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Radiologic Determination of Ischiopubic Index in Ijaw Ethnic Group of Nigeria

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ABSTRACT

Hip bone is an ideal bone for sex determination because it not only reflects the general differences between the two sexes but also the special adaptation of female hip bone for childbearing. The accurate determination of sex and race are important tools to forensic scientist and physical anthropologist.This retrospectivestudy was conducted in order to determine pubic length,ischial length and ischiopubic index in adult male and female Ijaws of Nigeria. Standardanterio-posterior (AP) pelvic radiographs of 200 normal adults comprising of 90 females and 110 males age ranged 18-65yrs. were employed in this study. The pubic lengths and ischial lengths were measured and the ischio-pubic index was calculated. From the parameters taken,the mean pubic length of adult ijaw male was 90.20mm, mean ischial length was 106.00mm andischio pubic index of adult ijaw male was 81.82while the mean pubic length ofan adult ijawfemale was100.00mm,meanischial length was 121.00mm andischiopubic index 94.00. The result showed the mean pubic length, mean ischial length were significantly higher in females than males ($P<0.05$). The result also showed higher ischiopubic index in females compared to males. The result of this study confirmed previous reports that irrespective of race, the ischio-pubic index for females is significantly greater than that of males. Ischio-pubic index greater than 90 will most probably be that of a female and less than 90 will most probably be for males.The demarking points of these parameters were worked out to determine sex, this assigned 55.29 % to adult Ijaw males and 87.71% to adult Ijawfemales. This study has therefore provided necessary data for obstetricians, physical anthropologists and forensic scientist.

Keywords: Radiographs, Ischial length, Pubic length, Ischiopubic index, Sexual dimorphism

INTRODUCTION

The sexual differences noticed in the pelvis are of interest to anatomist as well as gynaecologists.[1]Due to their sexually dimorphic nature, the most reliable sexing traits are found in the pelvic bones. The pelvic bones are large irregularly shaped bones; each of which develops from the fusion of three bones, the ilium, the ischium and pubis.[2]The pelvis shows the greatest male/female differences. The female pelvis is designed for childbirth. It is broad and shallow since the infant must pass through its bony openings at birth.[2] On the average the male pelvis is much heavier and narrower than that of the female, pelvic outlet is comparatively small in males and large in females, pubic arch and subpubic angle is narrower in males ($<70^0$) and greater in females ($>80^0$).Obturator foramen is round in males and oval in females, male acetabulum is also larger than those of the females.[2]The pelvic bone transfers the weight of the upper body from the calvaria of the skull bone to the lower part of the human skeleton.

The pelvic girdle is formed from two pelvic bones joined to the sacrum. In front the pelvic bones are held together by the pubic symphysis joint. This joint allows only slight bending movement, but it softens and becomes more flexible in a female giving birth. If the pelvic bones are separated it is hard to estimate the angle of the pubic arch or the width of the birth canal[3], in this case the most reliable measurement for determining the sex of a skeleton is the ischiopubic index which is an anthropometry index of significance. The sexual differences noticed in the pelvic region are of interest to the anatomist, anthropologists as well as the gynaecologists.[1,3]Ischiopubicindex derived is the measurement of the distance between the acetabulum and the pubic tubercle of the pelvic bone divided by the distance between the acetabulum and the ischial tuberosity of the pelvic bone multiplied by hundred.[1,4]The ischiopubic index is also given as the length of the pubis, divided by the length of the ischium, multiplied by 100; these lengths are taken from the site in the acetabulum where all three bones meet (triradiate cartilage). [5,6]

Several studies have been carried out on ischiopubic index in other parts of the world. Igbigbi and Msamati (2000) conducted a study in black Malawians and observed the ischio-pubic index, mean ischial length

