

Sexual Dimorphism of Index (2D) and Ring (4D) Digit Lengths and Their Ratio (2D:4D) Among Adult Bangladeshi Male

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Abstract:

Context: Human hand is one of the most studied subjects in modern science and evolutionary biology. By virtue of evolution and genetically arrangements, digital lengths vary from person to person according to age, sex, races, occupation or even environmental influences. It has been found that the digital lengths and their ratios are not the same in different sexes or even both hands. Specially, index to ring digit lengths and their ratios which already have been proved to represent sexual dimorphism may differ in both hands of an individual. Many studies among different races have shown that index to ring digit ratio (2D:4D) ≥ 1 among female and < 1.00 among male. In this study, this variation of the index finger (2D) and ring finger (4D) length and their ratio (2D:4D) has been analyzed and compared in both hands among the adult male Bangladeshis.

Materials & Methods: A Cross sectional analytical study was conducted in the department of Anatomy, Dhaka Medical College, Dhaka, from July 2012 to June 2013. The study was performed on 100 male MBBS students (20-25 years of age) of Dhaka Medical College, Dhaka. With the help of digital vernier caliper measurements of digital lengths were recorded. Paired t- test was done for statistical analysis of the results.

Results: Significant difference has been found in the lengths of index finger (2D) and ring (4D) digits and their ratios (2D:4D) between both hands where left index finger (L2D) length was higher than right index finger (R2D) length ($P < 0.05$) and the length of right ring finger (R4D) was significantly greater ($P < 0.001$) than left ring finger (L4D). The right index to ring digit ratio (R2D:4D) was significantly less than left index to ring digit ratio (L2D:4D) in male ($P < 0.001$) that indicated sexual dimorphism in 2D:4D ratio is more prominent in the right hand in male. Also, right index to ring digit ratio (R2D:4D) was recorded < 1.00 in 86% and ≥ 1 in 14% subjects and left index to ring digit ratio (L2D:4D) was recorded < 1.00 in 76% and ≥ 1 in 24% of subjects.

Conclusion: Digital lengths especially index (2D) and ring (4D) digit lengths are often use to determine sexual dimorphism. Also, study over the variations of digital lengths have great medicolegal importance to determine age, sex and race of an individual.

Keywords: Index finger length (2D), ring finger length (4D), index to ring finger ratio (2D:4D).

Introduction:

Evolutionary history states that any measurements of body parts can change with the alterations in size of the organs involved or general body size and this concept was defined concisely by

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Levinton¹. Throughout the following decades, one such study has been a marked increase in interest, that is measurements of digital length and its sexual variations. The index finger located between thumb and middle finger is the second digit (2D) which is usually the most dexterous and sensitive fingers of a human hand². Researchers claimed that the relative lengths of digits are set before birth³ and interestingly in human hands, the relative lengths of the index finger differs between male and female⁴. More recently, the researchers explored

the relationship between the index to ring digit ratio (2D:4D) and a wide variety of human characteristics as 2D:4D ratios appear to correlate with a variety of sex-dependent behavior as stated by Manning J.T. & Fink B.⁵, including personality traits like dominance, aggression, reproductive success and sexual performance, sexual orientation, hand preference, verbal skills, physical and mental health and diseases and musical and sporting talents. These associations appear to be often stronger for the right hand⁶. In the study of Manning⁷, it is seen that smaller index fingers in men have been associated with higher levels of physical aggression throughout their life⁸. Men with less smaller index finger are reported as being more masculine and dominant in nature and tend to perform better in a number of physical activities⁹. In human, number of physical and behavioral traits depends on index finger length (2D) in both sexes which were statistically proven. For example, males with smaller index finger are more fertile and have high life time reproductive success. Also, they are more aggressive and assertive in nature and have high musical and sports aptitudes¹⁰. Again, male with excessive smaller index finger often has some attributes like left-handedness, good visuo-spatial ability¹¹, fast running speed¹² but they may also experience some severe health related problems like autism, Asperger's syndrome, prostatic carcinoma, Hepatitis-B related hepatocellular carcinoma, urolithiasis and rheumatoid arthritis but male having longer index finger often has higher risk of early heart disease¹¹. On the other hand, females with long index finger are more fertile, have high reproductive success but also having higher risk of breast cancer and endometrial cancer. Again, female with an excess long index finger are associated with good verbal fluency but higher risk to have neurodegenerative disorders but, females with smaller index finger have greater tendency towards homosexuality/ bisexuality, spontaneous abortion, polycystic ovaries and also they are more aggressive and assertive in nature¹⁰.

