The correlative study of degrees of carrying angle with height of body in both the sexes of south Indian population

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Abstract

Aims and Objectives: a. By knowing the carrying angle one can explore the height in both the sexes and vice versa. b. It has medicolegal and ethnic importance.

150 normal subjects, out of which 68 males and 82 females were selected for study. The mean value of height of males was 170.2 (SD$\pm$ 7). Mean value of Left carrying angle in males was 163.6 (SD $\pm$ 6.1). The mean value of degree of right carrying angle in males was 169.8 (SD $\pm$ 4.4). In females the mean value of height was 155.6 (SD $\pm$ 5.9).The mean value of left carrying angle in females was 164.9 (SD $\pm$ 3.6). Mean value of right carrying angle in females was 171.2 (SD $\pm$ 3.4). The t 'test value for height was 13, 7, for left carrying angle was 8.5, for right carrying angle it was 8.6. All these values were statistically highly significant (P <0.01). While Correlating the height with left and right carrying angle in males, it was found that 't' test value of left carrying angle was 7.53, r= -0.68 and that 't' test value of right carrying angle in males was 7.33. r= -0.67 which was highly significant (P < 0.01).on correlation of height with right and left carrying angle in females, it was found that 't' test value of left carrying angle was 9.84, r= 0. -74, and of right carrying angle was 9.55, r= -0.73. Both the values are statistically highly significant (P < 0.01). In the study of logistic regression Y = 340.3 -0.986(Height) – 0.612 (Left carrying angle) -0.469 (Right carrying angle). These values are statistically highly significant. This present study of south Indian population have regional or ethnic significance. This study is important for the medicolegal experts as they can explore the height by knowing the degree of carrying angle of the person, Anatomists, Anthropologists, radiologists, after above all, to the Orthopaedicians to reconstruct the normal elbow joint by knowing the height of the patient.

Keywords: RT – Right, Lt – Left, CA –carrying angle, Goniometer, South India.

Introduction

Carrying angle is the angle between the long axis of humerus with long axis of ulna.

Degrees of carrying angle vary in both the sexes of males and females between 163 – 175 degrees towards the body. If it is more when measured away from the body it is called as cubits valgus and if less, it is Cubits varus.[1] Moreover the degrees of carrying angle given in the European text books seem to be European races because they differ with present study. The normal degree of carrying angle is useful in elbow dislocations, fractures or epicondylar disease management and for evaluation of elbow reconstruction. Hence attempt is made to correlate the height of both the sexes with degrees of carrying angle in right and left elbows so that in fractures or epocondylar diseases elbow reconstruction can be done efficiently by orthopaedic surgeon. Moreover the knowledge of normal degrees of carrying angle is also must for radiologists.

Materials and Method

68 males and 82 females having normal stature who are attendants of patients of AIMS medical college were selected for the study. The height is measured in centimetres and the carrying angle as per the description of text book 'An introduction to evolutionary anatomy 'by Aeilo. L. and Dean Christopher.[2]

Subject was made to stand in Anatomical position and the lesser tuberosity of humerus is located by a point (A) which is 3 cms below the lateral end of clavicle. Maximum prominence at the posterior aspect of elbow is located for the head of the ulna and corresponding point on the anterior aspect of the elbow is marked (B).Now join A with B. Locate a point at the base of proximal phalanx of the second finger (index finger) most laterally which corresponds to the axis of ulna (c). Join AB and C. The angle at B is measured with Goniometer. The obtained values are measured statistically. The height, carrying angle of both the elbows in both the sexes are correlated with logistic regression.
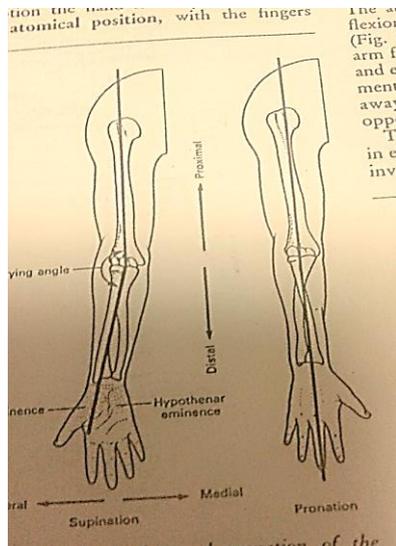
Statistical Analysis: It was performed using SPSS software version – 15. Students 't' test was performed and P value (< 0.01) is considered significant.

