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Determination of Gestational Age using Crown-Rump Length and its Associated Maternal Correlates in Igbos Living in Nnewi: An Ultrasound Study.

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Abstract

Purpose: The objective was to determine the accuracy of gestational age measured by CRL in fetuses of black women and also to identify the maternal factors affecting this accuracy in determining the gestational age by CRL measurement in fetuses of black women.

Methodology: This prospective cross-sectional study was conducted in Life and Trinity Specialist hospitals both in Nnewi, South-East, Nigeria. The gestational ages of the fetuses by CRL were determined using Siemens 2D ultrasound scan within 14 weeks and the accuracy compared with the gestational ages obtained from the Last Menstrual Period (LMP). Factors affecting the accuracy of CRL in determining the gestational age in women like the maternal heights and ages were measured. The ultrasound scan was done by a consultant in the department of Obstetrics. Analysis was done using SPSS Package version [20]. Regression analysis was used to compare dependent and independent variables. Paired t-test was carried out on gestation period by LMP and gestation period by CRL to know if the mean difference between the gestation period by LMP and gestation period by CRL is significant. Multiple correlation analysis was used to ascertain the degree of relationship between maternal weight and age and gestational age by LMP and CRL.

Findings: The result showed that two hundred and sixty-five women met the inclusion criteria but two were lost to follow up and two hundred and sixty-three were used finally for analysis. The accuracy of ultrasound scan in estimating the gestational age using CRL is within one week in majority of the cases. Maternal height, weight and age are poorly correlated to age of the fetus using the CRL. The fetuses of black women showed a marginal increase in length at gestational age below eight weeks but afterwards this difference is not pronounced. In conclusion, the accuracy of CRL in determining the gestational age is within one week in majority of cases. The maternal height and age are poorly correlated to the CRL of the fetus and thus to the gestational age.

Unique Contributor to Theory, Policy and Practice: Ultrasound scan incorporated with growth chart for fetuses of white women can be equally used to ascertain the gestational ages of fetuses of black women with insignificant difference

Keywords: Gestational Age, Crown-Rump Length, Maternal Correlates, Igbos Living In Nnewi, Ultrasound Study

INTRODUCTION

Crown-rump length is the measurement of the foetus from the vertex of the head to the apex of the buttocks. It should represent the longest length of the fetus excluding the fetal limbs and yolk sac. It is determined by placing calipers at the outer edge of the cephalic pole and the outer edge of the embryonic/fetal rump. For optimum accuracy in dating pregnancies, it is recommended that three independent CRL measurements be obtained and then averaged^{1,2}. The reported accuracy of CRL for estimation of gestational age depends upon the method used for validation (eg last menstrual period, known date of conception) and the gestational age when the measurement was obtained^{1,3}. Early and late first trimester CRL measurements (less than 9 mm and greater than 70 mm) are less precisely correlated with a specific gestational age so there is a wider confidence interval (CI) around the gestational age estimate at these times⁴. For this reason, some experts use the biparietal diameter (BPD) to estimate the gestational age after 10 weeks of gestation, but there is no consensus on this approach^{5,6,7}.

In practice worldwide, however, CRL is used for the majority of embryo/ fetuses in first trimester as there is consistently high-quality evidence supporting measurement of crown-rump length (CRL) as the best method of gestational dating^{8,9}. Once CRL can be measured, it should be used to estimate the gestational age instead of the mean sac diameter. Some authors stated that CRL gave the best prediction of gestational age between the gestational age of 5 and 14 weeks^{1,10}. Some other literatures observed that the estimation of gestational age using the CRL is most accurate when it is measured between 6 and 10 weeks of gestation since there is less biological variation and linear growth at that time^{11,12}. However, the growth rate in the first trimester does not appear to be linear¹³. There is seemingly a change in growth rate between 9 and 10 weeks of gestation. The 9 to 10-week mark betokens the ending of the embryonic period and the beginning of the fetal period with a shift from organogenesis to growth. CRL early in gestation is better visualized with transvaginal sonography (TVS) than with transabdominal sonography (TAS) but the transvaginal approach is not more accurate for determining gestational age^{14,15}. TVS is more useful in overweight/ obese women. As gestational age progresses, the CRL lengthens, the fetus curls up, and it is often difficult to get a straight-line measurement of the CRL due to its contour. This excessive curvature of the fetus may lead to erroneous reduction of CRL measurement and this usually occurs after 14 weeks. For this reason, measurement of the BPD or femur length (FL) may be used to determine the gestational age in some late first trimester fetuses.

Overtly, the inaccuracies of history and physical examination may limit their usefulness in the assessment of the gestational age. Methods that can predict with certainty the time of ovulation or conception can accurately establish gestational age (GA)^{16,17,18,19}. Timing of ovulation either by basal body temperature (BBT) recording or semi-quantitative assessment of Luteinizing hormone surge predicts GA within (+/-) 4 to 6 days. In vitro fertilization with known date of conception is likely the most accurate means of predicting gestational age (+/-) 1 day (Tunon *et al*, 2000). Nonetheless, in most pregnancies, the date of ovulation or conception cannot be

accurately predicted as outlined above and gestational age must be established by other methods of which the CRL is one of the most accurate within the first trimester^{21,22,23}.

