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Original Article

Correlation of Elbow Carrying Angle with Height and Forearm Length among Adult Bangladeshi Population

Kabir MA[1], Talukdar MAS[2], Islam MT[3], Huq AKMA[4]

Abstract

Objective: The carrying angle is important in walking, swinging, throwing and carrying objects. It varies with age, sex, hyperextension of the elbow, dominant upper limb, anthropometric characteristics such as height, weight, fore arm length, body mass index. Present study was designed to evaluate the carrying angle in normal adults of Bangladesh and to see its correlation with height and forearm length in both sexes.

Methods: It was a cross-sectional type of descriptive study that conducted in the Department of Anatomy, Sylhet MAG Osmani Medical College, Sylhet upon 150 male and 158 female adults of 18-60 years. After getting permission from the ethical review committee, carrying angle, height and forearm length of the participants were measured. Recorded data were analyzed by using SPSS version 22. Regression analysis was performmed to see the correlation.

Results: There was a significant positive correlation between height of the participants and carrying angle of both sides where right side was ($r=0.622$; $p<0.001$) and left side was ($r=0.631$; $p<0.001$). There was a significant also positive correlation between forearm length of the participants and carrying angle of both sides where right side was ($r=0.519$; $p<0.001$) and left side was ($r=0.525$; $p<0.001$).

Conclusion: Significant positive correlation was found between carrying angle and height also carrying angle and forearm length of both sides of participants.

Key words: Adult Bangladeshi population, Carrying angle, Height, Forearm length.

1. Md. Ashraful Kabir, Associate Professor (insitu), Anatomy, OSD DGHS, attached Center for Medical Education, Mohakhali, Dhaka
2. Md. Abu Sayeed Talukder, Assistant Professor, Medical Education, Center for Medical Education, Mohakhali, Dhaka
3. Md. Tobibul Islam, Associate Professor, Dermatology, Habiganj Medical College, Habiganj,
4. Dr. A K M Anamul Huq, Assistant Professor, Cardiology, Attached as Assistant Director (Audit), Directorate General of Medical Education (DGME), Dhaka.

Correspondence to :
Dr. Md. Ashraful Kabir MBBS,
M.Phil (Anatomy), Associate Professor (insitu), Anatomy, Center for Medical Education, Mohakhali, Dhaka.
Email: ashrafulkabirrmc37@gmail.com

Introduction

The angle formed laterally at the junction between the long axis of arm and the long axis of the extended forearm that is 1700 in case of male and 1670 in case of female.[1]

Anatomists define the carrying angle as the external angle formed between the humerus and the ulna when the forearm is fully extended and supinated. Clinicians usually uses the internal small angle that is formed by the long axis of the humerus with the deviated ulnar axis on the elbow. This is an acute angle about 14 degree in malesand 16 degree in females. This carrying angle also called supplementary angle. Supplementary angle (1800_ carrying angle) which is greater in female than males.[2,3,4] Carrying angle varies with age, sex, height, side with various parameters of body.[5]

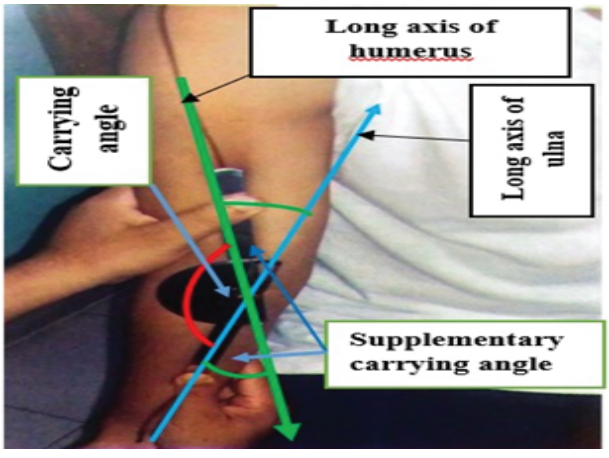

Figure 1: Shows the carrying angle and supplementary angle.

The carrying angle of the elbow is the clinical measurement of varus-valgus angulation of the arm with the elbow fully extended and the forearm fully supinated.[6] Height and forearm lengths are inversely related with the carrying angle.[7] The obliquity of the forearm is more pronounced in women than in men. The upper arm and forearm align in a straight line when the forearm is in its typical working position, which is nearly fully pronated. The carrying angle allows the forearms to avoid contact with the hips during swinging motions while walking and plays a crucial role when carrying objects. With this background this study will help in determination of impact of height and forearm length on carrying angle and how these two variables are connected with each other.

Methods

This cross-sectional type of descriptive study was conducted in the Department of Anatomy, Sylhet MAG Osmani Medical College, Sylhet. A total of 308 respondent's participated in this study where 150 male and 158 female adults of 18-60 years. This study was conducted from July 2016-June 2017. Consecutive, convenient sampling technique was applied to collect data. With approval from the ethical review committee, the participants' carrying angle, height, and forearm length were measured. The carrying angle of the elbow was measured in full extension of the elbow and in complete supination of the forearm, with a protractor goniometer. The angle was measured using the readout from the on goniometer's measurement plate and recorded in degree. Stature meter was used to measure the height in centimeter. Height was measured in a standing, erect anatomical position, from the vertex to the hill, without footwear, and expressed in centimeters. A measuring tape was used to measure the length of forearm. The distance between the medial epicondyle and styloid process of the ulna was recorded as the forearm length and noted in centimeters. The collected data were then analyzed using SPSS version 22. Regression analysis was performed to see the correlation. A probable value (P) of less than 0.05 was considered statistical significant.

