

Correlation of Handedness with Hand Shape Index in Right Hander and Left Hander Medical Students of Bangladesh

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Abstract

This cross-sectional, analytical type of study was performed in Department of Anatomy, Dhaka Medical College, Bangladesh, from July 2016 to June 2017 on 52 right hander male and 52 right hander female, 40 left hander male and 34 left hander female Bangladeshi medical students. Convenient purposive sampling technique was adopted. History of any injury of upper limb was excluded to construct standard measurement. Handedness of each medical student was determined by the Edinburgh handedness inventory. Hand breadth and hand length was measured with the help of vernier caliper. Paired and unpaired student's 't' test and Pearson's correlation coefficient test were done for statistical analyses. Handedness score showed non-significant positive correlation with right hand shape index ($r = +0.087$, $P > 0.05$) and left-hand shape index ($r = +0.008$, $P > 0.05$) in right hander males. Handedness score showed non-significant negative correlation with right hand shape index ($r = -0.017$, $P > 0.05$) and left-hand shape index ($r = -0.003$, $P > 0.05$) in right hander females. Handedness score showed non-significant negative correlation with right hand shape index ($r = -0.210$, $P > 0.05$) and left-hand shape index ($r = -0.247$, $P > 0.05$) in left hander males. Handedness score showed non-significant positive correlation with right hand shape index ($r = +0.051$, $P > 0.05$) and left-hand shape index ($r = +0.213$, $P > 0.05$) in left hander females. To summarize, handedness score showed non-significant positive correlation with right hand shape index and left-hand shape index in right hander males and left hander females. However, handedness score showed non-significant negative correlation with right hand shape index and left-hand shape index in right hander females and left hander males.

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Introduction

Handedness can be defined as "the individual's preference to use one hand predominantly for unimanual tasks, and the ability to perform the tasks more efficiently with one hand".¹ Usually only one hand is considered as dominant. The brain has the characteristics that its two hemisphere are functionally asymmetric in human. During childhood, one hemisphere slowly comes to dominate the other, and it is only after the first decades that, the dominance become fixed. Handedness, in most individual is controlled by dominant hemisphere.² About 70 to 90 percent of population is right hander rather than left hander or any other form of handedness.¹

Handedness is a major trait of human, generating a measurable directional bilateral asymmetry in the upper extremities. In case of the handedness,

different parts of the upper extremities show differences in anthropometric measurements between right and left half. Handedness is a behavioral trait of human. Unimanual actions are performed with one preferential hand.

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This behavior leads to a different load or stress on the muscles and bones of the extremities.³ The hand used by the individuals in writing has been used as the most reliable index of handedness. Writing is a learned behavior on which, skill have an influential effect.⁴ Handedness has been measured by questionnaires developed by several authors. These are the Edinburgh handedness inventory, Annet's questionnaire, Chapman and Chapman questionnaire etc.⁵ Among them the Edinburgh handedness inventory is reliable and well validated. There are several versions of Edinburgh Handedness Inventory based on 4 items, 7 items and 10 items questionnaire. The 4-items inventory measures a single handedness factor and has a brief and simple instructions and a small number of items.⁶ Anthropometric studies have revealed that, in comparison to two halves of the body, the values belonging to the right half are different than those of the left. This is because of directionality and handedness, a functional property of hand.⁷ The medical college students have to use medical equipment's and surgical instruments for their professional purpose. Most of the world population is right hander and left hander persons are in a minority, especially in the surgical field.⁸ Due to right hander majority, most of the surgical instruments and apparatuses are designed for right hander medical personnel, the locking and unlocking actions for the needle holders have also been designed for right hander surgeons. Left hander surgeons have several disadvantages in the field of surgery, where they always need supporting personnel to assist them, and they are required to adapt themselves to the given environment. The left hander surgeons must go through the surgical procedures as defined by the right hander surgeons and must add needful modifications to

practice the safe and convenient procedures. There is a general impression among medical community that left hander practitioners face difficulties while performing some basic procedures or some delicate surgical operations as all the apparatuses, medical equipment's and materials have been designed for the right hander population.⁸ Hand anthropometry is useful for determining various aspects of machineries, to design the equipment's and machines for use with better efficiency and more comfort, handedness being considered as an important factor in the design of hand tool in particular. The significant difference is present between right and left hand of male and female, between left hander and right hander. These differences are very important and should be taken into consideration in designing the hand tools or equipment's. So far it is known, no study concerning upper limb anthropometry in relation to handedness has been reported in our country. Hence, the importance of studying correlation of handedness with anthropometric variables of upper limb carries immense practical application in anthropometry.

