

## Comparative Study of the Sub-pubic Angles of Adult Ijaws and Igbos

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**Abstract:** This aim of this study was carried out to solve the aforementioned problems and to provide a comprehensive data for use by anthropologist and medical practitioner. Two hundred anteroposterior pelvic radiographs of adult indigenous Ijaws and Igbos aged 20-65 years were studied to determine their sub-pubic angle. The angle ranged from 91° -123° and 74-111° for male Ijaws and Igbos respectively, while for female Ijaws and Igbos ranged from 100-146° and 90-140° respectively. The standard deviation of 12.06 and 12.85 were for female Ijaws and Igbos respectively. Women had significantly wider angle than men ( $p < 0.05$ ) due to childbearing factor as indeed, has previously been shown in other population group studied. The value of the sub-pubic angle in adult Ijaws and Igbos can be said to be obtuse in females, but overlap between acute and obtuse in males. Using the watershed sub-pubic angle derived from mean of previously documented studies and present study, 62.5% of Nigerians, 63% of Ugandan, and 71% of Malawians could be accurately assigned to the black race. The study has demonstrated not only sexual but also regional variability of this angle among Ijaws and Igbos and among different population groups. This study is important and is therefore recommended to obstetricians, physical and forensic anthropologists especially in developing countries.

**Key words:** Sub-pubic angle, sexual, racial, regional variation, ethnic group, anthropology.

### INTRODUCTION

The sub-pubic angle is the angle that exists between the inferior rami and below the pubic symphysis in an articulated bony pelvis. It is also referred to as pubic arch (Keith and Dalley 1999; Harold, 1974). It has been observed that the size of the sub-pubic angles determines the size of birth canal which is an important criterion in vaginal delivery. The sub-pubic angle is more angular in male being 50-60° and in female more rounded, usually 80-85° (Harold, 1974).

When the vagina admits 3 fingers side by side, the sub-pubic angle is said to be sufficient to permit passage of foetal head after it has passed through the pelvic outlet (Keith and Dalley, 1999). When the need arises to determine the identity of an unknown skeleton, the skull were often, the first bone of the choice and an accuracy of about 80-90% has been reported (Igbigbi and Nanono, 2003). However the skull is not always available, but because it had been suggested that the shape of the pelvic may correlate with that of same extension (Schultz, 1999).

Attempts to sex an unknown pelvis using one criterion alone for example, could determine sex in 70% of the cases while several criteria could give 90-95% accuracy (Phenice, 1969). The ischio-pubic index for instance, produced values of 83.7-100% for adult white Americans and when correlated with dimensions of the sciatic notch, sex of 98% of the pelvis could be deduced (Phenice, 1969).

In a recent study of indices of Malawian subjects, sex could be accurately assigned to 87.8% for males and 100% females using X-ray films and 92.3% males and 100% female using skeletal bones (Igbigbi and Msamati, 2000). When the pelvis is used with the skull, it produces an accuracy of sex determination of 98-100% (Phenice, 1969).

Nevertheless, assessment of sex isolated and often incomplete human remains cannot always be certain. No significant differences have been seen to exist between the studies from skeletal remains. Radiological pelvimetry has become the most popular redefined technique in assessing obstetrics and forensic problems such as sexing and identification of skeletal remain which are usually mostly established from the pelvis (Borell and Fernstrom, 1960).

Despite the anthropological and forensic importance of the sub-pubic angle, only a few studies exist in sub-Saharan African population (Inuwa, 1992; Nwoha, 1992). Report in sub-pubic angle of Nigerians show a mean sub-pubic angle of 91.87° and 115.49° for male and female Nigerians respectively (Oladipo, 2006).

There is less report on the sub-pubic angles of Ijaws and Igbos. Thus, this study was carried out to solve the aforementioned problems and to provide a comprehensive data for use by anthropologist and medical practitioner.

## MATERIALS AND METHODS

The study was conducted to document the sub-pubic angles of adult Igbos and Ijaws in Nigeria and to compare result for possible differences. The study was carried out between February and April, 2008. In the measurement of the sub-pubic angle the following material were used: goniometer, a marker, an x-ray view box and anteroposterior radiographs. X-ray of 107 females and 93 males aged 20-65 years were examined from the archives of the University of Nigeria Teaching Hospital and Braithwaite Memorial Hospital, Port Harcourt. Only radiograph with the best alignment at the inferior margin of the pubic bones at the pubic symphysis were measured. This is because misalignment is best determined at the lower margin (Lusted and Keats, 1978). These radiographs were taken at a distance of 100cm in the anterior posterior view.

