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Ischiopubic Index of a Nigerian Population Residing in Rivers State

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Abstract - This study was carried out to determine the pubic length, ischial length and ischiopubic index of Nigerians particularly those living in Rivers State. It was also conducted to determine any possible sexual dimorphism and racial differences with respect to ischiopubic index in a radiological study when compared with studies carried out by other authors. Anteroposterior radiographs of adult pelvis (age range, 18-75 years) were evaluated. Six hundred and seventy four (674) radiographs (268 males and 406 females) were used for this study. The morphological measurements were pubic length, ischial length and ischiopubic index. The mean pubic lengths of males and females were 91.99 ±17.76 mm and 103.12±13.11 mm respectively. The mean pubic length of females was significantly higher than that of the males (P<0.05). The mean ischial lengths of the males and females were 101.16 ±18.53 mm and 90.07±12.19 mm respectively. The mean ischial length of males was significantly higher than that of the females (P<0.05).The mean ischiopubic indices in males and females were 90.88 ±5.52 and 114.87±8.08respectively.Females had significantly higher ischiopubic index(P<0.05).The results of the demarking points of ischiopubic index in the present study showed that sex was accurately assigned to 80% of Ibani males, 95% of Ibani females, using the formulae (Mean ± 2SD). The mean ischial lengths, pubic lengths and ischiopubic indices of males and females were compared with previous studies. There was sexual dimorphism and racial differences. Knowledge gained from this work will be useful to the forensic scientists, radiologists and gynaecologists.

Keywords - Forensic Science, Ibani, Ischial length, Pubic length Ischiopubic index.

INTRODUCTION

The accurate identification of sex and race in human skeleton remains pivotal in forensic science and physical anthropology, especially because of the escalating crime rates, which have become a worldwide phenomenon. The literature contains sufficient evidence that metric and morphologic biologic differences exists amongst Caucasoid, Mongoloid and Negroid races [1, 2]. Reports have suggested that data on pelvic bone can be considered for Forensic Science[2]. The ischiopubic index for instance produced values of 83.7 – 100% for adult white American[3]. In a study of ischiopubic index of Malawians sex could be accurately assigned to 87.8% of male and 92.3% of female using skeletal bones[4]. No significant differences have been reported to exist between studies from skeletal remains and radiological pelvimetry. Thus radiological pelvimetry has become the most popular defined techniques in assessing obstetric and forensic problems such as sexing and identification of skeletal remain which are most certainly established from the pelvis. These bones include: Pubic, ischium and ilium[5].Measurements of these bones and determination of related indices and angles have been very useful in forensic science, clinical practice, (most especially Obstetrics and Gynaecology) and Physical Anthropology[6]. Davivong[6]and Washburn[7]determined the ischiopubic index obtained by dividing the length of pubis by the length of the ischium. Sexual differences in adult pelvis has been studied and measured extensively. These studies involved metrical and non –metrical characteristics whose range overlap between the sexes. Medical studies of various indices have been carried out. Such indices include ischiopubic index [8], indices of the greater sciatic notch [9]and chilotic index[10]. These indices have been measured in different races and ethnic groups.

Udoaka et al., [11]in their research work used standard anterio-posterior (AP) pelvic radiographs of 100 normal adults comprising 54 females and 46 males to determine ischio-pubic index of Nigerians. It was observed that the pubic bone was longer in females but the Ischium was longer in males. They stated that Ischio-pubic index greater than 90 will most probably be that of a female and less than 90 will most probably be that of a male Nigerian in Port Harcourt. Oladipo et al., [1] carried out a study to determine and compare the pubic length; ischial length and ischiopubic indices of the Eastern people of Nigeria, in their work anteroposterior radiographs of 200 adult pelvis (age range, 18-65 years) were evaluated. The mean values of pubic length, ischial length and ischiopubic index of male Easten people were 71.0mm, 84.4mm and 84.0 respectively while those of their females were 85.0mm, 83.0mm and 102.6 respectively.