This accurate determination of the gestational age is invaluable to the obstetric care and also in a variety of conditions. For instance, the level of alpha-fetoprotein in both the amniotic fluid and maternal serum is related to gestational age and when dates are inaccurate, test results will be incorrect and misleading²⁴. Similarly, the magnitude of increased optical density above baseline at 450 nm (delta OD 450) by amniotic spectrophotometric measurement is used to predict the severity of fetal hemolytic disease in pregnancies complicated by Rhesus isoimmunization^{25,26}. Properly identified GA via crown-rump length measurement is extremely important in fetal growth assessment. Fetal growth retardation or macrosomia may be missed or improperly diagnosed due to error in GA assessment²⁷. Interpretation of antenatal biophysical profile (BPP) may be subject to variation in gestational age as well. Some of the components of biophysical profile like fetal heart reactivity and fetal breathing develop with advancing gestational age, therefore the absence of these biophysical parameters may be misinterpreted as abnormal in fetuses whose gestational ages have been over-estimated²⁸. Appropriate decisions regarding presumed preterm labour or postdate pregnancies are possible when gestational age is properly estimated. Likewise timing of repeat caesarean section requires accurate assessment of gestational age^{29,30} to avoid preterm delivery or labour commencing in women with multiple caesarean section scars.

Black women are more likely to experience pregnancy-related disorders such as pre-eclampsia which are known to account for diminished fetal growth yet studies have shown that the rate of increase of CRL was greater in fetuses of black compared to white women and increased with advancing maternal age³¹.

STATEMENT OF PROBLEM

Ultrasound is an indispensable machine in the hands of Obstetricians. However, most of the indices used for measurement such as CRL were obtained from the white population and incorporated into the machine. This study ascertains if there is a difference between the index, CRL, in whites and blacks.

JUSTIFICATION OF THE STUDY

The study was chosen because most of the previous studies were done on white and Asian women. These studies done on non-black races constituted a research gap which was tried to be filled by this study. In addition, the question of whether it is justified to use ultrasound that was formatted using indices generated from white races had been laid to rest by this study.

1.4 AIM AND OBJECTIVES OF THE STUDY

The aim of the study is to determine the CRL and gestational age of fetuses of black women.

OBJECTIVES

1. To determine the relationship between the gestational age measurement by CRL in the fetuses of black women and their gestational ages by last menstrual period.
2. To determine the effect of age and height of mothers on gestational age by CRL and gestational age by menstrual period.
3. To assess the rate of growth of black fetuses and compare it with that of whites already known.
4. To determine the accuracy in weeks in which the CRL predicts the gestational age.

SIGNIFICANCE OF THE STUDY

This study upholds whether black women will continue using ultrasound developed for whites or have specially-designed ultrasound for them.

SCOPE/ DEFINITION OF TERMS

The study was conducted on reproductive age women attending antenatal care in life and Trinity Specialist hospitals, Nnewi between September 2016 and August 2017.

Some of the terms used were well explained in parenthesis.

MATERIALS AND METHODS

Study site

This study was conducted in Life Specialist hospital Ltd and Trinity Specialist hospital both in Nnewi. Life Specialist hospital is a specialist private hospital that serves as a referral center for many cases from Anambra State and environs such as Enugu, Abia, Delta, Imo, Ebonyi and Rivers States. It also has well-equipped radiological and ultrasound facilities which are at disposal of the antenatal women who access them. Trinity Specialist Hospital is a specialist hospital that is run by Obstetrician-Gynaecologist, Paediatrician and Radiologist. It also has well equipped radiological and ultrasound facilities which are at the disposal of the antenatal women who access them.

Study area

This study was conducted in the Nnewi North Local Government Area (NNLGA), one of the 21 local government areas in Anambra State. Nnewi is a semi-urban town and the headquarters of Nnewi North Local Government Area of Anambra State, South-east Nigeria. It is the 2nd largest city in Anambra State with an estimated population of 391,227 with women of reproductive age making 22% of its population (2007 Census) and area of 2,789km² giving a population density of about 140/km². It is a fast-growing town often referred to as the industrial and commercial hub in South-East Nigeria. The town has the largest motor and motor-cycle spare parts market in West Africa region. The occupation of the people is mainly trading (Emerson *et al*, 1989) and the population is predominantly Igbos. Nnewi also has a handful of professionals as staff in the numerous financial and health care institutions. The people are predominantly Christians with a few traditionalists.

Study population

The study population consisted of women of reproductive age between 17 and 44 years attending antenatal clinic (ANC) in Life and Trinity Specialist Hospitals, Nnewi.

Study design

The study was a descriptive cross-sectional study.

Inclusion criteria

1. Those who gave consent to the study.
2. Pregnant women who were within the first trimester.
3. Women of black race who were pregnant.

Exclusion criteria

1. Women carrying multiple pregnancy.
2. Congenitally abnormal pregnancy.
3. Pregnancy complicated with missed abortion.
4. Pregnant women suffering from gestational diabetes (GDM).
5. Hypertension in pregnancy.
6. Renal disease in pregnancy.
7. Sickle cell disease in pregnancy.

Sample size determination

The sample size for the study group was derived using the formula by Araoye (2003):

$$n = \frac{z^2 pq}{d^2}$$

n = minimum sample size

z = standard deviation usually set at 1.96

p = proportion of reproductive-aged women in the population³² = 0.22

q = 1-p

d = precision or degree of accuracy 0.05

$$n = \frac{1.96^2 \times 0.22 \times (1-0.22)}{0.05^2} = 265$$

Thus, minimum sample size = 265

Sampling technique

Simple random sampling without replacement was used to select the samples until the sample size was reached.

CRL measurement could be carried out trans-abdominally or trans-vaginally. A midline sagittal section of the whole embryo or fetus should be obtained, ideally with embryo or fetus oriented horizontally on the screen. An image should be magnified sufficiently to fill most of the width of

the ultrasound screen, so that the measurement line between the crown and rump is at about 90° to the ultrasound beam^{33,34}. Electronic linear calipers should be used to measure the fetus in a neutral (ie neither flexed nor hyper-extended). The ends of the crown and rump should be clearly defined and measures are put in place not to include the yolk sac or limbs. In order to ensure that the fetus was not abnormally flexed, amniotic fluid should be visible between the fetal chin and chest. In the very early gestation, it is not usually possible to distinguish between the cephalic and caudal ends and a greatest length measurement was otherwise taken.

