

**ORIGINAL RESEARCH PAPER****Comparative Study of Carrying Angle Between Rural and Urban areas of Rajasthani population.****1. Vaibhav Saini 2. Vimal Modi 3. Pawan k. mahato**

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**ABSTRACT**

The elbow joint is formed between the humerus in the upper arm and the radius and ulna in the forearm and allows the hand to be moved towards and away from the body. When the arm is extended forward, the humerus and forearm are not perfectly aligned a deviation occurs laterally towards the long axis of the arm, which is referred as the “carrying angle”. The present study includes 200 (100 rural and 100 urban) healthy peoples of rural and urban areas of Rajasthan region of age group 18-40 years were selected. Carrying angle was measured by manual goniometer made of flexible clear plastic having both the fixed and movable arms. From the study it was found that mean carrying angle was  $12.40^{\circ} \pm 2.23^{\circ}$  in males and  $12.95^{\circ} \pm 2.58^{\circ}$  in females of rural areas. The mean Carrying angle was found to be  $10.15^{\circ} \pm 1.66^{\circ}$  in males and  $10.40^{\circ} \pm 1.81^{\circ}$  in females in urban areas. Mean Carrying angle of male & female were found to be greater in rural areas than in urban areas and differences were statistically highly significant ( $p < 0.01$ ). The data obtained in our study may be useful in anthropological research, forensics, genetic research, as well as in medical clinical practice.

Keywords: Carrying Angle, Rural, Urban, Goniometer, Rajasthan, Forensics.

**INTRODUCTION**

The elbow joint is formed between the humerus in the upper arm and the radius and ulna in the forearm and allows the hand to be moved towards and away from the body. When the arm is extended forward, the humerus and forearm are not perfectly aligned a deviation occurs laterally towards the long axis of the arm, which is referred as the “carrying angle”<sup>(1)</sup>. The angulation is as a result of the configuration of the articulating surfaces of the humerus and ulna which produce a normal valgus angulation of the forearm in relation to the humerus<sup>(2)</sup>. The angle is usually greater in females than in males and the difference has been considered to be a secondary

sexual characteristic<sup>(3-7)</sup>. However, some workers reported no significant difference in carrying angle of males and females of any age group<sup>(8-10)</sup>. Increased carrying angle may lead to elbow instability and pain during exercise. It may predispose to dislocations and increase chances of fracture around elbow when falling on an outstretched hand<sup>(11)</sup>. The type of fracture a child sustains after fall on an outstretched hand is determined by the value of carrying angle. Sometimes after healing of certain fractures of elbow, the carrying angle may increase or decrease abnormally, i.e. cubitus valgus or cubitus varus respectively<sup>(12)</sup>. The carrying angle also shows a direct relationship with the width of pelvis. Thus broader pelvis in females is also attributed to be a cause for wider carrying angle in females<sup>(13)</sup>. However, in 3-5 years of age group, the carrying angle is greater in males as compared to females<sup>(14)</sup>. The carrying angle permits the arm to swing without contacting the hips<sup>(15, 16)</sup>. The angle is greater in the dominant limb than in the non dominant limb of both sexes, suggesting that natural forces acting on the elbow modify the carrying angle<sup>(17, 18)</sup>. Natural forces acting on the elbow are different in rural and urban population because its depends upon their working condition and lifestyle. The present study is designed to estimate the difference in the carrying angle of rural and urban areas of Rajasthan region.

## MATERIALS AND METHODS

For the present study total 200 (100 rural and 100 urban) asymptomatic, healthy peoples of rural and urban areas of Rajasthan region of age group 18-40 years were selected. The carrying angle was measured using a manual goniometer made of flexible clear plastic having both the fixed and movable arms. The subject were asked to stand in anatomical position, in erect posture with the feet together, arms by the sides, and the palm facing forward. The arm was in extended supine position. The fixed arm of which could be placed on the median axis of the upper arm, the movable arm adjusted as to lie on the median axis of forearm & the angle read on the goniometer.

### Statistical analysis

The data collected were statistically analyzed using student t-test.

## RESULTS

Mean carrying angle of rural and urban areas of Rajasthan region are shown in table 1

**Table 1: Mean Carrying Angle of Rajasthan Region**

Parameters	Carrying angle (degree)		P Value
	Mean±SD		
	Rural Area	Urban Area	
Female (n=100)	12.95±2.58	10.40±1.81	p<0.01
Male (n=100)	12.40±2.23	10.15±1.66	p<0.01

## DISCUSSION

In this study the mean carrying angle was 12.40°±2.23° in males and 12.95°±2.58° in females of rural areas.

The mean Carrying angle was found to be  $10.15^{\circ} \pm 1.66^{\circ}$  in males and  $10.40^{\circ} \pm 1.81^{\circ}$  in females in urban areas. The mean carrying angle was higher in male and female of rural areas comparatively urban areas.

Khare GN *et al.* in 1999 conducted a cross-sectional study on Carrying angle in Varanasi in 200 adult males and 200 adult females. The mean Carrying angle was found to be  $13.56^{\circ}$  in males and  $16.92^{\circ}$  in females <sup>(19)</sup>. Purkait R *et al.* in 2004 undertook a study on dry bones in central India to identify the sexually dimorphic features in the bones of the elbow joint which makes the Carrying angle a sex indicator. The study included 40 humeri (20 males and 20 females) and 160 ulnae (100 males and 60 females). Two measurements of humerus (Trochlear angle and Inclination angle of Olecranon fossa) and three measurements of ulna (Olecranon-Coronoid angle, length and width of inferior medial trochlear notch) were studied.

The measurements on humerus did not show any sex difference. However the dimensions of ulna exhibited statistically significant differences in male and female bones. They concluded that Olecranon-Coronoid angle exhibiting high sexual dimorphism may be one of the causes of different values of Carrying angle observed in the two sexes. The smaller Olecranon-Coronoid angle of female ulna suggests that the projection of Olecranon process may be relatively larger in females as compared to males <sup>(20)</sup>. This was also later supported by Ruparelia S *et al.* <sup>(21)</sup>. Zampagni ML *et al.* in 2008 studied Carrying angle in 37 adults (17 males and 20 females) aged 41 to 81 years using an Electro-Goniometer and found a mean value of  $12.39^{\circ}$  in males and  $12.9^{\circ}$  in females. The difference was statistically not significant <sup>(22)</sup>. Ruparelia S *et al.* in 2010 conducted a cross-sectional study in Gujarat. They measured Carrying angle in 333 individuals (160 males and 173 females) aged 17 to 22 years and found a mean value of  $6.9^{\circ}$  in males and  $11.8^{\circ}$  in females. It was significantly greater in females than in males <sup>(21)</sup> which are similar to that found in the present study. Kothapalli J *et al.* in 2013 studied Carrying angle in 220 subjects (110 males and 110 females) aged 18-22 years belonging to Karnataka and Andhra Pradesh and found a mean value of  $12.09^{\circ}$  in males and  $13.54^{\circ}$  in females. It was greater in females than in males <sup>(23)</sup>.

## CONCLUSION

The Carrying angle is found to be greater in rural areas comparatively urban areas of both sexes and the knowledge of the measurement of the carrying angle and its variations is important while evaluating traumatic elbow injuries in adult of rural and urban areas and other elbow disorders that require reconstruction or arthroplasties.

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