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THE ABDOMINAL CIRCUMFERENCE OF NEONATES AT BIRTH AND ESTABLISHED ULTRASOUND VALUES IN RELATION TO GESTATIONAL AGE

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THE ABDOMINAL CIRCUMFERENCE OF NEONATES AT BIRTH AND ESTABLISHED ULTRASOUND VALUES IN RELATION TO GESTATIONAL AGE

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ABSTRACT

Background: Accurate estimation of Gestational age is important in obstetrics. The abdominal circumference is a tool in foetal biometry used to predict gestational age with ultrasound.

Objective: To determine the accuracy of established ultrasound values in estimating Gestational age of foetuses in Nigeria by comparing with the abdominal circumference of neonates measured at birth.

Design: A cross-sectional study.

Setting: The labour ward of Central Hospital Warri, in Delta State of Nigeria.

Subjects: Newborn Neonates who were up to term.

Results: Significant correlation between the abdominal circumference and gestational age was reported. A regression model for prediction of gestational age using the foetal abdominal circumference was deduced from the study. The study showed a Mean \pm SD of gestational age and abdominal circumference of 38.18 ± 2.35 wks and 29.87 ± 2.36 respectively for Nigerian population and 27.74 ± 7.45 wks and 23.25 ± 7.87 for the established ultrasound values. There was also a significant difference ($P < 0.05$) between the abdominal circumference of Nigerian neonates and the established ultrasound values.

Conclusion: The abdominal circumference of Nigerian neonates in relation to gestational age was higher than that of the established ultrasound values. Therefore the established ultrasound values should not be generalised for obtaining gestational age in Nigeria.

INTRODUCTION

Gestational age is defined as the period from the first day of last menstrual period to date of delivery. This is usually measured in weeks (1). Making appropriate decisions concerning the baby requires accurate determination of gestational age. For example, proper diagnosis and management of preterm labour and post date pregnancies are only possible when gestational age is accurately estimated. Antenatal test interpretation is dependent on accurate determination of gestational age because it provides valuable information on the development of the baby and therefore affects the medical treatment plan for the baby (2).

At present, gestational age is determined by the last menstrual period (LMP) and ultrasound scan (3). In cases where the last menstrual period is difficult to obtain, LMP is not a reliable method of determining gestational age and ultrasound is most

common recommended (4).

Conventional practice of ultrasound scan in determination of gestational age is based on biometric measurement of the foetus (5) and is then compared with a gestational age specific reference (6). This gestational specific reference is as obtained from the area of calibration, which may or may not be a different environment from the environment the ultrasound machine is being used in.

In the first trimester, gestational sac mean diameter and crown rump length measurements are used to evaluate gestational age (7-8). In the second and third trimesters, foetal head, body and extremity measurements have been most common used to assess gestational age. The parameters most common measured include the bi-parietal diameter (9), head circumference, abdominal circumference and femur length (10).

Abdominal circumference of foetus is defined as the distance around the outer edge of a baby's

abdomen and when measured accurately, it is an important tool for assessing foetal growth (2).

The established ultrasound values used to estimate gestational age with the abdominal circumference of foetus is based on Caucasian studies. Although it is widely used, few studies have been done to determine the accuracy of the established ultrasound values in estimating gestational age among Nigerians.

This study aims to determine the accuracy of the established ultrasound values in estimating gestational age amongst Nigerians by comparing with abdominal circumference of neonates measured at birth.

MATERIALS AND METHODS

The Approval for the study was sought and obtained from Central hospital Warri and the Department of Anatomy, Delta State University ethics committee.

The simple random sampling technique was used in this study. The study was carried out at the labour ward of Central Hospital Warri in Delta State of Nigeria. The subjects were newborn babies

who were up to term with mothers having history of regular menses, and knowledge of dates of the beginning of last menstrual period. Twins, malformed neonates, neonates small or large for gestational age and neonates of mothers with diseases known to affect normal foetal growth for example diabetes mellitus, chronic hypertension were excluded from the sample.

The newborn neonates were laid on a flat surface and a measuring tape calibrated in centimeter (cm) was used to measure their abdominal circumference. The abdominal circumference was measured by placing the measuring tape round the foetal abdomen at the umbilical level.

