



# Local Sexual Dimorphism Based on Chilotic Index of Human Dried Hip Bone: A Morphometric Study

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## ABSTRACT

**Introduction:** Human hip bone sexual dimorphism is an important parameter in determining gender of an unknown hipbone, an important point in Anatomy and Anthropology.

**Aims & Objectives:** To measure the Chilotic index of male and female dried hip bones in local population of Pakistan and determine a useful value to correctly identify male and female hip bones.

**Place and duration of study:** The study was conducted in the Department of Anatomy at University College of Medicine and Dentistry over a period of six months from October 2022 to Feb 2023.

**Material & Methods:** It was a descriptive cross-sectional study conducted on 44 (22 male and 22 female) dried hip bones gathered through stratified random sampling with 5% level of significance with desired power of 95%. Chilotic index was calculated after measuring sacral and pelvic parts of Chilotic line with vernier calliper. Data was analysed in SPSS 22, p value  $\leq 0.05$  was taken as significant.

**Results:** The range for the Chilotic Index for male hip bones was 81.92 to 124.91, with a mean and median of 102.08 & 103.75 respectively. On the other hand, the range for the Chilotic Index for female hip bones was 72.22 to 109.85, with a mean and median of 89.89 & 87.19 respectively. The *p* value of 0.0023 and *t* value of 2.01 indicate that there is a significant difference between the Chilotic Index of male and female hip bones in the local population.

**Conclusion:** Overall, the results suggest that the Chilotic Index, as well as the pelvic and sacral segments of the Chilotic lines, are different between male and female hip bones. The cut off value of 95.98 statistically correct in identifying male and female hipbones in local population.

**Keywords:** Chilotic Index, sacral, pelvic, stratified random sampling

## INTRODUCTION

Human hip bone sexual dimorphism is an important parameter in determining gender of an unknown hipbone<sup>1</sup>, an important point in Anatomy and Anthropology. The study of the human skeleton offers many benefits, including resistance to external environmental factors. Even after death, human bones can still be examined, observed, and measured with great accuracy. One area of particular interest is hip bone morphology, as it is known to show differences between males and females due to the influence of sex hormones<sup>2,3</sup>. This can provide important insights into anatomy and anthropology, as well as accurately determine the sex of an individual.

Human sexual dimorphism is a significant phenomenon, affecting various biological and psychological characteristics, including sexual maturity, fertility, mating success, general health, immune response, perceived age and gender

norms<sup>4</sup>. The hip bone, in particular, presents many metric and non-metric dimorphic features that play an important role in anthropology. It is considered one of the most reliable bones for sex determination. However, It is not possible to apply a single set of data universally, as variations in metric and non-metric features of bones exist among different populations and different races. The current study was conducted to measure the Chilotic Index in the local population of Pakistan, as data in this area is not available. The Chilotic Index is calculated by the formula:

$$CI = \text{sacral segment} / \text{Pelvic segment} \times 100^4$$

The aim of this study is to measure the Chilotic index of male and female dried hip bones from the local population and to determine the sexual dimorphism of male and female hip bones in terms of Chilotic index.

The objective of the study is to firstly identify male and female hip bones on the basis of non metric parameters. To calculate the sacral and pelvic segments of Chilotic lines in identified male and female hip bones using vernier caliper. And to

determine the Chilotic index of these identified male and female hip bones in the local population. Finally, to provide a useful value for identification of male and female hip bones.

**MATERIAL AND METHODS**

This was a cross-sectional descriptive study conducted at the University College of Medicine and Dentistry, University of Lahore. Ethical Committee of the University of Lahore, granted clearance with approval no: ERC/128/22/10, on Date: 28/10/22. The study lasted for 6 months in the Department of Anatomy at UCMD at UOL. The sampling technique used was a stratified random sampling and sample size calculated was 44, 22 hip bones from males and 22 from females. The hip bones were identified as males and females on the basis of non metric parameters such as pre auricular and post auricular sulci, piriform tubercle, orientation and shape of acetabulum and thickness of the hip bones. The metric parameter, the Chilotic line, is defined as the line extending from iliopubic eminence to the iliac crest. The chilotic line has two segments , the pelvic and the sacral. The part of the Chilotic line anterior to the auricular point is the pelvic part and the point posterior to the auricular point is the sacral part. It was calculated using a vernier caliper. Finally the Chilotic index was calculated using the above formula. The data was analysed using SPSS 22 and normality was assessed using the Shapiro-Wilk test, Skewness and Kurtosis of the data was also found. The independent t-test was applied to the variables and the level of significance was set at 0.05. T-value and p-values were calculated.

**Sample Selection Criteria:**

The sample selection for the study of hip bones had specific criteria for inclusion and exclusion. The inclusion criteria required that the bones must be without any pathological deformities, have complete ossification, and be undamaged. On the other hand, the exclusion criteria involved bones that were damaged, bones from infants and children, and bones with congenital anomalies. By following these criteria, the study aimed to ensure that the sample included only bones that were suitable for the analysis and would provide reliable results.

