EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 5
Issue: 5
144-149
Year: 2018

MORPHOMETRY OF THE BONY PELVIS

[1]Ogoun T. R.*, [1]Didia B. C., [2]Tobia P. S. [2]Osunwoke E. A. and [2]Yorkum L. K.

[1]Department of Science Laboratory Technology, School of Applied Sciences, Federal Polytechnic Ekowe, Bayelsa State, Nigeria.
[2]Department of Human Anatomy, Faculty of Basic Medical Sciences College of Health Sciences, University of Port Harcourt, Nigeria.

***Corresponding Author: Ogoun T. R.**
Department of Science Laboratory Technology, School of Applied Sciences, Federal Polytechnic Ekowe, Bayelsa State, Nigeria.

Article Received on 15/03/2018 **Article Revised on 04/04/2018** **Article Accepted on 25/04/2018**

ABSTRACT
The pelvis has shown to have diversed functions, thus this study is to assess the shape and dimension of the pelvis in a Nigerian populaion. Convenient sampling was done and a total of 1500 Anterior posterior pelvic radiographs were measured (703 males and 797 females between ages 25-45years). Samples were collected from Radiology Department of the University of Port Harcourt Teaching Hospital (UPTH), Braithwaite Memorial Hospital (BMH) Port Harcourt, Federal Medical Center (FMC) Yenagoa, Niger Delta University Teaching Hospital (NDUTH) Okolobiri Bayelsa State, University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu State, National Orthopedic Hospital Igbobi Lagos, University of Abuja Teaching Hospital (UATH) Gwagwalada, FCT, Nigeria. Pelvic Width is the measured breadth between the anterior superior iliac spine to posterior superior iliac spine on one side of the pelvis. Total Pelvic Width is the maximum distance between the outer lips of the iliac crests. Pelvic Height is the measured distance between the most superior part of the iliac crest and the tuberosity of ischium. Data was analyzed statistically (for Descriptive statistics) using SPSS software version 20.0 for windows. Z -Test was used and ($p<0.05$) was considered significant. The results showed that the mean values of pelvic width for males and females are 112.07±8.75 and 109.18±9.04 ($p<0.05$. The mean values of pelvic height for Nigerian males and females are 223.43 ± 11.85 and 215.68±12.70 ($p<0.05$). The mean value of total pelvic width for Nigerian males and females are 297.36±17.40 and 297.75±18.99. The mean values of pelvic index for males and females are 199.52±7.54 and 198.37±16.72. The mean values of total pelvic index for males and females are 75.17±0.74 and 72.70±5.14 ($p<0.05$). It is crystal clear, that the males have a higher pelvic width and height than the females. The females possess a higher total pelvic width than the males ($p>0.05$). Which is an indicator that the pelvis is a good estimator of sex for forensic settings with clear demarking points.

KEYWORDS: Demarking points, Indicator, forensic setting.

INTRODUCTION
The pelvis performs varying degree of functions ranging from weight bearing, protecting viscera, to muscles attachment (Ellis and Mahadevan, 2010) and more exclusively provide the bony support for the birth canal in the female sex making the pelvis a complex structure. It's shape charracteristic have shown to hold promise on the manner birthing takes place, whether it will nornal vagina delivery or it will be a clinically oriented delivery. Estimation of sex from the human skeleton is among the most important aspects of establishing the biological profile of unknown individuals in forensic anthropology (Patil and Mody, 2005). The discrimination of sex is central to the process of establishing a personal identification from human skeletal remains.

(*Macaluso, 2010*). The determination of sex from human skeletal remains is of fundamental importance in both medicolegal and bioarchaeological investigation (Macaluso, 2011).