Observation and Result

Table 1: Comparison of height, degrees of left with right carrying angle between both the sexes. All these results are highly significant. (P < 0.01).

Table 2: Correlation of height with degrees of left carrying angle and right carrying angles studied in both the sexes. Values are highly significant. (P < 0.01).

Table 3: Study of logistic regression model for both the sexes. Binary logistic regression model is used to classify as male and female with independent variables such as height, left and right carrying angle. All the values are highly significant. (P < 0.01).

Table 1: Comparison of Height, Left carrying angle and Right carrying angle between Male and Female

	N	Height	Left carrying angle	Right carrying angle
Male	68	170.28±7.02	163.63±6.13	169.87±4.43
Female	82	155.63±5.92	164.91±3.63	171.26±3.43
Test statistic	T test	t=13.77	t=8.59	t=8.69
Significance	P value	P<0.01	P<0.01	P<0.01

Difference observed in Height, Left carrying angle and Right carrying angle between Male and Female values (P<0.01).
Statistically results are highly significant

Table 2: Correlation of Height with Left carrying angle and Right carrying angle in Male and Female

		Height and Left carrying angle	Height and Right carrying angle
Male	N=68	r = -0.68	r = -0.67
	Test statistic	t= 7.53, p<0.01	t=7.33
Female	N=82	r = -0.74	r = -0.73
	Test statistic	t= 9.84, p<0.01	t=9.55, P<0.01

Negative correlation observed of Height with Left carrying angle and Right carrying angle in both Male and Female values(P<0.01)
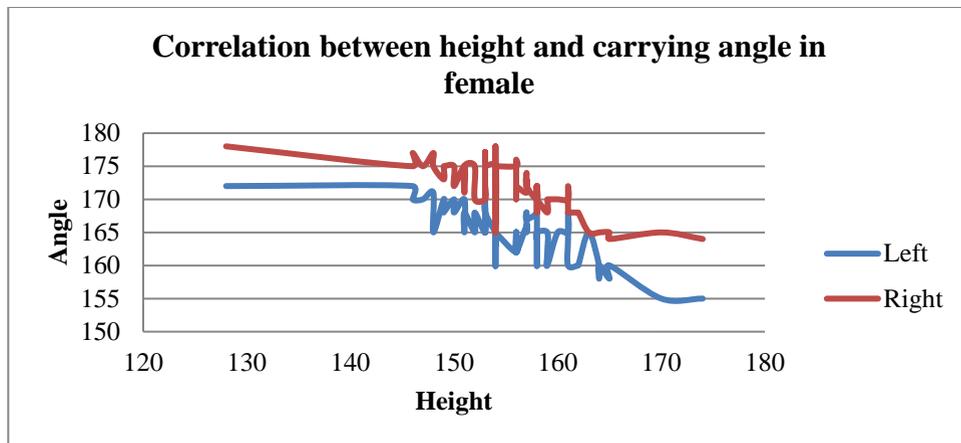Statistical results are highly significant.

Correlation between height and carrying angle in female
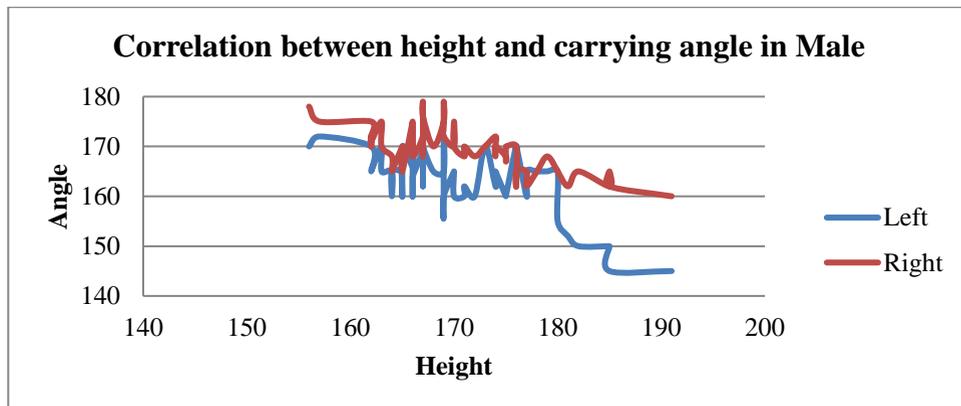
Table 3: Logistic regression model for sex

	B	S.E.	Wald	df	sig	Exp(B)	95.0 % C.I. for EXP(B)	
							Lower	Upper
Step 1ªHeight	-0.986	0.225	19.159	1	0.00	0.373	0.240	0.580
Left	-0.612	0.205	8.906	1	.003	0.542	0.363	0.810
Right	-0.469	0.196	5.750	1	.016	0.626	0.426	0.918
Constant	340.312	79.670	18.246	1	.000	6.245E147		

a. Variables (s) entered on step 1: Height, Left, Right

Binary logistic regression model is used to classify as male and females with independent variables are height, left and right carrying angle. All these independent variables are found highly significant ($p < 0.001$).

