

# The Morphometric Study of Sexual Dimorphism in Index & Ring Finger Length Ratio in Indian Population.

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## ABSTRACT

**Background:** Anthropometry is a science which deals with method and techniques of measurement of living as well as skeletons of individuals. The morphometry of different parts of human body helps in personal identification and also sexual dimorphism. **Methods:** Total number of students (200=Male & 200=Female) of age 17-25 years of Teerthanker Mahaveer University were examined for one year. With the help of vernier caliper, the lengths of index and ring fingers were measured and then ratio was calculated in both the genders. The data was tabulated & mean & standard deviation was calculated. The paired t- test was used and P- value was calculated. P value < 0.05 was considered significant. **Results:** The mean values of male population were found to be right 2D 7.04cm, right 4D 7.20cm, right 2D:4D ratio 0.97cm respectively, while in females the mean value were found to be right 2D 6.52cm, right 4D 6.72cm, right 2D:4D Ratio 0.96 cm respectively. Using t-test, in males and females the 2D:4D ratio was statistically insignificant for the right hand with p>0.05. **Conclusion:** The anthropometric ratios help in establishing the gender and race of the individual, thus plays an important role in forensic science.

**Keywords:** Index finger, Morphometry, Ring finger, Ratio, Sexual dimorphism.

## INTRODUCTION

Anthropometry is a science which deals with method and techniques of measurement of living as well as skeletons of individuals.<sup>[1]</sup>

The evidence of use of this branch of science in the field of legal medicine is available since 19th century when a French police expert Mr. Alphonse Bertillon defined the system of criminal identification of individuals based on anthropometric measurements. Most of the workers used intact long bones like femur, tibia, humerus and radius for estimation of stature which is natural heights of a person in an upright position and various methods, formulae and regression equations are devised for various population groups.<sup>[2]</sup>

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Since anthropometric measurements are extensively used in the field of forensic and legal medicine. Estimation of stature is very important

and main component of anthropological research which is necessary for identification and used by medico legal experts, forensic examiners and anatomist.<sup>[3]</sup>

If whole body is available then estimation of stature is easy but it is very difficult in case of only few parts of the body or some skeletal remains are available.<sup>[4]</sup>

MacDonnell is the researcher who had worked towards correlation of height and various finger lengths and also compared the stature with the finger length ratio.<sup>[5]</sup>

Tyagi et al, found accurate or near accurate correlation between stature and finger lengths in Delhi region of India. Each race and population of geographical area needs specific formulae as it is because many factors like race, ethnicity, nutritional factors, and environmental status play important role in the development and growth of human beings.<sup>[6]</sup>

The ring finger is the fourth digit of the human hand and it is situated between the middle finger and the little finger, while the index finger is the first finger and it is the second digit of a human hand. Index finger is located between the thumb and the middle finger and usually the most skillful and sensitive finger of the hand but shows that

males have relatively shorter index finger than the ring finger.<sup>[7]</sup>

Men with more masculine finger ratios are perceived as being more masculine and dominant by female observer and they tend to perform better in a number of physical activities and sports.<sup>[8]</sup> A low masculine finger ratio shows a correlation with high testosterone level which is characteristic feature of males, while higher ratio shows that correlation with low testosterone level which is a characteristic feature of females.<sup>[9]</sup>

In human finger length ratio of the index and ring finger (2D:4D) is a sexually dimorphic trait. The ratio in between index and ring digits length (2D:4D) may correlate with in utero testosterone level because it is sexually dimorphic. The relative length of the digits are set before birth and 2D:4D ratio have been reported to be negatively correlate with testosterone level and positively associate with oestrogen level in adults.<sup>[10]</sup>

The sex differences in 2D:4D ratio is present before birth in human which was ruled out the social influences that affect the digit growth differentiation between two sexes. A somatic sex difference in mammals was related either androgenic Masculinization or effects of sex chromosome.<sup>[11]</sup>

The study of the index and ring digits ratio and their association with some physical Characteristics of the Ebira tribe of Nageria was carried out to determine the values of digit ratio and their association with other anthropometric variable. Three hundred males and three hundred females in which one hundred males and one hundred females were selected. Males have longer fourth (4D) and shorter second (2D) digit length with lower 2D:4D ratio while females have shorter fourth (4D) and longer second (2D) digit length with higher digit ratio.<sup>[12]</sup>

## MATERIALS AND METHODS

Total number of students (200=Male & 200=Female) of Teethanker Mahaveer University were examined for one year as they were of cosmopolitan origin ranging age (17-25) years. A written consent was obtained by each student in prescribed format.

### Inclusion Criteria

The criteria for including the individuals from the study was as follows-

- Subject in age group of the 17-25 years.
- Healthy individuals without any deformity or abnormality.
- Willing to participate in study.

### Exclusion Criteria

- Age group below 17 and above 25
- Any type of physical deformity.
- Any type of congenital anomalies.

- Any of the finger injury.

