



Research Paper

Pelvic Size of the South-South Nigerians

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ABSTRACT

BACKGROUND: Possessing a data bank of various pelvic traits with their normative values that is race, sex and ethnicity specific is of great deal to the Orthopedic surgeons, Forensic Anthropologists, Obstetricians, Anatomists and Physiologists.

AIM: This study is aimed to showcase the normative values of various pelvic traits of South-South Nigerians using pelvic radiographs.

MATERIALS AND METHODS: Three Linear measurements such as Pelvic Breadth, Pelvic Height, and Total Pelvic Breadth were done and two indices [Pelvic Index and Total Pelvic Index] were calculated. Pelvic breadth was measured from the anterior superior ischial spine to the posterior superior ischial spine on one side of the pelvis. Pelvic height was measured from the most superior part of the iliac crest to the ischial tuberosity. The Total pelvic breadth is the complete distance between the out lips of the iliac crest of the pelvis. Pelvic Index is the ratio of pelvic height divided by the pelvic breadth multiplied by 100. Total Pelvic Index is the ratio of pelvic height divided by total pelvic breadth multiplied by 100.

RESULTS: The results indicates, mean value for pelvic breadth for males and females as 107.65 ± 0.30 and 108.74 ± 0.37 ($p < 0.05$) with demarking points as >112.97 for males which assigned sex to 97.8 % and <132.01 for females and can assign sex to 98.2%. The values for pelvic height for males and females are 217.22 ± 0.39 and 214.97 ± 0.53 ($p < 0.05$) with demarking points as >225 and <250 respectively. Sex could be assigned to 98.4% males and 98.9% females. The results also showed a mean value 288.31 ± 0.56 for males total pelvic breadth with a demarking point of >300 and assigned sex to 98.5% and 296.88 ± 0.71 for females' total pelvic breadth ($p < 0.05$) with demarking <343 and predict sex to 98.9% . For pelvic index, the mean value for male is 201.97 ± 0.29 and the female is 198.35 ± 0.74 ($p < 0.05$). The males possess a demarking point of <9.52 and indicates sex to 98% while the females cannot be demarked. Consequently, the mean value of total pelvic index for males and females are 75.36 ± 0.03 and 72.50 ± 0.24 ($p < 0.05$). While the males cannot be demarked, the females got a demarking point of <87.5 and identify sex to 98%.

CONCLUSION: All the parameters showed sexual dimorphism which of importance to the Prosthetic Engineers, Orthopedic Surgeons, Forensic Anthropologists, Obstetricians, Anatomists and the Physiologists.

Key words: Pelvic traits, Demarking points, Sexual Dimorphism.

Received 12 Sep., 2022; Revised 26 Sep., 2022; Accepted 28 Sep., 2022 © The author(s) 2022.
Published with open access at www.questjournals.org

I. INTRODUCTION

Modern humans are sexually dimorphic in size as well as in shape, and the differences between sexes are expressed in many osteological elements [1]. Some anatomical structures are used for sexing skeletal samples due to the fact that they display high levels of dimorphism. Accurate sex estimation is a basic issue in bioarchaeological studies since the establishment of sex and age profiles is essential in paleodemography, paleopathology, among others [2]. Sex diagnosis is a fundamental step for establishing the biological profile, and thus is of critical importance in the forensic task of identifying human skeletal remains [3]. In forensic anthropology and bioarcheology, most methods for sex estimation rely on statistical models generated through osteometric data collected from identified populations [4]. Among all the regions of the human skeleton, the pelvis has for long been consensually regarded as the most sexual dimorphic [5,6,7]. The articulated pelvis consists of the left and right innomates, the sacrum, the coccyx, and three major articulations: sacroiliac (left and right) and the pubic symphysis. It functions to support and protect the internal viscera, transmit weight between the upper body and lower body, and form the major joint for the articulation of the lower limbs. Both

