Morphometric Study and Sexual Dimorphism of Percutaneous Tibial Length in Indian Race.

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ABSTRACT

Background: "Anthropometry" includes the different techniques which express the human body and its parts in quantitative manner. Hence, this technique is considered as one of the useful and most applicable, non-invasive and also inexpensive technique worldwide. For the establishment of size of the body and also in sexual dimorphism this technique has been used by the anthropologist for many years. Aim: this study is undertaken to show sexual dimorphism in percutaneous tibial length in Indian race. **Methods:** The study was carried out on 200 subjects (100 male and 100 female) among the population of India. Percutaneous tibial length was measured with the help of spreading caliper. The data was collected and analyzed statistically. **Results:** Our study shows no significant difference between the Right and left PCTL in male and female among Indian races. Mean right PCT: Male – 37.82±1.99, Female – 34.84±1.91, Mean left PCT: Male – 37.79±1.98, Female – 34.79±1.89. The percutaneous tibial length was significantly high in males as compared to females. **Conclusion:** The present study reveals that there is no statistical significance difference occurs between the right and left percutaneous tibial length among male and female. It also shows that the percutaneous tibial length of male is significantly higher than female in the Indian race.

Keywords: Anthropometry, percutaneous tibial length, sexual dimorphism.

INTRODUCTION

"Anthropometry" is the branch of science which includes the different techniques which express the human body and its parts in quantitative manner. Hence, this technique is considered as one of the useful and most applicable, non-invasive and also inexpensive technique worldwide.[1] For the establishment of size of the body and also in sexual dimorphism this technique has been used by the anthropologist for many years.[2]

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Subdivision of anthropometry
Anthropometry can be subdivided into:-

- **Somatometry including cephalometry[3]**
- **Osteometry including craniometry[3]**

- ➤ **Somatometry** – it deals with the measurement of the body in living subject as well as in cadavers and it will also include the head and face.

- ➤ **Cephalometry** – it is a part of somatometry in which we study the measurement of head and face in living human being as well as in cadavers.
- ➤ **Osteometry** – it is the study of the measurement of skeleton and also different bone or its fragments including skull.
- ➤ **Craniometry** – it is a part of osteometry which include only the measurement of skull.[3,4]

Personal identification is considered as the most reliable factor in forensic science, which means "to determine the identity of a person". Personal identification can be divisible into two different parts, first is the complete (absolute) and second is the incomplete (partial). If the individuality of a person is absolutely fixed and also every aspect of the individual is considered than it will be termed as complete identification. If very few factors is considered in obtaining the identity of an individual than it will be considered in partial identification. There are many factors which are used to identify the identity and sex of the person.[5,6]

If the body of the human being has been mutilated then there are various parameters, which are used

by the Anthropologist to determine the identity and sex of the individual and these are[7]:

- The arm span length - when both the upper extremity is abducted at 90° in relation to the trunk and the length measured were from the tip of the middle finger of one hand to the tip of the middle finger of the other hand.
- The finger length.
- The length of the trunk as well as the head and the neck i.e., from the vertex to the symphysis pubis.
- From the forearm and the hand i.e., the length measured from the olecranon process of the ulna to the tip of the middle finger and this length is approximately equal to the 5/19 part of that of the total stature.
- The length of the vertebral column.
- From the measurement of the different bone specially the long bones.
- From the height of the head which can be measured by vertical distance between the top of the head to that of the chin. This part of the body is approximately equal to the 1/9 of the total body height of a person.
- By measuring the inter - acromial length.
- By measuring the inter - anterior superior iliac spine length.
- From the length of the whole upper or lower extremity.[7]

Percutaneous tibial length : It is the total length of tibia significantly presenting the distance between the medial most superficial point on the upper border of the medial condyle to the superficial lower most point (tip) of medial malleolus of tibia, and the person should maintain the angle between flexor surface of leg and thigh at 90°.[5]

Identification
Identification may be defined as the exactly fixation of the personality of an individual or to determine the identity of a human being which is based on the certain physical characteristics of the person.[8]
Identification of an human being is very much necessary in the following:-

- In the living individual.
- Identification is of immense importance in the dead individual.
- If any decomposed part of the human body had been found.
- If any mutilated part of the body is found.
- In the skeletal remains.
- If any mutilated part of bone had been found.[9]

Identification of an individual can be made by identifying certain physical characteristics about the individual like the name as well as age and sex of the individual.
It has been proved by many anthropologists that different body parts can be used to determine the sex of the person. So, an effort has been made to identify the individuality and sex differences from percutaneous tibial length in Indian race.

MATERIALS AND METHODS

The study was conducted on 200 subjects (100 male and 100 female) between the age group of 17 – 24 year among the population of India. The percutaneous tibial length was measured with the help of spreading caliper.

