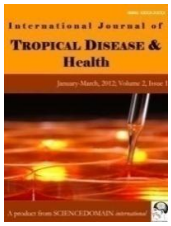

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A Comparison of the Accuracy of the Use of Last Menstrual Period and Symphysio-Fundal Height for Gestational Age Determination among Nigerian Women

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Authors' contributions

This work was carried out in collaboration between all authors. Author AEO designed the study, wrote the protocol, performed the statistical analysis and wrote the first draft. Authors JM and CCE designed the study objectives and managed the analyses in addition to contributing to the second draft. Author ASA managed the literature search and contributed to the final draft. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The aim of the study was to evaluate the accuracy of the symphysio-fundal height (SFH) in comparison to the last menstrual period (LMP) for gestational age assessment.
Study Design: Hospital-based prospective cross sectional study.
Place and Duration of Study: Maternity unit of the Jos University Teaching Hospital, Jos, Nigeria, between December 2012 and April 2013.

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Methodology: A total of 289 consecutive consenting women with singleton uncomplicated pregnancies at gestational ages of less than or equal to 20 weeks were recruited at the maternity unit of Jos University Teaching Hospital between December 2012 and April 2013. Ultrasound scan (USS) was used to confirm eligibility after which other information including the LMP were documented on a questionnaire. The women returned after 22 weeks' gestation based on ultrasound recorded GA for SFH assessment and some weeks thereafter for a second SFH assessment.
Results: Mean age of the women was 28.9±4.8 years with a range of 16-42 years. Most of them were of parity 1 – 4 (58.1%). The mean GA at booking was 15.3±3.1 weeks based on LMP and 14.9±3.1 from early ultrasound scan. The mean percentage accuracy for SFH method compared to USS dating was 95.8% while that of LMP was 91.0%. This difference was found to be statistically significant (*P* = .02).
Conclusion: The study showed a significant difference between the LMP and early ultrasound scan dating but not between SFH and early ultrasound scan. Also, the mean percentage accuracy was statistically higher for SFH, suggesting that SFH was a more accurate tool for gestational age assessment among these women.

Keywords: Comparison; gestational age; menstrual date; symphysio-fundal height; Nigeria.

ABBREVIATIONS

EGAUSS= Ultrasound estimated gestational age first visit after 22 weeks; EGALMP= Last menstrual period estimated gestational age first visit after 22 weeks; EGA2USS= Ultrasound estimated gestational age second visit after 22 weeks; EGA2LMP= Last menstrual period estimated gestational age second visit after 22 weeks; EGASFH1= SFH estimated gestational age first visit after 22 weeks; EGA2SFH2= SFH estimated gestational age second visit after 22 weeks.

1. INTRODUCTION

The accurate determination of gestational age is the cornerstone of optimal obstetric care. The diagnosis and interventions given to a pregnant woman including antepartum haemorrhage, intrauterine growth restriction, pre-term and post-term deliveries, the categorisation of pre-labour rupture of membranes(whether at term or pre-term)and the need for steroid administration, tocolysis or induction of labour, all rest on the correct assessment of the gestational age at the time of evaluation. In addition, it is important to the pregnant woman and her family who wants to know when to expect the delivery of the baby [1-4].

There are different ways of assessing the gestational age. Traditionally, the first day of the last menstrual period has been used to calculate the date of delivery (which is supposed to occur 280 days later) and date the pregnancy [5,6]. But this Naegele's rule is based on certain assumptions hence in women with irregular menstrual cycles, those on hormonal contraception, have lactational amenorrhoea prior to conception, or have poor recollection of her last menstrual period, then the application of the rule becomes difficult [2,3,7,8,9].

The symphysiofundal height (SFH) measurement in centimetres using a non-elastic tape, can be used after the 20weeks to 34weeks of gestation but it has its own limitations in dating pregnancy in women with multiple pregnancy, co-existing fibroid and pregnancy, polyhdramnious, oligohydramnious and fetal transverse lie [2,10,11].

The gold standard for assessing gestational age has been the use of early ultrasound scan done at first half of the pregnancy [2,4,12]. In resource endowed countries, ultrasound scan has become an essential part of obstetric practice but the same cannot be said of low resource countries like Nigeria especially in the rural areas [13]. In this setting, when available, the ultrasound machine is often of poor quality and operated by undertrained technicians. Furthermore, late presentation of our women for antenatal care in our environment, is a factor that limits the usefulness of ultrasound in assessing gestational age [3,7,14,15].