and mean pubic length of females was significantly greater than that of males.[7]Risech and Malgosa (2007) confirmed ischiopubic index as one of the variables for adult sex determination.[8]Krogman and Iscan (1984) tried to determine sex using several parts of the skeletal remains and concluded skull + pelvis gives 98% accuracy.[9] In Nigerians Oladipo *et al.,* 2010 conducted a study on eastern people of Nigeria, he examined 200 pelvic radiographs and observed the mean pubic length, and mean ischial length as well as ischiopubic index calculated was significantly higher in females than males.[10]Ekanem et al., 2009: Oladipo, 2009; Oladipo *etal.,* 2010;Oladipo etal., 2012; reported that ischiopubic index is a useful parameter in sexing of the hip bone.[1,4,11,12]The importance of ischiopubic index in obstetrics cannot be over emphasized. It has been observed that the size of the ischiopubic index determines the size of the birth canal, which is an important criterion in vaginal delivery.[12]Ischiopubic index is also pivotal in forensic and physical anthropology in the identification of unknown sex as it can provide accurate means of determining sex and race when the need arises.[13]The ischiopubic index for instance provided values of 83.7% – 100% for adult white Americans and when correlated with dimensions of the sciatic notch, 98% of pelvis could be sorted. In a study of Ischio-pubic index in adult black Malawians subjects, sex was accurately assigned to 87.8% of male and 100% of females using skeletal bones.[7] Furthermore, females usually have an ischiopubic index of 90 – 100 while males have values of 75 –85. [7,13,14,]The present study was therefore conducted in order to determine pubic length, ischial length and calculate ischiopubic index in adult male and female Ijaws of Nigeria from radiographs.

MATERIALS AND METHODS

A retrospective study on 200subjectswas carried out using anterior posterior pelvic radiographs (110 males and 90 females).These radiographs were gotten from Federal medical centre Yenagoa and Delta state teaching hospital Oghara after ethical clearance has been issued by the hospitals. The ages of the subjects ranged from 18 – 65 years since the ventral arc and the sub – pubic concavity are not well developed until about 18yrs of age. The radiographs were identified to be those of indigenous Ijaws based on their names and other data contained in there hospital folder (state of origin, tribe and nationality). They were radiographs of pelvis taken for other clinical conditions and appeared normal and showed no fracture of any kind. Only radiographs with best alignment at the inferior margins of the pubic bones at the pubic symphysis were measured. All films were taken using S&C medicals, Olympics model X-ray machines at the highest resolvable peak in differentiation pattern, object-film distance of 5 cm and focal film distance of 92cm in the antero-posterior view, and a magnification correction factor of 2.86% was applied[4,7]Measurements on the radiographs were taken by choosing three points on the radiograph, point A, B. and C.

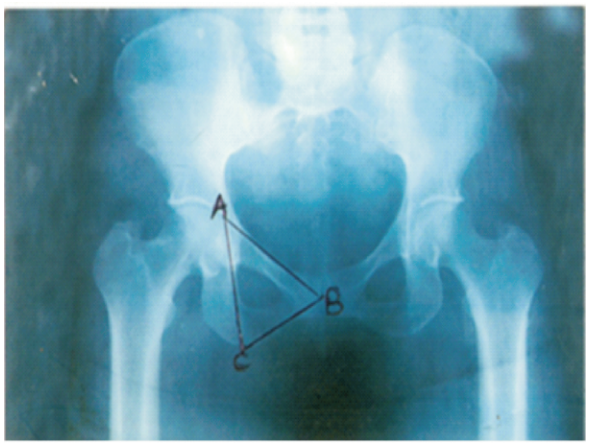

Figure 1: Radiograph showing the measurement of the ischial length AC and pubic length AB. [1]

- Point A: where all the three bones meet (Triradiate cartilage)
- Point B:pubic tubercle
- Point C: the ischial tuberosity

Radiographs were placed on an x-ray view box, the distance between these points ABC were then measured with the aid of a vernier calliper. Distance AB gave ischial length and distance AC gave pubic length. Each distance was measured twice. In order to assess intra observer error, technical error of measurement was calculated based on this formula TEM = square root of £D2/2N where D is difference between 1st and 2nd reading. TEM = 0.069, 0.048 respectively for both ischial and pubic length. These errors are very small and will not interfere with the result. Ischiopubic index was then gotten by dividing AC by AB x 100. The results were compared with previous studies on other population. SPSS version 16 was employed in the analysis of data. The student's t-test was used to determine the sex differences and $p<0.05$ was taken to be statistically significant. Sex was determined by using the demarking point method. This involves calculating the maximum and minimum limit of range of the ischiopubic index by using the formula, mean ± 2SD (Standard deviation).[1,4]

RESULTS

The results of the present study are presented in tables 1 and 2 below.