Technique for measurement of percutaneous tibial length
For measuring the percutaneous length of tibia the person was asked to sit on stool so that the thigh should be placed in a straight line, and the leg and thigh should be placed right angle to each other (maintain the angle of 90° with each other). Then proximal and distal point of tibia was marked by marker pencil [Figure 1]. Then the two points (proximal and distal) were measured by spreading caliper. The length of tibia was measured in centimeter. Both right and left tibia of the person were measured with the help of spreading caliper [Figure 1].

Proximal point: superior most point of upper border of the medial tibial condyle.

Distal point: tip of medial malleolus of tibia.

Statistical analysis
Mean and standard deviation was measured and students t-test was applied to compare the two groups and $p<0.05$ was considered as significant.

RESULTS

The study was conducted on 200 subjects (100 male and 100 female) among the age group of 17-24 year in India. Percutaneous tibial length was measured with the help of spreading caliper and the statistical analysis was done by calculating the mean and standard deviation, and students t-test was applied to compare the two groups and $p<0.05$ was considered as significant. [Table 1] shows that the maximum subjects have the age of about 19 years (35.5%).

Figure 1: Measurement of proximal and distal point of tibia.

Table 1: Age distribution table of the total sample

Age in years	Number	Percentage (%)
17	36	9 %
18	96	24 %
19	142	35.5 %
20	58	14.5 %
21	32	8 %
22	14	3.5 %
23	12	3 %
24	10	2.5 %

The minimum subjects have the age of 24 year (2.5 %). Among 400 subjects, 142 are of 19 year old and 10 are of 24 year old [Figure 2].
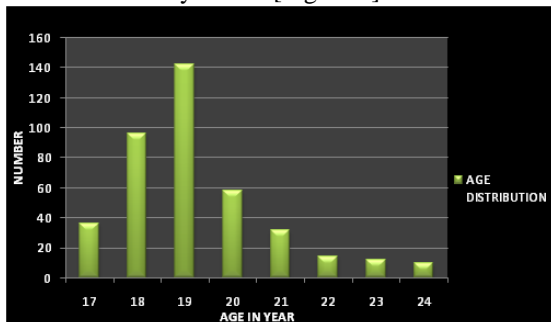

Figure 2: Showing age distribution of the total number of sample.

Table 2: Gender distribution of the total sample.

Gender	Number	Percentage (%)
Male	100	50
Female	100	50
Total	200	100

[Table 2] Depicts that total number of subject were 200 among them 100 were male and 100 were female. The percentage was 50 % male and 50 % female [Figure 3].
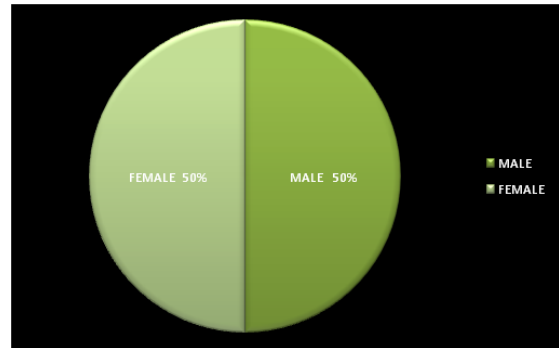

Figure 3: Pie chart is showing the gender distribution of the sample.

Table 3: Descriptive statistics of all parameter in male.

Group	RT PCTL	LT PCTL	t-value	p-value
Mean	37.82	37.79		
Standard Deviation	1.99	1.98	0.07	>0.05

[Table 3] shows that the mean length of right PCTL is 37.82 and the standard deviation is 1.99 whereas the mean length of left PCTL is 37.79 and standard deviation is 1.98. The t-value is 0.07 and p-value is >0.05 which is statistically insignificant.

Table 4: Descriptive statistics of all parameter in female.

| Group	RT PCTL	LT PCTL	t-value	p-value
Mean	34.84	34.79		
Standard Deviation	1.91	1.89	0.18	>0.05

