

An Anthropometric Study on the Carrying Angle of Elbow among Children Ages between 10 to 15 Years of Various Schools in Hyderabad, Pakistan: A Cross-Sectional Study

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Abstract

Aim: This study was conducted to determine the difference in carrying angles in the dominant and non-dominant hands of children

Study design: Cross-sectional study

Place and Duration: Schools of Hyderabad Pakistan from January 2021 to March 2021

Methodology: We target 250 normal children with no deformity, ages between 10 to 15 years (either gender). Individuals with a history of fractures and dislocations of and around elbow and shoulder joints and individuals with any congenital anomalies of elbow and shoulder joints were excluded from the study. The carrying angle of both the limbs was measured through Universal Goniometer

Results: The carrying angles of the elbows of 250 cases were measured. Among them 125 were females and 125 were males aged between 10-15 years. The carrying angle increases by age on the right side of the hand. After 13 years of age, it increased on the left side.

Conclusion: The current study was conducted at the various schools of Hyderabad Pakistan. The carrying angle was higher in females as compared to males. In both genders carrying angle of the dominant hand was more than the non-dominant arm. By increasing age carrying angle also increases till the age of 15 years.

Keywords: Children, schools, carrying angle, elbow

Introduction:

The elbow joint is a type of hinge joint ¹. It is formed by the humerus, radius, and ulna, it allows the arm to move around the body ². This joint causes flexion and extension of the forearm. Pronation and supination also occur at this joint due to another synovial joint ¹. Carrying angle is defined as lateral deviation of the arm towards the long axis of the arm because the humerus and forearm are not perfectly aligned ². It is the clinical measurement of varus-valgus angulation of the arm, while the elbow is fully extended and the forearm fully supinated ³. The carrying angle can be measured by radiographs and digital electrogoniometer ⁴. The manual goniometer requires the forearm, elbow, and arm. The normal carrying angle for males is 5 degrees while for females it is 10-15 degrees ⁵. It is essential to know about the elbow carrying angle and valgus deformity. It helps in handling and monitoring traumatic lesions of pediatric elbow ⁶. The literature review shows the variation in carrying angle among various age groups, races, and gender. Although females have higher carrying angles than males it is higher in males between the ages of 3-5 years. ⁷. In the case of full elbow flexion carrying angle disappears. During walking upper arm swings and forearm pronates, hence forming the carrying angle ⁸. Excessive carrying angle may occur due to elbow fractures that cause the arm to stick out from the body. Unilaterally increased carrying angle is always abnormal ⁹. A lot of problems may occur due to increased carrying angles like pain during exercise and throwing sports. It may reduce elbow flexion that can predispose to elbow dislocation and elbow fracture when falling on the outstretched hands ¹⁰. In the case of Pediatric elbow trauma monitoring of carrying angle is very important ³⁰. Hence, the present study aimed to study the difference in carrying angle between gender (Male & female) ages between 10 to 15 years and to find out any variation of carrying angle with increasing age or difference in the dominant or non-dominant hand.

Methodology

This cross-sectional study was conducted at various schools in Hyderabad through a simple random sampling technique from January 2021 to March 2021. We target 250 normal children with no deformity, ages between 10 to 15 years (either gender). Individuals with a history of fractures and dislocations of and around elbow and shoulder joints and individuals with any congenital anomalies of elbow and shoulder joints were excluded from the study. Materials used in the research are pen, universal goniometer for measuring angle, informed consent form, and data collection form for

assessment of each individual taken from the School of Physiotherapy RK. University. The carrying angles among 250 normal (125males and 125 females) healthy young participants within the age group of 10 to 15 years of age were selected. After taking informed consent of the patient, the carrying angle of both the limbs was measured through Universal Goniometer. Children were asked to stand up straight, elbow fully extended, and forearm fully supinated. Goniometers' arms were kept in a straight line and placed the goniometers plate at the fulcrum of the elbow. One arm of the goniometer was aligned with the middle of the upper arm while the other arm was moved along the middle of the forearm. The angle was recorded from the readout on the measurement plate. The same process was done on the other elbow. Frequency distribution tables, paired t-test, and chi-square from SPSS version 22 was used for this study.