the innominates and the sacrum exhibit sexually dimorphic differences in size and shape that begin at the onset of puberty, when females show increased growth in the acetabular and pubic areas relative to the growth in other pelvic regions [8]. The differences primarily center on the trade-off between efficient bipedal locomotion, which requires a narrower pelvis, and the need for a wider pelvis in females to accommodate childbirth, commonly referred to the “obstetrical dilemma” [9]. A direct correlation has been found between neonatal brain size relative to the pelvic canal and the level of sexual dimorphism in a species [10]. The pelvis has long been considered the best skeletal indicator of sex and has, therefore, been widely documented in the anatomical, anthropological, gynecological, and osteopathic literature. An extensive list of sexually dimorphic pelvis features is contained within these works; however, selection of which traits to use and when is largely dependent on the preferences and experiences of the observer. In 1994, Standards for data collection from Human Remains [11] suggest the use of Phenice’s (1969) three traits, the ventral arc, subpubic concavity, and medial aspect of the ischiopubic ramus, along with the greater sciatic notch and preauricular sulcus for pelvic sex estimation. In this study we will be looking at the size of the pelvis as a tool in determining the sex of an individual.



II. MATERIALS AND METHODS

MATERIALS

They include, digital sliding caliper, meter rule, pencil, pelvic radiographs, X-ray viewing box.

RESEARCH DESIGN AND STUDY POPULATION/AREA

This is a retrospective cross-sectional study of pelvic trait measured in the Radiology Department of the University of Port Harcourt Teaching Hospital, Braithwaith Memorial Hospital (BMH) Port Harcourt, Federal Medical Centre (FMC) Yenagoa, Niger Delta University Teaching Hospital Okolobiri, University of Benin Teaching Hospital and University of Calabar Teaching Hospital in South-South region of Nigeria. Convenient sampling was carried out and a total of 1000 Anterior-posterior pelvic radiographs were measured (450 males and 550 females) which were distinguished as either male or female based on the basis of the names of the subjects that is recorded on the radiographs and reinforced by gender details which was in the patient information card. Radiographs were viewed using x-ray viewing box on which radiographs was placed before any measurement.

Inclusion Criteria

1. Only radiographic films that showed the complete pelvis were measured
2. The measured radiographs were free from disease conditions and break in the continuity of the pelvis and sacrum.
3. Only radiographs with completely ossified pelvis were measured.

Exclusion Criteria

Fractured, not completely ossified pelvic radiographs were excluded

METHODS

PELVIC BREADTH

Pelvic breadth was measured from the anterior superior ischial spine to the posterior superior ischial spine on one side of the pelvis [12 and 13] methods.



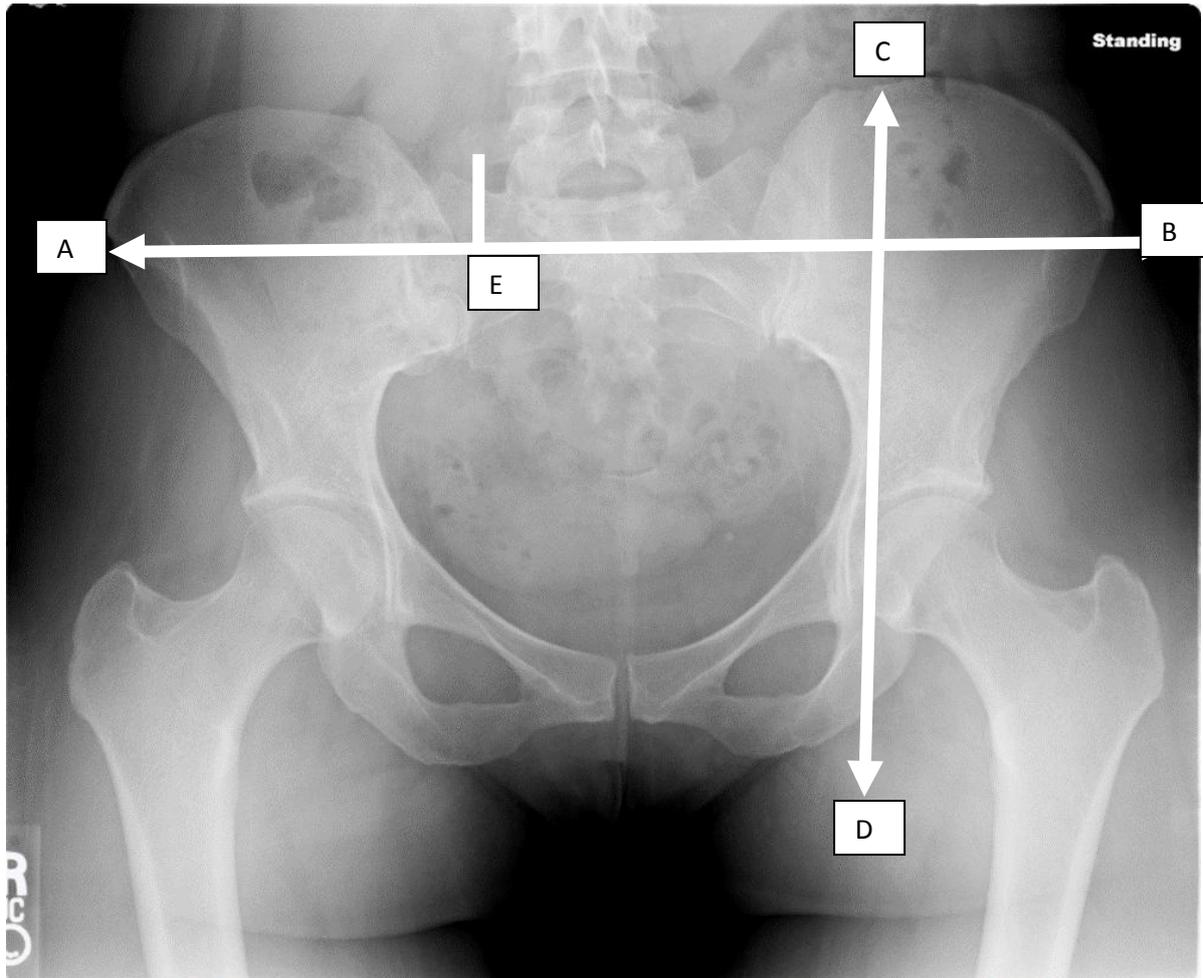
Fig 1: Pelvic breadth (mm)