The characteristics that separate sex of the human skeleton are dependent on the existence of sexual dimorphism which is as a result of the female adaptations to childbearing, influence of sex hormones between the sexes. Although present at all ages, sexual dimorphism becomes most marked after puberty when the secondary sexual characteristics have fully developed (Wood, 2002). Hence sex can be most readily and most reliably ascertained in skeletons from mature individuals. Senility may influence sexual characteristics of a skeleton and therefore alter the reliability of sex determination in ages (Wood, 2002). In a recent study of pelvic dimorphism, (Steyn and Patriquin, 2009) demonstrated that sex classification accuracies for a combined sample of South African blacks, South African whites, and Greeks living

on Crete, differed very little from those obtained separately for the three groups. These results suggest that population-specific formulae may be unnecessary when using pelvic dimensions to discriminate sex.

Although it is possible to determine sex accurately and rapidly from skeleton. It is not always possible to find all bones at the same time in forensic practice. It is therefore important to obtain as much information as possible for each bone and extract information such as age and sex regarding the bone owner when analyzing even a single bone. The pelvic height/ midpubic index, ischiopubic index are good parameters for determining sex in a Nigerian population for medico-legal cases (Osunwoke *et al*., 2013).

A forensic anthropologist creates a biological profile of the deceased which entails sex, height, period of existence (age), race, and extra physical traits associated with the death such as any ante mortem pathology or postmortem trauma of deceased from the skeleton (Kristina, 2009).

Numerous studies have focused on the differences, both osteometric and morphological between the sexes of a particular racial phenotype and population (Patriquin *et al*., 2005). The degree of development of sexual characteristics within the skeleton may vary greatly from one racial group to another (Stewart, 1948; Johnson *et al*., 1989); so there is need for awareness of and familiarity with this inter-racial variation in sexual traits. Techniques to identify sex from bones had been studied. Scientists have emphasized the need for population data (Steyn and Iscan, 2008; Macaluso, 2010; Oladipo *et al*., 2010), this is because variations occur in terms of body size in populations. While the establishment of identity from intact fresh corpses is often obvious, the correct estimation of sex may be difficult after catastrophic events such as fires, high impact crashes and explosions and in criminal cases where highly decomposed bodies are found (Zagga *et al*., 2014) which has been a problem in Nigeria and other parts of the world.

Sometimes during the course of a criminal investigation and its subsequent autopsy the pathologist may find his or herself faced with the task of identifying the sex of a skeleton after decomposition (Jack, 2015). Obviously before decomposition there are detailed differences between the forms of a male or a female but once decomposition has taken a hold and carried out the unpleasant tasks that nature has intended, all that remains is the skeletal form with teeth and possibly some hair to work with.

Most postmortem issues in Nigeria require importation of expertise from other parts of the world. This research is based on shape and size analysis of some pelvic parameters in a Nigerian population whether they can be a good source of sex discrimination and also to get normative values to juxtapose whether the pelvis is adequate enough for normal vagina delivery.

MATERIALS AND METHODS

Materials

Materials used for this study include sliding vennier caliper, meter rule, pencil, X-ray viewing box, pelvic radiographs.

Research Design

This is a prospective cross-sectional study of pelvic parameters from patients investigated in Radiology Department of seven (7) University Teaching Hospitals in Nigeria.

Study Population

A total of 1500 Anterior posterior pelvic radiographs were measured (703 males and 797 females between ages 25-45years); which were distinguished as either masculine or feminine gender on the radiographs and reinforced by gender details which was in the patient information card.

Radiographs were viewed with the help of an x-ray viewing box on which radiographs was placed before any measurement.

Inclusion Criteria

1. Only radiographic films that showed the complete pelvis were used.
2. Radiographic films used were free from disease conditions and break in the continuity of the pelvis and sacrum.
3. Only radiographs showing completely ossified pelvic were used.