Ekanem et al., [12] measured the pubic and ischial lengths in 214 x-ray films (114 males and 100 females) of Cross River State indigenes in other to determine Sex differences in Ischiopubic Index Of a Nigerian Population. The demarking point was worked out and it assigned sex to 69% males and 81% females. Oladipo et al., [13] carried out a retrospective study on the ischio-pubic index among the south– south and middle belt people of Nigeria. Their result shows that the mean ischiopubic index for males south – south was lower than those of middle belt while that of the female south – south was higher than those of female middle belt.

Pal et al., [14] studied the reliability of criteria used for sexing of hip bones for demarking a male from a female hip bone, the reliability of three most commonly used parameters i.e. chilotic line index, ischio-pubic index and acetabulo-pubic index were checked on 205 hip bones (143 males and 62 females). For all the three parameters "demarking points" were worked out. None of the parameters were promising in indentifying sex as a very low percentage of bones could be identified. The study concluded that the reliability of all the above parameters is doubtful.

The hip bone is the most reliable skeleton in sexual dimorphism[15]. The pelvic cavity is long and narrow in male and wide and short in female because of parturition. Also it is found that sex had a great influence on the dimensions of greater sciatic notch and its importance is more emphasized during pregnancy[16]. The relationship between age and pelvimetry has also been given attention. The racial differences observed may either be due to environmental or hereditary factors or both [17]. Maclanghlin and Bruce, [18] observed that sexual dimorphism in body size is a critical factor in influencing pelvic dimorphism. They observed that the pubic length for both sexes particularly that of the females showed accelerated changes depending on the body size. Rissech and Malgosa, [19]working on pubis growth study on sexual and age, confirmed that ischiopubic index is one of the good variables for sub- adult sex determination. Nwoha [20] reported that the sub – pubic angles were significantly greater in the older age group (46 – 70yrs) than in younger age group (21 – 45yrs) of Nigerian. Racial hereditary factor acts as primary factor within which functional activities operate as secondary factor.

Despite the anthropological, clinical and forensic importance of the ischiopubic index, reports on Nigerians most especially those from Rivers State are scarce. Thus, the present study was carried out to provide reliable data for this Nigerian population.

MATERIALS AND METHODS

Six hundred and Seventy four (674) normal pelvic anteriorposterior radiographs (268 male and 406 female) aged between 18 and 75 years were used for this study. The parameters measured included pubic length and ischial length, while the ischiopubic index was calculated. The study was conducted in the following hospitals: Bonny general hospital, Bonny Island(260 subjects), Opobo general hospital, Opobo town (184 Subjects), University of Port-Harcourt Teaching Hospital, Rivers State(174 subjects) and Braithwaite memorial Specialist Hospital, Port Harcourt, Rivers State(156 subjects).

The routine distance from which these radiographs were taken was 100cm. All the radiographs were of anteroposterior view. All the radiographs were free from pathological changes and belonged to adults from the ages of eighteen to seventy five years. In taking these measurements the radiographs were placed on the horizontal surface of an illuminator as shown Below

Fig.1. A radiograph of pelvis showing the measurements of the pubic length AB on one of the female subjects. and the measurements(pubic length and Ischial length) were taken with the help of a vernier calliper after a marker was used to mark these points for clear visualization.

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Fig. 2. The radiograph of pelvis showing the measurements of the ischial length AC and pubic length AB.

Ischial length: Is a straight line AC as shown on the radiograph(Figure 2).
Pubic length: Is a straight line AB as shown on the radiograph(Figure 2).
Ischiopubic index= Pubic length(AB) × 100
Ischial length(AC) [7]

STATISTICS

Data on all the parameters studied were analyzed for mean, range and standard deviation using discrete statistics and significant differences using SPSS for z-test, statistically significant level was taken at P<0.05 . The actual range for the male and female sexes was determined from the data. The highest and lowest values of this range were used in gender determination. The identification point is the low or high value got from the actual range of the values measured from male and female pelvis. The demarking point is the low or high values deduced from the calculated range which is got by using the formula mean ±2Standard Deviation [21].