An electronic weighing balance which had the component for measurement of height, calibrated in both centimeters and meters; and the weighing component calibrated in kilograms was used to weigh each individual patient and height taken as well. The age of the patient was retrieved from the folder.

Consecutive recruitment of patients is done until the sample size of 263 was reached which was needed for the study.

Data collection

Consecutive recruitment of pregnant women who gave consent was done using above-mentioned hospitals until the sample size is reached. For each patient, the following data were obtained: the crown-rump length of the embryo or fetus, gestational age, expected date of delivery was also noted. The other data required from the patients include their height, age and phone numbers which aided in reaching them when further information be required from them. The two-dimensional trans-abdominal ultrasound of 3.5MHz probe and 7.5 MHz transvaginal probe by Siemens[®] was used in this study. An electronic weighing scale from Mettler Tolado which had components for height and weight measurement was also used.

Data analysis

The data that was obtained in the study was analyzed using the statistical package SPSS version 20.0. Chi-square and cross-tabulations were used to compare proportions between variables. Statistical significance was set at p-values <0.05.

Limitation of the study

1. Some of the women in our environment booked late to antenatal care usually after 14 weeks when CRL measurement was not needed.
2. Some women did not give consent for the study.
3. There was paucity of work done on crown-rump length limiting literature search for the study.

RESULTS

Table 4.1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

The distribution of age among the women who participated in the study.

Variable	Frequency	Percentage (%)
Age (n=263)		
17-29 years	117	44.5
30-39 years	133	50.6
40 years and above	13	4.9
Total	263	100

PARITY

0	60(22.7)
1	94(35.8)
2	41 (15.7)
3	20(7.6)
4	13(4.9)
≥5	35(13.3)

GESTATIONAL AGE AT SCANNING

5-7	43(16.3)
8-10	100(38.0)
11-13	88(33.5)
13+	32(12.2)

LEVEL OF EDUCATION

No formal education	5(1.9)
Primary Education	13(4.9)
Secondary Education	177(67.3)
Tertiary Education	68(25.9)

MARITAL STATUS

Single	8(3.0)
Married	257(97.0)

In this longitudinal cross-sectional study, a total of 263 respondents were enrolled into the study and that served as the final sample size.

Table 4.1 above shows the age distribution, parity, gestational age by scanning, level of education and marital status.

The data used for this study was collected from two-hundred and sixty-three (263) women with the aim of determining the CRL and gestational age of fetuses of black women. The results from the study are arranged in tables and figures below. The mean age of the women was 28.7 ± 5.9 years who were predominantly between the age ranges of 17-39 years (95.1%). Majority of the women are married (97.0%); 3 were single (3.0%) and none was divorced. 30-39 years (n=133) had the majority of age distribution among women who participated in the study followed by 17-29 years (n=117) while 40 years and above (n=13) had the least of age distribution among women who participated in the study.

One hundred and seventy-seven (67.3%) of the women had secondary education, Sixty-eight (25.9%) had tertiary education, Thirteen (4.9%) had primary education while Five (1.9%) had no formal education.

Majority of the women presented for ultrasound scan between 8 and 10 weeks (37.8%), followed by ninety (34.0%) between 11 and 13 weeks while those presenting between 5 and 7 weeks were forty-three (16.2%) and those above 13 weeks were thirty-two (12.0%).

Table 4.2: Summary Statistics of age, height, GA by LMP, CRL, and GA by CRL among the respondents

Variable	Summary statistics			
	Mean \pm SD	Median (IQR)	Minimum	Maximum
Age (years)	28.7 \pm 5.9	31.0 (8)	17	44
Height (m)	1.6 \pm 0.1	1.6 (0.08)	1.47	1.84
GA by LMP (weeks)	9.3 \pm 2.4	9.0 (4)	5	14
CRL (mm)	30.6 \pm 20.4	25.0 (33)	5	79
GA by CRL (weeks)	9.3 \pm 2.4	9.0 (5)	5	13

Table 2 shows the summary of statistics. Age (years) has a mean of 28.7 ± 5.9 , Height (m) has a mean of 1.6 ± 0.1 , GA by LMP (weeks) has a mean of 9.3 ± 2.4 , CRL (mm) has a mean of 30.6 ± 20.4 and GA by CRL (weeks) has a mean of 9.3 ± 2.4 .

