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Analysis Of Morphometric Parameters Of The Dry Hip Bone In Adult Human From North Indian Population And Its Clinical Significance

Kanhaiya Jee [1], Anand Kumar Singh[2*], Vivek Kumar[3], Shravan Kumar Verma[4]

[1]Associate Professor, Department of Anatomy, Dr. K.N. Singh Memorial Institute of Medical Sciences, Barabanki, UP. 09628004440, kanhaiyaj51@gmail.com

[2*]Associate Professor, Department of Anatomy, Dr. K.N. Singh Memorial Institute of Medical Sciences, Barabanki, UP. 09415084230, anandsingh19@gmail.com

[3]Assistant Professor, Department of Anatomy, Government Medical Collage, Shivpuri, Madhya Pradesh. 07415176681, vivekkumarpurve@gmail.com

[4]Assistant Professor, Department of Anatomy, Dr. K.N. Singh Memorial Institute of Medical Sciences, Barabanki, UP. 09838593309, shravanbds@gmail.com

***Corresponding Author:** Dr. Anand Kumar Singh

*Associate Professor, Department of Anatomy, Dr. K.N. Singh Memorial Institute of Medical Sciences, Faizabad Road, Gadia, Barabanki, UP. 225001) Mobile No. 09415084230

Abstract

Background: Anatomical, anthropological, and forensic perspectives all of them are interested in the human hip bone due to its unique morphology. Thus, we may estimate an individual's age, sex, and race using visual criteria, metric methodologies, and discriminate function analysis. The aim of the study was to assess the different hip bone properties by performing morphometry on 96 dry human hip bones from the North Indian community.

Aims: To evaluate various hip bone parameters in the north Indian population

Methods and Material: The weight, length, width, and Coxal index of 96 randomly selected adult unpaired hip bones from North India of unknown sex were analyzed and evaluated for this study. Every hip bone that was chosen was entire, dry, and displayed typical anatomical characteristics. Excluded from the study were specimens exhibiting osteoarthritic alterations, signs of prior trauma, or skeletal diseases.

Statistical analysis used: Collected data was coded, entered into a computer, processed, edited, and analyzed using SPSS software (version 20).

Results: The acquired raw data was statistically examined. For every parameter, the following values were found: range, mean and standard deviation. To reach the conclusions, all values were compared with a number of other workers.

Conclusions: From this investigation, it was found that right hip bone has larger parameters and greater strength of skeletal parts. The difference seen between the values of present study and that of other workers might be explained on the basis of ethnic and racial variances.

Key-words: Coxal index, Hip bone, Morphometry

Introduction:

The hip bone is one of the best informative bones in the skeleton as it is made by three independent elements during the sub adult life and is directly involved with child birth [1] The ilium, which is oriented upward, and the pubis, which is formed of the ischium posteriorly and anteromedially, are the two bones that make up the hip. The hip bone's two blades meet at the center of the acetabulum, almost at a straight angle to one another. [2]

For population studies, the morphology of the hip bone is important to both anthropologists and anatomists. Morphometric measurements of the right and left sides reveal a bilateral asymmetry of the hip bones.

By looking at the hip bone, one can visually tell the sex. It is clear that different populations have different skeleton compositions, both metric and non-metric. Comparing the human hip bone to other skeletal remains such as the sacrum, femur, clavicle, mandible, etc., we can determine the sex of the bone by considering multiple criteria.

It is not so important for the determination of sex by a method other than metrics. But metric methods used for sex determination of human hipbone have shown highest level of correctness. It is clear that the metric method has a superior advantage over simple morphology observations when it comes to objectively assessing.[3]

There are numerous bones in the human skeleton that can be used to compare sexes, ages, and races; however, the hip bone has special qualities that are interesting from anatomical, anthropological, and forensic perspectives. Research on hip bones in the north Indian population is limited. We used adult dried human hip bones for this study in order to assess several hip bone properties in the north Indian population. Thus, the current study offers useful information on the population of north India that will benefit anthropologists, orthopaedic surgeons, and forensic specialists.

REVIEW OF LITERATURE

According to study by Bollavaram pullanna on dry hip bone ,he found the mean coxal index in male was 70.87 whereas in female was 73.73[4] According to Sudarshan Gupta Kiran Arora et.al male was 70.83, whereas in females it has 74.24[6] . According to Kishor Dattatray Khushale,Yuvaraj Jayaprakash Bhosal, K. the mean coxal index in male Right was 73.66, and Left was 70.52,whereas in female Right was 86.45, and Left was 76.81.[7] According to Sudarshan Gupta Kiran Arora et.al mean coxal index in male was 70.83, whereas in female was 74.24.[6] According to Griffith, the readings on the left side were more than on the right side (width of hip bone was 14.48cm and on left side it was 15.24cm), whereas in the present study the values for the width of hip bone are more on the right side.[8],

According to Zeenat Kausar Coxal index is 71.56 on right side and 70.85 on left side[9] The values are consistent with values taken by Garson in Andamenese, Peruvian, New Caledonian and Savage Islander populations[10] The mean weight of hip bone as studied by Dhindsa et al and Singh and Raju, was 130.7 and 134.94 gm and that in the present study is 127.25gms[11,12] The mean length of the hip bone was 19.01 and 19.71 cm on

right and left side. Dhindsa et got the values as 19.77 and 19.60cm which were nearly similar to results[11]

Subjects and Methods:

Materials and Methods

Study Area and Period

This study was conducted at the Department of Anatomy at DR KNS MIMS, Gadia Barabanki Uttar Pradesh India from December 2023 to march 2024.