RESULTS

The mean and standard deviation of the three measurements are shown in table 1. The mean pubic length of males and females in Rivers state were 91.99 ±17.76 mm and 103.12±13.11 mm respectively. The females mean pubic length was significantly higher than that of the males(P<0.05) thus, there was sexual dimorphism in the pubic length of the subjects. The mean ischial length of the males and females were 101.16 ±18.53 mm and 90.07±12.19 mm respectively. The males mean ischial length was significantly higher than that of the females(P<0.05).The mean ischiopubic indices observed for males and females were 90.88 ±5.52and 114.87±8.08respectively.There was a significant difference in the ischiopubic index(P<0.05). The females showed higher mean ischiopubic index (106.45 ±7.65). The mean ischial lengths and pubic lengths in the present study were compared with previous studies (table2). There was sexual dimorphism and racial differences. The range, mean and demarking points of ischiopubic index of the studied populations are shown in table3.Sex was accurately assigned to 80% of Nigerian males, 95% of females, when the formulae (mean ± 2SD) was used[21].The mean ischiopubic indices of various populations previously studied and the present study were shown in table4. Like in other populations previously studied, sexual dimorphism was observed.

Table1: Mean and standard deviation pubic length, ischial length and ischiopubic index

SUBJECTS	N	Pubic Length ±SD (mm)	Ischial Length±SD (mm)	Ischiopubic index±SD
MALES	268	91.99 ±17.76	101.16±18.53	90.88 ±5.52
FEMALES	406	103.12±13.11	90.07±12.19	114.87±8.08

P<0.05 SD: Standard deviation, N: Sample size

Table 2: **Mean pubic length and ischial length of males and females of different races and present study.**

Racial group source	Male Pubic Length(mm)		Female Pubic length(mm)		Male Ischial length(mm)		Female ischial Length(mm)		Source
	No	Mean	No	Mean	No	Mean	No	Mean	
Eskimos	129	74.1	95	80.1	129	88.4	95	81	Hanna and Washburn[22]
American whites	100	73.8	100	77.9	100	88.4	100	78.3	Davivong, [6]
American Negro	50	69.2	50	73.5	50	86.6	50	77.5	Washburn[7]
Bantu	82	66.2	70	73.2	82	80.3	70	74.8	Ekanem et al. [12]
Australian Aborigines	89	63.3	72	69.2	89	81.2	72	74.7	Davivong, [6]
Nigerians (calabar)	114	65.8	100	75.6	114	70.1	100	64.5	Ekanem et al. [12]
Nigerians in Rivers State.	268	91.99	406	103.12	268	101.16	406	90.07	Present study

Table4. 3**: Ischiopubic Indices, standard deviation, range and demarking points of Nigerians in Rivers State**

Measurements and calculations	Female Ischiopubic Index	Male Ischiopubic Index
N	406	268
Mean	114.87	90.88
Standard Deviation	±8.08	±5.52
Actual Range	96.83-137.88	64.98-103.95
Identification Point	>103.95	<96.83
Percentage identified	94.33%	85.80%
Calculated Range(Mean ±2SD)	98.71-131.03	79.84-101.92
Demarking Point	> 101.92	<98.71
Percentage identified by demarking point.	95%	80%