Previous studies conducted in Nigeria suggest that accurate measurement of symphysiofundal height is a reliable method of gestational age assessment in the second half of pregnancy [13,16]. Similarly, a study done in Pakistan

suggested that symphysio-fundal height measurement was more accurate than the reported last menstrual period as a tool for assessing gestational age when the ultrasound scan was used as a reference [2].

In developing countries where illiteracy compounds the general poor recollection of the LMP among pregnant women and where ultrasound facility is still not widely available [2-4,7,13,17], an alternative method that is independent of patient's recollection but based on the accurate measurement on the spot by the physician, will go a long way to solve the dilemma of inaccurate assessment of gestational age. Hence, this study was carried out in our center to compare the accuracy of the LMP with the symphysio-fundal height in assessing gestational age, using the ultrasound as a reference. This method will be particularly useful in our rural areas where ultrasound equipment and the needed expertise are not readily available.

2. MATERIALS AND METHODS

This hospital-based cross-sectional prospective research was carried out in the maternity unit of the Department of Obstetrics and Gynaecology, Jos University Teaching Hospital (JUTH), a tertiary health institution situated in Jos, Plateau state. The hospital is one of the three federal Teaching Hospitals in the North-Central zone of Nigeria. It serves as a referral center for the neighbouring states of Bauchi, Gombe, Benue, Kogi, Nasarawa, Taraba, Adamawa, part of Kaduna States. Jos is the capital city of Plateau State [18].

The study population comprised of consecutive pregnant women with singleton pregnancy in the antenatal clinic with estimated gestational age less than or equal to 20 weeks' gestation who consented to participate in the study. Women with co-existing pelvic mass, polyhydramnios or oligohydramnios, a fetus in transverse lie or fetal intrauterine growth restriction were excluded from the study.

2.1 Study Procedure

On presentation for booking at the Maternity unit of JUTH, eligible women were directed to the investigator who explained the purpose of the study to them. Those who consented to participate signed a written consent form. The investigator, who has received training in obstetric ultrasonography, then proceeded to have their gestational age determined by ultrasound to confirm eligibility after which other information were collected on a questionnaire including the first day of their last menstrual period (LMP) as they recalled. For those who could not recall the first day of their LMP, the 15th day of the recalled month was used. The number of weeks between the LMP and the day of enrolment provided the gestational age estimates.

The ultrasound scan was performed by means of a real-time Toshiba model (OTPS- 320A ultrasound machine fitted with a 3.75MHz transabdominal sector probe (Otawara, Japan, 2001). The fetal gestational sac, crown-rump (CRL) and biparietal diameter (BPD) were used depending on the gestational age (GA), using reliable landmarks and planes [19].

The women were allowed to go home to return for the study after 22 weeks of the ultrasound recorded gestational age for SFH assessment by a senior Registrar who was blinded to the GA estimated previously. The subjects had their bladder emptied and after lying down in supine position, each fundus of the uterus was outlined by gentle palpation. A non-elastic tape was then used with the graduation in centimetres facing the abdomen (to reduce bias) to take the measurement in the midline from the fundus uteri to the upper part of the pubic symphysis. Two measurements were taken for each subject and each measurement was rounded up to the nearest centimetre. The average of the two measurements was taken and the number of centimetres considered as corresponding to GA in weeks [20,21]. A second measurement of the symphysio-fundal height was done in a similar manner by the same senior registrar (who was the one that did it for all the women) two to six weeks later. The women were then seen by their respective managing units in subsequent antenatal clinics until delivery.

The data were collected using the study questionnaires including results of the early ultrasound findings and the subsequent SFH measurements. The information obtained were entered into a pre-design program in the Epi-info software version 3.5.4 (CDC, Atlanta Georgia, USA) and analyzed. The mean gestational ages were calculated for the Ultrasound scan estimation, LMP and SFH readings for the first and second visits after the 22 weeks of gestation and the mean differences determined. The test of

hypothesis was done using the student t-test and a *P*-value of less than .05 was considered statistically significant. Approval for this study was granted by the research and ethical committee of the Jos University Teaching Hospital, Jos.

3. RESULTS

A total of 301 women were screened between December 2012 and April 2013 for the study at booking. Nine of them were excluded as a result of the diagnosis of twin pregnancy and another 3 for pregnancy coexisting with uterine fibroids.