The measurements related to index (2D) & ring finger (4D) are taken with simple Vernier Calliper to measure the distance. It was measured straight distance from the midpoint of the proximal finger crease to the tip of the finger. Vernier calliper was used to measure the finger length; hand placed on the plane surface, palm of the hand is facing upwards. The dimension is taking three times by the same person and means are taking thus increasing the accuracy of the data. The subject is properly sitting or standing in position. All fingers is fully extended palmar region with digit fully stretched touching a flat hand surface and 2nd and 4th digit adducted with the thumb slightly extended [Figure 1]. The length of index and ring fingers were measured and ratio (2D:4D) was calculated.

Statistical Analysis:- The data was tabulated & mean & standard deviation was calculated. The paired t- test was used and P- value was calculated. P value < 0.05 was considered significant.



**Figure 1:** Measurement of ring finger length with the help of sliding caliper

## RESULTS

An observation of the anthropometric association of the index finger (2D) and ring finger (4D) shows a significant difference in both males and females. The mean values of male population were found to be right 2D 7.04cm, right 4D 7.20cm, right 2D:4D ratio 0.97cm respectively, while in females the mean value were found to be right 2D 6.52cm, right 4D 6.72cm, right 2D:4D Ratio 0.96 cm respectively. The mean observation of the ratio of R2D:4D were found to be similar in both sexes. Using t-test, in males and females the 2D:4D ratio was statistically insignificant for the right hand with  $p > 0.05$  [Table 1-3, Figure 2].

**Table 1:-** Descriptive measurement of index and ring finger (right) length in male (cm).

Parameter	Male	
	(R2D)	(R4D)
Maximum	8.2	8.3
Minimum	6	6
Mean	7.04	7.20
Sd	0.470	0.47
Variance	0.22	0.22

**Table 2:-** Descriptive measurement of index and ring finger length (right) in female (cm).

Parameters	Female	
	(R2D)	(R4D)
Maximum	7.5	7.9
Minimum	5.2	5.6
Mean	6.52	6.72
Sd	0.50	0.42
Variance	0.25	0.17

**Table 3:** Comparison of measurement of index & ring finger length in males & females.

Parameters	Male		Female		t-value	P-value
	Mean	SD	Mean	SD		
R2D	7.04	0.470	6.521	0.50	7.65	<0.05
R4D	7.20	0.476	6.722	0.42	7.52	<0.05
R2D:R4D	0.97	0.032	0.969	0.04	1.78	>0.05

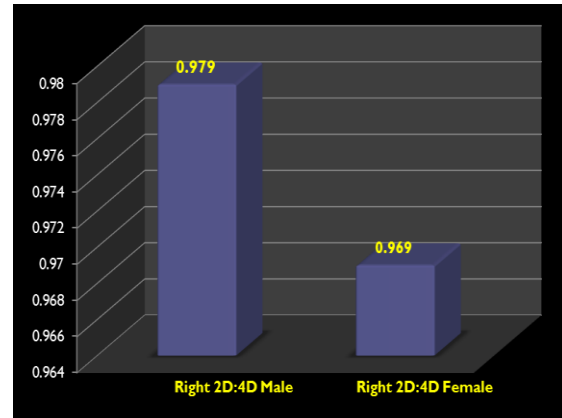
\*p value <0.05

### DISCUSSION

Determination of finger length ratio (2D:4D) was done in cross section of sample of North India and the results were compared between males and females. According to previous researches, done in the field show that the digit ratio values are consistently reliable in determination of sexual dimorphism and finger length ratio in Indian population.

Krishan et al found statistically significant correlation between stature, index finger length and ring length in right hand. Pearson correlation (r) was higher among males than females. Among males and females correlation coefficient was higher for the index finger length than the ring

finger length.<sup>[13]</sup> According to Brown et al, considerable proportion of normal males have low digit ratios compared to females.<sup>[14]</sup> Burley et al was also shown that males had relatively short second finger than fourth finger.<sup>[15]</sup>



**Figure 2:** Bar diagram showing the relationship between the right (2D:4D) Male and right 2D:4D Female.

The association of finger length ratio (2D:4D) of Ebara ethnic group of Nigeria with physical traits was done and the results was compared between males and females of adult Ebara people. Many researchers have attempted these measurements but the digit ratio values proved to be consistently reliable in sex dimorphism and it has been demonstrated that a considerable proportion of normal males have low digit ratios compared to the females.<sup>[16]</sup>

The work of Manning et al. shows that the females have longer second digits than fourth digits while males have longer fourth digits than second digits which were associated with height and weight. This accounted for the higher digit ratios in females than in males. The results of the males and females 2D:4D ratios however confirmed that digit ratios (2D:4D) are sexually dimorphic phenomenon.<sup>[17]</sup>

### CONCLUSION

In the present study, total 400 subjects had participated in which males = 200 and females = 200. In male subjects we found that index finger is longer than the female subjects and the length of the ring finger was longer in males than the females. The 2D:4D length ratio in males is greater than in females, which is statistically insignificant.

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