TOTAL PELVIC BREADTH

This is the complete pelvic width. The complete distance between the out lips of the iliac crest of the pelvis [13]. It is the breadth between anterior superior iliac spines.



Fig 2: Total pelvic breadth (mm)



Keys

1. AB: Total Pelvic Breadth
2. CD: Pelvic Height
3. AE: Pelvic Breadth

PELVIC HEIGHT

Pelvic height was measured from the most superior part of the iliac crest to the ischial tuberosity. It is height of entire pelvis.

Pelvic Index

Is the ratio of pelvic height divided by the pelvic breadth multiplied by 100.

Total Pelvic Index

Is the ratio of pelvic height divided by total pelvic breadth multiplied by 100

PRESENTATION OF DATA

The mean, standard deviation (S.D), and standard error (S.E) are presented for all linear (metric) measurements and the calculated indices of the South –South Nigerian pelvic parameters. Z-test was used to compare mean values between the males and the females at 95% confidence interval.

DATA ANALYSIS

The collected data from various University Teaching Hospitals of Nigeria were analyzed statistically (for Descriptive statistics) using SPSS software version 22.0 for windows. Z -Test was used and ($p < 0.05$) was considered significant. All linear measurements were taken in millimeters for every parameter and the indices in percentages.

III. RESULTS

The data collected from the South-South pelvic parameters were analyzed and the various results are displayed in the table below.

Table 1: Mean Values of South –South Pelvic Parameters

S/N	PARAMETER	Males	Females
1	Pelvic Breadth[mm]	107.65±0.30	108.74±0.37
2	Pelvic Height[mm]	217.22±0.39	214.97±0.53
3	Total Pelvic Breadth[mm]	288.31±0.56	296.88±0.71
4	Pelvic Index (%)	201.97±0.29	198.35±0.74
5	Total Pelvic Index (%)	75.36±0.03	72.50±0.24

Key: All values = Mean ± S.E

The mean value for pelvic breadth of the South-South males and females are 107.65±0.30 and 108.74±0.37 which have shown to be statistically significant ($p < 0.05$). The values for pelvic height for males and females are 217.22±0.39 and 214.97±0.53 and significant difference occurred amongst sexes. The results also showed a mean value 288.31±0.56 for males total pelvic breadth and 296.88±0.71 for females total pelvic breadth. For pelvic index, the mean value for males is 201.97±0.29 and the females as 198.35±0.74 ($p < 0.05$). Consequently, the mean value of total pelvic index for males and females are 75.36±0.03 and 72.50±0.24 ($p < 0.05$).

