Original article

Variation of index (2D) and ring (4D) digit lengths and their ratio (2D:4D) among adult females of Bangladesh

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Abstract

Objective: In Human hand. 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. 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 females of Bangladesh.

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 female 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: There was no significant difference between the lengths of right (R2D) and left (L2D) index finger but 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 female ($P<0.001$.) Also, right index to ring digit ratio (R2D:4D) was recorded <1.00 in 36% and ≥1 in 64% subjects and left index to ring digit ratio (L2D:4D) was recorded <1.00 in 07% and ≥1 in 93% of subjects. This indicates sexual dimorphism in 2D:4D ratio is more prominent in the left hand of female.

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

It has been known for a long time 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 Levinton[1]. Throughout the following decades, many studies have been conducted regarding body anthropometry and sexual variations. One such study is has gained marked interest in medical science that is measurement of digital lengths and their sexual variations. The index finger located between diabetes mellitus, hyper lipedemia etc. The other risk factors are high alcohol intake, positive family history, oral thumb and middle finger is the second digit (2D) and ring finger is located between middle and little finger are two most dexterous and sensitive fingers of a human hand[2]. Researchers claimed that the relative lengths of digits are set before birth[3] and they remain unchained rest of the life. Interestingly, in human hands, the relative lengths of the index finger and ring finger differ between two hands and even between male and female[3]. More recently, the researchers explored the relationship between the index to ring digit ratio (2D:4D) which has been found more practical applications. Many studies among different races have shown that index to ring digit ratio (2D:4D) ≥1 among female and <1.00 among male[4]. A wide variety of sex-dependent human behaviors are associated with 2D:4D ratios that has been stated by Manning J.T. & Fink B.[5] and those characteristics includes personality traits like dominance, aggression, reproductive success and sexual performance, sexual orientation, hand preference, verbal skills, different physical and mental health issues, or even musical and sporting talents. These associations

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appear to be often stronger for the right hand[6]. In the study of Manning[7], it is seen that smaller index fingers in women have been associated with higher levels of physical aggression throughout their life[8]. Women 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 activities[9]. It has been also reported that a number of physical and behavioral traits significantly depends on index (2D) and ring (4D) finger in both sexes. For example, males with smaller index finger and larger ring 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 aptitudes[10]. Again, male with excessive smaller index finger often has some attributes like left-handedness, good visuo-spatial ability[11], fast running speed[12] 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 disease[11]. 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. It has been also reported that females with excessive small index finger with relatively large ring finger have greater tendency towards the homosexuality or bisexuality, spontaneous abortion, polycystic ovaries and also they are more aggressive and assertive in nature[10]. The ratio between the length of the index and ring digit (2D:4D) of an individual found to be correlated with the prenatal testosterone and estrogen levels[4]. There is evidence that a low 2D:4D been positively related to prenatal testosterone while a high 2D:4D is positively associated with prenatal estrogen exposure or in other word a low 2D:4D ratio has been shown to correlate with high testosterone levels which is characteristic of males while a high 2D:4D ratio is correlated with low testosterone level, a characteristic of females. Initially, some other studies have reported null findings regarding these correlation studies and challenge the relationship between 2D:4D and its sensitivity to androgen but in 2009, some experimental studies proved that enhancement of prenatal testosterone reduces 2D:4D and nullify all the challenges.[12]

Materials & Methods

The study was performed on one hundred (100) female 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 centimeters. As ringer finger has two creases, the most proximal crease has been chosen. Length was recorded by measuring the crease-tip (c-t) length where "c" is the midpoint of crease at the base of the finger 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. Procedure of measurement of index finger (2D) and ring finger (4D) is shown in Fig:-1.The index to ring digit ratio (2D:4D) was calculated by dividing the index finger length with ring finger length. Data was expressed as mean ± Standard deviation (±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 female. Statistical significance was accepted at ($P < 0.05$). This thesis work approved by the Ethical Review Committee (ERC) of Dhaka Medical College, Dhaka.

Results

Results are shown in Tables and Figures.

Table-1: 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 female

Variables	Female (n = 100)	
	mean ± SD	P-value
R2D	6.710 ± 0.369 (5.952 - 7.813)	$P > 0.05^{ns}$
L2D	6.720 ± 0.362 (5.765 - 7.912)	
R4D	6.828 ± 0.390 (6.014 - 8.074)	$P < 0.001^{***}$
L4D	6.765 ± 0.388 (5.896 - 8.032)	
R2D:4D	0.982 ± 0.029 (0.931 ± 1.061)	$P < 0.001^{***}$
L2D:4D	0.993 ± 0.023 (0.943 - 1.054)	

