

Ischiopubic index of Edo people in Benin City, Nigeria

ABSTRACT

Background: Sex determination stands a key position in the human identification process. **Aim:** This study was conducted to determine the pubic length, ischial length, and ischiopubic index, and to ascertain their usefulness in sex determination among Edo people. **Materials and Methods:** This was a retrospective study that utilized 114 male and 86 female anteroposterior pelvic radiographs of patients who attended the radiological services of the University of Benin Teaching Hospital, between January 2010 and September 2014. The subjects were in the age range of 18–60 years, with a mean age of 36.56 ± 11.93 years. Pubic and ischial lengths were measured with digital Vernier Caliper and ischiopubic index derived. **Statistical Analysis:** Data were analyzed with descriptive and inferential statistics using statistical package of social sciences version 20. P value ≤ 0.05 was considered to be statistically significant. **Results:** The ischial and pubic lengths exhibited statistically significant sex differences ($P < 0.05$). Only the pubic length has the ability for accurate sexing of the bone, as 61.1% in males and 46.5% in females could be identified by the demarking point, using “mean \pm 2SD.” Ischiopubic index exhibited significant sexual dimorphism ($P < 0.05$) with a very high percentage identified ($\geq 93\%$) by demarking points in males and females, using “mean \pm 2SD and mean \pm 3SD.” **Conclusion:** Ischiopubic index is relevant in sex determination.

Key words: Forensic anthropology, ischiopubic index, ischium, pubis, sex determination

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INTRODUCTION

The hip bone is a tripartite bone with a focal point at the acetabulum.^[1] The ileum, which is the largest, makes up the upper part of the hip bone, joining the ischium and pubis posteriorly and anteriorly, respectively, to form the acetabular socket.^[2]

One of the physical adaptations associated with bipedalism in modern man is the design of the hip bone which “is suitable for sex determination, as it exhibits the differences between the male and female, and also the special adaptation of female hip bone for child bearing”.^[3,4] The dimorphic nature of the hip bone is significant in physical anthropology, anatomy, obstetrics, and gynecology.^[5]

Various studies utilizing the hip bone have been conducted in Nigeria^[3-11] and other parts of the globe^[12-14] to establish standards for human identification by sex in the respective populations. In spite of the above, little or none is known regarding sex determination from ischiopubic index of the Edo people. The purpose of this study was to generate population-specific data from ischial and pubic lengths and ascertain the feasibility of sex determination from these dimensions and ischiopubic index among the Edo.

MATERIALS AND METHODS

This was a retrospective study conducted between March 2014 and September 2014. All patients of Edo ethnic group

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who attended the radiological services of the University of Benin Teaching Hospital, between January 2010 and September 2014 formed the study population. Two hundred anteroposterior pelvic radiographs (114 males and 86 females) were used for the study. The age of the subjects were between 18 years and 60 years, with a mean age of 36.56 ± 11.93 years.

All the radiographs used were normal and showed no underlying bone disease or fracture of any kind. Only radiographs with the best alignment at the inferior margins of the pubic bones at the pubic symphysis were measured.

Method of measurements

The method of measurements and derivation of ischiopubic index adopted were as described by Washburn^[14] and Schult and Adolf:^[15]

- Ischial length: This was taken as the “distance from the point where the three bones meet in the acetabulum to ischial tuberosity (AC)” [Figure 1];^[14]
- Pubic length: This was taken as the “distance from the point where the three bones meet in the acetabulum to pubic tubercle (AB)” [Figure 2].^[14]

These distances were measured in millimeters with the aid of digital Vernier Caliper (Mitutoyo corporation, Japan). Each distance was measured twice and the average was recorded as the actual distance to reduce the error of measurements.

Ischiopubic index = (pubic length ÷ ischial length) × 100.^[14]

Data obtained were analyzed using the descriptive statistics to summarize the information, and inferential statistics (independent samples *t*-test) to verify if there were significant sex differences. $P \leq 0.05$ was considered to be statistically significant. In order to determine sex, the actual ranges for the male and female sexes were calculated. Okosemiema and Udoaka^[9] stated that “the

highest and lowest values of this range were used in sex determination and the identification point is the low or high value obtained from the actual range of the values measured from male and female pelvis.” They also stated that “the demarking point is the low or high values obtained from the calculated range got by using the formulae $\text{mean} \pm 3\text{SD}$ (where SD = standard deviation) in accordance with Jit and Singh^[16] or $\text{mean} + 2\text{SD}$ in accordance with Rao.”^[17]

RESULTS

The mean ischial length was greater in males than in females but the mean pubic length and ischiopubic index were greater in females compared to males [Table 1]. This sex differences in the parameters studied were statistically significant ($P < 0.05$) [Table 2].