Table 2: Significant Test between South-South Males and Females

S/N	PARAMETER	Calculated "Z"	Inference
1.	Pelvic Breadth (mm)	2.34	**
2.	Pelvic Height (mm)	-3.46	**
3.	Total Pelvic Breadth	-9.43	**
4.	Pelvic Index	4.54	**
5.	Total Pelvic Index	12.05	**

Key: ** = Statistically Significant.

Table 3: Demarking Points and Percentages of South-South Nigerian Pelvic Parameters Using [14] Formula.

S/N	PARAMETER	SEX	Mean± SD	Mean± 3SD	D.P	%
1	Pelvic Breadth (mm)	M	107.65±6.26	126.43 88.87	>112.97	97.8 %
		F	108.74±8.56	134.42 83.06	<132.01	98.2%
2	Pelvic Height(mm)	M	217.22±8.17	241.73 192.71	>225	98.4%
		F	214.97±12.31	251.9 178.04	<250	98.9%
	Total Pelvic Breadth	M	288.31±11.94	324.13 252.49	>300	98.5%
		F	296.88±16.72	347.04 246.72	<343	98.9%
4	Pelvic Index	M	201.97±6.10	220.27 183.67	<9.52	98%
		F	198.35±17.44	250.67 146.03		
5	Total Pelvic Index	M	75.36±0.63	77.27 73.47		
		F	72.50±5.52	89.06 55.94	<87.5	98%

Note: M= Male; F= Female; S.D= Standard Deviation, D.P = Demarking Points, % = Percentage.

Table 4: Comparison of Present and Previous Pelvic Parameters

Parameter	Sex	Present study	Ogoun et al (2018) Nigerians	Gupta and Arora (2013) Gujarat Region	Geneva Foundation for Education and Medical Research (2015)
Pelvic Width	M	107.65±0.30	112.07±8.75	137.31	
	F	108.74±0.37	109.18±9.04	133.24	
Pelvic Height	M	217.22±0.39	223.43±11.85	193.85	
	F	214.97±0.53	215.68±12.70	179.45	
Total Pelvic Width	M	288.31±0.56	297.36±17.40		
	F	296.88±0.71	297.75±18.99		
Average		293	298		250
Pelvic Index	M	201.97±0.29	199.52±7.54	141.18	
	F	198.35±0.74	198.37±16.72	134.68	
Total Pelvic Index	M	75.36±0.03	75.17±0.74		
	F	72.50±0.24	72.70±5.14		

All values=Mean± SD

Key: SD= Standard Deviation, M= Male, F= Female, (%) = Percentage, mm= Millimeter

IV. DISCUSSION

It is useful to know the pelvic dimensions of various races and tribes for forensic, ergonomics and surgical reasons, especially, hip replacement. The results of the present study have shown that, the South-South females possess a wider pelvic than their female counterpart ($p < 0.05$). This difference could be as a result of modelling of the females pelvis to child bearing function. The demarking point for male is >112.97 and can identify sex to 97.8%. The demarking point for female is <132.01 and can assign sex to 98.2%. In comparison, the South-South Nigerians possess narrow pelvis than the Gujarat people which is the result of Gupta and Arora 2013, as shown in [table 4].

The pelvic height is lengthier in the South-South males than the females ($p < 0.05$). The South-South Nigerian males possess a demarking point of >225 and can assign sex to 98.4%, while the female demarking point is <250 with could identify sex to 98.9%. This finding is in tandem with the result of Ogoun et al., 2018 on the Nigerian pelvis. The South-South and the Nigerians pelvises are lengthier than the Gujarat Region people which is the result of Gupta and Arora 2013, as shown in [table 4].

The South-South Nigerian females completely bear wider total pelvic breadth than their female counterparts ($p < 0.05$). The demarking point for females is <343 and sex could be assigned to 98.9%, while the males have a demarking point of >300 and can identify sex to 98.5%. The findings of Ogoun et al., 2018 on the Nigerian pelvis showed no sexual dimorphism between sexes. Taking into account, the mean total pelvis breadth, the present South-South Nigerian study show a value of 293mm, the study on the Nigerian population in general, showed a value of 298mm while Geneva Foundation for Education and Medical Research (2015) gave a value of 250mm [Table 4].