The angle was measured by placing each radiograph on an x-ray view box for clear visualization. A point was chosen at the inferior midline of inter-pubic disc and two tangential lines drawn at the inferior border of the pubic rami intersecting at an angle of the chosen point. Goniometer was placed over the intersection of these two lines and the angle measured.

The sex and age of the subjects shown in the radiograph jacket together with the angle were recorded. The results were compared with previous studies on Caucasian, Amerindians, Malawians and Ugandans analyzed with discrete statistics. Sex was determined by using the demarking point method. This method involves calculating the maximum and minimum limit of range of the sub-pubic angle by using the formula,  $\text{mean} \pm 2$  standard deviation (SD).

## RESULTS and DISCUSSION

The mean sub-pubic angles in males were  $109.38^\circ \pm 10.00$  and  $95.29^\circ \pm 10.52$  for Ijaws and Igbos respectively while  $119.48^\circ \pm 12.06$  and  $111.44^\circ \pm 12.85$  were recorded for female Ijaws and Igbos respectively. Women had significantly wider sub-pubic angle than men ( $p < 0.05$ ) (Table 1).

The highest frequency occurred at 91-100° class limits for both Ijaw and Igbo males and 101-110° class limit for both Ijaw and Igbo females (Table 2). The Table 2 also shows the mean angle for the corresponding class limit for both male and female in each class range.

Table 3 compares the ranges, mean and the demarking points of sub-pubic angle in Ugandans, Malawians, Nigerians, Ijaws and Igbos. The mean sub-pubic angles for Ijaws were higher than those of the Igbos for both males and females.

The result from this study confirms the existence of sexual and regional variations in the sub-pubic angle amongst the Ijaws and Igbos. Subjects sampled ( $p < 0.05$ ) as had been shown in the previous studies or Amerindians, White and Black Americans, Caucasians,

Ugandans, and Malawians (Igbigbi and Nanono, 2003). Also the degree of sexual dimorphism in the sub-pubic angle of Nigerians of  $23.62^\circ$  lies the 20-40° range previously reported for Amerindians, white American, Europeans and Malawians.

Significant difference were also found to exist in the sub-pubic angle between Ijaws and Igbos and other races in both sexes ( $p < 0.05$ ). This study has shown that the sub-pubic angle as described Harold (1974) with males being an acute angle of about  $60^\circ$  and females being a right angle of slightly greater than  $90^\circ$  is actually true and applicable to the Europeans not Africans and precisely not Nigerians as, thus confirming racial variability.

Races were assigned from the overall mean for each racial group (Table 4). From this mean, using the watershed pubic angle of  $76.05^\circ$ ,  $80.25^\circ$ , and  $98.1^\circ$  races were assigned as follows:

- Sub-pubic angles of more than  $76.05^\circ$  to less than  $80.25^\circ$  indicated white Americans.
- Sub-pubic angles of more than  $80.25^\circ$  to less than  $90.21^\circ$  indicated Africans.
- Sub-pubic angle more than  $98.21^\circ$  indicated Africans.

From this study, the Ijaws and Igbos had an overall mean of greater than  $98.21^\circ$  as assigned to Africans and thus can be assigned to the black race.

The presence of sexual, racial and regional variability of the sub-pubic angle could possibly be explained on genetic, dietary and environmental factors. Although, samples demonstrated significant differences between sexes, racial and regional variations. There would always be individual variation in pelvic structure within a given population which could explain why the subject did not show 100% accuracy in sexual and racial variability of the sub-pubic angle.

The relationship between age and pelvimetry has also been given attention. Report shows that the sub-pubic angle was significantly greater in older age group (46-70 years) Nwoha (1992) than in younger age group (21-45 years) of Nigerians (Oladipo, 2006)  $p < 0.05$ . In clinical practice however, individual measurement of a female patients are more significant than the estimated mean, since an obstetrician is more concerned with comparison between the mother's dimension and foetal head. The proper dimensions are those of the gynaecoid pelvis which meant to be the normal phenotype in women, although it may vary.

## CONCLUSION

This study has established the presence of sexual dimorphism in the sub-pubic angle of Ijaw and Igbo ethnic groups of Nigeria and also racial and regional variations. Thus, the value of the sub-pubic angle among Ijaws and Igbos can be said to be obtuse in females but overlap between acute and obtuse in males.