Materials & Methods:

The study was performed on one hundred (100) male medical students of Dhaka Medical College, Dhaka age ranging from 20-25 years. With the help of a digital vernier caliper the right index (2D) and ring (4D) finger lengths were recorded in millimeters. Length was measured by measuring

the crease-tip (c-t) length where "c" is the midpoint of proximal crease at the base and "t" is extreme end (tip) of the finger that is furthest from the crease. The distance between these two points indicates the length of index (2D) or ring (4D) finger. Measurements were taken three times independently and the maximum length was taken for analysis. The index to ring digit ratio (2D:4D) was measured by dividing the index finger length with ring finger length. Data was expressed as mean \pm Standard deviation (\pm SD) as descriptive statistics. Paired Student's t-test was done to analyze the differences between lengths of right index finger (2D) and ring finger (4D) and their ratios among both hands of male. Statistical significance was accepted at ($P < 0.05$). Procedure of measurement of index finger is shown in Fig.-1 and Fig.-2.

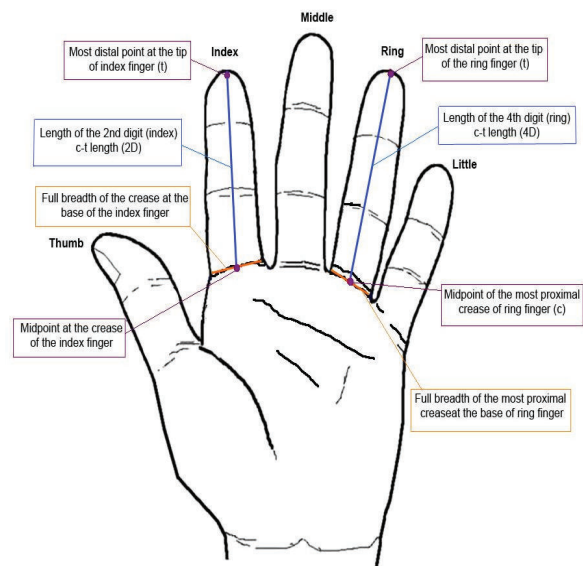


Fig.-1: Measurements of index (2D) and ring (4D) length

Index to ring digit ratio (2D:4D) was calculated by dividing the mean maximum length of index finger (2D) with the length of ring finger (4D)

Ethical clearances:

This thesis work approved by the Ethical Review Committee (ERC) of Dhaka Medical College, Dhaka.

Results:

Results are shown in Fig. 3,4,5,6, Table-1.

