Os Coxa Sex Classification in an Archaeological Population from the 1755 Earthquake of Lisbon

Guilherme Borges[1,2], Daniel Oliveira[1,2], Leonor Ferreira[1,2], Matilde Martins[1,2], Rui Santos[3], Cristiana Palmela Pereira[4]

1 Student of Master in Dental Medicine, Faculty of Dental Medicine, University of Lisbon, Portugal.
2 Junior Investigator of the CEAUL Forensic Analysis Group.
3 Assistant Professor at School of Technology and Management, Polytechnic Institute of Leiria, Portugal. Integrated Researcher at the Statistics and Applications Center of the University of Lisbon, Portugal (CEAUL). Orcid Number: 0000-0002-7371-363X.
4 Auxiliary Professor at Faculty of Dental Medicine, University of Lisbon, Portugal. Integrated Researcher at the Statistics and Applications Center of the University of Lisbon, Portugal (CEAUL). Orcid Number: 0000-0002-9164-7189.

Introduction

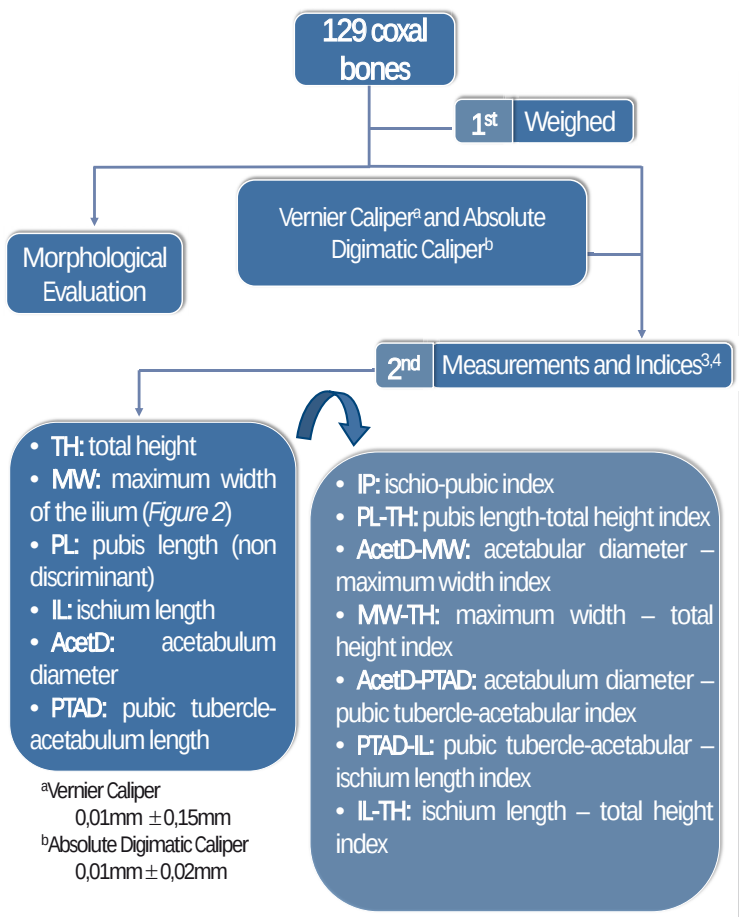
In regards to Forensic Odontology, the present work of investigation is related to the characterization of the population whose skeletal remains were recovered in the archaeological research carried out in 2004, in the Southern Cloister of *Academia das Ciências de Lisboa* (*Figure 1*), concerning the 1755 Earthquake, a disaster that affected Lisbon, struck the city and destroyed a large part of it, causing the death of countless people, who were left under the rubble or later buried in mass graves[1]. This event was followed by a tsunami and several fires[2]. As it presents a great sexual dimorphism, the coxal bone allows the characterization of disarticulated skeletal populations, using metric and morphological parameters based on normal bone development. Pasuk Mahakkanukrauh[3] studied 200 coxal bones from a Thai population in order to obtain a quantitative method for estimating sex. On the other hand, Phenice's study[4] allows sexual discrimination through the observation of the subpubic region. Following this line, P. Walker[5] defined a method with the same goal, through the analysis of the form of the greater sciatic notch. In Forensic Odontology, the classification of the generic factor sex is crucial in the reconstruction phase of skeletal remains.

Figure 1: Photo obtained during the 2004 excavations of the Cloister's South Wing of *Academia das Ciências de Lisboa*, provided by Professor João Luís Cardoso.

Objectives

Characterize, from a paleodemographic point of view, the population concerning the 1755 Earthquake in Lisbon, regarding the generic factor sex, through quantitative discriminating methods and morphological characteristics, applied to the coxal bone.

Materials and Methods



Regarding to the morphological evaluation, four methods were aplied – Phenice, P. Walker, Buikstra and Ubelaker, Suchey-Brooks.

Method	Description
Phenice[4]	Categorization of the subpubic region, through the analysis of the ventral arc, subpubic concavity and ischiopubic ramus ridge. 0 – Non observable; 1 – Female; 2 – Male; 3 – Ambiguous.
P. Walker[5]	Comparison between the greater sciatic notch with a scheme. For this, the bone is placed 15 cm from the diagram, aligned with the drawings. 1,2 – Female; 3 – Ambiguous; 4,5 – Male.
Buikstra e Ubelaker[6]	Analysis of the preauricular sulcus and classification according to the characteristics described: 0 – Male; 1-4 – Female.
Suchey-Brooks[7]	Comparison between the pubic symphysis and the available plates. These, not only distinguish development stages, but also the sex.

