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A comparative study of variations of Carrying Angle Between Rural and urban regions of Haryanvi Population

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Abstract

Background: The elbow joint formed between the humerus within the arm,and the ulna and radius in the forearm permits the hand to be moved toward and far from the body.While the elbow joint is extended, the arm and forearm are not perfectly aligned,a deviation occurs laterally closer to the long axis of the arm, which is known as the "carrying angle". **Aim and objective: i)**To measure the variation of carrying angle between rural and urban region of Haryana population between age group of 12-40 years. ii)To estimate the variation of carrying angle between male and female of age group of 12-40 year population of Haryana. **Material and Methods:** The present study consists of 230 (one hundred fifteen rural and one hundred fifteen urban subject) asymptomatic,healthy humans from urban and rural areas of the Haryana location within the age group of 12-40 years.Carrying angle was measured by using a physical goniometer made out of flexible clear plastic having each fixed and movable arm. **Results:** our study observed that mean of the carrying angle is $12.68^{o}\pm2.14^{o}$ in adult males and $15.34^{o}\pm2.17^{o}$ in females in rural regions. The mean carrying angle is $11.13^{o}\pm1.89^{o}$ in adult males and $13.50^{o}\pm2.24^{o}$ in females in urban areas respectively. Mean of carrying angle of males & females is larger in rural regions than in urban areas.Differences are statistically significant ($p<0.001$). **Conclusion** carrying angle is larger in male and female of rural region as compared to male and female of urban regions. Knowledge of measuring of the carrying angle and its differences are important even in assessing stressful elbow injuries in adults of rural and urban regions and other elbow deformities that require arthroplasties or reconstruction. The information in the present study may be useful for the evaluation in comparison to pathologic conditions as well as inside the management of disorders of the elbow,and is additionally beneficial as a forensic tool for sex determination. Our data may be beneficial in anthropological studies, Genetic studies, Forensics, and clinical practice.

Keywords: Goniometer, Carrying Angle, Haryana, Forensic, Rural, Urban,

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Introduction

Angulation is an impact of a formation of the articulating margins of the humerus,radius and ulna which produce an ordinary valgus angulation of the forearm with arm(2). The angle is generally larger in women than in men and the difference has been considered to be a secondary sexual character (3-7). A few researchers recommended no significant distinction in the carrying angle of women and men of any age category (8-10) whether or not the carrying angle is the angle sustained at the elbow joint at the lateral side is a protracted-debated issue. While the arm is extended in the anatomical position, the longitudinal axis of the upper arm and forearm form a lateral angle at the elbow joint which is the angle of deviation (approximately 5º in males and between 10º and 15º in females) at the medial condyle. This angle is considered as carrying angle by a few authors. The elbow joint is situated 2 cm underneath a line joining the two epicondyles.

Larger carrying angle may cause elbow instability and discomfort in the routine exercise. It can predispose to dislocation and overgrowth.The possibility of fracture of the elbow joint can occur by falling with a stretched forearm (11). The type of fracture an infant sustains after a fall on a outstretched forearm is decided using the value of the carrying angle. Sometimes after recovery of certain fractures of the elbow, the carrying angle may show variations, i.e., cubitus valgus or cubitus varus.(12). The carrying angle additionally suggests a proper-way courting with the width of the pelvis. For that reason, a broader pelvis in women is likewise attributed to being a reason for a larger carrying angle in females (13). But, within the 3-5 years of age categorization, a carrying angle is more in men in comparison to women (14). The carrying angle shall be the arm swing without touching the hips (15, 16). The angle is larger within the dominant limb than in the non-dominant limb of each adult group, suggesting that natural forces acting at the elbow modified the carrying angle (17, 18). Natural forces acting at the elbow are distinct in rural and urban populations as it depends upon their running situation and way of lifestyle. The present study is designed to estimate the distinction between the carrying angle of rural and urban areas of the Haryana region.

Material and Method

Our present study comprises of 230 (one hundred fifteen rural and a hundred and fifteen urban subjects) asymptomatic, healthy humans of urban and rural areas of the Haryana region within the age group 12-40 years. The carrying angle is measured by the usage of a manual goniometer made out of flexible strong plastic having secure and portable arms. The subject is asked to position in anatomical position.The constant arm of goniometer is positioned at the median axis of the arm, and the movable arm is used to lie at the median axis of the forearm & the angle is measured on the goniometer.

