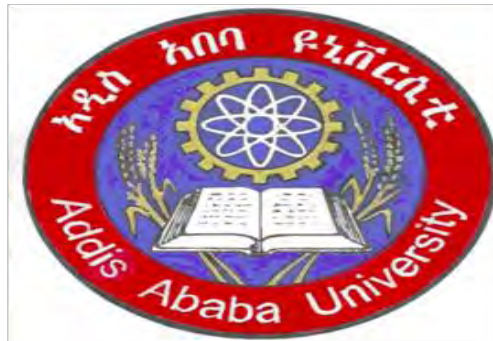


ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCE
SCHOOL OF MEDICINE
DEPARTMENT OF HUMAN ANATOMY



Estimating Gestational Age by Symphysis Fundal Height, Last Normal Menstrual period and Parameters of Ultrasound in Third Trimester Pregnancy at Gandhi Memorial Hospital, Addis Ababa, Ethiopia.

The Thesis Submitted to Department of Human Anatomy, School of Medicine, College of Health Science, Addis Ababa University in partial fulfillment of the requirements for the Degree of Masters of Science (MSc) in Human Anatomy.

By: Teshome Gensa (BSc)

December, 2016

Addis Ababa, Ethiopia

Declaration

This is to certify that the thesis prepared by Teshome Gensa, entitled: Estimating Gestational Age by Symphysis Fundal Height, last normal menstrual period and Parameters of Ultrasound in Third Trimester Pregnancy at Addis Ababa University on year 2016 and submitted in partial fulfillment of the requirements for the Degree of Masters of Science in Medical Anatomy complies with the regulations of the university and meets the accepted standards with respect to originality and quality. This thesis has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged.

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LIST OF ABBREVIATIONS

AC:	Abdominal circumflex
ANC:	Antenatal care
BMI:	body mass index
BPD:	Biparietal diameter
CI:	Confidence interval
CRL:	Crown rump length
EDD:	Expected date of delivery
FL:	Femoral length
GA:	Gestational age
HC:	Head circumference
IUGR:	Intrauterine growth retardation
KG:	kilogram
LNMP:	Last normal menstrual period
NICE:	National Institute for Health and Care Excellence
OR:	Odds ratio
PROM:	Premature rupture of membrane
SD:	Standard deviation
SFH:	Symphysis- fundal height
SGA:	Small for gestational age
SPSS:	Statistical package for social science
US:	Ultrasound

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ABSTRACT

INTRODUCTUION: *Gestational age is the age of the unborn baby. The accurate knowledge of gestational age is the key for appropriate interpretation of antenatal test and effective planning for intervention or treatments.*

OBJECTIVE: *To assess the accuracy of estimating gestational age by symphysis fundal height (SFH) , last normal menstrual period (LNMP) and Ultrasound (US)measurements during third trimester pregnancy.*

METHODS AND MATERIALS: *Hospital based cross sectional study was carried out from June 9, 2016 – October 20, 2016 in radiology unit of Gandhi Memorial Hospital. Estimated gestational age was taken from 182 women of third trimester by LNMP, SFH and four parameter of ultrasound; femur length (FL), biparietal diameter (BPD), head circumference (HC) and abdominal circumference (AC). Data was analyzed using SPSS version 21 computer program. The mean difference among different methods was tested for significance using paired t-test. Correlations among measurements were tested. P-values less than 0.05 were taken as statistically significant.*

RESULT: *The mean gestational age of pregnancy by recalled LNMP was 36.35 weeks with standard deviation of 3.35 weeks. The mean gestational age by the parameters of ultrasound scan done by FL was 36.64 weeks, BPD was 36.57 weeks, HC was 34.01 weeks, and AC was 33.94 weeks. The mean gestational age by SFH measurement was 34.88 weeks. The mean gestational age estimated by all three methods; SFH, LNMP and US measurements had statistically significant difference ($p \leq 0.05$). SFH estimate had only 0.39 week difference from estimate by composite of FL, BPD, HC and AC. FL and BPD had stronger correlation than HC and AC with composite US measurements. SFH had stronger correlation with all ultrasound measurement than LNMP.*

CONCLUSION: *SFH was better method to estimate gestational age than LNMP. The BPD and FL were more accurate measurement followed by AC and HC during third trimester in comparison with composite US measurement*

Key words: *Gestational age; Symphysis fundal height; Ultrasound parameters; Third trimester*

1. INTRODUCTION

1.1 Background

Gestational age is the age of the unborn baby. The accurate knowledge of gestational age is the key for successful antepartum care, appropriate intervention or treatment (1).