Exclusion Criteria

Fractured, not completely ossified pelvic radiographs were excluded

Sample and Sampling Technique

Convenient sampling technique was used.
Minimum sample size was calculated using (Moazzam, 2014 formula).

$$n=Z^2 (P\ q)/d^2$$

Where,
n= minimum sample size
Z= the standard normal deviate (Standard Error) at 95% confidence level =1.96
p= proportion of the target population (estimated percentage of the population), if no estimate set as 0.5
q= 1-p
d or e= absolute precision or accuracy(acceptable sample error); set as 0.05
n=384

Nature And Source of Data [Study Area]

Samples were collected from Radiology Department of the University of Port Harcourt Teaching Hospital (UPTH), Braithwaite Memorial Hospital (BMH) Port

Harcourt, Federal Medical Center (FMC) Yenagoa, Niger Delta University Teaching Hospital (NDUTH) Okolobiri Bayelsa State, University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu State, National Orthopedic Hospital Igbobi Lagos, University of Abuja Teaching Hospital (UATH) Gwagwalada, FCT, Nigeria.

Methods

Pelvic Width

This is the measured breadth from the anterior superior iliac spine to posterior superior iliac spine on one side of the pelvis according to (Gupta and Arora, 2013).

Fig 1: Measurement of pelvic width (mm).

Total Pelvic Width

The breadth of entire pelvis. The maximum distance between the outer lips of the iliac crests (Gupta and Arora, 2013). It is the breadth between anterior superior iliac spines.

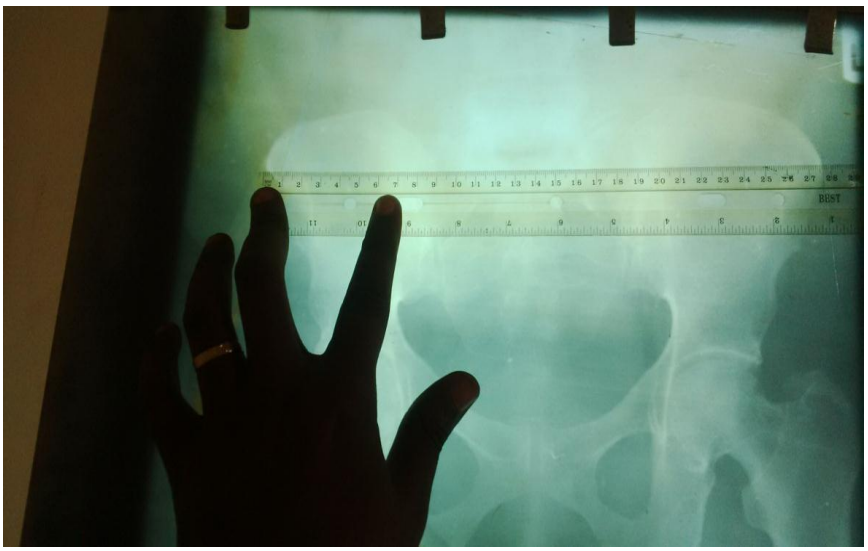

Fig 2: Total pelvic width measurement (mm).

Pelvic Height

It is height of entire pelvis. This is the measured distance between the most superior part of the iliac crest and the tuberosity of ischium (Gupta and Arora, 2013) method.

Presentation of Data

The presented results are based on the methods with which data was collected and analyzed. The mean, standard deviation (S.D), and standard error (S.E) were presented for all linear (metric) measurements and the calculated indices of the pelvic parameters of Nigerians. 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 was analyzed statistically (for Descriptive statistics) using SPSS software version 20.0

for windows. Z -Test was used and ($p<0.05$) was considered significant. All linear measurements were taken in millimeters for every parameter.

RESULTS

Table 1: Comparison of Mean Values of Nigerians Pelvic Parameters.

S/N	PARAMETER	Males	Females
1.	Pelvic Width (mm)	112.07±0.33	109.18± 0.32
2.	Pelvic Height (mm)	223.43±0.45	215.68± 0.45
3.	Total Pelvic Width	297.36± 0.66	297.75± 0.67
4.	Pelvic Index (%)	199.52±0.28	198.37± 0.59
5.	Total Pelvic Index	75.17±0.03	72.70± 0.18

Key: All values= Mean ± S.E

Table 2: Statistical Test for Significance between Nigerian Males and Females.