Statistical study

Our data is analyzed by student t-test

Result

Table no.1, shows that the mean (CA)carrying angle of the men and woman of Haryana rural area is 12.68 and 15.34 respectively while the mean (CA)carrying angle in men and women of Haryana urban area is 11.13 and 13.5 respectively inside the 12-40 age group. There has been a more significant difference in the carrying angle of the two aspects of upper limbs both of women and men and a significantly Larger (CA) carrying angle was found in females.

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The mean carrying angles of males and females of the rural and urban regions of the Haryana region are shown in Table No.1 and Table No.2 mean carrying angle for every aspect by use of chart

Table 1: Mean Carrying Angle of the Haryana Region

Sexes	Carrying angle (CA) (degree) Mean ± SDIV		P -Value
	Rural Area	Urban Area	
Women (n=115)	15.34 ± 2.17	13.50 ± 2.24	p<0.01
Men (n=115)	12.68 ± 2.14	11.13 ± 1.89	p<0.01

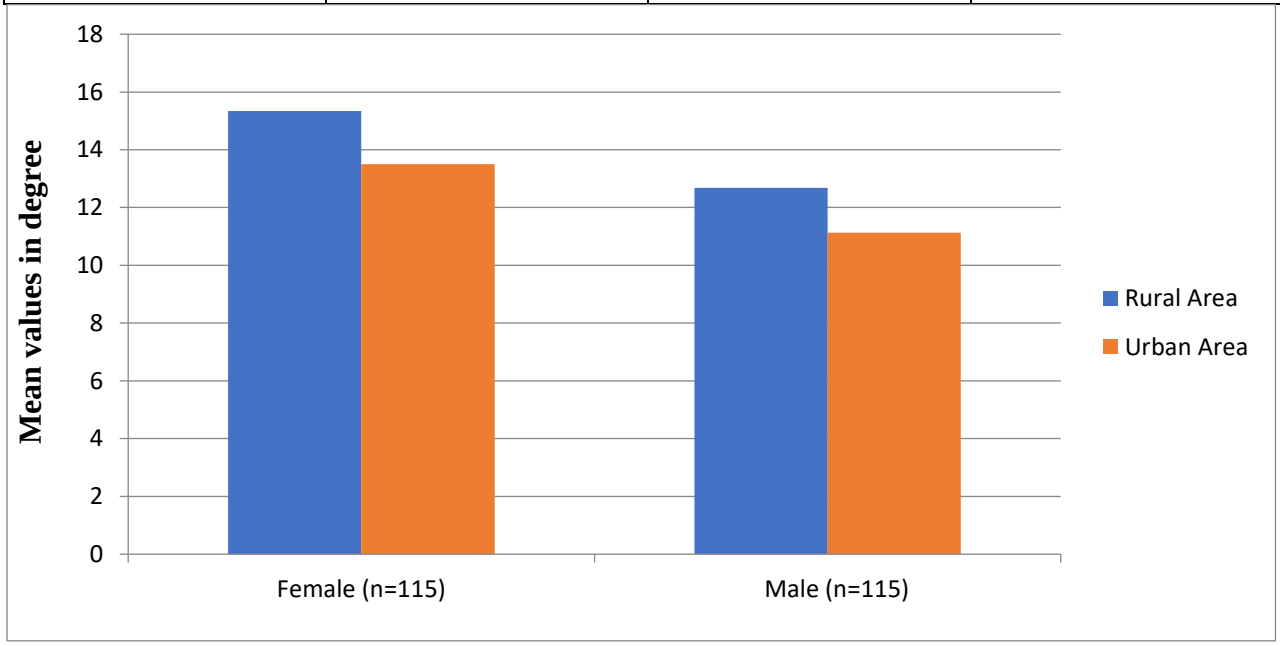

Table 2 Mean carrying angle for each side by type of constitution

% Of sample		Angle (·)	
		Right	Left
Men			
Slim	38.2	11.87	10.15
Sports person	51.7	14.81	13.67
Obese	9.1	17.65	13.66

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Women			
Slim	31.6	14.25	13.16
Sports woman	49.8	17.22	16.57
Obese	18.6	21.31	19.98