Methods

This cross-sectional, analytical type of study was carried out at Department of Anatomy of Dhaka Medical College, Dhaka from July 2016 to June 2017. 52 right hander male and 52 right hander female, 40 left hander male and 34 left hander female Bangladeshi medical students, aged between 20 and 25 years, were selected from 4 public and 4 private medical colleges of Bangladesh. Age was confirmed by the national identity card.

Procedure of determination of handedness and estimation of handedness score:

Handedness was determined by Edinburgh Handedness Inventory-short form.⁶ The participants of this study were asked to indicate their preferences in the use of hands in the following activities/ holding items (Table-I).

Table-I: Determining handedness through activities

Activities/ holding items	Always right	Usually right	Both equally	Usually left	Always left
Writing					
Throwing					
Toothbrush					
Spoon					

Table-II: Determining handedness by scoring

Classification	Handedness score
Left-hander	-100 to -61
Mixed-hander	-60 to 60
Right-hander	61 to 100

For each item there is a score. Always right = 100; usually right = 50; both equally = 0; usually left = -50; Always left = -100. For each activities/holding objects participants was given score. Then the score for the above four items were added. To obtain handedness score the sum of the score was divided by four. Then the handedness of participant was determined according to the score (Table-II).

Procedure of measurement of hand breadth:

To measure the hand breadth, the subject was requested to put his or her palm extended and facing up with second to fifth digit in adducted position except the thumb, touching a flat hard surface. Hand breadth was measured by sliding caliper as a straight distance between the outside projections of the ends of second and fifth metacarpals of the hand in mm (Fig. 1).

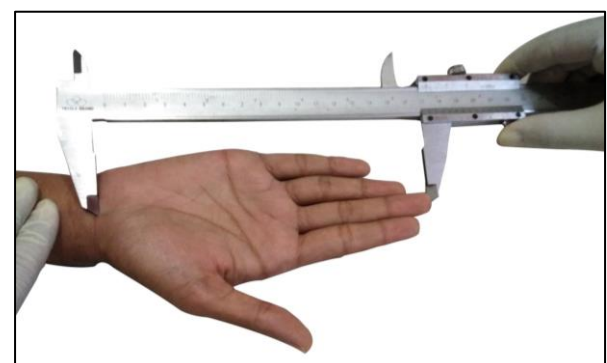
Fig.1: Photograph showing measurement of hand breadth



Procedure of measurement of hand length:

For measurement of hand length, the subject was requested to put his or her palm extended and facing up with digits in extended and adducted position. Hand length was measured from the midpoint of the distal transverse wrist crease to the midpoint of the tip of the middle finger along the long axis of the hand.⁹ The length was measured in mm, using vernier caliper. Fixed jaw of the caliper was placed on the midpoint of the distal transverse wrist crease and the sliding jaw of the caliper was placed on the midpoint of the tip of the middle finger. This reading was recorded as hand length (Fig. 2).

Fig. 2: Photograph showing measurement of hand length



Procedure of calculation of Hand Shape Index:

Hand shape index was calculated by dividing the hand breadth by the hand length and multiplying by 100., i.e. Hand Shape Index = (Hand Breadth ÷ Hand length) × 100

Paired and unpaired student's 't' test and Pearson's correlation coefficient test were done for statistical analyses. The study was approved by the Ethical Review Committee of Dhaka Medical College, Bangladesh.

Results

Handedness score showed non-significant positive correlation with right hand shape index ($r = +0.087$, $P > 0.05$) and left-hand shape index ($r = +0.008$, $P > 0.05$) in right hander males. Handedness score showed non-significant negative correlation with right hand shape index

($r = -0.017$, $P > 0.05$) and left-hand shape index ($r = -0.003$, $P > 0.05$) in right hander females. Handedness score showed non-significant negative correlation with right hand shape index ($r = -0.210$, $P > 0.05$) and left-hand shape index ($r = -0.247$, $P > 0.05$) in left hander males. Handedness score showed non-significant positive correlation with right hand shape index ($r = +0.051$, $P > 0.05$) and left-hand shape index ($r = +0.213$, $P > 0.05$) in left hander females. To summarize, handedness score showed non-significant positive correlation with right hand shape index and left-hand shape index in right hander males and left hander females. However, handedness score showed non-significant negative correlation with right hand shape index and left-hand shape index in right hander females and left hander males.