In the past, gestational age has been estimated by combination of historical information and physical examination. Predictions were based on menstrual history, maternal sensation of fetal movement, assessment of uterine size by bimanual examination, initial detection of fetal heart tone by ultrasound (US) and uterine fundal height measurement (1).

Normally, human gestation lasts for an average of 266 days from the date of conception or 280 days from the first day of the last normal menstrual period (LNMP) (2). Based on the assumption that typical menstrual cycle lasts 28 days, with ovulation occurring on approximately day 14. The 19th century obstetrician, Franz Karl Naegele developed the simple calculation to estimate expected date of delivery that involves adding 9 months and 7 days to the first day of the LNMP (2). This calculation, referred as Naegele's rule, provides an indirect measurement of the time of conception and remained the current standard for calculating the duration of pregnancy based on the LNMP.

The reliability of estimating gestational age by LNMP may depends on a number of factors including the woman's accurate recall of her LNMP, the regularity of her menstrual cycles and possible use of contraceptives or breast feeding that could influence the timing of ovulation. In absence of these potential affecting factors estimating gestational age shows true gestational age or menstrual age.

Leopold maneuver or fundal palpation using Tape measurement; symphysis to fundal height in centimeter with tape meter is used as one of the methods to estimate gestational age. Finger method; one finger above umbilicus is equal to two weeks and below umbilicus one finger is equal to one week. Uterus felt at symphysis corresponds to 12 weeks, at umbilicus 20 weeks and at xiphosternum 38 weeks (3).

The reliability of Symphysis fundal height may depend on various factors like empty bladder during first trimester, normal position of fetus, normal uterine shape and mass; and normal growth of fetus.

As fetal ultrasound (US) scan is based on biometric measurements of the fetus, it is considered as the gold standard for establishing GA when done before 20 weeks of gestation, as the biologic variations in fetal size and the effects of growth restriction are still small (4). The accuracy is less if the scan is performed during the third trimester. In many high-resource countries, the first-trimester US scan and the second scan between 18 and 22 weeks are essential parts of obstetric practice because they establish GA and screen for fetal anomalies (4). However, US equipment is often unavailable in low-resource countries, especially in rural areas. In place where the equipment is available, it is expensive to use, often of poor quality and operated by undertrained technicians. In addition, women often seek prenatal care late in pregnancy, which further limits the use of ultrasound to assess GA (4).

Clinically, the gestational period is divided into three trimesters, each lasting 3 months. At the end of the first trimester, all major systems are developed. In the second trimester, the fetus grows sufficiently in size so that good anatomic detail can be visualized with ultrasonography. Various measurements and external characteristics are useful for estimating fetal age. Crown rump length (CRL) is the method of choice for estimating fetal age until the end of the first trimester because there is very little variability in fetal size during this period. In the second and third trimesters, several structures can be identified and measured ultrasonographically, but the basic measurements are biparietal diameter, head circumference, femur length and abdominal circumference (5).

According to the National Institute for Health and Clinical Excellence (NICE) of the United Kingdom, an US check performed at 10 weeks to 13 weeks and 6 days of gestation is considered the most accurate method for estimating GA because the variation in fetal growth rate is very low in this period (6).

1.2 Statement of Problem

In most developing countries like Ethiopia, seeking help from health services in the diagnosis of pregnancy and initiating antenatal care tends to be delayed, which hinders conducting US checks in the early stages of pregnancy. Moreover, in most part of Ethiopia it is difficult to find ultrasound examination for gestational age determination unless if there is any problem that oblige the ultrasound examination. Some district hospitals and almost all health centers in Ethiopia were using LMP and fundal height measurement for estimating gestational age as part of routine ANC services. But level of effectiveness of symphysis fundal height in estimating gestational age is not addressed by many studies.