Study Design

A Observational study design was used to determine correlation between morphometric measurement of dry hip bone and its relationship with coxal index .

STUDY POPULATION

A regularly shaped dried hip bone with no obvious deformities or malformations. Direct determination of standard dimensions of hip bone is impossible in the cadavers by dissection; hence dry hip bone will be used.

Data Collection

Study Materials - Dried human hip bones**,** Scale, Measuring Tape, Weighing Machine

Method-

Weight, length and width of hip bone were measured with the help of scale, measuring tape and weighing machine.

Coxal index was calculated using the formula-

Coxal index = width of hip bone/length of hip bone x 100.

Weight of hip bone:- Each bone will measured separately using and electronic weighing machine and weight was recorded in grams.

Figure-I Image showing weight of hip bone

Length of hip bone:- Maximum distance from superior point on the iliac crest to a plane drawn along the inferior surface of the ischium and length where record in centimetre(cm.).

Figure-II Image showing measurement of length of hip bone using osteometric board

Width of hip bone:-Maximum distance between the anterior superior iliac spine and the posterior superior iliac spine and measurement were record in centimetre.

Figure-III Image showing measurement of width of hip bone using osteometric board

Coxal index:- Calculated from the observed values of length and width of the hip bones.

DATA ANALYSIS

Collected data was coded, entered into a computer, processed, edited, and analyzed using SPSS software (version 20). One-way analysis of variance (ANOVA) was done to determine statistical differences among right side and left side variation in dry hip bone . The results of the data were presented as mean ± standard deviation (SD). A P-value < 0.05 was considered statistically significant.

Ethical Considerations

The ethical clearance was obtained from the Department of Anatomy, Research and Ethical Review Committee of Dr. K.N.Singh Memorial Institute of Medical Sciences, Gadia Barabanki Uttar Pradesh India , by approval letter with Ref. No- IEC/2024/1

Results:

For the purpose of studying various parameters were correlated with each other , a total of 96 hip bones of unknown sex were collected; of these, 49 were from the right side and 47 from the left. Data on the various properties of the hip bones was entered into an Excel sheet.

Table 1 Displays the weight of hip bones in grams: mean, standard deviation, and range.

SIDE	MEAN	SD	RANGE
RIGHT	133.18	14.72	98-149
LEFT	109.08	11.06	96-130
TOTAL	127.85	11.03	96-149

Table 2. Displays the distribution of lengths of hip bones in centimeter: mean, standard deviation, and range.

SIDE	MEAN	SD	RANGE
RIGHT	19.84	1.65	16.9-21.4
LEFT	19.25	1.42	16.9-22.9
TOTAL	19.05	1.50	16.9-22.9

Table 3 .Displays the distribution of width of hip bones in centimeter: mean, standard deviation, and range.

SIDE	MEAN	SD	RANGE
RIGHT	16.08	1.80	12.1-19-.3
LEFT	15.1	1.96	12.1-17.6
TOTAL	15.43	2.06	12.1-19.3

Table 4. Displays the coxal index of hip bones in : mean, standard deviation, and range.

SIDE	MEAN	SD	RANGE
RIGHT	81.04	2.61	76.1-87.1
LEFT	78.44	2.72	76.2-87.0
TOTAL	80.99	2.70	76.1-87.1

Discussion:

Hip morphometric investigations are valuable not only for anthropologists and anatomists but also for orthopedicians, forensic medicine specialists, and osteopathic physicians. For racial and population studies, anthropologists will find these works useful. India is home to a vast array of ethnic groups, hence its population is distinct in each demographic sector. This study was conducted in view of the dearth of research on hip bones in the North Indian community. The data generated will be helpful to orthopaedicians for geometric modeling, forensic specialists for specimen identification, and sex determination from skeleton remains.

The hip bone's typical weight in the current study is 127.85 grams, compared to 134.94 grams in the research of Singh and Raju[13]. The mean hip bone weight in this study is higher on the right side (133.18 grams) than the left side (109.08 grams), which is also consistent with the findings of the prior study. As a result, the current values agree with the historical values. In the current study, the hip bone's mean length is 19.25 cm on the left side and 19.84 cm on the right. These measurements align more closely with those of Singh and Raju, who found that although the values for males are 19.75 cm on the right side and 19.72 cm on the left, respectively, for females they are 18.13 cm on the right side and 18.21 cm on the left.[13]

Rosenberg K reported that the right hip bone measured 13.78 cm on average.[14] The mean length of the hip bone was found in the investigations by Verneau, Lander, and Maruyama et al. to be marginally longer than in the current study. [15]

