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Collodiaphyseal Angle of the Femur in Normal Nigerians of the South Eastern Zone

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ABSTRACT
We measured the collodiaphyseal angle (CDA) from normal X-radiographs of one hundred and ten (110) patients attending radiology department of the University of Nigeria Teaching Hospital, Enugu, Nigeria. The mean angles for males were 132.9^0 $\pm 4.185^0$ and 129.99^0 $\pm 4.107^0$ for females. In males, the mean angles for right and left hips were 131.1^0 $\pm 4.215^9$ and $132.75.2^0$ $\pm$ 4.146^0 respectively. In females, the values for right and left were 129.98^0 $\pm 4.180^0$ and 130^0 ± 4.043. The angles were higher in males than in females. In both sexes, there were no significant difference between the right and left angles. Comparison of our results with earlier data from other parts of the Country did not show remarkable changes in the angle over a period of nearly two decades. These preliminary findings provide base line data on the value of this angle in our environment; the South Eastern zone of Nigeria. It is hoped that this data will enhance our on-going studies (on application of this angle) in the management of the pathological conditions arising from its variations among Nigerians.

INTRODUCTION
The neck of the femur connects the head to the shaft. It runs infero-laterally to meet the body at an angle of about 125[1]. The neck is limited laterally by the greater trochanter and is narrowest at the center. It is frequently fractured in older persons. The neck has several pits especially postero-superiorly for entrance of blood vessels and so has four possible sites of fractures. These include sub-capital, the cervical, the basal and the pertro-chanteric sites.

There is age related pattern of the hip injuries from birth to puberty, for example, children usually sustain greenstick injuries of the femoral neck, schoolchildren may displace the epiphysis of the femoral neck while in adults, there is usually dislocation of the hip as a result of the fracture of the femoral neck. These fractures can lead to shortening of the limb due to sharp contraction of the extremely strong surrounding muscles and/or may lead to a decrease in the angle sustained by the femoral neck to the shaft. This condition is referred to as coxa vara deformity. Increase in this angle as a result of impacted abduction fractures is referred to as coxa valgus.[2] Some authors had earlier reported that the angle was smaller in shorter bones than in longer ones, and in wider pelvis than in narrower ones[3]

Several studies have been done to establish the collodiaphyseal angle in parts of Nigeria. Singh et.al[4] in Calabar, South South zone and Nwoha[5] 1991 in Ile-Ife, South West zone and Tahir et al[6] 2001 in North Eastern Nigeria. All the authors reported higher values of CDA in the right femur compared to the left and in males than in females. They also observed regional variations from one region of country to another.

Some studies have focused on the use of this angle and other femoral head parameters as indices for identifying post mortem remains. Nwoha[5], has established limits identification points (IP) for sexing and racial differentiations of post mortem bone specimens

As a result of the importance of the role played by this angle in orthopedic and cosmetic surgeries and forensic medicine, we have used x-radiographs of patients attending x-ray examinations of the hip in UNTH, Enugu to measure these angles on Nigerian population from the South East Zone of the Country. Our findings will serve as a base line data on our on-going studies on the role of this angle in the management of disease conditions arising from its variations among Nigerians.

MATERIALS AND METHODS
Normal antero-pelvic radiographs of patient's hips who attended the departments of radiology of the University of Nigeria Teaching Hospital in Enugu were selected for this study. The number of radiographs that satisfied the purpose of this study

was one hundred and ten AP views of X-ray films, taken at FFD of 100 cm with the feet directed slightly medially.

A meter rule and protractor were used. The neck-shaft angle was measured using the methods described by Singh et.al[4] and Nwoha[5]. The axis of the neck was determined by joining the line drawn through the mid-axis of the maximum diameter and mid-axis of the minimum diameter of the head of femur. The axis of the shaft was determined by measuring the transverse diameter of the shaft of the femur at a appoint just below the level of lesser tronchanter and recording its mid axis. Similarly, the transverse diameter of the shaft at a point away from its distal end was measured and its mid-axis noted. A line joining the two mid axis gives the axis of the shaft. The angle enclosed by the axis of the neck and that of the shaft is the collodiaphyseal angle.

RESULTS

Table 1 shows that the mean angles for males were 132.9 ±4.185 and 129.99 ±4.107 for females. In males, the mean angles for right and left hips were 131.1^0 ±4.215 and $132.75.2^0$ ± 4.146 respectively. In females the values for right and left were 129.98^0 ±4.180 and 130^0 ±4.043. The angles were higher in males than in females. In both sexes, there were no significant difference between the right and left angles as shown in Table 2. Table 3 is a summary of the collodiaphyseal angles measured in different zones of Nigeria.

Collodiaphyseal angles in males in this study were found to be significantly higher than those of females. These findings are in support of data in the literature[5] The reason for smaller angles in females has been explained to be due to wider pelvis, greater bi-condylar angle and shorter length of the femora in females[6]

Our results showed that in each of the sexes, the angle of the right femora were higher than left angles but the differences were not significant as also found by some author[7]. However, other works[8] did reveal significant differences between the right and left angles in both sexes.

Analysis of results from the Southern and Northern parts of the Country showed the values in the North were higher than those from the South in all parameters measured. However, the differences were not significant.

Males in the South (East, West and South) generally, have higher angles than females. Females from South, South has lowest angles recorded in this study. South East male right angles, were slightly lower than those of South West and South South. South West right angles in males and females were higher than those of South South zone. Comparison of the mean collodiaphyseal angle in studies made in Nigeria shows that there has been no significant change in pattern of variation for over approximately two decades.

DISCUSSION

Table 1. Collodiaphyseal angles showing statistical readings.

Sex	Side	No	Range	Mean	SD	SE	T	P
M	RT	50	123-141⁰	133.1⁰	4.215	0.6	3.85	‹0.001*
	LT	50	122-=141⁰	132.75⁰	4.146	0.59	3.48	‹0.001**
F	RT	60	121-137⁰	129.98⁰	4.180	0.54		
	LT	60	119-136⁰	130⁰	4.034	0.52		

* When compared to that of the female right femur.
** When compared to that of female left femur.

Table 2, Mean collodiaphyseal Angle (110): 50 males and 60 females

Sex	No	Range	Mean	SD	P
M	50	122-141^0	132.9^0	4.18	‹0.001*
F	60	119-137^0	129.99^0	3.148	‹0.001**

* When compared to the female.
** When compared to the male.

Table 3. Comparison of mean collodiaphyseal angles in the Nigerian population.

	MALES		FEMALES	
Locations	Right	Left	Right	Left.
S. West 1991	133.7^0	132.9^0	131.7^0	130.2^0
South South 1986	132.6^0	133.0^0	126.2^0	126.3^0
North East 2001	136.0	137.8	131.0	130.5
S. East 2005 - present study	133.1^0	132.75^0	129.9^0	130.00^0

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