ashley Jacob (2014):** the carrying angle of elbow, An Anthropometric Study on the Carrying Angle of Elbow among Young Adults of Various Ethnicities in Malaysia, NJIRM 2014; Vol.

5(6).November-December pISSN: 2230 – 9969: The findings in this study will be useful for clinicians, anatomists, archaeologists, anthropologists and forensic scientists when such evidence provides the investigator the only opportunity to gauge that aspect of an individual's physical description which are of value in management of arm fractures, introduction of prosthesis, evolutionary studies and forensic assessments.

**Sharma K, Mansur DI, Khanal K, Haque MK (2013):** Variation of Carrying Angle With Age, Sex, Height and Special Reference to Side, Kathmandu Univ Med J 2013;44(4):315-318. The present study showed that the carrying angle was greater in female than in male and was greater in nondominant arm than in dominant arm and the carrying angle was not inversely related to the height of the person.

**Chen-Wei Chang MD, Yi-Chian Wang MD, Chang-Hung Chu MD (2008):** Increased Carrying Angle is a Risk Factor for Nontraumatic Ulnar Neuropathy at the Elbow, The Association of Bone and Joint Surgeons 2008,

466:2190–2195 suggested that greater carrying angle may increase the angulation of the ulnar nerve pathway and increase or cause a chronic stretching injury of ulnar nerve at the elbow.

**Kothapalli1, Pradeepkumar H. Murudkar1, Lalitha Devi (2013):** "The carrying angle of elbow- a correlative and comparative study", Int J Cur Res Rev, Apr 2013/ Vol 05 (07) Carrying angle increases with age and greater in females may be because Olecranon coronoid angle exhibiting high sexual dimorphism may be one of the causes and it may also considered as secondary sexual characteristic. Carrying angle measurement helpful in reconstruction of elbow disorders observed after treatment of distal humerus fractures and evaluating traumatic elbow injuries.

**Khare GN, Goel SC, Saraf SK, Singh G, Mohanty C.** New observations on carrying angle. Indian J Med Sci. 1999; 53:61–67. Carrying angle increases with age and greater in females may be because Olecranon-coronoid angle exhibiting high sexual dimorphism may be one of the causes and it may also considered as secondary sexual characteristic.

Carrying angle measurement helpful in reconstruction of elbow disorders observed after treatment of distal humerus fractures and evaluating traumatic elbow injuries.

**Dr Srushti Ruparelia, Dr Shailesh Patel, Dr Ankur Zalawadia, Dr Shaival Shah, Dr S. V. Patel (2010):** Study Of Carrying Angle And Its Correlation With Various Parameters, NJIRM 2010; Vol. 1(3). July-Sept.

ISSN: 0975-9840: According to the present Study, Height of the person is inversely related with the carrying angle. Average height of female is 153.9cm and in male it is 166.8 cm. There is significant difference between male & female carrying angle, in female it is 11.8 degree and in male it is 6.9 degree.

Greater carrying angle in female is considered as secondary sex characteristic. From the present study it is clear that the height & length of the forearm are directly related to each other. Length of the forearm in female is 22.7 cm on right side and 22.6 cm on left side where as in male this value is 24.9 cm on both sides which is inversely related to the carrying angle. It may be considered as secondary sex characteristics in female because according to the study of some workers there is no difference in the carrying angle in male & female up to the puberty. But in the female, it is increased after puberty.

**METHODOLOGY**

- STUDY DESIGN** : Non-Experimental study
- STUDY TYPE** : observational type
- SAMPLING METHOD** : Convenient sampling
- SAMPLING SIZE** : 200
- STUDY DURATION** : 2 weeks
- STUDY SETTING** : SRM College of Physiotherapy

**INCLUSION CRITERIA**

- Age 18-25
- Both males and females were included in this study
- Healthy Population

**EXCLUSION CRITERIA**

- Any recent fracture or dislocation in Upper limb
- Arthritis or nervous diseases of the upper limb
- Any other condition that restrict the application of hand force
- Upper limb congenital defects

**MATERIALS USED**

- Goniometer
- Stadiometer

**PROCEDURE**

The participants was explained about the procedure and consent form was taken into account to participate in the study.

Participants was selected on the basis of inclusion and exclusion criteria. Individuals baseline data was collected. The samples were divided into two groups Group A and Group B. Total 200 subjects in which Group A consists of 100 subjects (Male-50, Female-50) and Group B consists of 100 subjects (Male-50, Female-50). Their age ranges between 18-25 years. The carrying angle was measured in Manual Goniometer which had movable arm and stationary arm. The stationary arm was placed on median axis of upper arm, and the movable arm was adjusted on median axis of forearm and the angle was read on goniometer. The angle was measured in three trials and the average of them was noted. Bicipital groove, biceps brachii tendon and its insertion and palmar tendon at wrist were palpated and marked as anatomical landmarks to demarcate the median axis of arm and forearm respectively. Measurement of carrying angle was taken on both sides. subjects height, age and sex were noted. Height was measured in meters and carrying angle in degrees. All the Data was collected and statistical analysis was done.