The identification point for ischial length was 65.39 mm in males and 89.76 mm in females, based on the minimum value and maximum value of ischial length in females and males, respectively. These identification points assigned 0.9% to males and 0.0% to females. The demarking point for ischial length was <64.93 mm in males and >88.71 mm in females, based on the limiting points of the calculated range ($\text{mean} \pm 2\text{SD}$) while it was <60.71 mm in males and >93.62 mm in females based on the limiting points of the calculated range ($\text{mean} \pm 3\text{SD}$). The percentage identified by demarking point in both sexes using both “ $\text{mean} \pm 2\text{SD}$ and $\text{mean} \pm 3\text{SD}$ ” was 0.0%.

Identification point for pubic length was <69.28 mm in males and >84.36 mm in females, based on the minimum value and maximum value of pubic length in females and males, respectively. These identification points assigned 26.3% to males and 8.1% to females. The demarking point for pubic length was <69.98 mm in males and >79.58 mm in females, based on the limiting points of the calculated range ($\text{mean} \pm 2\text{SD}$);

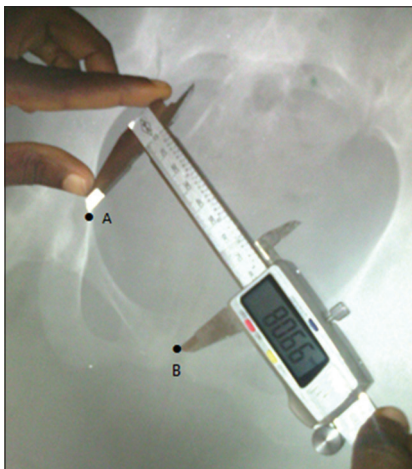


Figure 1: Measurement of pubic length (AB)



Figure 2: Measurement of ischial length (AC)

Table 1: Range, mean, identification point, and demarking point of parameters studied

| Sex | N | Designation | Ischial length (mm) | Pubic length (mm) | Ischiopubic index |
|--------|-----|--|---------------------|-------------------|-------------------|
| Male | 114 | Actual range | 67.26-89.76 | 58.65-84.36 | 74.65-105.14 |
| | | Mean±SD [†] | 78.89±4.91 | 69.02±5.28 | 87.54±4.87 |
| | | Identification point | <65.39 | <69.28 | <97.49 |
| | | Percentage identified | 0.9% | 26.3% | 98.2% |
| | | Mean±2SD | 69.07-88.71 | 58.46-79.58 | 77.80-97.28 |
| | | Demarking point | <64.93 | <69.98 | <99.37 |
| | | Percentage identified by demarking point | 0.0% | 61.1% | 99.1% |
| | | Mean±3SD | 64.16-93.62 | 53.18-84.86 | 72.93-102.15 |
| | | Demarking point | <60.71 | <65.70 | <95.49 |
| | | Percentage identified by demarking point | 0.0% | 28.9% | 95.6% |
| Female | 86 | Actual range | 65.39-87.50 | 69.28-85.70 | 97.49-121.93 |
| | | Mean±SD | 73.37±4.22 | 78.54±4.28 | 107.13±3.88 |
| | | Identification point | >89.76 | >84.36 | >105.14 |
| | | Percentage identified | 0.0% | 8.1% | 60.5% |
| | | Mean±2SD | 64.93-81.81 | 69.98-87.10 | 99.37-114.89 |
| | | Demarking point | >88.71 | >79.58 | >97.28 |
| | | Percentage identified by demarking point | 0.0% | 46.5% | 100.0% |
| | | Mean±3SD | 60.71-86.03 | 65.70-91.38 | 95.49-118.77 |
| | | Demarking point | >93.62 | >84.86 | >102.15 |
| | | Percentage identified by demarking point | 0.0% | 5.8% | 93.0% |

