



**STUDY OF LENGTH OF INDEX AND RING FINGER OF HAND IN  
NORTH INDIAN POPULATION**

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**Abstract:**

**Introduction:** Forensic pathologists suffer glitches, when it comes to deal with amputated bony remnants of human's lingering parts such as hand and foot for a medico-legal investigation to conceal the identity, gender, and age of the victim. Among various parameters of identification, one of the criteria in differentiating gender is by measuring second and fourth finger length.

Many studies have proved that the length ratio of the second digit to fourth digit (2D:4D) helps to reveal gender, as length of second digit is more in females than in males ( $2D:4D > 1$ ) and the second digit found comparatively shorter than fourth digit in males. The present study has been conducted to investigate the sexual dimorphism by evaluating index and ring finger's length ratio in North Indian population.

**Materials and methods:** This study was conducted on 408 healthy adults (204 males and 204 females). Index & ring finger length of right & left hand were measured using digital vernier caliper. After collection of data appropriate statistical analysis were done.

**Result:** The ratio of index and ring finger is 0.97mm in males and 0.98mm in females' right hand and 0.98 mm in males and 0.99mm in females for left hand, however the ratio of index & ring finger length of females was higher when compared to the males.

**Conclusion:** The present study is significant for sex determination and also plays an important role in medicolegal cases & anthropological studies.

**Keywords:** Ring finger, Index finger length, Ratio, Anthropology,

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## **Introduction:**

Identification of people as a result of natural disasters like floods, cyclones, earthquakes, explosions or death due to burn always cause problem for investigators [1,2]. In Anthropology, investigator deals with the bone remnants for personal identification of an individual or any birth marks on body like tattoo marks, moles, scar marks etc [3,4]. The second and fourth finger ratio reflects sexual differentiation early in life and it may be an endpoint for the organizational effects of prenatal androgens in the human body. The second digit is comparatively shorter than fourth digit in males. In fetal life, the lower ratio of second and fourth digit can be used as an indicator of greater androgen exposure [10]. Among all the digits of hand, middle digit is the most projected digit followed by ring, index, little finger and thumb. The thumb is regarded as the first digit of hand. The digits of hand are numbered from lateral to medial side and the axial line of hand is represented by a line drawn through the middle finger [12]. Individual identity is a set of physical, functional or psychic and normal or pathological characteristics of human. Length of the fingers of hand is considered as one of the important parameters for determining the identity and gender of an individual. There are several types of parameters which are being used for measuring the length of digits of hand [13, 14]. Before birth in humans, the sex differences in the ratio of second and fourth digit are present, which was excluded from the social influences that influence the differentiation of digit development between two sexes. Either androgenic masculinization or sex chromosome impacts were associated with a somatic sexual distinction in mammals [19]. It is further argued that children with Down's syndrome have a smaller ratio of second and fourth digit and it can be used as an indication in this condition. In another study comparison of second and fourth digit ratio was estimated on subjects suffering with congenital adrenal hyperplasia and healthy individuals [20, 21]. It was established that ratio of second and fourth digit on the right hand of the female subjects and left hand of the male subjects was significantly lower as compared to the individuals without congenital adrenal hyperplasia [22, 23]. In the past studies, some researchers had established correlation between length of fingers and gender. According to Manning et al, gender estimation can be done by obtaining a ratio of length of the second and fourth digit that showed lower ratio of the index and ring finger

length in males than in females. The second and fourth digits show pattern of approximate symmetry around the central axis of the middle finger in hand [24].

The present study is done to help in identification of an individual by measuring length of digits of hand and correlate ratios among Indian male and female population.

### **Material and method:**

The study was conducted in Department of Anatomy, IIMS&R, Lucknow. This study was conducted on 408 adults (204 males and 204 females) who were randomly selected from the population of north India. Informed consent was obtained from each volunteer before taking the measurements.

### **Inclusion criteria:**

- Interested volunteers included in the study.
- Healthy adult subjects.
- Subjects belonging to North India.