It is obvious that if there is no correct estimation of gestational age, the mother as well as the fetus will not get right health care services at the time of ANC follow up. Incorrect gestational age determination also results in incorrect plan and service during delivery and neonatal care.

Many research shows ultrasound examination in first trimester is effective in determining gestational age but the readings of different parameters at different trimester shows variation in accuracy of estimating gestational age.

There is scarcity of research done on effectiveness of ultrasound measurements in late pregnancy in Ethiopia. It is critical to determine its effectiveness on late pregnancy in developing country since most of pregnant mothers seek ultrasound examination during late second and third trimester. So this research intended to fill this gap; effectiveness of the ultrasound and symphysis fundal height (SFH) measurement for estimating gestational age in late pregnancy.

1.3 Significance of the Study

This study was undertaken to find out accurate method of estimating gestational age during third trimester. It assessed effectiveness of symphysis fundal height measurement; easy and inexpensive method for resource limited area. Accurate parameters of ultrasound measurement were determined to estimate gestational age in third trimester pregnancy.

The outcome of this research helps ANC providers to know optimal timing for necessary intervention or treatment and avoidance of unnecessary ones especially for late presenters to antenatal follow up.

This research had also important significance for pregnant mothers to know relatively accurate timing of their pregnancy. This helps them to correctly plan for different activities during pregnancy and after pregnancy.

The study provided important base line information for the researcher and future researchers in related area.

2. LITERATURE REVIEW

Ultrasound equipment is not always available in low-resource countries and alternate methods such as LNMP and SFH are used to determine GA and predict the date of delivery. There was a significant difference in the mean GA estimates obtained by the 3 methods for Pakistani women between 20 and 26 weeks of pregnancy. Moreover, the LMP and SFH methods produced larger mean and median GA values, and a wider range of values, than the US method (7).

The degree of disagreement between the LNMP estimate and the clinical estimate varied substantially by maternal characteristics and ultrasound use during pregnancy and by gestational age group (20–27, 28–31, 32–36, or 37–42 weeks). Higher disagreement was found at 28 – 31 weeks' and 32 – 36 weeks' gestation (8).

SFH remains the proxy for gestational age in much of the resource-poor world. While more accurate measures should be encouraged. The formula that incorporates at least three SFH measures from an individual mother provides a significant increase in the accuracy of prediction (9).

The mean gestational age estimated on the basis of LNMP was higher than mean gestational age by ultrasound i.e. the fetuses were usually smaller at ultrasound examination than expected by LNMP (10).

The obese mothers were significantly more likely to have the expected date of delivery (EDD) postponed i.e. fetuses were smaller at ultrasound examination than according to the LNMP, compared with the reference group. Mothers with BMI = 30 had increased risk for postponing of EDD between 7 and 13 days (OR, 1.45; 95% CI, 1.42–1.48) and even significantly elevated risk for postponing of at least 14 days (OR 1.65; 95% CI 1.60-1.70) in comparison with women with normal weight (10).

The correlation analysis showed a strong positive correlation between BPD and FL ($r = 0.981$), the correlation between FL and GA was 0.966 which is a strong and high. On the other hand, the correlation between BPD and GA was 0.970 which is a strong and higher than that of FL ($r = 0.966$), but there is no statistically significant difference. There was a strong positive correlation between gestational age, and femoral length and biparietal diameter ($r = 0.97$, $r = 0.98$) (11).

The most accurate equation to estimate the fetal gestational age was derived from the equation $GA = 4.970 + 0.157FL + 0.218BPD$. The estimation of gestational age with fetal biparietal diameter and femoral length still remain the most common measurements to assess the fetal growth. Evaluation of gestational age with biparietal diameter and femoral length joined together is more accurate than biparietal diameter and femoral length when used separately (11).

Among 53 women who came for ultrasonography in the third trimester, 44 (84.62%) pregnant woman have different gestational age from US and last menstrual period (LMP). The main method to follow fetus growth in third trimester is not biparietal diameter measurement only. The BPD in third trimester is not reliable and less important when the pregnancy passes 30 weeks. The BPD has to be used with other measurements to emphasize the normal growth of fetus and avoid wrong measurement of ultrasound (12).