[†]SD=Standard deviation

Table 2: Test of significant difference between males and females

| Parameter | Mean difference (mm) | t | df | P |
|-------------------|----------------------|---------|--------|-------|
| Ischial length | 5.52 | 8.350 | 198 | 0.001 |
| Pubic length | -9.53 | -13.672 | 198 | 0.001 |
| Ischiopubic index | -19.60 | -31.667 | 197.38 | 0.001 |

the percentage identified by the demarking point was 61.1% in males and 46.5% in females. When the limiting points of the calculated range was based mean ± 3SD, the demarking point for pubic length was <65.70 mm in males and >84.86 mm in females; the percentage identified by the demarking point was 28.9% in males and 5.8% in females.

Identification point for ischiopubic index was <97.49 in males and >105.14 in females, based on the minimum value and maximum value of ischiopubic index in females and males, respectively. These identification points assigned 98.2% to males and 60.5% to females. The demarking point for ischiopubic index was <99.37 in males and >97.28 in females, based on the limiting points of the calculated range (mean ± 2SD); the percentage identified by the demarking point was 99.1% in males and 100.0% in females. When the limiting points of the calculated range was based mean ± 3SD, the demarking point for ischiopubic index was <95.49 in males and >102.15 in females; percentage

identified by the demarking point was 95.6% in males and 93.0% in females.

DISCUSSION

In the present study, ischial and pubic lengths and ischiopubic index were assessed regarding their dimorphic nature as well as degree of identification. The mean ischial length was significantly higher in males than in females while the mean pubic length and ischiopubic index in females were significantly higher than in males ($P < 0.05$). This observation was in agreement with some previous reports.^[3,4,6-12] Our result was at a variance with a study conducted in Portugal^[13] that reported that the mean ischiopubic index in males was greater than in females. This dispersion might be related to genetic and environmental factors, which are which are known denominators for intra- and inter-population variability.

The mean ischial and pubic lengths in this study are lower than some studies conducted previously^[3,8,9] but higher than the study by Ekanem *et al.*^[6] The mean value of ischiopubic index in the present study was similar to some previous reports^[8,9] and lower than that reported by Ekanem *et al.*^[6] and Oladipo *et al.*^[3] These differences in skeletal forms and morphology might be adduced to genetics and environmental factors such as nutrition.

In the present study, sexing of ischial length based on demarking point was not possible because the percentage

identified was 0.0% in males and females. Pubic length showed improved levels of percentage identified by demarking point, and only by using the limiting range based on 'mean \pm 2SD' is sexing possible, which is better in the males (61.1%) than females (46.5%). Nonetheless, these parameters showed sexual dimorphism based on statistically significant gender differences ($P = 0.001$). Apart from pubic length that gave 61.1% identified by the demarking point, using the limiting range based on "mean \pm SD," they could not be used in accurate sexing because the percentage identified by the demarking points was poor.

Regarding ischiopubic index, the percentage identified using demarking points in both sexes was observed to be very high ($\geq 93\%$) in both the sexes. Consequently ischiopubic index provided accurate sex determination of the pelvis.

Previous studies also reported the percentage identified using demarking points in various populations. Ekanem *et al.*^[6] observed 46.67% in males and 50% in females; Osunwoke *et al.*^[8] reported 56% in males and 84% in females; Okoseimiema and Udoaka^[9] observed 68.72% in males and 62.53 in females; Oladipo *et al.*^[11] found out 78% and 91% in males and females, respectively; Oladipo *et al.*^[10] reported 84% in males and 94% in females and 90% in males and 98% in females, among the Kalabari and Ikwere, respectively.

CONCLUSION

The ischial and pubic lengths exhibited statistically significant differences between males and females ($P < 0.05$) and therefore, have dimorphic potential. However, only the pubic length has the ability for accurate sexing of the bone, as 61.1% in males and 46.5% in females could be identified by demarking point, using the limiting range based on "mean \pm 2SD." Ischiopubic index exhibited significant sexual dimorphism ($P < 0.05$) with very high percentage identified ($\geq 93\%$) using the demarking points in both sexes, using the limiting range based on "mean \pm 2SD and mean \pm 3SD." Consequently the ischiopubic index may be of relevance in forensic anthropology, archaeological analyses, and in obstetrics.

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Conflicts of interest

There are no conflicts of interest.

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