

# Measurement of length and weight of non-articulated adult humerus in Nepalese corpses

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## Abstract

**Background:** Anthropometry is the science that deals with the measurement of size, weight and proportion of human body. Measurements of long bones play an important role in the estimation of stature of individuals in palaeoanthropology and forensic investigations.

**Objectives:** The objectives of this study were to determine length and weight of humerus in Nepalese population and to compare these with the data from other population for use in forensic and archaeological studies.

**Methods:** This is a descriptive study. A total of 200 (100 right, 100 left) humerus bones were included. The Maximum humerus length (mm) was measured by osteometric board and weight (g) of the humerus was measured by electronic weighing machine.

**Results:** The mean and standard deviation for humerus length and weight of humerus were found to be 308.580±19.169 mm and 122.261 g for right humerus and 307.270±16.1301 mm and 118.473 g for left humerus respectively.

**Conclusion:** In conclusion, our measurements on the humerus have demonstrated that the length and weight of humerus in Nepalese population is similar to that of other country population values.

**Key words:** Anatomy, Anthropometry, Humerus, Morphometry

## INTRODUCTION

Estimation of stature from bones plays an important role in identifying unknown bodies, parts of bodies or skeletal remains. Anthropometric techniques have been used to estimate stature and bone length from the skeletal remains and unknown body parts by anthropologists, medical scientists and anatomists for over a hundred years<sup>1-3</sup>. Knowing the mean length and weight of humerus segments is very important for anatomy and forensic science and helps the investigator to define identity of a skeleton. These data also give evidences to indicate the characteristic features of a population for archaeological studies<sup>4-6</sup>.

Estimation of bone length from incomplete long bones was first done by Muller<sup>6</sup>. She defined five segments for humerus using the margins of articular surfaces and key

points of muscle attachment. Knowing these segment measurements is very helpful for determining the humerus length<sup>7</sup>. Humerus, the longest and largest bone in upper limb, has upper and lower end and a shaft. The rounded head is the proximal and medial part of upper end of the bone and forms an enarthrodial articulation with the glenoid cavity of scapula. The distal end is adapted to forearm bones at the elbow joint<sup>8</sup>.

## METHODS

This is a descriptive study. Two hundred dry adult humerus bones were collected from the department of anatomy Maharajgunj Medical Campus from February 2010 to March 2011. Information about sex was not available, since the bones were collected from didactic collection of the Department of Anatomy. Length of humerus (the distance between the most proximal point of the caput humeri to the most distal point of the trochlea humeri) was measured by osteometric board (Paleo-Tech Laboratory Osteometric Board) in millimeters and weight of humerus was measured by electronic weighing machine (Diamond Weight Scale) in grams.

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Statistical Package for Social Sciences (SPSS) 19.0 was used for statistical analysis. From the measurements, mean and standard deviations were calculated.

## RESULTS

A total of 200 (100 right, 100 left) adult humerus bones were included in this study. To determine the mean values of length and weight of humerus, descriptive statistics were used. With the morphometric evaluation of the humerus, the distances from the head of humerus to trochlea of humerus and weight of humerus were found to be 308.58 mm and 122.26 g for the right humerus and 307.27 mm and 118.473 g for the left humerus respectively. The mean and standard deviation (SD) for length and weight of humerus are shown in the Table 1 and Table 2.



Figure 1: Collection of 100 right humerus



Figure 2: Collection of 100 Left humerus



Figure 3: Demonstrating the measurement of maximum length of humerus (MHL) in osteometric board.



Figure 4: Weighing the humerus with electronic weighing machine.

## DISCUSSION

In forensic and archaeological studies, the mean value of total humerus length gives important evidence to indicate the characteristic features of a population. In a study from Guatemala with forensic Maya samples, the distance from the proximal point on the articular surface of the caput humeri to the distal point of trochlea was  $312 \pm 20.51$ mm. In this study this measurement was  $308.580 \pm 19.169$  mm and  $307.270 \pm 16.1301$  mm on the right and left side respectively.<sup>6</sup>

When we compare our finding with other populations, the results were similar to the Turkish population (307.1

Table 1: Descriptive statistics for length of humerus (in mm).

Side	Sample size (n)	Minimum	Maximum	Mean	Standard Deviation
Right	100	218	361	308.58	19.17
Left	100	276	350	307.27	16.13
<b>Total</b>	<b>200</b>	<b>218</b>	<b>361</b>	<b>307.92</b>	<b>17.68</b>

Table 2: Descriptive statistics for weight of humerus (in g)

Side	Sample size	Minimum	Maximum	Mean	Standard deviation
Right	100	96.0	182.3	122.26	16.81
Left	100	98.1	176.1	118.47	15.81
<b>Total</b>	<b>200</b>	<b>96.0</b>	<b>182.3</b>	<b>120.37</b>	<b>16.39</b>

$\pm 20.8$  on the right side of humerus and  $304.8 \pm 18.9$  on the left side of humerus), but there were significant differences with Maya populations<sup>7</sup>.

In forensic anthropology, a method for estimating height based on the distances of segments of long bones is important. Steele and McKern created a method based on the proportionality between determined distances among fixed points of bones and their total length. According to their study the maximum length of humerus was  $334 \pm 28$  mm and our study shows the maximum length of humerus was  $308.580 \pm 19.169$  mm for right humerus and  $307.270 \pm 16.1301$  mm on the left<sup>9</sup>.

It was reported over 100 years ago that dry bones are slightly smaller than fresh ones and this difference has been established as approximately two mm. According to this information this difference could be considerable<sup>10</sup>.

In a study from university of Kansas and Missouri the length and weight of the humerus on the right side  $303 \pm 17.71$  mm,  $93-93 \pm 17.53$  gm, and on the left side  $300.85 \pm 18.35$  mm,  $90.82 \pm 17.11$  gm respectively. In this

study the mean and standard deviation for humerus length and weight of humerus were found to be  $308.580 \pm 19.169$  mm and  $122.261$  g for right humerus and  $307.270 \pm 16.1301$  mm and  $118.473$  g for left humerus respectively<sup>11</sup>.

We consider that these discrepancies could be a result of factors such as age, sex, race and also environmental factors affecting bone growth, such as nutrition, physical development and genetic factors. Moreover these diversities could depend on the differences in the reference points which are taken as criteria in the measurements.

## CONCLUSION

We believe that knowledge of the morphometric values of humerus is important in forensic, anatomic and archaeological cases. It is also helpful for the clinician in the treatment of proximal and distal humerus fractures. As a result, these measurements may help to indicate the characteristic morphological features of humerus in our Nepalese population and also help the orthopaedic surgeon to place the various implants in the reconstruction of humerus fractures.

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