Results

There were 150 (48.7%) male participants and 158 (51.3%) female participants. Carrying angle of right side was 166.72 ± 3.52 degree in male participants and 160.93 ± 3.81 degree in female participants. There was a significant difference of mean carrying angle of right side between male and female (t=13.823; p<0.001). Carrying angle of left side was 169.67 ± 3.92 degree in male participants and 164.19 ± 3.39 degree in female participants. There was a significant difference of mean carrying angle of left side between male and female (t=13.155; p<0.001). Unpaired 't' test was performmed to see the association. Mean height was 166.13±6.875 cm in male and 154.06±6.830 cm in female. In male mean forearm length was 26.967±1.589 cm. In female mean forearm length was 25.209±1.443 cm.

Table 1 Comparison of different variable between male and female

Variables	Sex	
	Male (n=150) (Mean ±SD)	Female(n=158) (Mean ±SD)
Right carrying angle (^{0})	166.72 ±3.522	160.93 ±3.813
Left carrying angle (^{0})	169.67 ±3.918	164.19 ±3.390
Height (cm)	166.13 ±6.875	154.06 ±6.830
Forearm length(cm)	26.967 ±1.589	25.209 ±1.443

Table 1 shows that different variable between male and female. Mean carrying angle of left side was greater than right side both in male and female. All these measurements were greater in male than female.

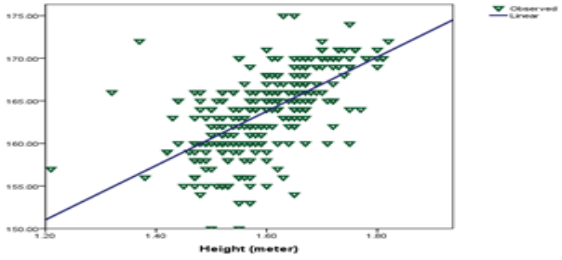

Figure 2 shows the correlation between height and carrying angle of right side (n=308). There was a significant positive correlation between height of the participants and carrying angle of right side (r=0.622; p<0.001). Regression analysis performed to see the correlation. P≤0.05 was deterimned as level of significance.

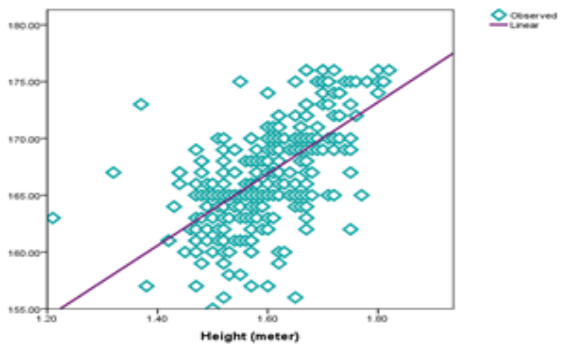

Figure 3 shows the correlation between height and carrying angle of left side (n=308). There was a significant positive correlation between height of the participants and carrying angle of left side (r=0.631; p<0.001). Regression analysis performmed to see the correlation. P≤0.05 was deterimned as level of significance.

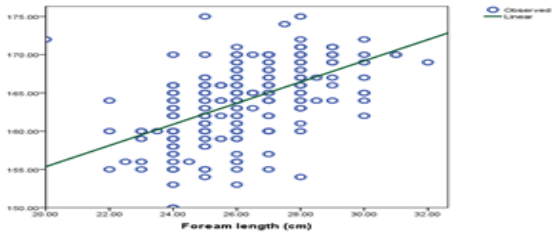

Figure 4 shows the correlation between forearm length and carrying angle of right side (n=308). There was a significant positive correlation between forearm length of the participants and carrying angle of right side (r=0.519; p<0.001). Regression analysis was performed to see the correlation. P≤0.05 was deterimned as level of significance.

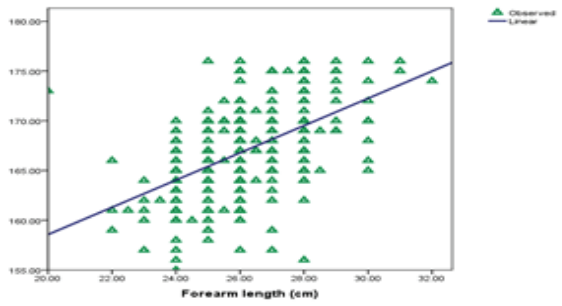

Figure 5 shows the correlation between forearm length and carrying angle of left side (n=308). There was a significant positive correlation between forearm length of the participants and carrying angle of left side (r=0.525; p<0.001). Regression analysis performmed to see the correlation. P≤0.05 was deterimned as level of significance.