Some clinicians fear that the exclusive use of US based estimates of gestational age would result in pregnancy complications because of the potential to miss early growth discordance. A large for gestational age fetus might be mistakenly assigned a greater gestational age because of its larger size or an early growth restricted fetus may be incorrectly assigned earlier due date. This may potentially mask an underlying fetal or placental problem leading to pregnancy complications, such as preterm birth, preeclampsia, and fetuses small for gestational age, or it may cause a delay in the recognition of fetal abnormalities (13).

When performed with quality and precision, ultrasound alone is more accurate than certain menstrual date for determining gestational age in the first and second trimesters (< 23 weeks) and it is the best method for estimating the delivery date (13).

Aside from ultrasound, other methods used to assess gestational age have included uterine size assessment, time at quickening and fundal height measurements. However, these clinical methods are often suboptimal. Uterine size determination by bimanual examination produced incorrect assessments by more than two weeks in over 30% of patients (14). Similarly, fundal height estimation does not provide reliable guide to predict gestational age during the second and third trimesters (14).

When choosing the optimal parameter for estimating gestational age, it is essential that the structure has little biologic variation, and can be measured with a high degree of reproducibility. In the past, the biparietal diameter (BPD) had been described as a reliable method of determining gestational age. While the BPD was the first fetal parameter to be clinically utilized in the determination of fetal age in the second trimester (14).

Of the 1483 pregnant women studied, 1427 (97.4%) had information about the LNMP; among those with this information, 1097 (76.9%) were certain about the date. The women who reported being certain of the LNMP showed a higher rate of agreement with the reference US (68.7%) than the ones who were not sure ($P < 0.001$). Discrepancy found between LMP and US-based GA estimates could be explained in part by the low socioeconomic level of the women who enrolled (15).

Statistical tests such as correlation and T-test had been used between humeral length and femoral length to analyze and get the correlation coefficients and significant values. There was a strong positive correlation between gestational age (last menstrual period) and humeral length ($r = 0.80$). Also strong correlation exists between gestational age and femoral length ($r = 0.89$). There was no statistically significant difference between humeral length and femoral length ($p = 0.630$) (16).

The SFH formula overestimated newborn GA by 3.94 weeks for a pre-term newborn of 34 weeks gestation with a Z-score of 0 who had at least three SFH measurements. Newborn of 34 weeks gestation and a Z-score of -2.0, the SFH formula performed slightly better, overestimating newborn GA by 3.62 weeks (95% LOA: 2.18, 5.06). For a term newborn of 40 weeks gestation with a Z-score of 0 the SFH formula performed well, overestimating newborn GA by just 0.22 weeks if its Z-score was 0 (95% LOA: -1.21, 1.65) (17).

HC biometry tended to underestimate GA, especially when measured later in pregnancy, while BPD tended to overestimate GA regardless of the gestation time of measurement. On average, HC biometry underestimated GA by 0.39 weeks. When measured at 16 weeks gestation, HC biometry was more accurate in small for gestational age (SGA) of newborns, slightly over estimating GA by 0.75 weeks. However, when measured at 40 weeks gestation, HC biometry was less accurate in small for gestation age (SGA) newborns, under-estimating GA by 1.81 weeks (17).

BPD cannot be relied upon for determination of gestational age after 26 weeks, though before 26 weeks BPD is a reliable parameter and statistically significant. Neither single US examination nor multiple US examination of BPD does not improve reliability after 34 weeks (18). AC is better than BPD and almost equal to FL in determining gestational age. Hence AC and FL are most acceptable indicators of gestational age after 34 weeks (18).

BPD (53%) is most accurate individual parameter followed by HC (42%) and FL (40%), with AC is least accurate individual parameter to determine gestational age during second trimester. In third trimester BPD (32%) and FL (31%) were equally accurate parameter followed by AC (20%) and HC (19%) to determine gestational age (1).

Biparietal diameter and Head circumference were found to be equally best predictor of gestational age and to determine expected date of delivery in second trimester, and BPD and FL in the third trimester. AC was least accurate parameter in both trimesters. The accuracy decreased and variability increased as pregnancy advanced from the second trimester to third trimester (1).