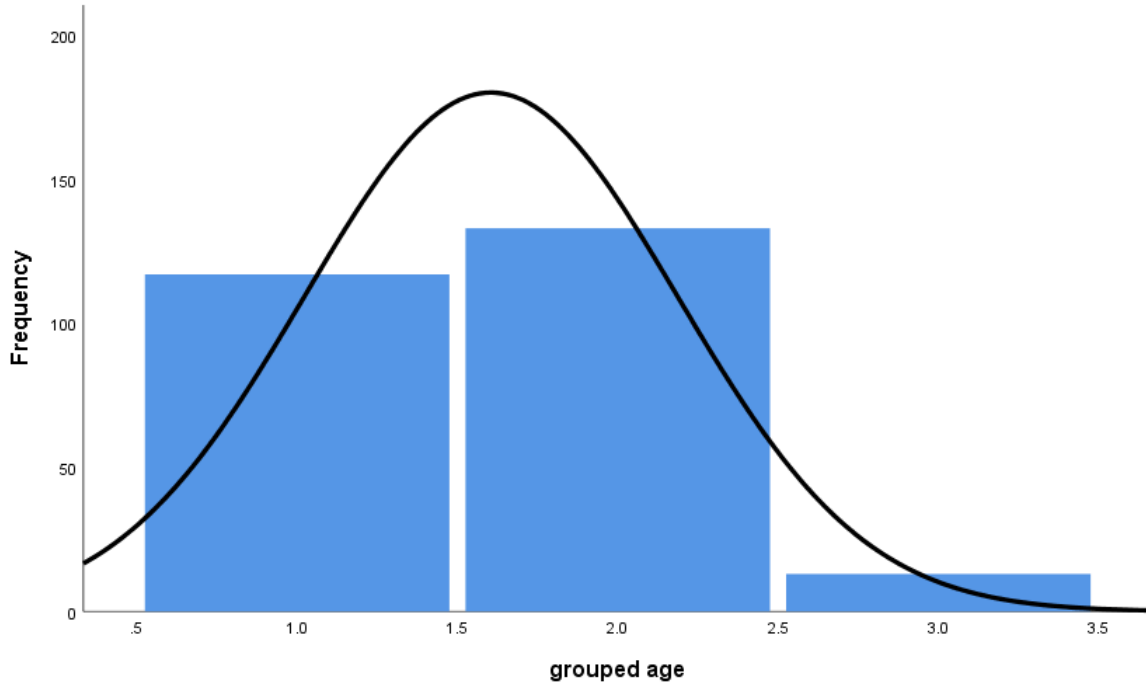


Fig 4.1: Gaussian curve showing normal distribution for the Age of the women.

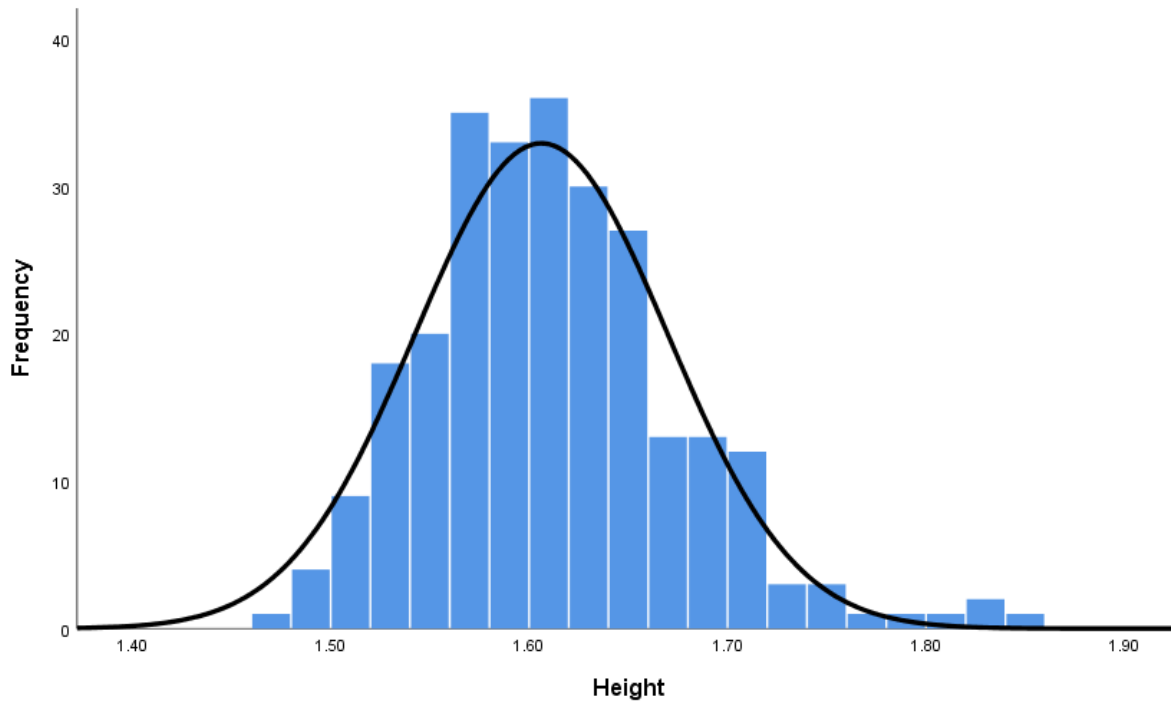


Fig 4.2: Gaussian curve showing normal distribution for the height of the women.