Table-III: Comparison between right and left palm length and hand length of right hander and left hander male and female medical students

Group	Hand breadth in mm			Hand length in mm		
	Right (Mean±SD)	Left (Mean±SD)	P Value	Right (Mean±SD)	Left (Mean±SD)	P Value
Male						
Right hander (n=52)	81.46 ± 4.56 (73.0-94.0)	79.06 ± 4.90 (71.0-92.0)	<0.001*	181.58 ± 9.51 (159.0 - 203.0)	183.67 ± 9.21 (161.0 - 207.0)	<0.001*
Left hander (n=40)	77.78 ± 4.42 (67.0-87.0)	80.98 ± 3.65 (73.0-90.0)	<0.001*	182.78 ± 8.10 (159.0 - 200.0)	181.45 ± 8.96 (158.0 - 200.0)	0.022*
Female						
Right hander (n=52)	74.06 ± 2.80 (65.0-80.0)	71.73 ± 2.51 (65.0-78.0)	<0.001*	165.71 ± 8.37 (144.0 - 188.0)	167.77 ± 8.14 (146.0 - 188.0)	<0.001*
Left hander (n=34)	72.74 ± 2.72 (68.0-77.0)	74.91 ± 2.94 (68.0-80.0)	<0.001*	168.82 ± 6.66 (158.0 - 186.0)	167.35 ± 6.54 (156.0 - 183.0)	<0.002*

Figures in parentheses indicate range. SD = Standard Deviation. Comparison between values of right and left hand of same group was done by Paired Student's 't' test. ns= not significant, *= significant.

Table-IV: Comparison between right and left hand shape index of right hander and left hander male and female medical students

Group	Hand shape index		P Value
	Right (Mean±SD)	Left (Mean±SD)	
Male			
Right hander (n=52)	44.91 ± 2.29 (41.01 - 50.56)	43.05 ± 2.16 (39.34 - 47.70)	<0.001*
Left hander (n=40)	42.70 ± 1.96 (39.44 - 47.70)	44.22 ± 2.23 (40.50 - 49.13)	<0.001*
Female			
Right hander (n=52)	44.36 ± 2.11 (39.65 - 49.05)	42.81 ± 1.83 (38.58 - 46.34)	<0.001*
Left hander (n=34)	43.14 ± 1.61 (40.11 - 46.38)	44.79 ± 1.68 (42.07 - 49.05)	<0.001*

Figures in parentheses indicate range. SD = Standard Deviation. Comparison between values of right and left hands of same group was done by Paired Student's 't' test. ns= not significant, *= significant.

Fig. 3: Correlation of handedness score with right hand shape index of right hander male and female

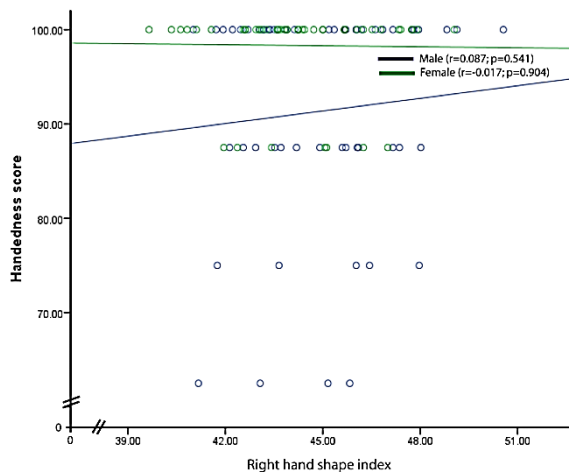


Fig. 4: Correlation of handedness score with right hand shape index of left hander male and female

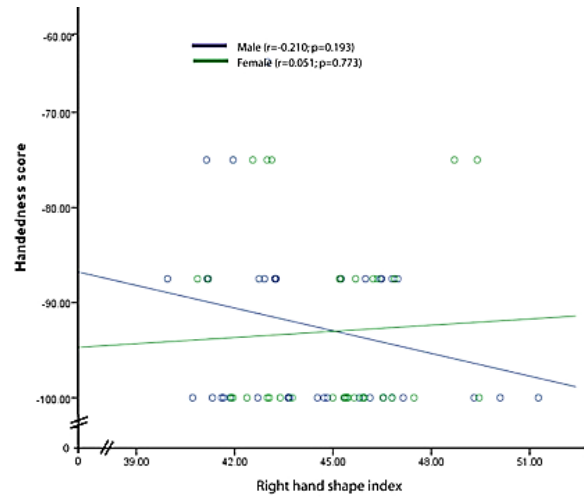


Fig. 5: Correlation of handedness score with left hand shape index of right hander male and female