[Table 3] shows that the mean length of right PCTL is 34.84 and the standard deviation is 1.91 whereas the mean length of left PCTL is 34.79 and standard deviation is 1.89. The t-value is 0.18 and p-value is >0.05 which is statistically insignificant.
[Table 3 and 4] shows that there is no statistical significant difference occur between the right and left PCTL of male as well as of female.
[Table 5] shows that the mean length of right PCTL in male is 37.82 and the standard deviation is 1.99 whereas the mean length of right PCTL in female is 34.84 and standard deviation is 1.91. The t-value is 10.99 and p-value is <0.05 which is statistically significant [Figure 4].
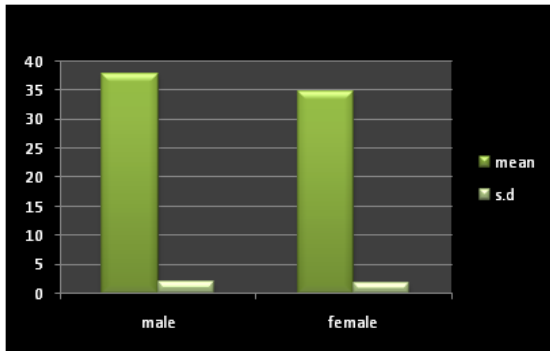
Figure 4: Shows the mean and standard deviation of right PCTL of male and female.
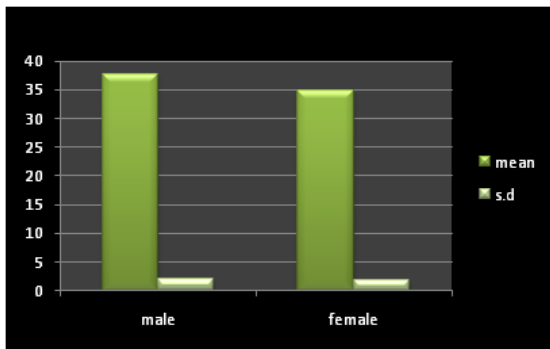
Figure 5: Shows mean and standard deviation of left PCTL in male and female.

Table 5: descriptive statistics of right PCTL in male and female.

Group	Male	Female	t-value	p-value
Mean	37.82	34.84	10.99	<0.05
Standard Deviation	1.99	1.91		

Table 6: Descriptive statistics of right PCTL in male and female.

Group	Male	Female	t-value	p-value
Mean	37.79	34.79	10.81	<0.05
Standard deviation	1.98	1.89		

[Table 6] shows that the mean length of left PCTL in male is 37.79 and the standard deviation is 1.98 whereas the mean length of left PCTL in female is 34.79 and standard deviation is 1.89. The t-value is 10.81 and p-value is <0.05 which is statistically significant [Figure 5].

[Table 5 and 6] shows that male has higher percutaneous tibial length of both right and left side as comparison to female.

DISCUSSION

Personal identification is considered as the most reliable factor in forensic science, which means "to determine the identity of a person". Different body parts are used by the forensic expert to identify the personality and also the sex of the individual.

In our study, we have found that there is no statistical difference occur between the left and right tibia length of male as well as in female. Our finding correlate with that of Nath et. al.[10], Chavan et al[11], Kaore et al[12] as well as Agnihotri et. al.[13] who also have the similar view that no significant statistical difference occur between the right and left PCTL in male as well in female.

In our study we have found that the mean PCTL of right side in male is 37.82 and in female is 34.84 whereas the mean PCTL of left side in male is 37.79 and in female is 34.79 and we have found that male has more PCTL length as comparison to female. Similar result was found by Kaore et al[12] and Trivedi et al.[14]

Our study also correlates with the study conducted by Saini et. al[15] in which the PCTL of male was found to be 40.90 cm and that of the female was 38.09 cm. Similar finding was observed by Mohanty[10] in which the PCTL of male was 37.08 cm and that of female was 35.03 cm.

Our study also matches the study done by N. C. et al.[2] in which they had concluded that the mean PCTL of male was 37.93 cm and that of the female was 33.94 cm.

Similar type of finding was also done by Chavan et al[11] in which they had estimated stature by measuring PCTL of male and female and they had observed that the mean PCTL of male was 37.32 cm and that of the female was 34.44 cm.

In the study conducted by Sah RP and Shrestha I[1], the measured value of PCTL in male was 37.57 cm and of female was 34.90 cm which was similar to our finding.

Magdy et al.[16] had also conducted a similar type of study and they concluded that the PCTL of male was greater than female and found that the PCTL of male was 38.04 cm and that of female was 36.52 cm.

CONCLUSION

The present study reveals that there was no statistically significant difference occurs between the right and left tibial length in male as well as in female. We have also found that the mean right and left PCTL of male is more as comparison to female.

The following observation was found: -
- Mean right PCTL
  - Male – 37.82±1.99
  - Female – 34.84±1.91
- Mean left PCTL
  - Male – 37.79±1.98
  - Female – 34.79±1.79

t – value for right PCTL in male and female – 10.99

t – value for left PCTL in male and female – 10.81

It shows that PCTL of male is statistically higher as comparison to female.

This study is very much useful for forensic expert as well as for the anthropologist. In medico legal investigation cases if they found any mutilated part of the body or bone from any mass disaster like bomb blast, earthquake, plane crash etc, in such cases the identity of an individual can be identified from measuring the bone length.

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