**DATA ANALYSIS**

**TABLE-1**

Mean values of carrying angle measurement in male students

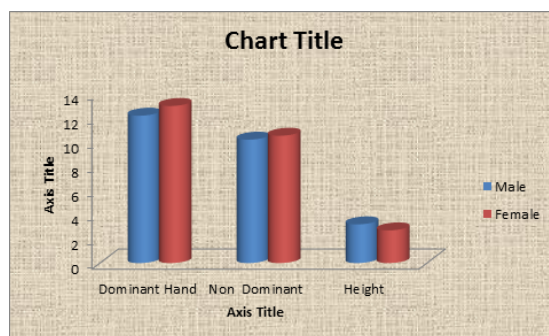
Gender (Male)	Dominant Hand	Non-Dominant Hand	Height
Mean	12.18	10.20	3.20
Standard Deviation	1.438	1.370	1.355
Range	6	6	5
Maximum	15	13	176-180
Minimum	9	7	150-155

**TABLE-2** Mean values of carrying angle measurement in female students

Gender (Female)	Dominant Hand	Non-Dominant Hand	Height
Mean	12.98	10.20	3.20
Standard Deviation	1.438	1.370	1.355
Range	6	6	5
Maximum	15	13	176-180
Minimum	9	7	150-155

**GRAPH-I**

COMPARISON BETWEEN DOMINANT AND NON-DOMINANT HAND IN STUDENTS



**TABLE-3**

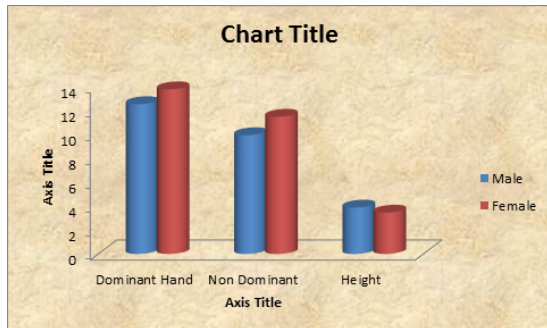
Mean values of carrying angle measurement in male players

Gender (Male)	Dominant Hand	Non-Dominant Hand	Height
Mean	12.54	9.94	3.88
Standard Deviation	1.606	1.504	0.940
Range	7	6	4
Maximum	16	13	175-180
Minimum	9	7	156-160

**TABLE-4**  
Mean values of carrying angle measurement in female players

Gender (Male)	Dominant Hand	Non-Dominant Hand	Height
Mean	13.78	11.48	3.46
Standard Deviation	1.266	1.344	0.838
Range	5	5	3
Maximum	16	14	171-175
Minimum	11	9	156-160

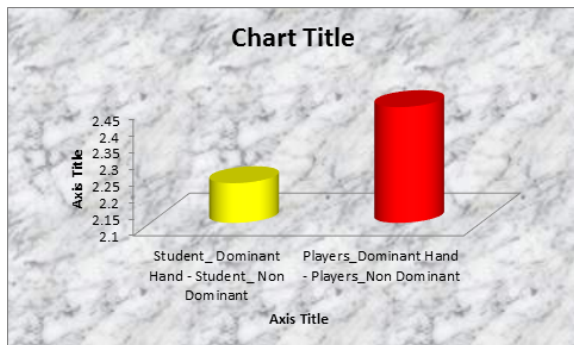
**GRAPH-II**  
COMPARISON BETWEEN DOMINANT AND NON-DOMINANT HAND IN PLAYERS



**Table-5**  
COMPARISON OF MEAN VALUES BETWEEN SUDENTS AND PLAYERS

	Mean	SD	SE	t-test	P-Value
Student_Dominant Hand - Student_Non Dominant	2.220	0.629	0.063	35.298 df=99	0.000
Players_Dominant Hand - Players_Non Dominant	2.450	0.770	0.077	31.804 df=99	0.000

**GRAPH-III**  
COMPARISON OF MEAN VALUES BETWEEN DOMINANT AND NON-DOMINANT HAND AMONG STUDENTS AND PLAYERS



**RESULT**

**Table-1** shows the mean value of dominant hand in students is 12.18 and 10.20 in non-dominant hand among male students  
**Table-2** shows the mean value of dominant hand in students is 12.98 and 10.20 in non-dominant hand among male students  
**Table-3** shows the mean value of dominant hand in students is 12.54 and 9.94 in non-dominant hand among male players  
**Table-4** shows the mean value of dominant hand in students is 13.78 and 11.48 in non-dominant hand among female players  
**Table-5 and Graph-III** represents the comparison of mean value of dominant and non-dominant hand among students and players

**DISCUSSION**

The angle is greater in the dominant limb than the non-dominant

limb of both sexes, suggesting that natural forces acting on the elbow modify the carrying angle. Developmental changes may be seen due to imposed stress over the dominant limb which may lead to change in the carrying angle. Aging and possibly racial influences add further to the variability of this parameter.

Knowledge of the measurement of the elbow carrying angle and of its variations is important when evaluating traumatic elbow injuries and other elbow disorders that require reconstruction or arthroplasties.

Sharma k Mansur et.al in their study Variation of Carrying Angle With Age, Sex, Height and Special Reference to Side has also found that the carrying angle of the dominant limb is more than the non-dominant limb. The clinical significance of this study lies in the prevention of deformities and neuropathies in post-traumatic elbow or condylar fractures of humerus

Several authors have attempted to determine the variation of carrying angle with age and sex. Potter was the first to carry out an investigation on variation of carrying angle in male and female.

He observed the greater carrying angle in females than in males. Subsequent measurements were made by Mall.

Since, then different measurements of carrying angle have been performed in a variety of ways ranging from use of a simple goniometer to some complex radiological procedure.

This study intended to determine the variation of carrying angle with age, sex and its relation with height and special reference to side. Many similarities as well as differences were observed as compared to the result obtained by other authors.

**CONCLUSION**

In this study the carrying angle of the dominant limb was found to be more in comparison to the non-dominant limb. The difference was found in both the genders. Any patient who had suffered from elbow fractures or humerus fracture surely go for the measurement of carrying angle in order to prevent any future deformities or disorders. The carrying is found to be more on the dominant limb so the chances of ulnar neuropathy increases. There is a high significant changes between students and sports players due to excessive use of hand activities.

**REFERENCE**

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