Results:

The carrying angles of the elbows of 250 cases were measured. Among them 125 were females and 125 were males aged between 10-15 years (As shown in Table 1). Minimum and maximum carrying angle values in males according to age are shown in Table 2, while in females it is shown in Table 3. Boys and Girls in different Schools are shown in Table 4. The correlation between dominant and non-dominant carrying angle among males and females are shown in Table 5. The carrying angle increases by age on the right side of the hand. After 13 years of age, it increased on the left side (As shown in Table 6)

Table 1: Gender distribution according to age and gender

Age group (Years)	Boys	Girls
10	09	03
11	08	14
12	33	16
13	25	39
14	27	31
15	23	22

Table 2: Minimum and maximum carrying angle values in males according to age

Male Group	Minimum		Maximum	
	Right	Left	Right	Left
10	12 ⁰	9 ⁰	18 ⁰	16 ⁰
11	11 ⁰	10 ⁰	19 ⁰	19 ⁰
12	10 ⁰	8 ⁰	22 ⁰	20 ⁰
13	9 ⁰	9 ⁰	25 ⁰	30 ⁰
14	11 ⁰	10 ⁰	25 ⁰	22 ⁰
15	12 ⁰	9 ⁰	28 ⁰	21 ⁰

Table 3: Minimum and maximum carrying angle values in females according to age

Female group	Minimum		Maximum	
	Right	Left	Right	Left
10	13 ⁰	10 ⁰	20 ⁰	18 ⁰

11	10 ⁰	12 ⁰	21 ⁰	22 ⁰
12	10 ⁰	10 ⁰	25 ⁰	22 ⁰
13	12 ⁰	10 ⁰	22 ⁰	22 ⁰
14	12 ⁰	11 ⁰	25 ⁰	20 ⁰
15	11 ⁰	10 ⁰	25 ⁰	20 ⁰

Table 4: No. of Boys and Girls in different Schools

School Name	Boys	Girls
The Spark School	32	27
The Public School	07	-
Anna English School	04	-
The Pace School	08	12
Beacon School System	01	03
Blue Sea School	01	42
Bahria Foundation School	-	41
Govt. Boys School	72	-

Table 5: Correlation between dominant and non-dominant carrying angle among males and females.

Gender	Dominant	Non-dominant
Male	16.92	15.03
Female	18.70	16.01
Mean of carrying angle	Left	Right
Male	15.16	16.78
Female	16.08	18.64

Table 6: Mean right carrying angle and left carrying angle of both male and female in different age groups.

Age (Years)	Mean carrying angle of the right hand	Mean carrying angle of the left hand
10	16	13.3
11	16.2	14.4
12	17.2	15.6
13	17.9	16.3
14	18.3	15.7
15	18.7	15.9

Discussion

The current study was done to measure the carrying angle between the males and females of the same age groups. It was observed that the carrying angle was more in females as compared to males. We also observed an increase of carrying angle with the increase in age (up to 15 years of age). After 15 years of age, it remains constant for the lifetime of the individual.

Among the various ethnic Malaysian population, females, in general, had a wider carrying angle with non-significant variation among the races. Since the ethnic cohorts were small, further validation with a study based on a larger population is warranted. Incidentally, the authors found that the carrying angle in 3 participants who used both hands (meaning that they were not partial to either the right or left arm as the dominant) to do daily activities, were equal for both arms¹². Another incidental finding was a participant who had a “cubitus varus” carrying angle. This observation is unique and needs further assessment and data regarding the precipitating factors or genetic association. In a similar Turkish study, the mean angles measured from dominant arms were significantly greater than those of the contralateral side in both sexes and age groups. The mean angles of both elbows were greater in girls than those of the corresponding elbows in boys¹³. The result of an Indian study was similar to ours showing that the average carrying angle was 13.6 for females and 6.7 degrees for males¹⁴. A study was done on Kashmiri young adults showing that the females carrying angles were greater than the males’ in both dominant and non-dominant limbs. The carrying angle of the dominant right limb was greater than the non-dominant left limb in both males and females¹⁵.

Limitations of the study

The Study is done only within the particular city and only healthy adolescents were taken for the study

Conclusion:

The current study was conducted at the various schools of Hyderabad Pakistan. The carrying angle was higher in females as compared to males. In both genders carrying angle of the dominant hand was more than the non-dominant arm. By increasing age carrying angle also increases till the age of 15 years.

Conflict of interest:

None

Funding source

None

Permission

It was taken from the ethical review committee of the institute

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