In consideration of pelvic height to breadth ratio [Pelvic Index], the South-South males tends to have a higher value than the females ($p < 0.05$). This pelvic trait have shown to be sexually dimorphic, with the male having a demarking point of <9.52 and could assign sex to 98%. While the females cannot be identified. This findings corroborates the result results of Ogoun et al., 2018 on the Nigerian population. Concurrently, The

Total pelvic index [ratio of pelvic height and total pelvic breadth], the South-South males tends to have a higher value in contrast to the females ($p < 0.05$). The males cannot be identified while the female possess a demarking point of < 87.5 and assign sex to 98%. The study on the Nigerian pelvis by Ogoun et al., 2018 supports this findings.

V. CONCLUSION

With the rising killings that requires forensic settings and the high occurrences of surgical hip replacement in the world recently. Getting a data base of normative values for various pelvic parameters that is race, sex and tribe specific has become imperative. The various under studied pelvic parameters of the South-South Nigerian pelvis have shown to be sexually dimorphic with varying normative values which is of utmost importance to Prosthetic Engineers, Orthopedic Surgeons, Forensic Anthropologists, Obstetricians, Anatomists and the Physiologists.

ACKNOWLEDGEMENT

We sincerely, thank TETFund for sponsoring this research.

FUNDING: Tertiary Education Trust Fund [TETFund]

REFERENCE

- [1]. Acsa'di, G., Nemeske'ri, J. History of Human Lifespan and Mortality. Akade'mai Kiado', Budapest. 1970..
- [2]. Meindl, R.S., Russell, K.S. Recent advances in method and theory in paleodemography. *Annu. Rev. Anthropol.* 1998. 27, 375-399.
- [3]. Bru J., žek, P. Murail, Methodology and reliability of sex determination from the skeleton, in: A. Schmitt, E. Cunha, J. Pinheiro (Eds.), *Forensic Anthropology and Medicine*, Humana Press, New Jersey, USA, 2006, pp. 225–242.
- [4]. Murail P., Bru J., žek, F. Houët, E. Cunha, DSP: A tool for probabilistic sex diagnosis using worldwide variability in hip-bone measurements, *Bulletins et mémoires de la Société d'Anthropologie de Paris* (2005) 167–176.
- [5]. Krishan, K., Chatterjee, PM., Kanchan, T., Kaur, S., Baryah, N., Singh, R.K. A review of sex estimation techniques during examination of skeletal remains in forensic anthropology casework, *Forensic Sci. Int.* 261 (2016) 165, doi:<http://dx.doi.org/10.1016/j.forsciint.2016.02.007>.
- [6]. Serra, J.A. A pelvenos Portugueses: morfologia da pelve no Homem [the pelvic complex in the Portuguese: morphology of the human pelvis], *Contribuições Para o Estudo Da Antropologia Portuguesa* 3 (1938) 1–174.
- [7]. Phenice, T.W. A newly developed visual method of sexing the os pubis, *Am. J. Phys. Anthropol.* 30 (1969) 297–301, doi:<http://dx.doi.org/10.1002/ajpa.1330300214>.
- [8]. Coleman, W. H. Sex differences in the growth of the human bony pelvis. *American Journal of Physical Anthropology*, (1969). 31, 125–151.
- [9]. Washburn, S. L. Tools and human evolution. *Scientific American*, (1960). 203, 62–75.
- [10]. Ridley, M. Pelvic sexual dimorphism and relative neonatal brain size really are related. *American Journal of Physical Anthropology*, (1995). 97, 197–200.
- [11]. Buikstra, J. E., & Ubelaker, D. H. Standards for data collection from human skeletal remains: Proceedings of a seminar at the Field Museum of Natural History, organized by Jonathan Haas (3rd ed.), (1994). Fayetteville, AR: Arkansas Archeological Survey.
- [12]. Gupta, S., Arora, K. Study of Significance of Total Pelvic Height and Pelvic Width in Sex Determination of Human Innominate Bone in Gujarat Region. *Journal of Medical Science*; (2013).2: 2.
- [13]. Ogoun, T.R., Dida B. C., Tobia P.S , Osunwoke E.A and Yorkum L.k. Morphometry of The Pelvis. *European Journal of Biomedical and Pharmaceutical Sciences*. (2018). Volume 5. (5);
- [14]. Pg, 144-149.
- [15]. Jit, I., Singh, S. Sexing of Adult Clavicle. *Indian Journal of Medical Research*; (1966). 54:551-571.
- [16]. Geneva Foundation for Education and Medical Research (2015). Contracted Pelvis. *Obstetrics Simplified - Diaa M. El-Mowafi*. Edited by Aldo Campana.