

## Original Articles

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# Comparison of Anthropometric Dimensions of Lower Limb Between Bangladeshi Male & Female Garment Workers

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### Abstract

**Context:** The measurement of lower limb dimensions showed a high success rate in establishing individual identity in terms of sex and stature in various populations. The study was aimed to measure the thigh length, lower leg length, biepicondylar breadth of femur & bimalleolar breadth of Bangladeshi garment workers.

**Materials and Methods:** Sixty male & sixty female aged 20-35 years were enrolled in this study. The anthropometric measurements of the subjects were measured with the help of anthropometric equipment such as digital slide calipers and flexible measuring tape.

**Results:** Male garment workers had higher mean values of lower limb variables ( $p < 0.001$ ).

**Conclusion:** In the present study significantly higher value of anthropometric measurements was found in male Bangladeshi garment workers than female. These results are significant in forensics and orthopedic reconstructive surgery.

**Keywords:** thigh length, lower leg length, biepicondylar breadth of femur, bimalleolar breadth

### Introduction

The lower limb extends from the lower part of the trunk to the foot. The bones of the lower limb are the hip bone in the gluteal region, the femur in the thigh, the patella in the knee, the fibula and tibia in the leg, the tarsals, metatarsals, and the phalanges in the foot.<sup>1</sup>

The human lower limb is structurally and functionally adapted for bipedal locomotion and weight bearing.

This adaptation affects bone length and strength, joint complexes, muscle mass, and muscle origin and insertion in relation to lines of joints and foot development (e.g. arches). Moreover, humans have very long and strong lower limb bones relative to upper limb bones.<sup>1</sup>

Anthropometry is a systematic measurement technique which reflects sizes of human body.<sup>2</sup> Various body parts have been measured to develop population-specific standards for both living and unidentified deceased subjects, with high success rates.<sup>3, 4</sup> Stature estimation by the length of femur plays an important role in the identification of decomposed body. It also helps in the estimation of age, sex, race and time of death of a person.<sup>5</sup>

An understanding of sub-segments of lower limb provides a good knowledge of the landmarks required in the measurement for body height prediction.<sup>6</sup> The human lower leg and foot have been the subjects of

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research in various non-forensic fields, such as anatomy, anthropology, evolution, ergonomics, and orthopedics. The study of the human lower leg and foot in forensics identification has been emphasized because of the increased likelihood of retaining the tibia (the second largest bone in the body) and the foot (often protected by the shoes) in the case of mass disasters, terrorists' attacks, wars, explosions, high-impact transportation accidents, and mass murders.<sup>7, 8</sup>

The foot and the lower leg have been shown to be a relatively accurate biological characteristic from which identification can be made in terms of estimating sex and stature.<sup>9, 10</sup> The reconstruction of lower intra limb parts has many advantages. It can be used in the process of matching multiple mutilated or dismembered fleshed lower limb parts, which is the initial step for any identification conducted by forensic investigators. Reconstruction can also be used in post-traumatic reconstructive surgeries to estimate the part's length or breadth.<sup>11</sup>

This study aims to explore the comparison of anthropometric changes of lower limb among the Bangladeshi male & female garment workers. This study helps to develop population-specific standards for the reconstruction of different parts. This research can provide valuable data for future comparative studies within other population.

### **Materials and Method**

One hundred and twenty garment workers ( sixty male and sixty female) age ranging from 20-35 years, having five years working experience on sewing machine were selected from different garment factories of Gazipur city. They worked eight hours daily. Four lower limb measurements were taken from each subject using standard anthropometric instruments in units of centimeter and millimeter. These measurements were obtained from the subject's right side for three times and the median value was taken.