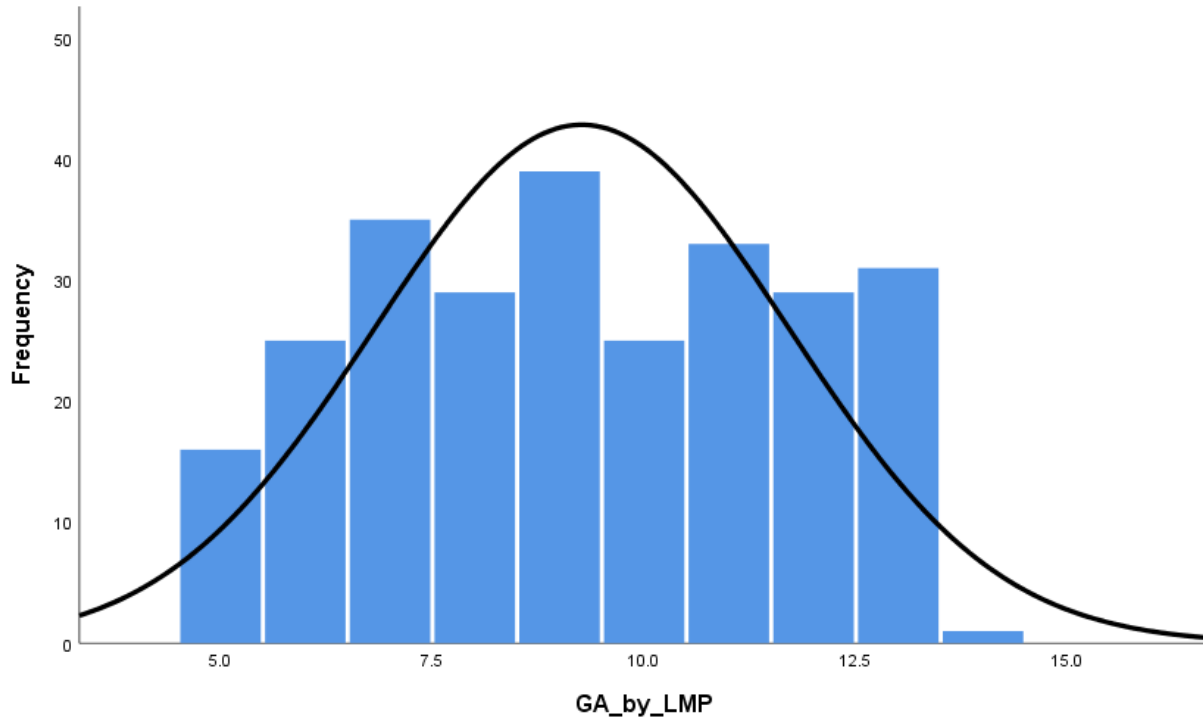


Fig 4.3: Gaussian curve showing normal distribution for GA by LMP of the women.

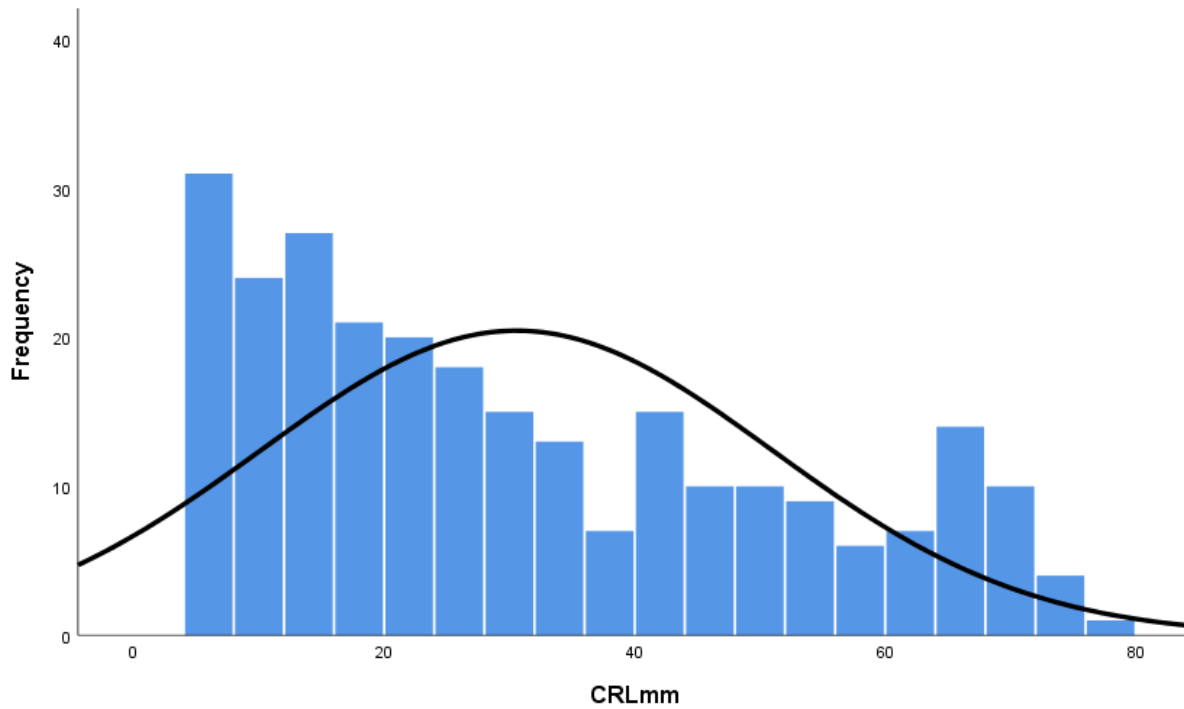


Fig 4.4: Gaussian curve showing normal distribution for CRL count of the women.