### **Exclusion criteria:**

- Subject with any musculoskeletal deformities, history of injury or surgery of hand.
- Congenital finger malformation.
- Subjects below 18 years of age.

### **Material & Methods:**

- Digital vernier caliper.

The measurement was done by Digital Vernier Caliper with a sensitivity of 0.01 mm.

- Measured by Digital vernier caliper.
- The subject's hand was placed on a plane hard surface with palm facing upward and fingers fully extended.
- Measurement of the finger was taken from the midpoint of the proximal finger crease to the tip of respective finger.

### **Statistical analysis:**

- The data was statistically analyzed using student t-test with p- value <0.001 taken as highly significant and value less than 0.05 as significant.

## Aim and Objectives

To determine the sexual dimorphism by evaluating index and ring finger's length ratio.

- To measure index and ring finger length.
- To compare the length of index & ring of right and left hand.
- To compare the length of index and ring finger of individual hand in male and female.



**Fig. 1. Measurement of Length of fingers**

## Results

The mean index finger length of the right hand was 70.71 mm with maximum length of 84.22 mm and minimum length being 59.94 mm whereas the minimum length was 81.90 mm with mean value of 71.39 mm. the mean ring finger length of right hand was 72.93 mm with maximum length of 85.28 mm and minimum length being 61.01 mm whereas the minimum length on left hand was 59.82 mm and maximum length was 84.63 mm with mean value of 73.00 mm (table-1). The ratio of ring and index finger is 0.97 mm in males and 0.98 mm in females for right hand and 0.98 mm in males and 0.99 mm in females for left hand. The ratio of index and ring finger is 0.97 mm in males and 0.98 mm in females for right hand and 0.98 mm in males and 0.99 mm in females for left hand(table-2).

S.NO	PARAMETERS	GENDER	SIDE	NO OF SUBJECTS (408)	MIN-MAX	MEAN $\pm$ SD (MM)
1	INDEX FINGER	MALE	RIGHT	204	59.94 - 84.22	70.71 $\pm$ 4.20
			LEFT	204	59.06 - 81.90	71.39 $\pm$ 4.07
		FEMALE	RIGHT	204	43.66 - 79.44	64.25 $\pm$ 4.91
			LEFT	204	44.01 - 78.03	64.83 $\pm$ 5.10
2	RING FINGER	MALE	RIGHT	204	61.01 - 85.28	72.93 $\pm$ 4.48
			LEFT	204	59.82 - 84.63	73.00 $\pm$ 4.64
		FEMALE	RIGHT	204	44.05 - 77.95	65.45 $\pm$ 4.72
			LEFT	204	44.74 - 81.80	65.47 $\pm$ 5.07

**Table. 1: Sexual Dimorphism of Index and Ring Finger Length.**

Finger	Male		Female	
	Right Hand	Left Hand	Right Hand	Left Hand
2D:4D	0.97	0.98	0.98	0.99

**Table. 2: The Ratio of Length of Index and Ring Finger of Right and Left Hand in Males & Females.**

## Discussion:

Defining the parameters of digit during “adulthood provides greater information on individual variations [56]. The knowledge about the variations in digit can help in diagnose of the developmental pathologies and anomalies of the skeleton and the endocrine system. The digits are significant indicators of an individual’s developmental characteristics during the fetal and postnatal periods [57]. Digital and metacarpal formulae is morphological variables have a functional significance. Many authors have a measured digit length” radiologically or morphometrically with the help of digital caliper [46]. In the previous studies, various researchers established the mean length of “digits of hand in males and females. According to Lorenzo Lolli et al [46] the mean length of second digit of the right hand was found 73.82 mm in males and 67.77mm in females. The mean length of fourth digit of right hand was found 75.27mm in male and 68.31mm in female. Khaled E. Aboul-Hagag et al, [28] reported that the mean length of second digit 78.00mm in male and 71.03mm in female for right digit of hand, and 78.05mm in male and 71.03mm in female for left digit of hand. The mean of length of the fourth