Table 1: The number of case (n), range, mean, SD, & SE of the sub-pubic adult Ijaws and Igbos.

Subjects	N		Range(°)		Mean(°)		S.D		S.E	
	Ijaws	Igbos	Ijaws	Igbos	Ijaws	Igbos	Ijaws	Igbos	Ijaws	Igbos
Male	38	55	91-123	74-111	109.38	95.29	10.00	10.52	1.62	1.57
Female	62	45	100-146	90-140	119.48	111.44	12.06	12.85	1.53	1.73

S.D=Standard Deviation, S.E=Standard Error

Table 2: Frequency distributions of various class limits and their individual mean angles for males and females Ijaws and Igbos.

Class limit	Frequency Male(n=83)		FrequencyFemale(n=117)		Mean angle(°)Male		Mean angle(°)Female	
	Ijaws	Igbos	Ijaws	Igbos	Ijaws	Igbos	Ijaws	Igbos
71-80	0	7	0	0	0	77.71	0	0
81-90	0	13	0	1	0	86.08	0	90
91-100	19	14	2	5	96	96.64	100	96.2
101-110	16	9	26	15	105.5	105	106.35	106.06
111-120	2	2	15	15	113	111	115.53	115.47
121-130	1	0	10	12	123	0	113.50	124.5
131-140	0	0	8	7	0	0	135.50	136.43
141-150	0	0	1	0	0	0	146	0

n=frequency

Table 3: The ranges, mean and the demarking points of sub-pubic angle In Ugandan, Malawians and Nigerian previously studied with similar methods for Ijaws and Igbos.

Sub-pubic angle(°)	Range(°)	Mean ±S.D	Mean±2S.D	Demarking point	Identification of sex
Malawians					
M(n=75)	66-150	99.16±15.73	67.71±130.62	<99.95	67.12
F(n=48)	86-174	129±14.19	99.95±158.19	>130.62	63.02
Ugandans					
M(n=110)	50-140	93.86±21.12	51.52±136.1	<80.53	31.82
F(n=95)	75-155	116.11±17.79	80.53±151.69	>136.10	10.53
Nigerians					
M(n=99)	74-123	91.87±10.60	70.67±113.07	<92.33	56.57
F(n=101)	90-146	113.49±11.38	92.33±138.65	>113.07	53.47
Ijaw					
M(n=38)	91-123	109.38±10.00	98.38±129.38	<95.36	78.95
F(n=62)	100-146	119.48±12.06	95.36±143.6	<129.38	14.52
Igbo					
M(n=62)	74-111	95.29±10.58	75.96±116.04	<85.74	26.67
F(n=55)	90-140	111.44±12.85	85.74±137.14	>116.04	52.73

M=Male, F=Female, S.D= Standard deviation

Table 4: Mean sub-pubic angles between sexes in various population groups

Population group	Sex	n	Mean±S.D	Overall MA(°)	P	Authors
Amerindians	M	253	67.4±81	80.25	<0.05	Tague,1989
	F	212				
White Americans	M	50	63.7±7.8	76.05	<0.05	Tague,1989
	F	50				
Black Americans	M	50	65.8±8.7	88.4±8.5	<0.05	Tague,1989
	F	59	85.2±8.5			
Caucasians	M	-	<60	(s)		Caldwell & Moloy,1933
	F	-	<90			
Black Malawians	M	73	99.2±15.7		<0.051	gbigbi & Msamati, 2000
	F	46	129.1±14.6			
Black Ugandans	M	110	93.86±21.12		<0.05	Igbigbi & Nanno, 2003
	F	93	116.11±17.79			
Nigerians	M	99	91.87±10.66		<0.05	Oladipo, 2006
	F	101	115.49±11.58			
Ijaws	M	38	109.38±10.00		<0.05	Preseant Study
	F	101	119.48±12.06			
Igbos	M	55	95.29±10.52		<0.05	Preseant Study
	F	45	111.44±12.85			

MA=Mean angle, S.D=Standard deviation, M=Male, F=Female, n=frequency, s=significant

The high level of accuracy of this non-invasive method cannot be over emphasized, and it is thus recommended to obstetricians, physical and forensic

anthropologists for sex and race determination in developing countries while more sophisticated methods are awaited.

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