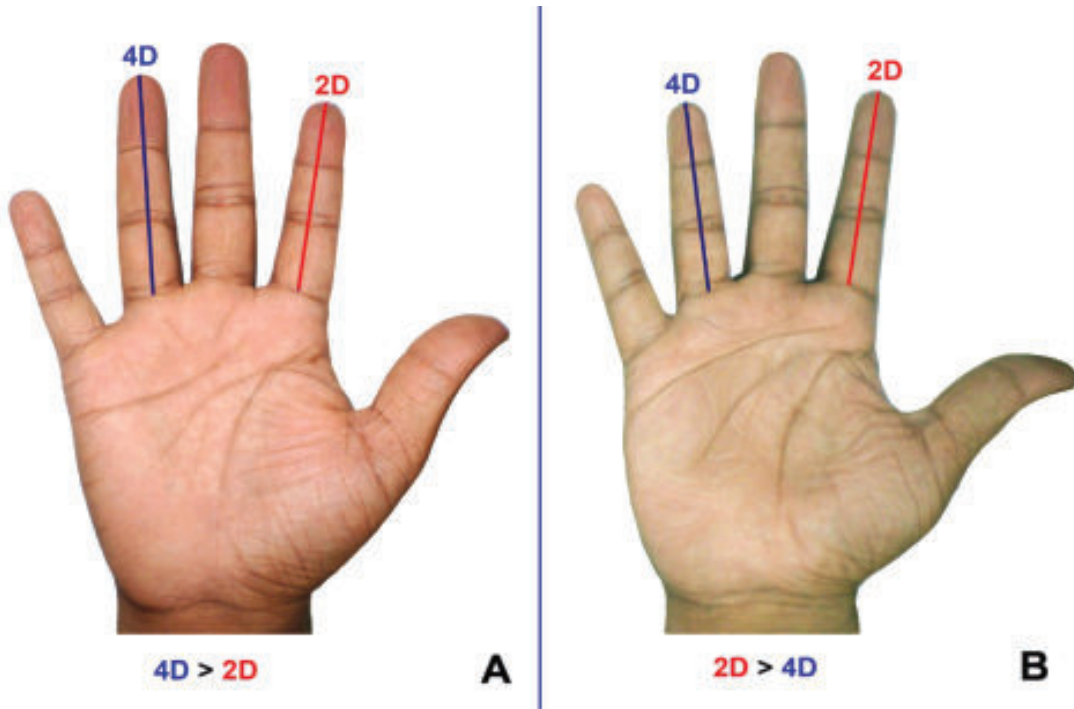


Fig.-2: Photograph showing Index (2D, red line) and ring (4D, blue line) digit length pattern in male. (A) Typical male pattern, 4D> 2D (B) Female pattern, 2D> 4D

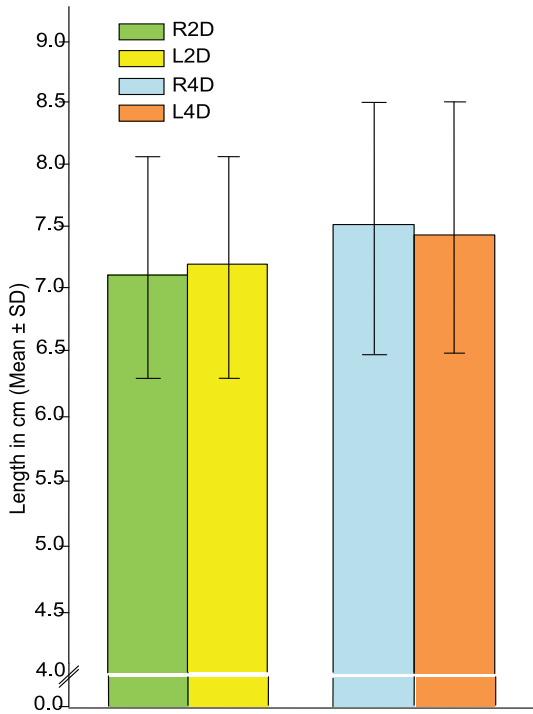


Fig-3: Comparison between the length of right (R2D) and left (L2D) index finger and right (R4D) and left (L4D) ring finger

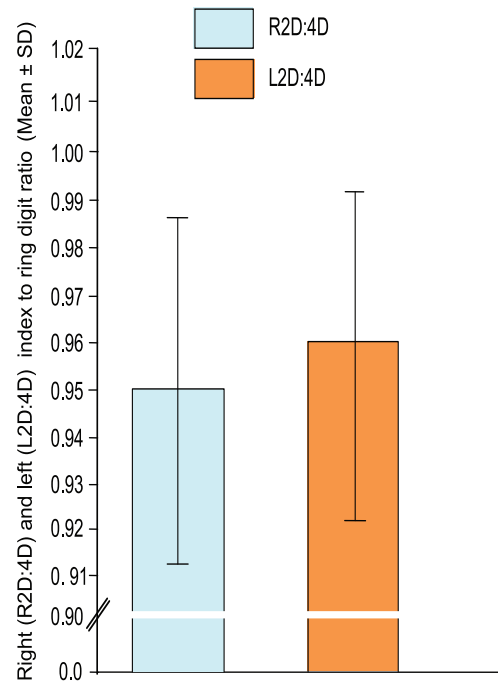


Fig.-4: Right index to ring digit ratio (R2D:4D) and left index to ring digit ratio (L2D:4D) in male