Table 1 shows the socio-demographics features of the 289 study population analyzed. The mean age of the women was 28.9±4.8 years with a range of 16-42 years. Most of them were within the age group of 20-34 years (82.0%) and 9 (3.1%) were teenagers. Most of the women were of tribes from Plateau state (Plateau tribes) (50.9%), Christians (80.6%), had at least secondary school education (88.2%), Married (99.3%) and Civil servants (45.0%). One hundred and twenty one of them were nulliparous (41.9%), while 168 (58.1%) have had at least one prior delivery, out of which 21 (7.2%) were grand multiparous women.

The average gestational age at booking from the LMP was 15.3±3.1 weeks while that from the early ultrasound scan done was 14.9±3.1 with a range of 8-20 weeks. The total number of women who were unsure of the first day of their LMP was 24, giving a prevalence of 8.3% of the total population. Table 2 presents the mean differences between the gestational ages obtained by the ultrasound scan and those of the last menstrual period (LMP) and symphysio-fundal height (SFH) for both the first and the second visits after 22 weeks of gestation. The mean differences were higher for the LMP values and these were found to be statistically significant (*P* = .001). The mean differences for the SFH values were not statistically significant.

Table 3 shows the mean percentage accuracy which was higher for the SFH compared to the LMP (95.8% Vs 91%) and this was statistically significant (*P* =.02).

4. DISCUSSION

Our study showed that symphysio-fundal height is a better method for gestational age assessment compared to the last menstrual period. This was reflected in the fact that the paired mean differences of the LMP with the early ultrasound scan were higher and found to be statistically significant (*P* = .001) compared to the mean differences of the SFH with the early ultrasound scan which were not as high and statistically insignificant (*P* = .755 and .715). This implied that the SFH assessment from the study was not statistically different from the early ultrasound scan as a tool for gestational age assessment and may be more useful than the LMP in the absence of an early ultrasound scan. Furthermore, the mean percentage accuracy of the last menstrual period compared to early ultrasound scan was 91% as against the mean percentage accuracy of 95.8% for the symphysio-fundal height compared to the early ultrasound scan. And this higher accuracy with the symphysio-fundal height method was found to be statistically significant (*P* = .02). Although traditionally the LMP is used to date pregnancy, it is subjective compared to the SFH which may be considered more objective with identifiable landmarks. The subjective problem with the LMP could be because a woman may fail to remember for sure the first day of her last menstrual period and just assigned one of the days around it. This is generally compounded by the level of literacy. However, even a literate woman who conceives after a period of lactational amenorrhoea or oral contraceptive pill will obviously have a problem knowing her LMP. Up to 24 (8.3%) of the women from our study could not recall the first day of their LMP. It has been estimated that 10-45% of pregnant women cannot provide useful information about their LMP and that 18% of women with certain menstrual dates have significant differences between their menstrual and ultrasound dating [17,22].

Our finding is similar to the finding from the study by Adewale and Ijaiya which showed that the SFH was a reliable method of gestational age assessment in the second half of pregnancy [13]. Although in that study, the researchers did not compare the SFH with the LMP to ascertain the more accurate tool. In a prospective study conducted in Cape Town, South Africa to compare different dating methods commonly used in their setting, the authors concluded that ultrasound dating was most accurate of all the other methods, but their study also revealed a better agreement between the ultrasound dating method and the SFH compared with the LMP [23].

Table 1. Baseline characteristics of the women

Variable	Total (N=289)	Percent (%)
Age group (Mother)		
≤19 years	9	3.1
20-34 years	237	82.0
≥ 35 years	43	14.9
Ethnicity		
Hausa	40	13.8
Igbo	20	6.9
Plateau tribes	147	50.9
Yoruba	22	7.6
Others	60	20.8
Religion		
Christian	233	80.6
Muslim	56	19.4
Education of the mother		
None	28	9.7
Primary	6	2.0
Some Secondary	182	63.0
Completed Secondary	17	5.9
Tertiary	56	19.4
Education of spouse		
None	4	1.4
Primary	8	2.8
Some Secondary	9	3.1
Completed Secondary	180	62.3
Tertiary	88	30.4
Marital status		
Married	287	99.4
Never Married	1	0.3
Widowed	1	0.3
Occupation of mother		
Civil Servant	130	45.0
Trader	41	14.2
Seamstress	85	29.4
Housewife	21	7.3
Others	12	4.1
Parity		
0	121	41.9
1-4	147	50.9
≥5	21	7.2

Table 2. Comparing the accuracy of the LMP and SFH using ultrasound as the standard