GA estimated from FL in 512 cases between 27-39 weeks of gestation showed that quadratic model has a good fit to the data and $R^2 = 0.785$ with standard error + 8 days. The paired t -test between Indian and Bangladesh women was significant ($p < 0.001$) (19).

Of the 390 patients studied, SFH correctly assessed GA in 80% compared to 81.3% for BPD, 82.1% for FL, 84.1% for BPD and FL. There is no significant difference in the sensitivity of SFH 93.1% and ultrasound 97.9%. There is also no significant difference in the margin of error between the true gestational ages obtained by the two methods (SFH 15-41days Vs ultrasound 15-33days) (20).

There is wide margin of error when the composite gestational age is determined on the basis of usual fetal parameters like BPD, AC, HC and FL. Also they give false results in presence of fetal anomalies like there is alteration of BPD and HC in presence of brachycephaly, FL in femoral achondroplasia, AC in presence of IUGR (21).

FL was found to give correct assessment of gestational age in 232 out of 327 with diagnostic accuracy of 70.9%, which is statistically significant ($p < 0.001$) (22). Fetal head starts to mould as it engages and descends in preparation for birth so that both the BPD and the head circumference (HC) may measure less than they should. Since the fetal thigh does not mould, FL remains unaffected. Hence, in late gestation, FL is the standard biometric parameter to ascertain and establish fetal age, not BPD (22).

Study done on 580 normal pregnant females in 2nd and 3rd trimesters showed correlation coefficient between BPD and HC, BPD and AC, BPD and FL, FL and AC, FL and HC, AC and HC are 0.98, 0.98, 0.98, 0.98, 0.97, and 0.98 respectively. Based on the above results it is observed that all the parameters are very strongly correlated with each other (23).

The serial measurements increases the accuracy of fetal age estimation in late pregnancy but the fetal age estimation in late pregnancy is fraught with considerable error (24). The composite estimates of BPD, AC, HC and FL have shown 28% improvement in late pregnancy (24).

Mean differences between the gestational ages obtained by the ultrasound scan and those of the last menstrual period (LMP) and symphysis fundal height (SFH) for both the first and the second visits after 22 weeks of gestation shown the mean differences were higher for the LNMP values and these were found to be statistically significant ($P = .001$). The mean differences for the SFH values were not statistically significant (25).

The study on symphysis fundal height nomogram in ultrasound dated pregnancies shown a significant difference in fundal height values of Nigerian women especially in late pregnancy compared with SFH measurement from other country. A positive linear correlation between symphysis fundal height and fetal gestational age was found in Nigerians with a correlation coefficient of $R^2 = 0.9962$ ($p < 0.001$) (26).

Femur length (FL) measurement is used as accurate predictor of gestational age between 14 weeks gestation and term. The accuracy of the FL and BPD measurement was similar in the third trimester. The accuracy of gestational age prediction based on FL is greatest in the second trimester (27).

The most accurate measurement was the fetal kidney length with a standard error (SE) of 10.29 days, while the most inaccurate was the abdominal circumference with a SE of 14.54 days. The best predictor of gestational age from these models was the one combining head circumference, biparietal diameter, abdominal circumference and femur length. The accuracy of predicting gestational age from these indices was ± 9.45 days (28).

The research on the length of human pregnancy as calculated by ultrasonographic measure of the fetal biparietal diameter concluded the mean pregnancy length calculated from ultrasonically measured biparietal diameter in second trimester was 280.6 days, a figure that corresponds well with Naegele's rule 280 days (29).

3. OBJECTIVES

3.1 General Objective

To assess the accuracy of estimating gestational age by symphysis fundal height, last normal menstrual period and ultrasound measurements during third trimester pregnancy at Gandhi Memorial Hospital, Addis Ababa.

3.2 Specific Objectives

- To determine accuracy of estimating gestational age by SFH during third trimester.
- To determine accuracy of estimating gestational age by ultrasound measurement; FL, BPD, HC and AC during third trimester.
- To determine accuracy of estimating gestational age by LNMP during third trimester.
- To test the correlation among different methods during third trimester.

4. METHODS AND MATERIALS

4.1 Study Area

The study was conducted at Radiology unit of Gandhi Memorial Hospital, Addis Ababa, Ethiopia. Gandhi Memorial Hospital is one of the referral hospitals in Addis Ababa. This hospital primarily provides service for women and neonates.