The average hip bone width in the current study is 15.1 cm on the left side and 16.08 cm on the right. According to Singh and Raju, the hip bone width in men was 14.32 cm on the right side and 14.35 cm on the left, whereas in women it was 13.78 cm on both the right and left side. The measurements that Verneau recorded were similar those of the current study 15.6 cm for females and 16.4 cm for males.[16]

In the current study, the Coxal index is 78.44 on the left side and 81.04 on the right. The values match those that Garson determined for populations of Andamenese, Peruvians, New Caledonians, and Savage Islanders.[17]

CONCLUSION

From the foregoing, it may be inferred that the skeletal element is generally stronger and the right hip bone has larger dimensions. Racial and ethnic differences may be the cause of the discrepancy observed between the values of the current study and those of other workers. The right hip bone's mean weight (133.18 gm) in this study is greater than the left hip bone's mean weight (109.08 gm). The hip bones on the right side have greater average length and width than those on the left. Comparable to other Indian studies are the values. In the current investigation, the Coxal index was 78.44 on the left and 81.04 on the right.

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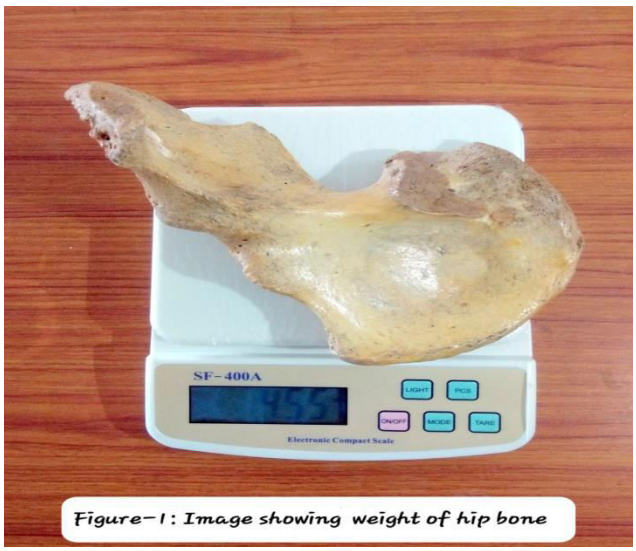

Figure-1: Image showing weight of hip bone

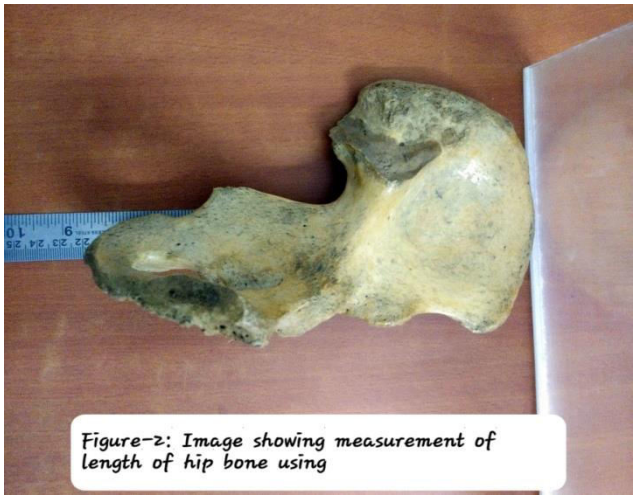

Figure-2: Image showing measurement of length of hip bone using

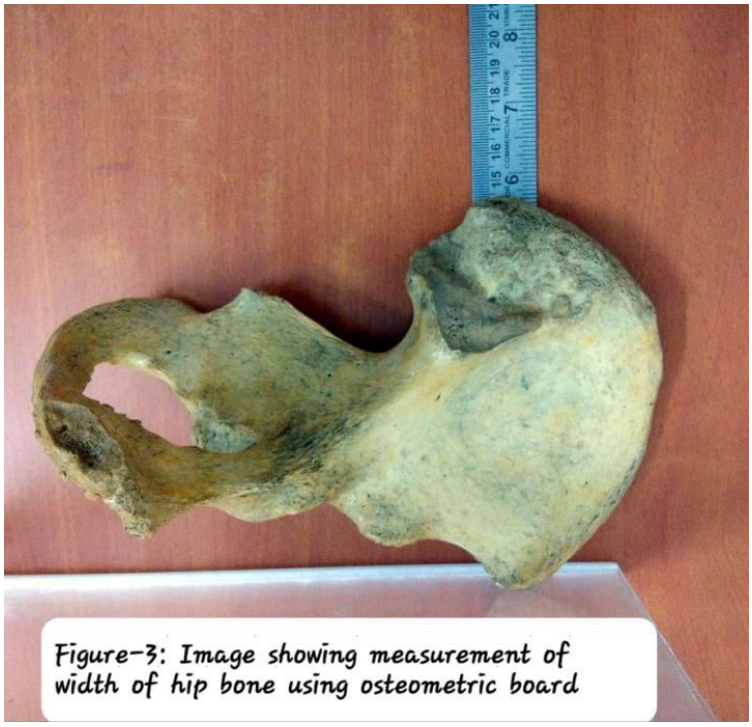

Figure-3: Image showing measurement of width of hip bone using osteometric board