S/N	PARAMETER	Calculated "Z"	Inference
1.	Pelvic Width (mm)	6.28	P<0.05*
2.	Pelvic Height (mm)	12.17	P<0.05*
3.	Total Pelvic Width	0.41	p>0.05
4.	Pelvic Index	1.75	P>0.05
5.	Total Pelvic Index	13.4	P<0.05*

*Key: * = Statistically Significant.*

Table 3: Demarking Points and Percentages of Nigerians Pelvic Parameters Using (Jit and Singh, 1966 Formula).

S/N		Sex		Mean± SD	Mean± 3SD	D.P	%
1.	Pelvic Width (mm)	M	112.07±8.75	85.82	138.32	>136.3	1.00%
		F	109.18±9.04	82.06	136.3	<85.82	1.00%
2.	Pelvic Height (mm)	M	223.43±11.85	187.88	258.98	>253.78	1.00%
		F	215.68±12.70	177.58	253.78	<187.88	1.00%
3.	Total Pelvic Index	M	75.17±0.74	72.95	77.39		
		F	72.70±5.14	57.28	88.12	>77.12	9.30%

Note: S.D= Standard Deviation, D.P = Demarking Points, % = Percentage.

Table 4: Comparison of Mean Values of Pelvic Parameters between Present and Previous Studies.

Parameter	Sex	Present study Nigerians	Gupta and Arora (2013) Gujarat Region	Geneva Foundation for Education and Medical Research (2015)
Pelvic Width (mm)	M	112.07±8.75	137.31	
	F	109.18±9.04	133.24	
Pelvic Height (mm)	M	223.43±11.85	193.85	
	F	215.68±12.70	179.45	
Total Pelvic Width (mm)	M	297.36±17.40	250	
	F	297.75±18.99		
Pelvic Index (%)	M	199.52±7.54	141.18	
	F	198.37±16.72	134.68	
Total Pelvic Index (%)	M	75.17±0.74		
	F	72.70±5.14		

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

DISCUSSION OF FINDINGS

The mean values of pelvic width for males and females are 112.07±8.75 and 109.18±9.04; statistical significant difference exists ($p<0.05$) in their mean values.

The results of mean values of pelvic height for Nigerian males and females are 223.43 ± 11.85 and 215.68±12.70. Their difference is statistical significant ($p<0.05$).

The values of the mean total pelvic width for Nigerian males and females are 297.36±17.40 and 297.75±18.99. No statistically significant difference ($p>0.05$).

The mean values of pelvic index for males and females are 199.52±7.54 and 198.37±16.72. No statistical significant difference existed ($p<0.05$).

The outcome of the mean values of total pelvic index for males and females are 75.17±0.74 and 72.70±5.14. There is mean significant difference in this calculated layer of the pelvis ($p<0.05$).

In this present study, the males have a higher pelvic width and height than the females. This finding is in corroboration with Gupta and Arora (2013) findings of the Gujarat Region of which the males have a higher pelvic height and width than the females (table 4). There is sexual difference from present findings ($p<0.05$). Taking in to account the ratio of pelvic height to width, the males possess higher values as compared to the value of the females. The demarking points for males and females were >136.30 and <85.82. Only 1% each for males and females could be assigned sex with the pelvic width (table 3). For pelvic height the demarking points are >253.78 for males and<187.88 females. In line with the width, pelvic height could only assign 1% each for males and females in identifying sex (table 3). Comparing the values of Nigerians with the Gujarat people (Indians); the Gujarat people have a wider hip than the Nigerian for both males and females which showed that racial, genetic, nutritional above all environmental factors have come into play. These results also affirm the findings of Segebarth-Orban (1980) and Davivongs (1963) study of Australian Aborigine.

For total pelvic width, the females value is higher when it is compared with the value of the males ($p>0.05$). Results from the mean pelvic index showed that, the males have a higher value than the females ($p>0.05$) as shown in (table 1).

Also in this present study, the total pelvic index for the males are greater than the value of the females ($p<0.05$) this shows the existence of sexual dimorphism. The demarking point for females is >77.12; sex could be assigned to 9.3% of the females. The males could not be assigned to sex (table 3).

