



### Morphometric analysis of index and ring finger and comparing with height weight and BMI in north Indian population

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#### Abstract

**Background:** Sex determination in identification of human remains is one of the most important components in forensic identification and it is a major task in medico legal investigation.

**Objective:** To study the morphometric analysis of index finger and ring finger and comparing with height weight and BMI.

**Material and Methods:** Present study was carried out on 200 individual of both sexes. Length of index and ring fingers and the ratios between them were estimated.

**Results:** Mean age of male subject were 18.94 and in female 19.34. The mean length of Index finger of male was 7.049 cm and female was 6.521 cm. The mean length of ring finger was in male and female following 7.20 & 6.722 cm. The mean height of male was 170.7 and in female 158.5, weight of male 65.36 and female 48.41 where as both male and female BMI was 22.8 & 19.80.

**Conclusion:** The index finger and ring finger length ratio in males is greater than in females which is insignificant. In males height was greater than the height of females. Weight and BMI of the males was greater than that of the females. In males out of all the anthropometric parameters, only BMI was significantly correlated with index finger length. In males no anthropometric parameters- was significantly correlated with ring finger length. In females neither index nor ring finger showed any significant co- relation with all the three anthropometric parameters i.e

**Keywords:** human identification, forensic science, sex determination, Index/Ring finger

#### 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 19<sup>th</sup> 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>. 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>. Krogman WM in his research found the correlation between 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>.

#### Material and Methods

##### Study Design

The present study was descriptive type of observational study. A total of 400 subject which was student of different branches of University out of which 200 male and 200 female examined in Teekshner Mahaveer University were enrolled for present study. They were of cosmopolitan origin ranging age (17-25) years. A written consent was obtained by each student in prescribed format

##### Instrument

1. Vernier caliper
2. Weight machine

##### Method

###### Measurement of height

**Stature:** Maximum distance from vertex to floor, maintaining the anatomical

###### Measurement of Index and Ring Finger Length

The measurements related to index & ring finger are taken with simple Vernier Caliper to measure the distance. It was measured straight distance from the midpoint of the proximal finger crease to the tip of the finger. Vernier caliper 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 2<sup>nd</sup> and 4<sup>th</sup> digit adducted with the thumb slightly extended.

### Measuring of Weight

Subject was stand on weight machine without jacket and shoes.

### Inclusion Criteria

1. Subject in age group of the 17-25 years.
2. Healthy individuals without any deformity or abnormality.

### Exclusion Criteria

1. Age group below 17 and above 25
2. Any type of physical deformity.
3. Any type of congenital anomalies.
4. Any of the finger injury.

### Statistical Analysis

Statistical analysis was performed by using computer based software, Statistical Package for Social Science (SPSS). Mean values of parameters were compared to determine.

### Result

According to our present study the measurements of stature, weight, index and ring finger were selected by using direct physical procedure among 400 subjects (200 each male and female). The Mean and Standard Deviation were calculated for each variable. Gender wise distribution of Height, Weight and BMI were studied. In our current study mean age of male subject were 18.94 and in female 19.34 it was show in table no 1. The mean length of Index finger of male was 7.049 cm and female 6.521 cm. The mean length of ring finger was in male and female following 7.20 & 6.722 cm data was given in table number 2. The mean height of male was 170.7 and in female 158.5, weight of male 65.36 and female 48.41 where as both male and female BMI was 22.8 & 19.80 show in table number 3.

**Table 1:** Distribution of mean age

| Age Distribution |          |        |      |  |
|------------------|----------|--------|------|--|
| (Group)          | (Number) | (Mean) | (SD) |  |
| Male             | 200      | 18.94  | 1.49 |  |
| Female           | 200      | 19.34  | 1.59 |  |

**Table 2:** Comparison of measurement of index & ring finger length in males & females.

| Parameters          | Male  |        | Female |       | t-value | P -value                |
|---------------------|-------|--------|--------|-------|---------|-------------------------|
|                     | Mean  | SD     | Mean   | SD    |         |                         |
| Index finger        | 7.049 | 0.470  | 6.521  | 0.504 | 7.65    | <0.05*                  |
| Ringer finger       | 7.20  | 0.476  | 6.722  | 0.424 | 7.52    | <0.05*<br>(significant) |
| Index : Ring finger | 0.97  | 0.0323 | 0.969  | 0.041 | 1.78    | >0.05 (In significant)  |

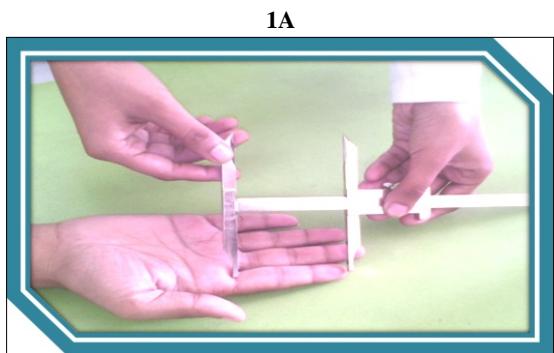
**Table 3:** General statistics of the anthropometric parameters used in males and female.

| Parameter | Sex    | Mean    |
|-----------|--------|---------|
| Height    | Male   | 170.7   |
|           | Female | 158.585 |
| Weight    | Male   | 65.36   |
|           | Female | 48.41   |
| BMI       | Male   | 22.8    |
|           | Female | 19.80   |

### Discussion

Determination of finger length ratio index finger and ring finger was done in cross section of sample of North India and the results were compared between males and females. According to previous research done in the field shows that digit ratio values were consistently reliable in determination of sexual dimorphism and finger length ratio in north Indian population. Tyagi *et al.* observed that the positive correlation between stature and finger length and also suggested that the index finger was best for the prediction of stature in both the sexes studied in Delhi's population [6] According to Bailey *et al* who observed that males with lower finger length ratios had significantly higher physical aggression scores [7]. 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 [8]. According to Brown *et al*, considerable proportion of normal males have low digit ratios compared to females [9]. Burley *et al* was also shown that males had relatively short second finger than fourth finger [10]. The present study was done to establish the relationship between the male and female finger length ratios index finger and ring finger equal and to ascertain if it has any correlation with height, weight and BMI. The result showed that there was correlation between index finger and ring finger and height in females of north Indian population and also observed that male had relatively short second digit than fourth digit. The association of finger length ratio index finger and ring finger of Ebira ethnic group of nageria with physical traits was done and the results were compared between males and females of adult Ebira 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 [11]. The present study was designed to establish the relationship between the male and female finger length ratios index finger and ring finger mostly equal in north Indian population. 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 was associated with height and weight. This accounted for the higher digit ratios in females than in males. The results of the males and females index finger and ring finger ratios however confirmed that digit ratios index finger and ring finger are sexually dimorphic phenomenon [12]. Current study shows that the females have almost equal index finger and ring finger length and males also have equal length of both fingers incorporated with height and weight. Ratio of the digits in both sexes was also similar and it was statistically insignificant correlation between males and females.





1A



1B

1C

**Fig 1A:** Indicates measurement of ring finger, **Fig. 1B** indicates measurement of index finger, **Fig. 1C** indicates measurement of height.

### Conclusions

The index finger and ring finger length ratio in males is greater than in females. Weight and BMI of the males was greater than that of the females. In males out of all the anthropometric parameters, only BMI was significantly correlated with index finger length. In males no anthropometric parameters- was significantly correlated with ring finger length. In females neither index nor ring finger showed any significant correlation with all the three anthropometric parameters i.e. Height, Weight, & BMI. In both males & females no statistical significant difference was found in correlation between ratio (2D:4D) with anthropometric parameters.

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