Discussion

In the present study, the mean of carrying angle is found to be 12.68º±2.14º in adult men and 15.34º±2.17º in women respectively in rural areas of Haryana population. The mean of the carrying angle is found to be 11.13º±1.89º in men and 13.50º±2.24º in women in urban areas of Haryana population. The mean carrying angle has been found larger for women and men in rural areas and moderately in urban areas of Haryana population. In similar studies, Khare GN et al. study found a cross-sectional observation on carrying attitudes in Varanasi in 200 men and 200 women. The mean of the carrying angle was found to be 13.56° in adult males and 16.92° in females (19). Purkait R et al. found that dry bones in essential India identify the sexually dimorphic features in the bones of the elbow joint which makes the carrying attitude an intercourse indicator. The examination included 40 humeri (20 grownup men and 20 women) and 160 ulnae (100 men and 60 women). Measurements of the humerus (Trochlear angle and Inclination attitude of Olecranon fossa) and 3 measurements of the ulna (Olecranon-Coronoid attitude, length, and width of inferior medial trochlear notch) have been studied.

The dimensions on the humerus did not show any sex distinction. but, scale of the ulna showed statistically that significant differences in male and woman bones. Olecranon-Coronoid angle showing excessive sexual dimorphism can be one of the reasons for different values of the carrying angle detected in the sexes. The olecranon-Coronoid angle of a woman's ulna suggests that the plan of the Olecranon process can be relatively large in women compared to men (20). This ends up additionally advanced supported by using the use of RupareliaS et al (21). Zampagni ML et al. 2008 studied the carrying angle in 37 adults (17 person men and 20 females) aged forty-one to eighty-one years with the use of an Electro-Goniometer and determined a mean value of 12.39° in adult men and 12.9° in women. The difference was statistically no longer enormous (22). Ruparelia S et al. in 2010 carried out a cross-sectional take a look at in Gujarat. They measured the angle in 333 individuals (one hundred sixty men and 173 girls) elderly 17 to 22 years and determined an average fee of 6.9° in adult men and 11.8° in women. It was considerably extra in women than in adult males (21) which is much like that positioned in the present study. Kothapalli J et al. 2013 studied found the carrying angle in 220 subjects (one hundred ten men and a hundred and ten females) aged 18-22 years belonging to Karnataka and Andhra Pradesh and observed a mean value of 12.09° in men and 13.54° in women. It became greater in women than in men (23). 17.02° in males and 17.77° in females and the difference was statistically not significant (24). Rana G *et al*. 2013 conducted a study on the Carrying angle in 30 males and 30 females of the age group 18-25 years in Nepal and found it to be greater in females than in males in both methods.

Similarly, Niyati Airan et. Al. also found the mean right Carrying angle was found to be 8.71°±2.54° in men and 12.31°±2.53° in women. The mean left Carrying angle was found to be 8.06°±2.77° in men and 11.76°±2.73° in women. Mean right Carrying angle and mean left Carrying angle was found to be more in women than in males and differences were highly significant. The Carrying angle is significantly more in women as compared to men and the

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difference has been considered to be a secondary sexual character (25). Sharma k et. Al. studies found that the carrying angle is more in women than in men and it increases at the time of puberty. The carrying angle is not inversely related to the height of the person (26).

Strength and Limitations of the Present Study

There are a few limitations of the study. In the present study, 12-40 years age subjects participated in the research. Hence, in the future, we would like to include an increase in the number of participants to reach a concrete conclusion. The Present study given an impact on understanding the Knowledge of carrying angle is of considerable importance in clinical Medicine, Anatomy, and Surgery (Orthopaedics and Paediatrics units in particular).

Conclusion

The present study has found carrying angle to be more in rural regions relatively than of urban regions of both sex.Our data on the dimension of the carrying angle in adults of rural and urban regions is usefull for elbow disorders that need reconstruction or arthroplasties. The statistics in the present work may be useful for the evaluation in comparison to pathologic conditions as well as in the management of disorders of the elbow and its reconstruction after fractures.It is also useful as a forensic tool for sex determination. Knowledge of carrying angle is of greater importance in clinical medicine, anatomy, and surgical procedures (Orthopaedics and Paediatrics departments in particular).

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