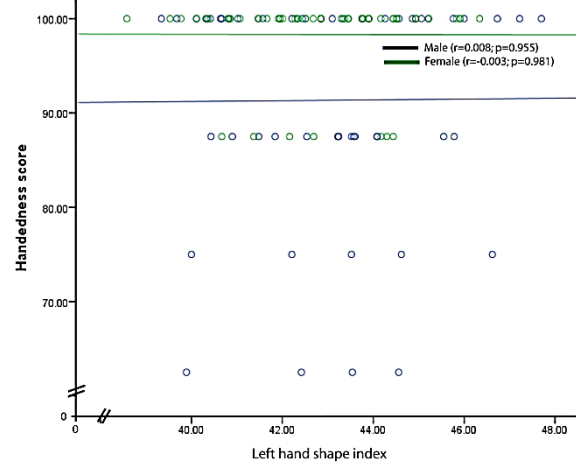
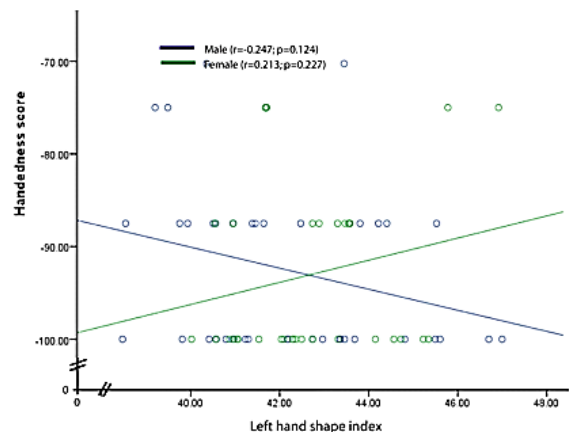


Fig. 6: Correlation of handedness score with left hand shape index of left hander male and female



Discussion

Handedness shows substantial individual variability. Skeletal and morphological asymmetries are present in human body though it appears to be bilaterally symmetrical. Bilateral asymmetry is defined as the difference between the measurements of the left and right half of the human body. Our findings showed dissimilarities with some finding of the studies carried out by Swami, Kumar & Sharma and Kulaksiz & Gozil.¹⁰⁻¹² Swami, Kumar & Sharma carried out a study on 233 right hander (123 male and 110 female) and 6 left hander (1 male and 5 female) Haryanvi Brahmins of age 18 years and above.¹¹ They recorded non-significant negative correlation between handedness score and right hand shape index ($r=-0.001$, $P>0.05$) and non-significant positive correlation between handedness score and left hand shape index ($r= +0.018$, $P>0.05$) in Haryanvi Brahmins. In another study, Swami, Kumar and Sharma also carried out a study on 245 right hander (130 male and 115 female) and 7 left hander (5 male and 2 female) Kashmiri pandit of age 18 years and above.¹² They showed non-significant positive correlation between handedness score and right hand shape index ($r= +0.151$, $P>0.05$) and non-significant positive correlation between handedness score and left hand shape index ($r= +0.031$, $P>0.05$) in Kashmiri pandits. In Turkey, Kulaksiz & Gozil carried out a study on 235 right hander (130 male and 105 female) and 14 left hander (08 male and 06 female) university students.¹² They reported handedness score showed non-significant positive correlation between handedness score and right hand shape index ($r=+0.0587$, $P>0.05$) and non-significant negative correlation with left hand shape index ($r= -0.1242$, $P>0.05$) in those Turkish students. Swami, Kumar & Sharma, and

Kulaksiz & Gozil conducted study on right handers and left handers; however, they did not show separate data for males and females.¹⁰⁻¹²

In the present study the data was collected separately from both right hander male and right hander female, left hander male and left hander female. This could be the cause of such dissimilarity and sexual dimorphism.

Conclusion

Handedness score showed non-significant positive correlation with right hand shape index and left hand shape index in right hander males and left hander females. However, handedness score showed non-significant negative correlation with right hand shape index and left hand shape index in right hander females and left hander males.

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