4.2 Study Period

The study was carried out from June 9, 2016 – October 20, 2016.

4.3 Study Design

Hospital based comparative cross sectional study was carried out.

4.4 Source Population

All third trimester pregnant women visiting Gandhi Memorial hospitals for ANC follow up during the study period.

4.5 Study Population

All women of third trimester pregnancy who referred to radiology unit for obstetric ultrasound examination.

4.6 Inclusion and Exclusion Criteria

The study subjects were mothers with singleton pregnancy of third trimester who attend ultrasound examination with following inclusion criteria.

- ✓ Certainly know first day of last normal menstrual period
- ✓ Regular menstruation on last three months prior to LNMP.
- ✓ No history of taking tobacco and drug abuse
- ✓ No history of diabetes and hypertension
- ✓ No history of chronic diseases; malnutrition, infection

The exclusion criteria were obese (weight more than 90 kg), polyhydramnios, oligohydramnios, ruptured membranes, oblique and transverse lie, breech presentation, obvious congenital abnormalities of fetus, abruptio placenta, placenta previa and placental infraction.

4.7 Sample Size

Sample size was determined by using sample size calculation formula considering the following assumptions:

Two-tailed level of significance = 0.05

Power chosen = 99%

Minimum detectable difference = 1 week

Standard deviation of the differences between gestational age by US and LNMP = 2.1 weeks (7). This assumption is considered to be the same for all the US parameters; FL, BDP, HC and AC.

There is scarcity of literature that reported standard deviation of the difference between gestational age by SFH and LNMP. But it is considered that there is no significant difference between this standard deviation and standard deviation of the differences between Gestational age by LNMP and US. Because of potentially minor existing difference between the two, the standard deviation of 3 was considered for the difference between gestational age by SFH and by LNMP. This standard deviation provides largest sample size which increases precision of the required estimates.

After considering these assumptions the following formula was used to calculate the required sample size

$$n = (Z_{\alpha/2} + Z_{\beta})^2 \sigma^2 / d^2$$

Where n: sample size

$Z_{\alpha/2}$: Z value corresponding to two sided significance level of 0.05

Z_{β} : Z value corresponding to one sided power of 99%

σ : standard deviation of the difference (largest SD, i.e. 3 was used; because it gives largest sample size)

d: minimum detectable difference with the given power in weeks, i.e. 1 week.

After substituting the values into the formula, approximately 166 women were required. Because potential non response and loss to follow up, additional 10% of the sample size were added giving final sample size 182.

4.8 Sampling Procedures or Techniques.

Women with third trimester pregnancy who fulfill the inclusion criteria and were taking ultrasound examination during study period were consecutively recruited in the study until the sample size was filled.

4.9 Study Variables

4.9.1 Dependant Variable

- ✓ Gestational age

4.9.2 Independent Variables

- ✓ SFH measurements
- ✓ LNMP
- ✓ Ultrasound parameters; FL, BPD, HC and AC.

4.10 Operational Definitions

Gestational age: -the age of unborn baby counted from first day LNMP

First trimester: - is pregnancy from gestational age of 1–13 weeks.

Second trimester: - is pregnancy from gestational age of 14–27 weeks.

Third trimester: - pregnancy from 28 - 42 weeks.

Polyhydraminous – amount of amniotic fluid when amniotic fluid pool greater than or equal to 8cm

Oligohydraminous- amount of amniotic fluid when amniotic fluid pool less than or equal to 1-2cm.

4.11 Data Collection Tools and Techniques

4.11.1 Data Collection Instruments

The following data collection tools were used

- ✓ Structured questionnaire
- ✓ Non elastic tape meter
- ✓ Real time 2D ultrasound with 3.5 MH linear sector transducer

4.11.2 Methods of Data Collection

All mothers were consented to participate in the study and were asked if they know first day of LNMP certainly. The women who knew their LNMP with certainty were participated in the study.

Data was collected through interview based questionnaire, clinical examination of measuring fundal height and ultrasound examination. Questionnaire was coded by using patient's card number as code. The phone number of participant and her husband was taken. The phone number of investigator was also given for participant to make free call if they change their phone number. The data include socio-demographic characteristics such as age, religious, and level of education and occupation of mothers. Obstetric history of mothers like gravidity, parity and regularity of last menstrual period was included in the questionnaire.