Binary logistic regression model for sex is,

Y = 340.312-0.986*(Height)-0.612*(Left carrying angle)-0.469 *(Right carrying angle)

Percentage of correct classification as male and female from the above model is 97 %.

Hence the results of binary logistic regression are highly significant.

Discussion

In the present study of correlation of height of both the sexes, in males the mean value of height was 170.28 (SD $\pm$ 7.02), The mean value of left carrying angle was 163.6 (SD $\pm$ 6.13) and right carrying angle was 169.87 (SD $\pm$ 4.43). In females mean value of height was 155.63(5.92), left carrying angle was 164.91 (SD$\pm$ 3.63) and right carrying angle was 171.26 (SD $\pm$3.43). 't' test value of height was 13.7, of left carrying angle was 8.5, and that of right carrying angle was 8.6. All these values are highly significant. ($P < 0.01$) (Table 1).

While correlating height with carrying angles of both the elbows in both the sexes, in males with left carrying angle, r=-0.68 and 't' value is 7.53 which has highly significant P value, and with right, r= -0.67 and t = 7.33 which is also highly significant. In females height is correlated with the degrees of carrying angle of both the sides, on the left side, r=- 0.74, and 't' = 9.84.which is highly significant and on the right side, r= -0.73and 't'= 9.55.P value is significant ($p < 0.01$) (Table 2).

In the logistic regression for both the sexes, degree of carrying angle can be explored by binary logistic regression method. All these independent variables that is height, degrees of left and right carrying angles are found highly significant.($p < 0.01$) Table 3.

The present study was more or less with other previous studies of north Indian[3] and abroad[4] though the method of measurement was different. Moreover it was also confirmed by the previous studies that degree of carrying angle was more in females than males[5] but in both the sexes degree of carrying angle is more in dominant hand than recessive, because the load carried by the arm passes to the forearm and hand and vice versa.it is the reason that carrying angle is more significant in working hand, there by elbow joint becomes more strong and held away from the body during walking[6] Also natural forces like gravity and age will play a vital role in increasing the degree of carrying angle.[7,8] In the present study, it is noted that values of the height are correlated with statistically significant values. It certainly indicates that race and nutritional factors also contribute for the degree of carrying angle. Hence, low degree of carrying angle is always treated as pathological due to trauma, inflammation etc. rather than physiological. Moreover non traumatic ulnar neuropathy,[9] at the elbow joint will also play a contributory role in the degrees of carrying angle.

Carrying angle is more in females because olecranon coronoid angle is more in females than males, which can be considered as secondary sexual character[10] and is more, also due to wider pelvis.

On the other hand, increased degree of carrying angle may be due to genetic abnormalities like Turner's syndrome locus or loci at XP11.2P22.1[11] and this condition is called as 'Cubitus valgus 'which is accepted as robust personality and reduced degree of carrying angle is 'Cubitus varus 'could be due to traumatic etiology and is an abnormality to be rectified for cosmetic as well as for relieving ulnar nerve, if compressed.

Summary and Conclusion

In the present study of correlation of height with carrying angle, it was observed that dominant or working hand has more degree of carrying angle. Moreover degrees of carrying angle is more in females than males. By knowing the height, one can predict the carrying angle and vice versa. Hence this study is important for medicolegal experts, Anthropologists and Anatomists apart from orthopaedicians and radiologists. But this study demands further genetic and nutritional studies, to throw more light on the variations of degrees of carrying angle. Because these joints co-ordinates or reciprocates with body movements under particular neural pathway, but variations in degrees of carrying angle is due to particular genetic makeup, and still it is not clear of the exact mechanism of such pathway under the CNS stimulation. In addition to this nutritional status also plays a vital role to keep the genes active. Under malnutrition these genes are called as 'silence 'genes.

Acknowledgment

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