Variables	Mean difference	Standard deviation	95% confidence Interval	t-test	*P*-Value
EGAUSS-EGALMP	-0.391	1.501	(-0.565 to -0.217)	4.429	.001
EGA2USS-EGA2LMP	-0.391	1.501	(-0.565 to -0.217)	4.429	.001
EGAUSS-EGASFH1	-0.028	1.504	(-0.202 to-0.146)	0.313	.755
EGA2USS-EGA2SFH2	-0.031	1.449	(-0.199 to -0.137)	0.365	.715

EGAUSS= Ultrasound estimated gestational age first visit after 22 weeks, EGALMP= Last menstrual period estimated gestational age first visit after 22 weeks, EGA2USS= Ultrasound estimated gestational age second visit after 22 weeks, EGA2LMP= Last menstrual period estimated gestational age second visit after 22 weeks, EGASFH1= SFH estimated gestational age first visit after 22 weeks, EGA2SFH2= SFH estimated gestational age second visit after 22 weeks

Table 3. Comparison of mean percentage accuracy of LMP and SFH

Method	No of subjects	Gestational age assessment		*P*-value
		Mean accuracy* n (%)	Inaccurate n (%)	
SFH	289	277 (95.8%)	12 (4.2%)	.02
LMP	289	263 (91%)	26 (9%)	

**Accuracy was defined by the number of subjects within 2 weeks of USS estimated gestational age*

In a longitudinal study conducted in rural Guatemala between 1996 and 1999 for 171 women–infant pairs, comparing LMP, neonatal examination and SFH using ultrasound as the reference, the authors concluded that the recalled LMP provided the best estimate of gestational age [3]. They observed in addition, that the SFH measured during the second trimester may provide a reasonable alternative when the LMP is unavailable [3]. In their study however, the researchers used SFH measured between 15 and 24 weeks of gestation on the assumption that this earlier measure would be less influenced by growth retardation. But as a tool for determining gestational age (GA), it has been generally reported that SFH in centimeters equals GA in weeks between 20 and 34 weeks [10,11]. Hence, the early measurement could have provided a suboptimal assessment of the SFH in that population.

In Nigeria and other resource-constraint developing countries where ultrasound machines are not readily available especially in the rural areas, and where even when available the expertise may be lacking, the knowledge that SFH which is simple, cheap, easy to learn method is more accurate than the LMP will make estimation of gestational age easier and less doubtful than previously perceived.

The strength of the study is that, it was a prospective study and early ultrasound scan was done for all the women. In addition a good proportion of the women (88.2%) had at least secondary school education (lower educational attainment is one of the sociodemographic characteristics associated with uncertain LMP [24]).

The limitations of this study included the fact that although ultrasound was use as the gold standard in this study, it has its own error margin even with the best biometric measurement which is the CRL (±5 to 7 days). Also, Parity and body mass index which are covariates for SFH measurement in this study were not considered during data collection. Another limitation of the study is the fact that the few women (8.3%) who could not recall their LMP, the 15th day of the month was used to calculate their EGA. The convenience sampling technique is subject to sampling bias, hence, the sample might not be representative of the entire population. This limits the ability to generalize the findings of the study to the entire population.

5. CONCLUSION

The findings from this study showed a significant difference between the last menstrual period and the early ultrasound scan as tools for gestational age assessment, but not between symphysio-fundal height and early ultrasound scan. In addition, the mean percentage accuracy of the symphysio-fundal height was higher and statistically more significant compared to that of the last menstrual period. This suggests that barring factors which may erroneously increase the symphysio-fundal height estimation like multiple pregnancy, polyhydramnious, co-existing pelvic mass or other factors which may abnormally decrease the symphysio-fundal height estimation like fetal transverse lie, oligohydramnious or intrauterine growth restriction, the SFH estimation is a more accurate tool for gestational age assessment after the 22nd week of gestation compared to the LMP in this Nigerian obstetric population.

It is our recommendation that, there should be training and re-training of Doctors, Midwives and Nurses at different levels of health care in the proper technique for symphysio-fundal height measurement for GA assessment as described in this study especially in low resource settings where ultrasound is a luxury and where women have poor recollection of their LMP.

ETHICAL APPROVAL AND PATIENT CONSENT

The proposal for the study was presented to the institutional research and ethical committee of the Jos University Teaching Hospital and approval was duly obtained for it. Consent was obtained from each subject before enlistment.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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