The gestational age of the neonate at birth was obtained from the maternal case note. It was calculated using the mother's menstrual history i.e. using the first day of her last menstrual period.

Data analysis was done using statistical package for social sciences (SPSS). The data obtained were subjected to statistical analysis using descriptive statistics (standard deviation and mean), test of significance (t-test), and correlation and regression coefficients. Values at $P < 0.05$ were considered

statistically significant.

RESULTS

Table 1

The descriptive statistics for gestational age and abdominal circumference

	N	Mean	S.D
Gestational age (weeks)	99	38.179	2.346
Abdominal circumference (cm)	99	29.874	2.360

Table 1 shows the total number of subjects (N=99), the mean and standard deviation of the Abdominal Circumference (cm) and Gestational Age (weeks).

Table 2

The correlation statistics of gestational age and abdominal circumference

	N	Correlation	Significance
Gestational age and Abdominal circumference	99	0.326	0.001

Table 2 shows that the correlation between gestational age (weeks) and abdominal circumference (cm) is 0.326 and it shows that the correlation is highly significant ($P=0.001$).

Table 3

The summary of the regression analysis

Correlation	P-value	Standard estimate of error	Significance
0.326	0.001	2.229	Significant

Prediction equation: $GA = 28.495 + 0.324(AC)$

Table 3 shows a correlation of 0.326 and significance of 0.001 showing that the correlation is highly significant ($P < 0.05$). A prediction equation was derived and this can be used to calculate gestational age when the

abdominal circumference is known.

Table 4
The comparison of the parameters measured and established values using independent sample t-test

Parameters	Data type	Mean	S.D	T	Df	P-value	Significance
Gestational age (weeks)	Study data	38.177	2.346	10.04	151	0.000	Significant
	X- data	27.735	7.446				
Abdominal circumference (cm)	Study data	29.874	2.360	6.04	151	0.000	Significant
	X-data	23.250	7.866				

This shows the test of significance between (study data) and x-data (established values). It shows that with $df = 151$ and $P\text{-value} = 0.000$, there was a significant difference between both data types compared ($P < 0.05$).

DISCUSSION

Accurate estimation of gestational age is important in obstetrics for a variety of situations. The foetal abdominal circumference is one of the parameters used to estimate gestational age and it is technically easier to obtain in the third trimester of pregnancy (10).

This study (table 2 and 3) showed that there is a significant difference and significant correlation between the abdominal circumferences and gestational ages of Nigerian neonates. This implies that an increase in gestational age has a correlational increase in abdominal circumference of foetuses in Nigeria. This result is consistent with the result obtained by Dare *et al.*, (11) that the relationship between the Gestational age and abdominal circumference as verified by a simple linear equation is a linear one.

The regression analysis in this study resulted in a formula (table 3), with which Gestational age can be calculated when the abdominal (12) that it was possible to predict the Gestational age from the knowledge of the abdominal circumference.

From table 4, the MeanSD values for Gestational age and abdominal circumference in this study were 38.18 2.35 and 29.87 2.36 respectively. The established values showed a Gestational age of 27.74 7.45 and Abdominal circumference of 23.25 7.87. There was also a significant difference ($P < 0.05$) between the abdominal circumference of Nigerian neonates and the established ultrasound values. This implies that Nigerian babies had a higher abdominal circumference in relation to Gestational age than Caucasians (established values). This variation may be due to geographical, genetic, racial or environmental factors. It could also be due to difference in menstrual cycles or due to difference in sample size. This contrasts the study conducted by Okonofua *et al.*,

(13) where it was found that when compared with Caucasians the foetal abdominal circumference values were consistently less in our Nigerian sample.

In conclusion, the findings of this study suggest that the abdominal circumference of Nigerian neonates was higher than those of Caucasians (established values) in relation to Gestational age. Therefore, the established values should not be generalised for obtaining Gestational age amongst Nigerians and when used, should be used carefully while predicting gestational age. Further Efforts should be made to make ultrasound scans calibration more enviro-specific.

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