Paired Student's 't' test, ns = not significant,
*** = significant at P <0.0001

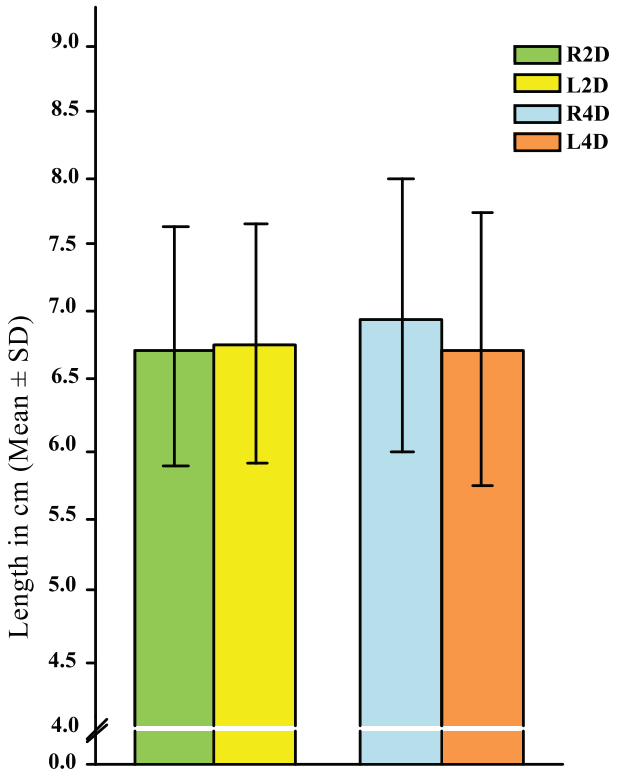

Fig-1 : Comparison between the length of right (R2D) and left (L2D) index finger and right (R4D) and left (L4D) ring finger

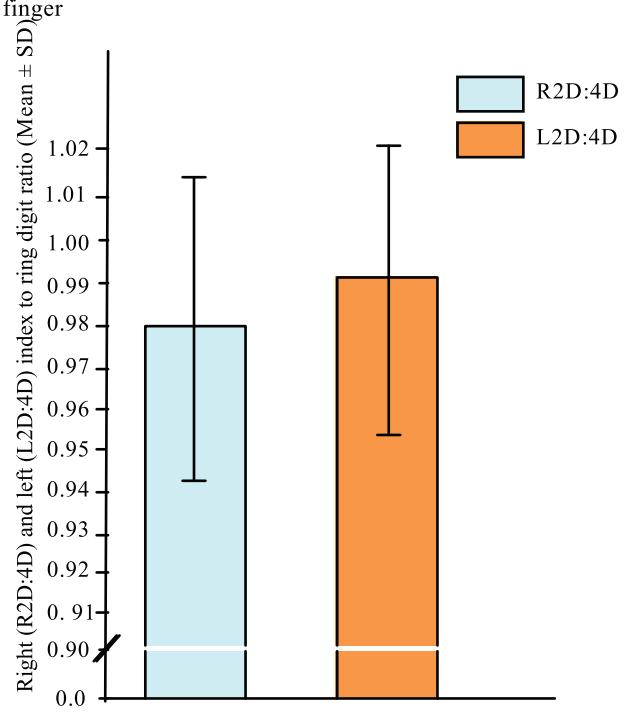

Fig. 2 : Right index to ring digit ratio (R2D:4D) and left index to ring digit ratio (L2D:4D) in female