CONCLUSION

The pelvis have shown to be a good estimator of sex for forensic settings with clear demarking points. In addition, it has shown that wide pelvis has a significant role in culture aesthetics and aesthetic ergonomics. Specifically the steatopygic nature of the Nigerian women. This study is of great importance to prosthetic engineers, orthopaedic surgeons, forensic anthropologists and obstetricians.

REFERENCES

1. Davivongs, V. The Pelvic Girdle of the Australian Aborigine: Sex differences and sex determination. *American Journal of Physical Anthropology*, 1963; 21(4): 443-455.
2. Ellis, H., Mahadevan, V. Clinical Anatomy. Applied Anatomy for Students and Junior Doctors. 12th Edition, Wiley- Blackwell, 2010; 132-165.
3. Geneva Foundation for Education and Medical Research. Contracted Pelvis. Obstetrics Simplified - Diaa M. EI-Mowafi. Edited by Aldo Campana, 2015.
4. 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.
5. Jack, C. Determining Sex. Analyzing the Body. Basic Human Anatomy - O'Rahilly, Müller, Carpenter & Swenson, 2015.
6. Jit, I., Singh, S. Sexing of Adult Clavicle. *Indian Journal of Medical Research*, 1966; 54: 551-571.
7. Johnson, D. R., O'Higgins, P., Moore, W. J., McAndrew, B. Determination of Race and Sex of the Human Skull by Discriminant Function Analysis of Linear and Angular Dimensions. *Forensic Science International*, 1989; 41: 41-5.
8. Kristina, R.G. Forensic Anthropology. Estimating sexual Dmorphism from Sternal Rib Ends, 2009.
9. Macaluso, J.P. Sex determination from the acetabulum: test of a possible non-population-specific discriminant function equation; *Journal of Forensic and Legal Medicine*, 2010; 17(6): 348–351.
10. Macaluso, J.P. Metric sex determination from the basal region of the occipital bone in a documented French sample. *Bulletins et memoires de la Societa d' anthropologie de Paris*, 2011; 23(102): 19-26.
11. Moazzam, A. Sampling and Sampling Size Estimation. World Health Organization, Swizerland. Presented at Geneva Foundation for Education and Medical Research, 2014.
12. Osunwoke, E. A., Olotu, E. J., Allison, T. A., Oriji, C. N., Mbadugha, C. C. The Discriminant Formula for the Determination of Sex of Adults in a Nigerian Population (Using Pelvic Radiographs). *Journal of Natural Sciences Research*, 2013; 3: 6.
13. Patil, K.R., Mody, R.N. Determination of sex by discriminant function analysis and stature by regression analysis: a lateral cephalometric study. *Forensic Science International*, 2005; 147(2-3): 175-180.
14. Patriquin, M.L., Steyn, M., Loth, S. R. Metric analysis of sex differences in South African black and white pelvis.Department of Anatomy, University of Pretoria, P.O. Box, 2034; Pretoria 0001.
15. Segebarth-Orban, R. An evaluation of the sexual dimorphism of the human innominate bone. *Journal of Human Evolution*, 1980; 9: 601-617.
16. Stewart, T.D. "Medico-legal Aspects of the Skeleton. Sex, Age, Race and Stature." *American Journal of Physical Anthropology*, 1948; 6: 315-322.
17. Steyn M. and Patriquin M.L. Osteometric Sex Determination from the Pelvis- Does Population Specificity Matter?. *Forensic Science International*, 2009; 191(1-3): 133.el-113.e5.

18. Wood, W. B. Sex Determination from the Skeleton, the University of Queens land, 2002.
19. Zagga, A. D., Ahmed, H. O., Ismail, S. M. and Tadros, A. A. Molecular sex identification of dry human teeth specimens from Sokoto, Northwestern Nigeria. *Journal of Forensic Dental Science*, 2014; 6: 132-8.