**RESULTS**

The study analyzed 44 dried hip bones obtained from the Anatomy Museum of the University College of Medicine and Dentistry. The Chilotic

lines were calculated using a Vernier caliper. Both pelvic and sacral segments of the Chilotic lines were calculated separately for each hip bone and the Chilotic Index was then determined.

Variable	Gender	N	Max	Mini	Mean	Median	SD	t-Value	p-value
Pelvic segment	F	22	93	71	83.68	83	6.74	2.022	0.022
	M	22	86	70	79.54	80.5	4.96		

**Table-1: Comparison of pelvic segment of Chilotic line of male and female hip bones**

Variable	Gender	N	Max	Mini	Mean	Median	SD	t-Value	p-value
Pelvic segment	F	22	81	65	74.54	75.5	4.96	2.022	0.001
	M	22	90	68	80.68	80	6.74		

**Table-2: Comparison of sacral segment of Chilotic line of male and female hip bones**

Variable	Gender	N	Max	Mini	Mean	Median	SD	t-Value	p-value	Cut off value
Pelvic segment	F	22	109.85	72.22	89.89	87.1	4.96	2.02	0.002	95.98
	M	22	124.28	81.92	102.08	103.75	6.74			

**Table-3: Comparison of chilotic index of male and female hip bones.**

The range of the Chilotic line pelvic segment in male hip bones was 70-86, with a mean of 79.54 and that for female hip bones was 71-93 with a mean of 83.68. The p value was 0.022 and the t value was 2.022 as shown in Table-1.

The Chilotic line sacral segment of male hip bones had a range of 68-90, with a mean of 80.0. The range for female hip bones was 65-81, with a mean of 74.54. The p value was 0.001 and the t value was 2.022 as shown in Table-2.

The Chilotic Index of male hip bones ranged from 81.92-124.91, with a mean of 102.08. The standard deviation was 6.74 and the median was 103.75. The Chilotic Index of female hip bones ranged from 72.22-109.85, with a mean of 89.89. The standard deviation was 4.96 and the median was 87.1. The p value was 0.002 and the T-value was calculated 2.019. Using T-test the means and variance of two samples were measured to obtain the cut off value which was being calculated 95.98 as shown in Table-3.

**DISCUSSION**

The degree of sexual dimorphism is influenced by overall morphological diversity within the population<sup>5</sup>.

Based on the results presented, it appears that the Chilotic Index for male hip bones was found to be higher than that for female hip bones. This has been

supported by previous studies done by Gupta et al. The range for the Chilotic Index for male hip bones was 81.92 to 124.91, with a mean of 102.08 and a median of 103.75. On the other hand, the range for the Chilotic Index for female hip bones was 72.22 to 109.85, with a mean of 89.89 and a median of 87.19. The *p* value of 0.0023 and *t* value of 2.01 indicate that there is a significant difference between the Chilotic Index of male and female hip bones. This has been supported by the earlier observations made by Sarangee et Al. The racial and regional factors have dramatic effects on the metric parameters of hip bones as their values vary differently in different regions and races around the world. Different regions has different values of Chilotic index of male and female hip bones such as in studies conducted by Gupta<sup>6</sup>, Sachdeva<sup>7</sup>, Sarangee<sup>8</sup>, Janetaa<sup>9</sup> and Ahmed<sup>10</sup> it has been noticed that Chilotic index in males hipbone was always on higher side as compared to female hip bones but obviously with different values in different regions of globe. Also the data from Pakistani population was calculated which shows remarkable differences in mean median of sacral and pelvic segments of Chilotic lines of hip bones, and Chilotic Index and can be compared to those calculated by the above mentioned studies<sup>6,7,8,9</sup>. Overall, the results suggest that the Chilotic Index, as well as the pelvic and sacral segments of the Chilotic lines, are different between male and female hip bones<sup>11</sup>. Chilotic index value is higher in male hip bones. These differences could be related to various factors including and not limiting to racial, regional<sup>12</sup>, hormonal, sexual differences in hip bone structure, size, and shape between males and females overall. Further research would be required on a bigger population scale to confirm and explain morphological, metric and non metric differences between male and female hip bones across various races and regions. Moreover the cut off value found was 95.98 as shown in Table-3 which is statistically correct in identifying the gender of hip bone in the local population accurately. Further studies can be done in other regions of Pakistan.

#### **Conclusion:**

In conclusion, the findings indicate that there are notable differences in the Chilotic Index, as well as the pelvic and sacral segments of the Chilotic lines, between male and female hip bones. The Chilotic index tends to be higher in male hip bones compared to female hip bones. Moreover, the statistically established cut-off value of 95.98 for the Chilotic index appears to be accurate in identifying male and female hip bones within the local

population. These results highlight the potential utility of the Chilotic index as a reliable indicator for distinguishing between male and female hip bones in anthropological and forensic contexts.

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