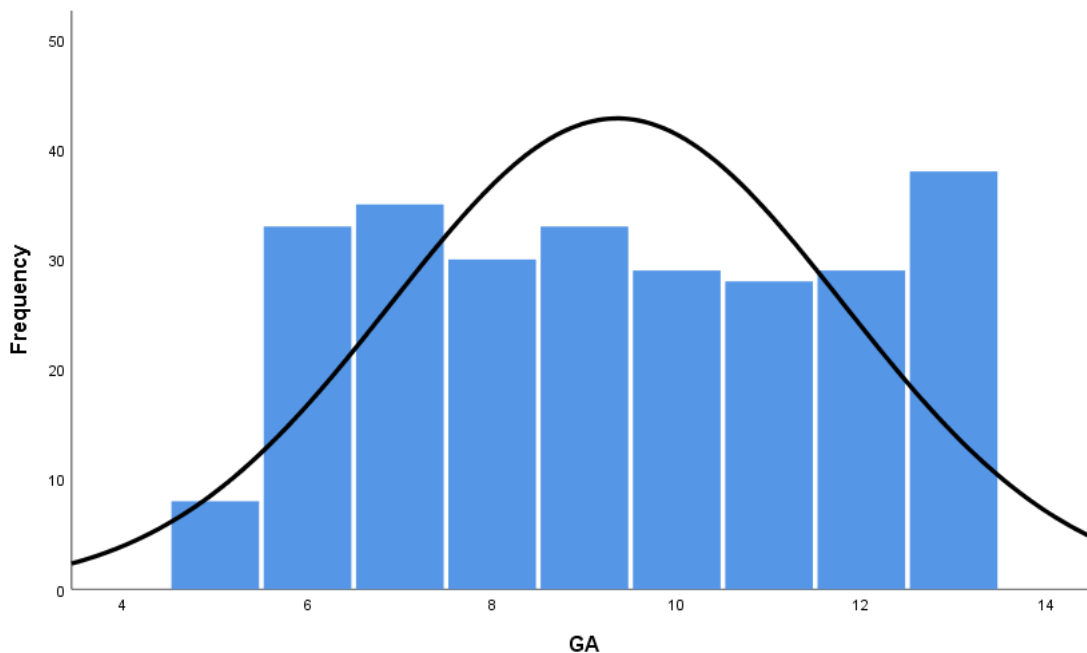


Fig 4.5: Gaussian curve showing normal distribution for GA by CRL of the women.

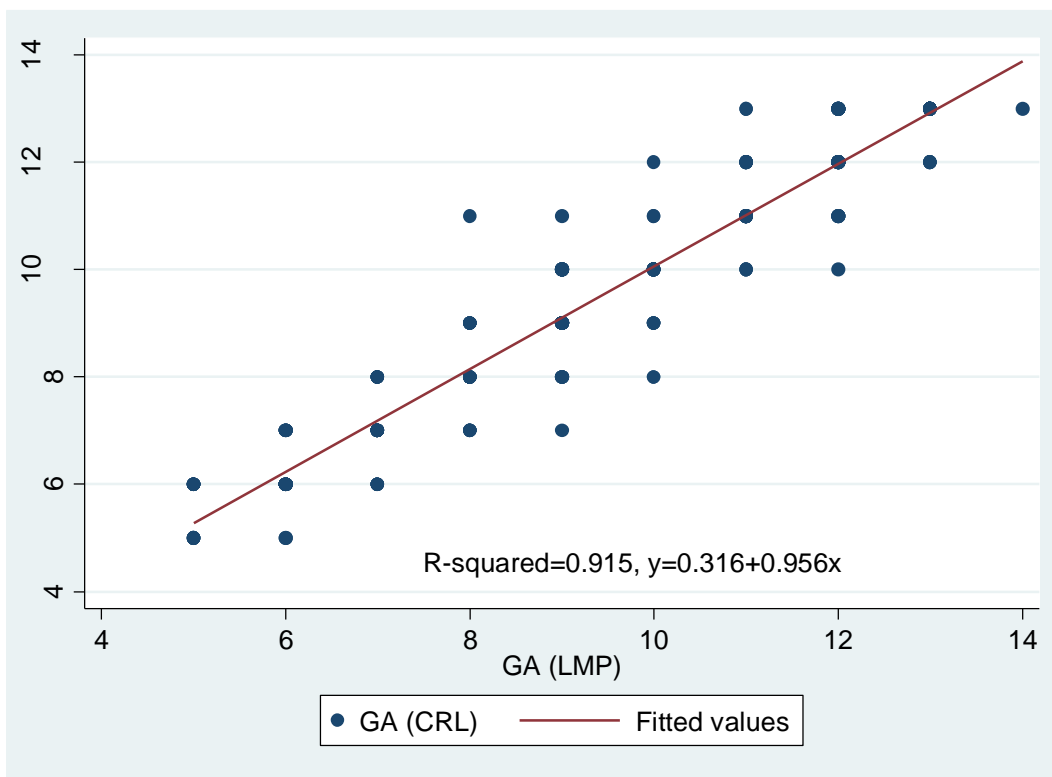


Figure 4.6:

Scatterplot with line of best fit showing the linear association between GA by CRL and GA by LMP

Table 4.3: Pearson Correlation analysis showing the level of linear association of the variables measured in the study.

Variables	Correlation coefficient (r)	p-value
GA by LMP vs GA by CRL	0.957	<0.001*
Age vs GA by LMP	-0.007	0.913
Age vs GA by CRL	-0.026	0.671
Height vs GA by LMP	0.068	0.274
Height vs GA by CRL	0.050	0.421

*=*significant p-value*<0.05

Table 3 shows that GA by LMP vs GA by CRL has its correlation coefficient at 0.957 with a (p-value = 0.001) is a positively strong significant correlation, Age vs GA by LMP has its correlation coefficient at -0.007 with a (p-value = 0.913) is a negatively weak non-significant correlation, Age vs GA by CRL has its correlation coefficient at -0.026 with a (p-value = 0.671) is a negatively weak non-significant correlation, Height vs GA by LMP has its correlation coefficient at 0.068 with a (p-value = 0.274) is a positively weak non-significant correlation, Height vs GA by CRL has its correlation coefficient at 0.050 with a (p-value = 0.421) is a positively weak non-significant correlation.

Table 4.4: Simple Linear Regression model showing the level of prediction of the outcome variables measured in the study.

Variables	Correlation coefficient (r)	R ²	p-value	Regression model
GA by LMP vs GA by CRL	0.957	0.915	<0.001*	y=0.316+0.956x
Age vs GA by LMP	0.007	0.001	0.913	y=9.359-0.003x
Age vs GA by CRL	0.026	0.001	0.671	y=9.728-0.012x
Height vs GA by LMP	0.068	0.005	0.274	y=5.086+2.600x
Height vs GA by CRL	0.050	0.002	0.421	y=6.277+1.916x

*=*significant p-value*<0.05

In Table 4.4, the simple linear Regression model shows a high correlation coefficient ($r = 0.0957$) with a significant p-value when GA by LMP was correlated with GA by CRL. For other paired variables, the correlation coefficients were weak and p-values were non-significant.