Table 1: Morphological methods applied to the coxal bone and respective description and classification.

Figures 2 and 3: Measurement of the coxal bone MW and comparison of pubic symphysis with plate IV-2, respectively.

Results

A minimum number of individuals (MNI) equal to 23 was obtained. Five of the seven indices evaluated were used, since the interobserver evaluation indicated that AcetD_MW and IL_TH indices had an intraclass correlation coefficient below of what is considered adequate. For all measurements, the ICC ranged from 0.671 to 0.967, being considered between good and excellent[8]. It was not possible to obtain sex estimation results with more than three cross measurements.

Measurement	Minimum (cm)	Maximum (cm)	Mean (cm)
TH	17,27	21,40	19,40
MW	13,04	17,54	15,08
PL	5,70	8,56	7,51
IL	5,73	7,82	6,59
AcetD	4,70	6,15	5,27
PTAD	4,34	7,23	5,41

Table 2: Minimum, maximum and mean obtained with linear measurements, taken in the coxal bone.

Index	Minimum	Maximum	Mean
IP	74,91	103,52	87,42
PL-TH	29,61	41,57	36,72
AcetD-MW	33,29	38,19	35,71
MW-TH	70,99	82,51	76,02
AcetD-PTAD	69,80	129,75	102,52
PTAD-IL	60,61	114,47	80,58
IL-TH	30,69	35,44	33,03

Table 3: Minimum, maximum and mean obtained with indices, calculated from the linear measurements, taken in the coxal bone.

For the morphological evaluation, the values of ICC varied between 0,587 and 0,894 and it was possible to study a partial number of 84 coxal bones, of which the subpubic region characteristics were observed in 63 – only 41 allowed the use of three Phenice's measurements[4] –, the greater sciatic notch in 60 – P. Walker's Method[5] –, the preauricular sulcus in 62 – Buikstra and Ubelaker's Method[6] -, and the pubic symphysis in 30 coxal bones – Suchey-Brooks' Method[7].

Discussion

Comparing morphological characteristics and linear measurements, the results are very different for the same bones, with the morphological evaluation obtaining better results discriminating by sex. Morphological features also present a higher number of coxal bones able to be analyze, 84 versus 57, with the application of the measurements - this is the result of the objectivity underlying the linear measurements. Despite the ICC of the measurements being good and excellent[8], it was not possible to discriminate the sex of this population of coxal bones through the measurements used. Although Pasuk Mahakkanukrauh[3] has very high correlation factors for all linear measurements and indices, in a population where sex is not known, it is not possible to use these measurements and indices for discrimination according to sex. Regarding the different morphologic methods, it can be seen how some may be better than others (*Figure 4*) . With Phenice's Method[4] it was possible to discriminate using its morphological characteristics, being the most reliable, since with other methods the ambiguous classification was higher. It also proved to be one of the best to estimate the sex because it didn't get any conflicting results.

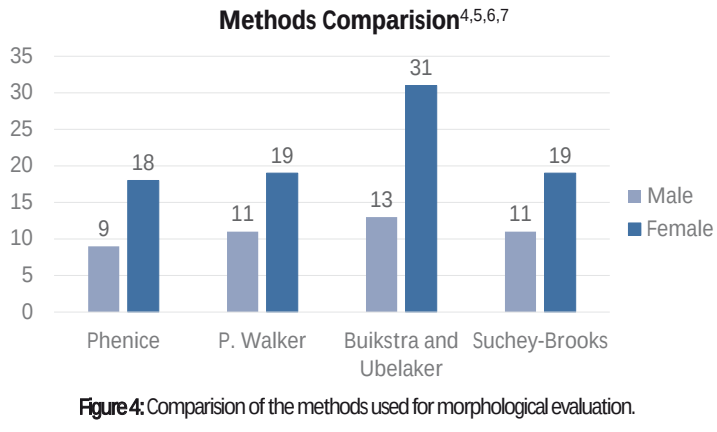


Figure 4: Comparision of the methods used for morphological evaluation.

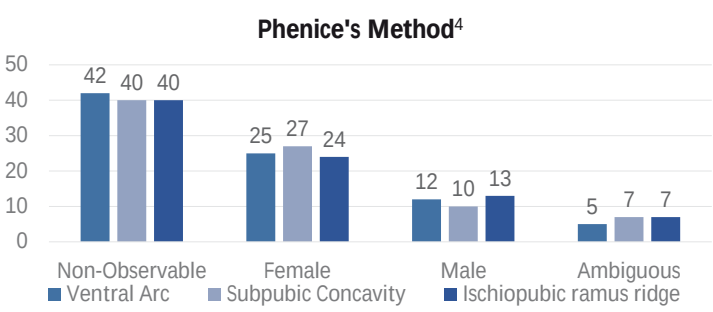


Figure 5: Results from the application of the 3 Phenice's characteristics to the 41 bones.

Conclusion

The sexual classifications obtained through the indices are not reliable. On the other hand, Phenice's Method[4] is the one that allows more accurate results concerning sexual discrimination. According to the results achieved, the methods based on the morphology of the coxal bone are more conclusive in estimating sex.

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