The Ischio-Pubic Proportions in Skeletal Sex Determination: Evaluation in a Recent Sample of Known Sex

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Introduction

Although indices have always been extensively used in the description of the proportions of skeletal remains, the systematic use in the diagnosis of sex is relatively recent (Hoyme, 1957). The evaluation of the Ischium-Pubis proportions by using an appropriate index, in practice, was proposed and introduced by Schultz (1930) and subsequently by Washburn (1942).
In 1977 it was reproposed in "Recommendations for age and sex diagnoses of skeletons" (Ferembach et al., 1980). Its popularity is justified in the fact that it permits quantification of the ischio-pubic proportions, one of the characteristics of the pelvis that is greatly differentiated between the sexes. In this work the measurements for the evaluation of the ischio-pubic index are obtained using a recent sample of known sex from the Apulia region, in order to characterise metrically and define the characteristics of proportions in relation to sex.

Materials and Methods

A collection of recent skeletal samples of known sex from Southern Italy (Bari, Puglia) from the "Istituto di Medicina Legale" of the University of Bari was utilised for this work. The collection has previously been studied by various authors in relation to sexual dimorphism, utilising morphological characteristics of the cranium and post cranium (Colonna et al., 1980; Introna et al., 1983). In the study 111 isolated coxal bones (53 male and 58 female) were considered.
The remains pertain to subjects deceased in the 1960s of last century with a range of age at death between 24 and 90. The Ischium-Pubis Index (IPI) was obtained according to the indications of Schultz (1930) and Washburn (1942), and according to the variant of Novotny (1975); in the second case the use of the acetabular point that in many cases is difficult to assess, is not required. The measurements for the ischium (IS) and the pubis (PU) were detected using digital calipers and recorded in millimetres to the first decimal point. The statistical description of the measurements and the index for the male and female group was obtained and a comparison was made using a t-test for unpaired data. Lastly, a multivariate discriminant analysis to evaluate the efficiency of the metric characterisation obtained in the sex determination was carried out.

Results and Discussion

The descriptive statistics and the t-test are shown in Tab. 1. The dimensions of the pubis are greater, as expected, in the female group but the differences are small both for

	Male					Female					t test		
	N.	Min	Max	Mean	DS	N.	Min	Max	Mean	DS	t	df	p
PU-M	53	60.0	73.7	68.0	3.5	58	61.0	80.0	70.6	4.7	3.3	105	0.001
IS-M	53	96.0	113.7	105.2	4.0	58	83.0	101.5	93.2	4.5	14.9	109	0.000
IPI-M	53	59.4	69.5	64.6	2.5	58	64.2	85.6	75.8	5.2	14.5	84	0.000
PU-A	53	70.7	91.0	79.3	5.0	58	68.7	89.0	79.8	4.6	0.5	106	0.582
IS-A	53	79.2	96.0	88.9	4.0	58	72.0	86.7	79.8	3.3	13.2	109	0.000
IPI-A	53	77.5	99.4	89.2	5.7	58	87.5	111.1	100.1	4.8	10.8	109	0.000

Tab. 1. Descriptive statistics of measured variables (mm) and indices obtained following Novotny (PU-M, IS-M, IPI-M) and Schultz (PU-A, IS-A, IPI-A); two-sample t-test (two-sided).

the Novotny and Schultz standards. The differences in the height of the ischium are greater (circa 12 mm according to Novotny and 9 mm according to Schultz). It could be said, therefore that the differences in the proportion are evident principally in the height of the ischium rather than in the length of the pubis. The indexes found largely overlap. The comparision between the mean values are all highly significant, with the exception of the pubis measurement obtained according to Schultz standard. It is possible that the differences between the lengths of the pubis, already small, are further mitigated by uncertainty in defining the acetabular point. However the fact that both indices obtained according to Novotny and according to Schultz are significant confirm that, in this case, the differences in the proportion of the Ischio-pubic tract are largely substained by the ischium.

	Func. 1	Func. 2
Coefficient 1	0.158 (PU-M)	0.114 (PU-A)
Coefficient 2	-0.258 (IS-M)	-0.307 (IS-A)
Constant	14.621	16.726
N. M/F	53/58	53/58
Misclassified M/F*	0/4	8/1
Correct class.% M/F	100/93	95/98
Correct class.% total	96	92
group means M/F; Sectioning point	-1.831/1.673; -0.079	-1.501/1.371; -0.065
Wilks's Lambda	0.243	0.323
Approx. F-ratio	168.5	113.1
df	2, 108	2, 108
p-value	0.000	0.000

* jackknifed, leaving one out.

Tab. 2. *Discriminant function analysis (unstandardized coefficients) for pubic and ischium dimentions obtained according the two different standards.*

If the index values obtained by Washburn for some populations are considered (*ibid*), the value obtained for the male Apulian group (89.2) is high in respect to an Euro-American (83.6) and an Afro-American group (79.9). The index of the female Apulian group (100) however is comparable with that reported for a Euro-American

group (99.5). The values given for the Apulian group (64.6, male; 75.8, female) according to Novotny method, are comparable with those reported by the same author for a central European population (1975).

In Tab.2 the results of a preliminary evaluation of the diagnostic efficiency of the reported measurements performed by multivariate discriminant analysis are shown. The pair of measurements for the pubis and the ischium obtained according to the Novotny method show a correct attribution of the sex in 96% of cases. The measurements obtained according to Schultz and Washburn show a correct attribution in 92% of cases.

Conclusions

Overall the results confirm the diagnostic efficiency of the ischio-pubic tract. In applicative terms the metric and proportional variations hereby given, place the studied samples, with some specifity, in the range of variability expressed in other population groups. There are however, some aspects of the measurements (length of the pubis according to Schultz) and therefore of the proportions (relative height of the ischium) that, if considered singularly, can steer the diagnosis erroneously.

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