digit was show as 80.07mm in male and 72.01mm in female for” right hand digit, and 81.01mm in male and 72.02 mm in female for left hand digit. In the study of Mayura Setiya et al, [45] the mean length of second digit was found 71.09mm in males 66.01mm in females for right hand and 72.00mm in males and 66.01mm in females for left hand. The mean length of fourth digit was 74.01mm in males and 65.04mm in females for right hand and 74.03mm” in males and 65.05mm in females for left hand. A.O. Igbu et al, [30] observed that the mean length of second digit was 74.03mm in males and 70.07mm in “females for right hand and 74.03mm in males and 70.07mm in females for left hand. The mean length of fourth digit was found 80.03mm in males and 75.07mm in females for right hand and 80.03mm in males and 75.07mm in females for left hand. Sumita Shukla et al, [40] observed that the mean length of second digit was 70.04mm in males and 65.02mm “in females for right hand. The mean length of fourth digit was 72.00mm in males and 67.02cm in females for right hand. Rengin Kosif et al, [29] observed that the mean length of second digit was 73.05mm in males and 67.45mm in females for right hand and 72.88mm in males and 67.09mm in females for left hand. The mean of fourth digit was 74.37mm in males and 68.28mm in females for right hand and 73.99 mm in males and 67.97mm in females for left hand. Vishram Singh et al, [39] reported that the mean length of second digit was 84.34mm in males and 77.46mm in females for right hand and 84.21mm in males and 77.07mm in females for left hand. The mean of fourth digit was 91.72mm in males and 83.93mm in females for right hand and 92.10 mm in males and 83.51mm in females for left hand. Present study, the mean length of second digit is 70.71mm in males and 64.25mm in females for right hand and 71.39mm in males and 64.83mm in females for left hand. The mean of fourth digit is 72.93mm in males and 65.45mm in females for right hand and 73.00mm in males and 65.47mm in females for left hand. In the study of Lorenzo Lolli et al, [46] the ratio of length of second and fourth “digit of right hand was found 0.984 in males and 0.992 in females. Khaled E. Aboul-Hagag et al, [28] observed that the ratio of length of second and fourth digit was found 0.967 in males and 0.987 in females for right hand digit and 0.968 in males and 0.987 in females for left hand digit. Raciha Sinem Balci et al, [54] observed that ratio of length of second and fourth digit was found to be 0.99 in males and 1.006 in females for “right hand and 0.997 in males and 1.007 in females for left hand. In the study of Mayura setiya et al, [45] the ratio of second and fourth digit was observed as 0.97 in males and 1.01 in females for right hand and 0.97 in males and 1.008 in females for the left hand. A.O. Igbu et al, [30] observed that the ratio of second and fourth digit was 0.97 in males and 0.94 in females for right hand and 0.93 in males and 0.94 in females for left hand. Sumita Shukla et al, [40] observed that the ratio of second and fourth digit was found 0.97 in males and 0.969 in females for right hand. Sonia Gupta et al (2017) reported that the ratio of second and fourth digit to be 0.98 in males and 1.01 in females for” right hand and 0.96 in males and 1.01in females for left hand. Rengin Kosif et al, [29] reported that the ratio of second and fourth digit was 0.98 in males and 0.98 in females for right and left hand. Singh vishram et al, [39] reported that the ratio of second and fourth digit was 0.92 in males and 0.92 in females for right hand and 0.91 in males and 0.92 in females. Present study, the ratio of second and fourth digit is 0.97 in males and 0.98 in females for right hand and 0.98 in males and 0.99 in females for left hand.

## Conclusion

We are found that index finger of right and left hand is longer in males as compared to the females and also ring finger length was longer in males than the females, which statistically

Significant. the ratio of index & ring finger length of females was higher as compared to the males. Which are helpful for sex determination and also plays an important role in medico legal cases & anthropological studies.

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