Based on LNMP gestational age and expected date of delivery were calculated at the end of each data collection day. Expected dates of delivery was calculated using Nagele's rule by counting back three months from the first day of the LNMP and adding one year and seven days (5).

Symphysis fundal height was measured by using non elastic tape meter. The measurement was distance from the uterine fundus to the superior border of the pubic symphysis. Measurements were made by health professional that has no prior knowledge of the patients' gestational age. The graduation in centimeters of tape facing the abdomen during measurement before turning the tape to the centimeter side to take the actual reading. All measurements were recorded to the nearest centimeter.

Four parameter of ultrasound measurement such as FL, BPD, HC and AC were taken to estimate gestational age and expected date of delivery by using Real time 2D ultrasound with 3.5 MH linear array transducer which works with Hadlock's standard growth curve for estimation of gestational age. The ultrasound measurement was done by senior radiologist who was blind to gestational age.

Femur length was measured along long axis of diaphysis by using straight line from tip of head to lateral epicondyle (11). The BPD was assessed in the axial plane of fetal head where the skull being in oval shape at the level of two thalami (11). The fetal head circumference was traced along outer perimeter of calvarium at the same level as BPD. AC was measured by tracing along the outer margin of fetal abdomen with electronic digitizer.

Each pregnant mother followed for duration from data collection to delivery. Actual date of delivery, birth weight of neonate and other birth outcomes were collected from delivery report recorded in patient card. Those mothers who gave birth away from study hospitals were asked for exact date through phone call.

4.12 Data Quality Control

The quality of data that gives reliability and representativeness to the study was maintained by incorporating only the complete data of the subjects within the study period. The collected data was checked at different levels for completeness and consistency by principal investigator at the end of each day. Whenever an error was found at any level, the investigator was traced back and corrected as needed. Double data entry was done by the principal investigator.

4.13 Data Processing and Analysis

Data collected was analyzed using SPSS version 21 computer program. The mean gestational age by each method were computed. Mean difference of LNMP based gestational age with SFH and different US were tested by using paired t-test. The mean difference between SFH and all ultrasound parameter were tested. P-values less than 0.05 were taken as statistically significant. The correlation among different measurements of US was tested. The significance of correlation was also done. The data was presented by using statements, figure and tables.

4.14 Ethical Considerations

Ethical clearance was obtained from Institutional review board of College of Health Science, Addis Ababa University. The same document and letter from department of medical anatomy was used to secure written permission from the administration of Gandhi Memorial Hospital. All the study participants were briefed with research activities and confidentiality of the information collected. Written consent obtained from each participant. The participants were told as they had right not to participate or even can excluded themselves from study at any point of time during the study if they feel discomfort.

5. RESULT

5.1 Socio-demographic Characteristics

Total of 182 women were recruited for the study based on inclusion criteria from third trimester pregnancy attending ultrasound room for examination. Among them 6 were excluded from the study because they gave birth out of hospital and even unable to contact through phone. For this reason final analysis was done on 176 pregnant mothers with response rate 96.7%.

Socio-demographic characteristics of the study participants were shown in table 1. The mean age of the women was 26.6 years with standard deviation of 4.23. Almost all had at least primary school education (98.29%). Sixty three (35.80%) of the mothers were nulliparous, 109(61.93%) were primiparous and multiparous, and 4(2.27%) were grandmultiparous. The mean parity was 1.07 with a range of zero to seven. The mean gravidity of the women was 2.23.

The data of birth outcome shown that 172 (97.73%) were live birth and 4(2.27%) were still births. All new birth had no gross congenital anomaly. The mean birth weight of the babies' was 3.14kg with standard deviation of 0.50kg. About 7.40% of neonates were low birth weight, 79.60% were normal birth weight and 13% were overweight. Ninety four (53.41%) of the babies were male while the remaining eighty two (46.59%) were female.