## **Procedure of measurement of various anthropometric measurements of lower limb**

### **A. Thigh length**

The subject was asked to sit straight with the right knee bent at a 90 degree angle. The sliding caliper was positioned to measure the breadth of the patella. The blades of the caliper were positioned against the distal end of the femur on either side of the patella. The horizontal bar of the caliper was close to the anterior surface of the thigh, proximal to the patella. Using the superior edge of the horizontal bar of the caliper as a guide, a line was marked on the anterior surface of the thigh. The measuring tape was placed at the inguinal crease. The tape was extended along the midline of the thigh to the line just proximal to the patella.<sup>12</sup>

### **B. Lower leg length**

It is the vertical distance from tibiale to malleolus. Tibiale is the upper margin & edge of the interior prominence of the head of the tibia & malleolus is the lowermost or most inferior point of lower leg. The tibiale and malleolus were marked by points and the distance between them was measured.<sup>12</sup>

### **C. Biepicondylar breadth of the femur**

It is the maximum width across the outermost points on the epicondyles of the distal end of the femur. The subject sat on a chair with the knee bent at right angle. The caliper was applied to the epicondyles of the femur. Measurements were taken on both the sides and the larger value was recorded.<sup>13</sup>

### **D. Bimalleolar breadth**

It is the distance between the most medial projection of medial malleolus and the most lateral projection of lateral malleolus. The subject sat on a table with legs hanging freely. The caliper arms were placed on two malleoli and pressure was exerted before taking the measurement. The measurements were recorded in centimeters to the nearest 0.1 cm.<sup>13, 14</sup>

## **Results**

Male had significantly higher ( $p < 0.001$ ) thigh length, Lower leg length, biepicondylar breadth of femur and bimalleolar breadth than female (Table I).

**Table I**  
*Comparison of anthropometric measurements of lower limb in male and female garment workers*

Parameters	Male (n=60) Mean±SD (Range)	Female (n=60) Mean±SD (Range)	p value
Thigh length (cm)	41.44 ± 1.35 (38.60 - 44.20)	38.21 ± 1.73 (34.20 - 40.80)	0.0001***
Lower leg length (cm)	39.03 ± 0.90 (37.09 - 42.40)	36.94 ± 1.79 (34.00 - 40.60)	0.0001***
Biepicondylar breadth of femur (mm)	8.43 ± 0.72 (7.07 - 9.29)	7.51 ± 0.32 (6.70 - 8.07)	0.0001***
Bimalleolar breadth (cm)	6.14 ± 0.32 (4.90 - 6.81)	5.26 ± 0.20 (4.72 - 5.75)	0.0001***

n = Sample size. \*\*\* = Significant at p<0.001

Comparison between male and female was done by Unpaired Student's 't' test.

### Discussion

In present study, highly significant difference was observed between all anthropometric measurements of lower limb of male and female garment workers, where all values of male were significantly higher (p<0.001) than female.

In the present study, mean thigh length was 41.44 ± 1.35 cm and 38.21 ± 1.73 cm in male and female respectively. Singh<sup>15</sup> conducted a study on triple jumpers of Manonmaniam Sundaranar University Tirunelveli (Tamilnadu) age ranging 18 to 25 years and found that mean thigh length were 53.08±0.76 cm and 51.65±0.95 cm in high & low performers, which was significantly higher than the present study.<sup>15</sup>

In the present study, mean lower leg length were 39.03±0.90 cm and 36.94±1.79 cm in male and female respectively. Singh<sup>15</sup> reported mean lower leg length were 40.11±0.51 and 39.10±0.67 cm in high & low performers, which was higher than the present study. Bimalleolar breadth was 6.14±0.32 cm and 5.26±0.20 cm in male and female respectively in present study. Singh<sup>15</sup> reported mean bimalleolar breadth of jumpers were 6.90±0.13 and 6.70±0.16 which was slightly higher than the present study.

In the present study biepicondylar breadth of femur were 8.43±0.72 cm in male and 7.51±0.32 cm in female garment workers respectively. Diafas et al<sup>16</sup> conducted a study on Greek flatwater kayak athletes and stated that mean biepicondylar breadth of femur were 7.5±0.9 and 9.3±1.7 in male and female respectively. Study conducted by Ajayi et al<sup>17</sup> on Nigerian medical students stated that mean biepicondylar breadth of femur in male & female were 9.38±0.83 and 8.59±1.08 respectively. The findings of those two studies were slightly higher than present study.

### Conclusion

In the present study significantly higher value of anthropometric measurements was found in male Bangladeshi garment workers than female. These results are significant in forensics and orthopedic reconstructive surgery.

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