Table 4.5: Paired sample t-test showing the mean comparison between (LMP) GA and (CRL)GA

Variable	Mean±SD	t-value	p-value
Gestational Age by LMP	9.26±2.45		
		-2.056	0.041*
Gestational Age by CRL	9.35±2.45		

*=*significant p-value*<0.05

In Table 4.5, the test of mean difference between the 2 variables (gestational age by LMP and gestational age by CRL), using t-test, shows a significant p-value ($p < 0.05$).

Table 4.6: Showing the level of accuracy of gestational age measurement by CRL in the fetuses of black women in relation to their gestational ages by last menstrual period.

Accuracy Status	Frequency	Percentage (%)
Most Accurate	157	59.70
Moderately Accurate	97	36.88
Mildly Accurate	8	3.04
Accurate	1	0.38
Total	263	100

Table 4.6 measures different levels of accuracy (in weeks) gestational age measurement by CRL when compared to their gestational age by LMP. Those whose accuracy were within one week were labelled- most accurate; those whose accuracy were above one week but below two weeks were labelled- moderately accurate; those whose accuracy were above two weeks but below three weeks were labelled- mildly accurate while those whose accuracy were above three weeks were labelled- accurate. Majority of the gestational ages were predicted correctly with accuracy within one week of known LMP in 157 cases (59.70%); 97 cases were predicted correctly with a gestational age accuracy within 2 weeks (36.88%); 8 cases were predicted correctly with a gestational age accuracy within 3 weeks while 1 case has gestational age accuracy predicted above 3 weeks (0.38%).

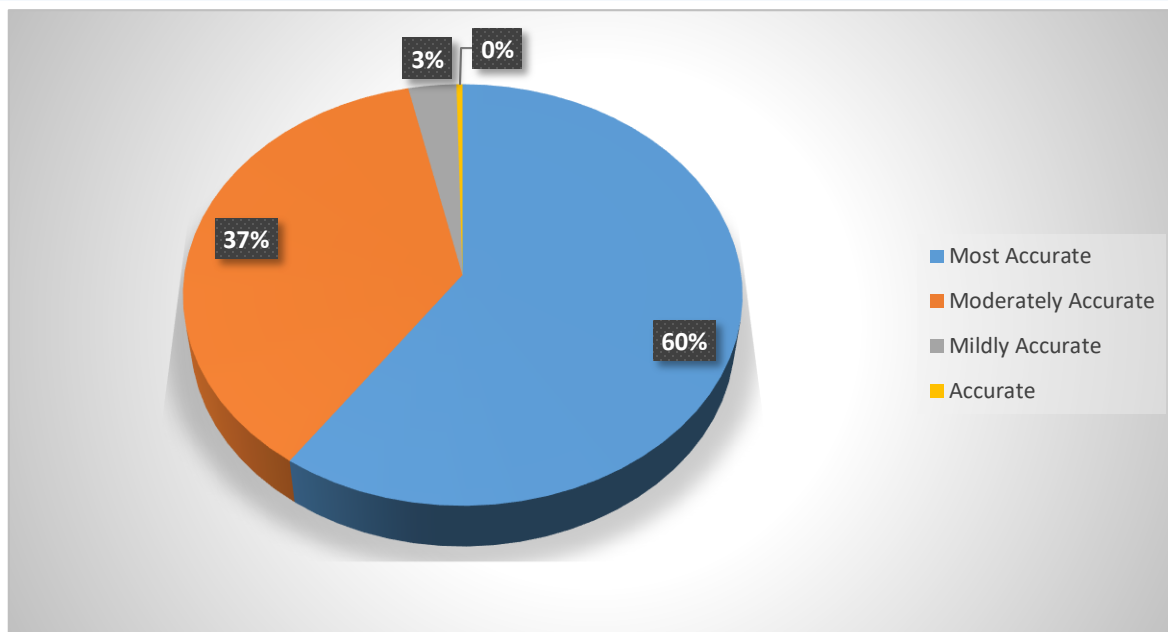


Figure 4.7: Pie chart showing the level of accuracy (in weeks) of gestational age measurement by CRL

Table 4.7: Showing factors affecting the accuracy in predicting the gestational age by CRL measurement in fetuses of black women for instance height or age of the woman

Factors	Accuracy Status (%)				χ^2 -value	p-value
	Most Accurate (n=157)	Moderately Accurate (n=97)	Mildly Accurate (n=8)	Accurate (n=1)		
Age (years)						
17-29 years	66 (42.04)	47 (48.45)	3 (37.50)	1 (100)	3.116	0.794
30-39 years	82 (52.23)	46 (47.42)	5 (62.50)	0 (0)		
40 years and above	9 (5.73)	4 (4.12)	0 (0)	0 (0)		
Height						
<1.60m	73 (46.50)	41 (42.27)	5 (62.50)	1 (100)	6.067	0.733
1.60-1.69m	69 (43.95)	47 (48.45)	3 (37.50)	0 (0)		
1.70-1.79m	14 (8.92)	6 (6.19)	0 (0)	0 (0)		
1.80-1.89m	1 (0.64)	3 (3.09)	0 (0)	0 (0)		

Table 7 shows that there is no relationship between Age factor, Height factor and Accuracy status. This is because there is no statistically significant relationship between Age factor (p-value=0.794), Height factor (p-value=0.733) and Accuracy status.