Table 1: Measurement in (mm) of pubic length, ischial length and calculation of ischiopubic index in male and female Ijaws

Subject	N	Pubic length (SD)	Ischial length(SD)	Ischiopubic index (SD)
Male	110	90.2 mm (0.47)	106mm (0.33)	81.82 (2.62)
Female	90	100 mm(0.79)	121 mm (0.82)	94.83 (1.71)
P values		<0.01	<0.01	

Table1 revealed a total of 110 male radiographs was employed in the study, mean ischial length in males is 106mm (0.33), mean pubic length is 90.2 mm (0.47), ischiopubic index is 81.82 (2.62).From the tablealso a total of 90 female radiographs were employed in the study. Mean ischial length in females is 121mm(0.82), mean pubic length is 100 mm(0.79), ischiopubic index is 94.83 (1.71). Table 2 is a summary of mean values of ischiopubic index of values populations of the world.

Table 2: Mean ischiopubic index of various populations

Populations	Sex	Mean (SD)	N	P	Authors
Portuguese	Male	78.20(6.2)	129	< 0.05	Phenice, 1989
	female	71.30(3.1)		<0.05	
Americans	Male	67.40(8.1)	253	< 0.05	Tague,1989
	female	93.10(10.4)	212	<0.05	
Caucasians	Male	<60	-	< 0.05	Caldwell and Moloy,1933
	female	<90	-	<0.05	
South-south Nigeria	Male	81.40(6.4)	30	< 0.05	Oladipo et al, 2009
	female	104.2(11.1)	40	<0.05	
Middle belt Nigeria	Male	83.10(5.8)	20	< 0.05	Oladipo et al, 2009
	female	101.7(11.3)	30	<0.05	
Eastern Nigeria	Male	84.0(10.4)	100	< 0.05	Oladipo et al, 2012
	female	102.6(11.7)	100	<0.05	
Cross river	Male	94.2(9.9)	114	<0.001	Ekanem et al, 2009
	female	118.8(12.8)	100		
Ijaw of Nigeria	Male	81.82(2.62)	110	< 0.05	Present study
	female	94.83(1.71)	90	<0.05	

DISCUSSION

From values presented in table 1female pubic length, female ischial length and female ischiopubic index are significantly higher when compared to males ($p<0.01$, $p<0.01$, $p<0.013$ respectively).The result of this study confirmed previous reports as shown in table 2 that irrespective of race, the ischio-pubic index of females is significantly greater than that of males and that ischio-pubic index can be accurately used in sex determination in this environment.

Sexual dimorphism has been previously reported in the ischiopubic index of French, [6] Malawians, [7] Portugueses[15] and the white and black Americans.[16]
Ischiopubic index for the Ijaw agrees with the study of Washburn (1949)[6], it is also in partial agreement with the work of Oladipo et al done in the middle belt region and south south of Nigeria.[13] This study has established the presence of sexual dimorphism in ischiopubic index of the Ijaw in southern Nigeria and has also confirmed regional and racial variations as data obtained slightly differ from other population. The racial differences observed may either be due to environmental or genetic factors or both. Sexual dimorphism in body size is critical factor in influencing pelvic dimorphism. It is observed that pubic size for both sexes particularly that of females showed accelerated changes depending on the body size. Body size is known to be influenced by environmental, nutritional and genetic factors.
In forensic practise, experts are often called upon to identify skeletal remains which may involve determination of sex.[17] In the present study the ischiopubic index has been observed to be useful in sex identification. The differences listed earlier come into play in distinguishing between male and female pelvis. These indexes differ in different races. Ischio-pubic index greater than 90 will most probably be that of a female and less than 90 will most probably be for males.[7]The demarking points of these parameters were calculated to determine sex, this assigned 55.29 % to adult Ijaw males and 87.71% to adult Ijaw females. Comparing the demarking points assigned to Ijaw males and females to the study of Igbigbi (92.3% males and 100% females)[7] and Ekanem et al.,(69% males and 81%females)[1]demarking point can be accurately used in sex determination. The result obtained has therefore provided necessary data for obstetricians, physical anthropologists and forensic scientist to identify sex from skeletal remains and differentiate races whenever they need to do so.This can be employed as a simple and less sophisticated method in medico-legal cases in Nigeria.

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