Discussion

Carrying angle and correlation with height:

This study showed that there was a significant positive correlation between height of the participants and carrying angle of right side (p<0.001) and left side (p<0.001). Ruparelia et al., (2010) found that the height in male and female of both side was inversely related to the carrying angle.[7] Khare, (1999) found that the carrying angle has an inverse relationship with a person's height. Since females, on average, are shorter than males, their average carrying angle is greater than that of males.[8] According to Ikechukwe, et al., (2012), there was no correlation between the height of an individual and the carrying angle.[9] Allouh and Khasawneh, (2014) studied that no significant variation in supplementary angle with height but was significantly greater in the dominant side (right side).[10] Sharma et al., (2013) found that carrying angle was not inversely related to the height of a person; there was significant positive correlation between height and carrying angle in left side but negative correlation in right side.[11] The present study somewhat supported such result. But the difference from some researchers may be due to that they measured the supplementary angle but in the present study we measured the complementary carrying angle. Various authors have used term carrying angle or both the angles.[12,13]

Carrying angle and correlation with fore arm length:

This study showed that there was a significant positive correlation between forearm length and carrying angle of right side (p<0.001) and left side (p<0.001). Bari et al., (2015) found that no correlation was established between length of the forearm and carrying angle in either sex.[14] Kothapalia et al., (2013) observed that there was no correlation between forearm length with carrying angle in female but forearm length and carrying angle of male has significant negative correlation.[15] Ruparelia et al., (2010) found that the length of the forearm in male and female of both side was inversely related to the carrying angle.[7] The difference might be procedural deference in the measurement carrying angle. In their study Ruparelia et al., (2010) measured the supplementary angle and we measured the complimentary angle as carrying angle.[7]

Conclusion

A significant positive correlation was observed between

forearm length of the participants and carrying angle of right side ($r=0.519$; $p<0.001$) and left side ($r=0.525$; $p<0.001$).

A significant positive correlation was found between height of the participants and carrying angle of right side ($r=0.622$; $p<0.001$) and left side ($r=0.631$; $p<0.001$).

Author Contributions:

1. Dr. Md. Ashraful Kabir conducted the statistical analysis and was primarily responsible for drafting the Results and Discussion sections of the manuscript.
2. Dr. Abu Sayeed Talukdar contributed to the development of the Introduction and Methodology, and provided critical revisions to enhance the intellectual content of the manuscript.
3. Dr. Md. Tabibul Islam supervised the overall research process, contributed to the Abstract, Conclusion, and References, and reviewed the final version of the manuscript prior to submission.
4. Dr. A K M Anamul Huq, supervised the overall research process, contributed to the Abstract, Conclusion, and References, and provided critical revisions.

Conflict of interest:

The authors declare no conflict of interest.

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References

1. Snell RS. 2008. Clinical Anatomy by Region. 8th ed. USA: Williams and Wilkins Company; pp. 480

2. Khare GN, Goel SC, Saraf SK, Singh G, Mohanty C. 1999. New observations on carrying angle. Indian J Med Sci, 53(2), 61-67.

3. Baskar S, Kumar S. 2013. Variations in Carrying Angle between Two Sexes on Complete Extension. J Phar Sci Res, 5(12), 269.

4. Adhikari RK, Yadav SK, Karn A. 2017. A Comparative Study of Carrying Angle with Respect to Sex and Dominant Arm in Eastern Population of Nepal. Int J Cur Res Rev, 9(7),19-22.

5. 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, 44(4), 315-318.

6. Alsubael MO, Hegazy AAM. 2010. Radiographic Evaluation of The Normal Elbow Carry Angle. J Med Sci, 10(2), 40-44.

7. Ruparelia S, Patel S, Zalawadia A, Shah S, Patel SV. 2010. Study of carrying angle and its correlation with various parameters. NJIRM, 1(3), 28-32.

8. Khare GN, Goel SC, Saraf SK, Singh G, Mohanty C. 1999. New observations on carrying angle. Indian J Med Sci, 53(2), 61-67.

9. Ikechukwu MS. 2014. Carrying angle of an adult Nigerian population. World Journal of Medicine and Medical Science, 2(3), 1–7.

10. Allouh, M.Z. and Khasawneh, R., 2014. Measurement of the carrying angle in Jordanians with respect to different body parameters. Jordan Medical Journal, 48(2).

11. 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, 44(4), 315-318.

12. Moore KL, Dalley, AF II, Agur AMR. 2010. Clinically Oriented Anatomy. 7th ed. Philadelphia: Lippincott Williams & Wilkins, p.803.

13. Standring S. 2008 Gray's Anatomy, The Anatomical Basis of Clinical Practise. 40th ed. Spain: Churchill Livingstone Elsevier. 2008, p 786-833. London, pp. 777-800, 831-845.

14. Bari W, Alam M, Omar S. 2015. Goniometry of elbow carrying angle: a comparative clinical study on sexual dimorphism in young males and females. Int J Res Med Sci, 3(12), 3482-3484.

15. Kothapalia j, murudkar PH,Seerla LD,2013.The Carrying Angle of Elbow- A Correlative and Commparative Study.IJCRR vol 05(07),71-76.