Table 4: **Mean Ischiopubic indices of various populations**

Population	Sex	Mean ±SD	N	**P**	**Authors**
Black Malawians	Male	85.0 ± 15.7	120	<0.05	Igbigbi and Msamati [4]
	Female	104.6 ± 15.7	135		
France	Male	82.0 ± 7.2	93	<0.05	Wasburn[7]
	Female	94.5 ± 3.1	61		
Portuguese	Male	78.2 ± 6.2		<0.05	Phenice[23]
	Female	71.3 ± 3.1			
Americans	Male	67.4 ± 8.1	253	<0.05	Tague[3]
	Female	93.1 ± 10.4	212		
White American	Male	63.7 ± 7.8	50	<0.05	Tague[3]
	Female	88.4 ± 8.5	50		
Black Americans	Male	65.8 ± 8.7	50	<0.05	Tague[3]
	Female	85.2 ± 8.5	49		

Caucasians	Male	<60	_	<0.05	Caldwell and Moloy[16]
	Female	<90	_		
South-South Nigerians	Male	81.4 ± 6.4	30	<0.05	Oladipo et al. [1]
	Female	104.2 ± 11.1	40		
Middle Belt Nigerians	Male	83.1 ± 5.8	20	<0.05	Oladipo et al. [1]
	Female	101.7 ± 11.3	30		
Eastern Nigeria	Male	84.0 ± 10.4	100	<0.05	Oladipo et al. [1]
	Female	102.6 ± 11.7	100		
Port Harcourt, Nigeria	Male	81.0 ±5.70	46	<0.05	Udoaka et al. [11]
	Female	102.7± 9.20	54		
Calabar indigenes	Male	94.2± 9.9	114	<0.001	Ekanem et al. [12]
	Female	118.8± 12.8	100		
Nigerians in Rivers State	Male	90.88±5.52	268	<0.05	Present study
	Female	114.87 ±8.08	406		

DISCUSSION

For forensic and anthropologic reasons ischiopubic index is important for sex and race determination in our country. Washburn[7] working on ischiopubic index identified 80% and 100% for American males and females respectively. In a recent study, Igbigbi and Msamanti[4]measured the ischiopubic index in black Malawian and found that it was useful for gender determination using adult skeletons or radiographs. With the skeletal bones, sex was assigned to 92% males and 100% females whereas using radiographs sex was accurately assigned to 87.8% males and 92.3% females respectively. In this present study, the percentage identified by demarking point was 80% for males and 95% for females when using the formula Mean ±2SD[21].

The pubic length, ischial length and ischiopubic index differ in different races. A comparative data of these parameters in different races are shown in table 2. In this study, it was observed that the Ibani males and females has a larger value of pubic length and ischial length than the other racial groups studied.

The mean ischiopubic index was highest in this present study in both males and females when compared to other races apart from the study carried out on Nigerians in Calabar by Ekanem et al. [12]. In Nigerian males and females, in the present study, the mean ischiopubic indiceswere 90.88±5.52 and 114.87 ±8.08 respectively. Though the primary function of the pelvis in males and females is for locomotion, it is specially adapted for childbirth in the females[22]. This may explain the significantly higher sexual differences in ischiopubic index observed in the females in all the races when compared with that of the males.

From this study, the Nigerian population studied has an overall mean ischio-pubic index of 105.32 ±13.77 as assigned to the black race. However, the mean index was significantly higher than that of black Malawians ($p<0.05$). This is an indication of regional variation of the ischio-pubic index. The relationship between age and pelvimetry has also been given attention.

The racial differences observed may either be due to environmental or hereditary factors or both [17]. Maclanghlin and Bruce[18]observed that sexual dimorphism in body size is a critical factor in influencing pelvic dimorphism. They observed that the pubic length for both sexes particularly that of the females showed accelerated changes depending on the body size. Rissech and Malgosa [19], working on pubis growth on sexual and age diagnosis confirmed that ischiopubic index is one of the good variables for sub-adult sex determination. Racial hereditary factor acts as primary factor within which functional activities operate as secondary factor.

CONCLUSION

The relevance of the use of ischiopubic index in identification of sex cannot be over emphasized. Data

gained from this study will serve as a reference value for the Rivers people.. It is therefore recommended to obstetrics, physical and forensic anthropologists for sex and race determination in developing countries.

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