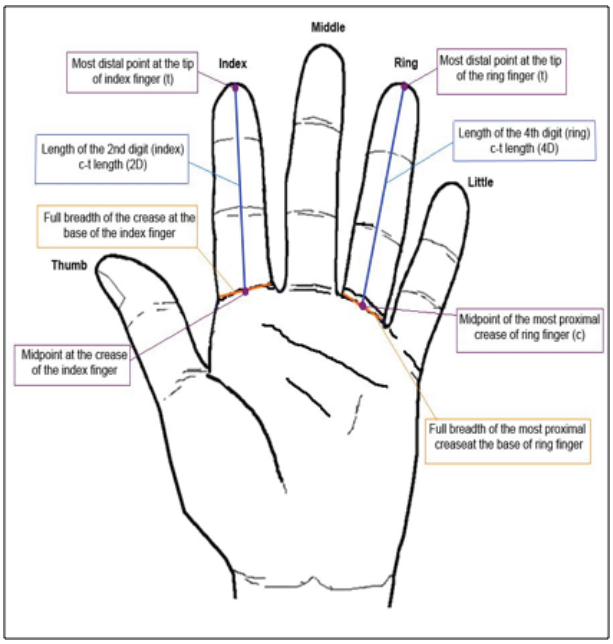

Fig 3 : Measurements of index (2D) and ring (4D) length

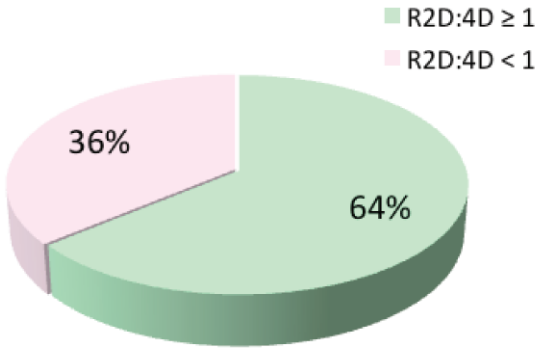

Fig.4: Right index to ring digit ratio(R2D:4D) in female

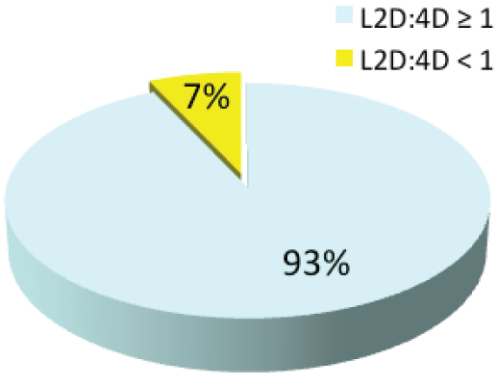

Fig.5: Left index to ring digit ratio (L2D:4D) in female

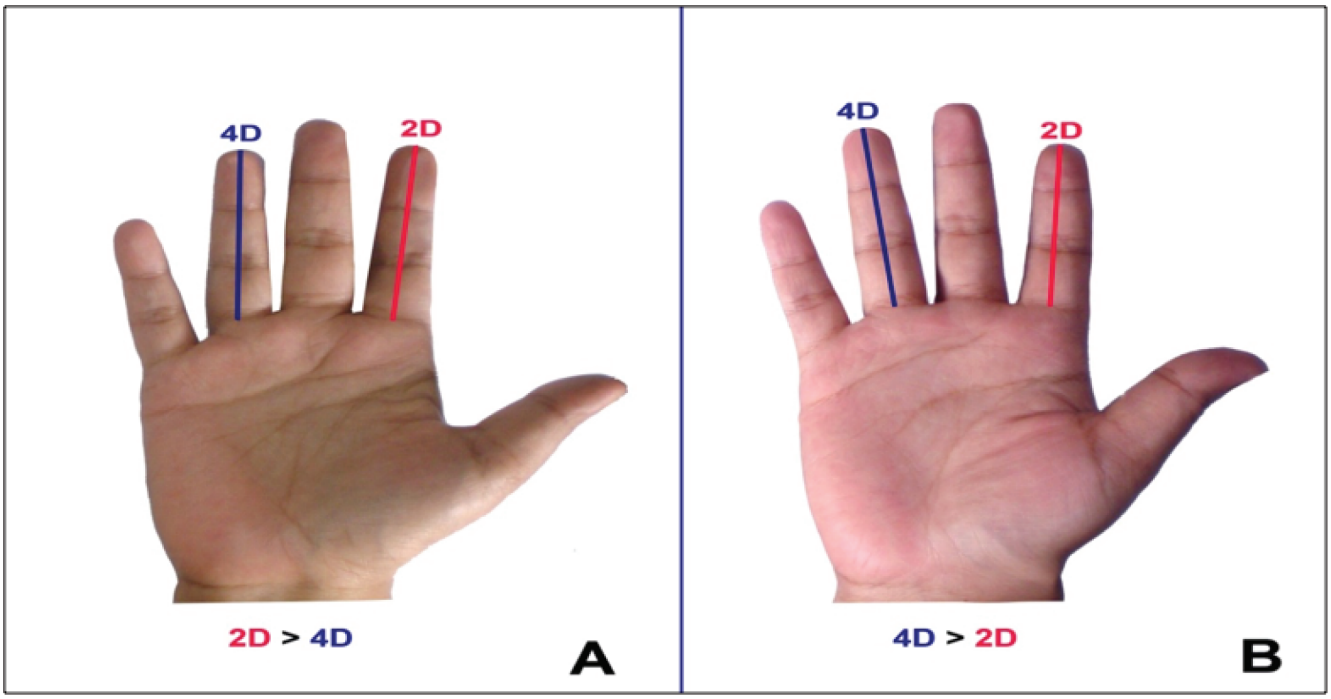

Fig. 6: Photograph showing Index (2D, red line) and ring (4D, blue line) digit length pattern in female.
(A) Typical female pattern, 2D> 4D (B) male pattern, 4D> 2D

Discussion

There was no significant differences between the length of right (R2D) and left (L2D) index finger (P > 0.05 ns). Significant difference between the length of right ring finger (R4D) and left ring finger (L4D) were observed in female (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 female (P<0.001). In this study, right index to ring digit ratio (R2D:4D) was recorded <1.00 in 36% and ≥1 in 64% subjects and left index to ring digit ratio (L2D:4D) was recorded <1.00 in 07% and ≥1 in 93% of subjects that indicates sexual dimorphism in 2D:4D ratio is more prominent in the left hand among Bangladeshi female. 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], KOSÏF R. and Diramali M. B.[17], Danborno et al.[18] and Ibegbu A.O. et al.[19] McFadden D. and Shubel E.[20] but differ from the study of Shima M. A. et al.[21]

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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