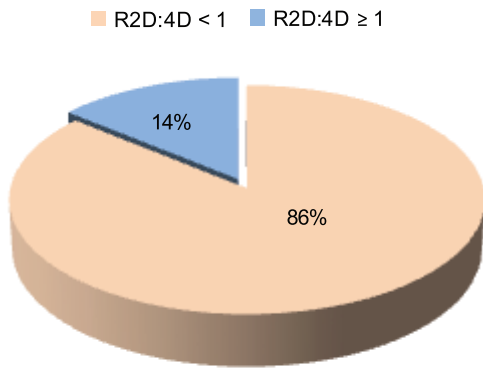


Fig.-5: Right index to ring digit ratio (R2D:4D) in male

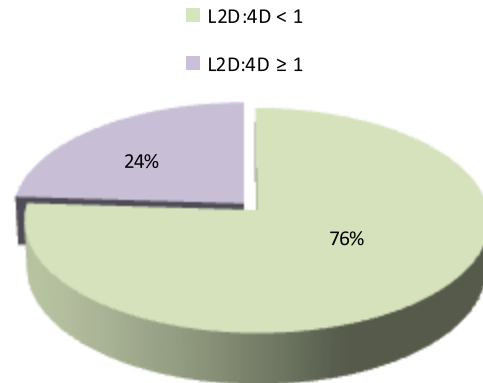


Fig.-6: Left index to ring digit ratio (L2D:4D) in male

Table-I

Comparison between the lengths of right index (R2D) and left index (L2D) finger, right ring (R4D) and left ring (L4D) finger and right index to ring digit ratio (R2D:4D) and left index to ring digit ratio (L2D:4D) in male

Variables	Male(n=100)	
	mean ± SD	P-value
R2D	7.140 ± 0.367 (6.359 - 8.124)	P < 0.05*
L2D	7.170 ± 0.379 (6.319 - 8.183)	
R4D	7.513 ± 0.397 (6.681 - 8.683)	P < 0.001***
L4D	7.463 ± 0.419 (6.606 - 8.583)	
R2D:4D	0.950 ± 0.018 (0.900 - 0.987)	P < 0.001***
L2D:4D	0.960 ± 0.015 (0.913 - 0.988)	

Figures in parentheses indicate range. Comparison between R2D and L2D, R4D and L4D and R2D:4D and L2D:4D was done by paired Student's 't' test, ns = not significant, * = significant at P < 0.05, * = *** = significant at P < 0.0001

Discussion:

The length of left index finger (L2D) was significantly higher than right index finger (R2D) in male (P < 0.05). Significant difference between the length of right ring finger (R4D) and left ring finger (L4D) were observed in male (P < 0.001) where right ring finger length (R4D) was higher than left ring finger length (L4D). There was significant difference between right index to ring digit ratio (R2D:4D) and left index to ring digit ratio (L2D:4D) where left index to ring digit ratio (L2D:4D) was higher than right index to ring digit ratio (R2D:4D) in male (P < 0.001). In this study, right index to ring digit ratio (R2D:4D) was recorded < 1.00 in 86% and e"1 in 14% subjects and left index to ring digit ratio (L2D:4D) was recorded < 1.00 in 76% and e"1 in 24%. This indicates sexual dimorphism in 2D:4D ratio is more prominent in the right hand in male. The results of this study were very much familiar with the studies conducted by William et al.¹³, Lippa, R.A.¹⁴, Rahman Q.¹⁵, Wilson GD.¹⁶, KOSİF R. and Diramali M. B.¹⁷, Danborno et al.¹⁸ and Ibegbu A.O. et al.¹⁹ but differ from the study of Shima M. A. et al.²⁰

Conclusion:

Index (2D) and ring (4D) digit lengths and their ratio (2D:4D) are one of the precise method to determine sexual dimorphism. Also, study over the variations of digital lengths have great medicolegal importance to determine age, sex and race of an individual. Doing studies on digital lengths and

ratios often reveal so many mysterious characters of human hand that indicates general sexual characters and hormonal status of adult population of Bangladesh.

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