DISCUSSION

At matched crown-rump length (CRL) of 5 mm, similar gestational ages (GA) of between 6+0 to 6+2 weeks were obtained in separate studies done by Robinson and Fleming *et al*¹, Maclennan and Schluter *et al*³⁵, Verburg *et al*²⁷, Sahota *et al*³⁶, using white women. However, in this study done on black women, there was marginal increase in CRL (7mm in black women against 5 mm in white women at gestational age of 6 weeks). This marginal increase was sustained up till 8th week. Thereafter the trend was reversed and the fetuses of white women assumed a longer crown-rump length than those of their black counterpart at a matched gestational age till the end of the first trimester. This was indirectly related to the study done by Kramer *et al*³⁷. It was concluded in their study that the closer coherence of revealed small for gestational age (SGA) and neonatal mortality rates based on a single standard and the intermediate pattern among foreign-born Blacks strongly suggested that Black-White differences in birth weight for gestational age were pathological rather than physiological. However, this was contrary to findings by Alvear and Brooke *et al*³⁸. In their study, three racial groups of mothers and their newborn babies – North European 75, Indian- Asian 37- were matched for parity, gestational age, sex, maternal age, maternal smoking habits and social class. Multiple anthropometric measurements, including skin-fold thickness, limb circumference and various linear measurements were made on the mothers and their infants to determine the effects of race and smoking on fetal size. Indian- Asian mothers; though shorter and lighter than European and negroid, had similar skinfold thickness and weight/ height ratio and gained as much weight during pregnancy. Their infants, however, were lighter than the others, and had smaller head and limb circumferences, although their linear measurements were the same. Negroid and European infants were almost identical in size. This study was partly different from the above two studies because at matched gestational ages, the fetuses of Negroid women showed greater growth than their European counterpart only at 8 weeks and below and the reverse at gestational age above 8weeks.

In table 4.3, Pearson correlation analysis of GA by LMP versus GA by CRL which shows a high correlation coefficient which indicates a strong association between the two variables The p-value is <0.05 which also shows a significant association between the 2 variables. Similarly, in table 4.6, there is high accuracy (in weeks) of predicting the gestational age (59.70%) using the CRL. This was similar to study done by Amita *et al*³⁹. Their prospective study was carried out on 143 women who were trying to conceive. In 71 ongoing pregnancies, gestational age was estimated from LMP, CRL at 10- 14 weeks, ovulation and implantation day. For each method of gestational age assignment, the distribution in observed gestational age was derived and both agreement and correlation between the methods determined. The result showed that the median ovulation and implantation days were 16 and 27 respectively. The gestational ages based on

LMP, CRL, ovulation and implantation were similar: 279, 278, 276.5 and 276.5 days respectively. The distributions for observed gestational age were widest where the gestational age was assigned from CRL and LMP and narrowest when assigned from implantation and ovulation. The strongest correlation for gestational age assessment was between ovulation and implantation ($r = 0.98$) followed by CRL and LMP with also a strong correlation ($r = 0.88$). They concluded that CRL and known LMP are accurate ways of assessing the gestational age even though according to their study, ovulation and implantation days remain the most accurate in assessing the gestational age.

A similar study that corroborated the high accuracy of CRL in determining the gestational age of pregnant women, similar to above study, though with a different methodology, was that done by Khandelwal *et al*⁴⁰. In their study, CRL was compared with composite biometric measurement including head, abdominal and femur measurements using 1716 pregnant women. They concluded that CRL-based dating is more accurate up to 13 weeks when compared with composite biometric measurement. However, according to their study, after 13 weeks, CRL underestimates the gestational age while the composite biometric measurements under-estimates the gestational age after 14 weeks. The underestimation of gestational age after 13 weeks is known to be caused by excessive curling of the fetus within that period. However, there is no plausible explanation for the under-estimation of the fetus using composite biometric measurements after 14 weeks as found in their study.

This high accuracy of CRL in previous studies had led the American College of Obstetricians and Gynaecologists (ACOG) to indicate in their guideline that ultrasound done in the first trimester is the most accurate way of estimating the gestational age (ACOG practice bulletin, 2009/2021)^{41,42}. The guideline also states that the earlier in pregnancy the scan is done within the first trimester, the more accurate the scan (ACOG practice bulletin, 2009)⁴¹. It was further stated in a newer guideline that if a pregnancy is dated in first trimester using CRL and the gestational age given by the CRL differs from that given by known LMP by more than 7 days, the expected date of delivery (EDD) will be changed to correspond with ultrasound dating (ACOG practice bulletin, 2017)⁴³ thus corroborating the high accuracy assigned to CRL which had been detected from the results of independent studies across the globe.

Although maternal height and weight did not appear measurably associated with fetal growth in the first trimester (Mook-Kanamori *et al*⁴⁵), length and weight of the parents in their study were associated with ultrasound measurements from second and third trimester. Similarly, in this study, maternal height correlates poorly with CRL of the fetus as shown in tables 4.7.

In table 4.5, paired t-test was carried out on gestational age by LMP and gestational age by CRL to assess if the mean difference between the gestational age by LMP and gestational age by CRL is significant. It showed that the gestational age estimate by LMP is similar to that estimated by CRL. However, this is contrary to findings by Ohuma *et al*²² which stated the fetal crown-rump is recommended over the Last menstrual period (LMP) for estimating gestational age when

measured in early pregnancy between 9+0 to 13+6 weeks. It was similarly found out in their study that the LMP given by most mothers were inaccurate.

5.1 CONCLUSION

Embryos and fetuses of black women have a longer CRL at gestational age of 8 weeks and below when compared with embryos and fetuses of their white counterpart. This trend is reversed after 8 weeks of gestation. The maternal height and age correlate poorly with the crown-rump length (CRL).

5.2 RECOMMENDATION

CRL in first trimester is ideal in estimating fetal age in pregnant black women where the mother is uncertain about her LMP. Ultrasound scan that is designed for whites can be used effectively for black women as there is no statistical difference in their growth rate.

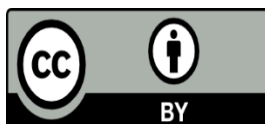
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