Table1. Socio-demographic characteristics of the pregnant women at Gandhi Memorial Hospital, Addis Ababa, Ethiopia, 2016

Variable	Category	Frequency (%)
Residence	Addis Ababa	174 (98.86)
	Others	2 (1.14)
Age in year	< 20	6 (3.40)
	20 – 25	64(36.37)
	26-30	82(46.59)
	31-35	18(10.23)
	>35	6(3.41)
Religion	Orthodox Christian	121 (68.75)
	Muslim	29 (16.48)
	Protestant Christian	26 (14.77)
Level of education	Cannot read and write	1 (0.57)
	Can read and write	2 (1.14)
	Primary school	74 (42.05)
	Secondary school	63(35.79)
	College and above	36(20.46)
Occupation	Housewife	91 (51.70)
	Government employed	37 (21.02)
	Self employed	47 (26.70)
	Others	1 (0.57)

5.2 Estimation of Gestational Age and Expected Date of Delivery

The mean gestational age of pregnancy from the LNMP was 36.35 weeks with standard deviation of 3.35 weeks. The mean gestational age from the parameters of ultrasound scan done by femoral length (FL) was 36.64 weeks, BPD was 36.57 weeks, HC was 34.01 weeks and AC was 33.94 weeks with standard deviation of 3.05 weeks, 2.98 weeks, 2.18 weeks and 2.13 weeks respectively. The mean gestational age by SFH measurement was 34.88 weeks with standard deviation of 2.71 weeks. The mean gestational age by different parameters described in figure 1 below.

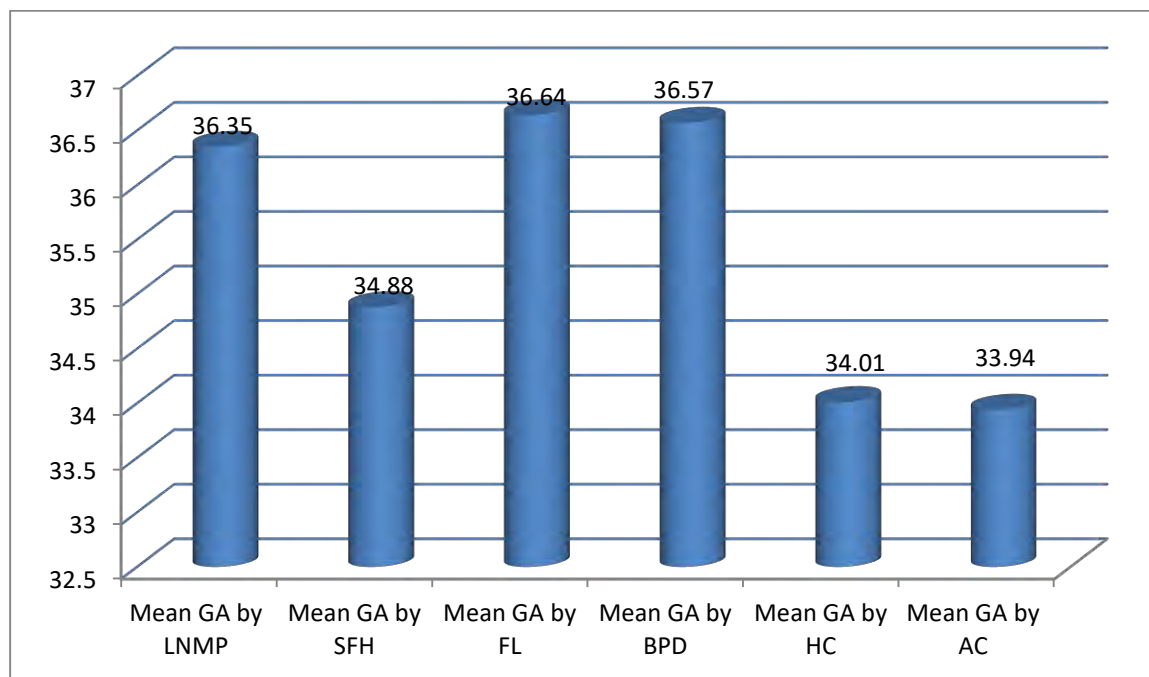


Figure 1- Mean gestational age by LNMP, SFH and four ultrasound parameters at Gandhi Memorial Hospital, Addis Ababa, Ethiopia, 2016

The mean gestational age estimated by certainly recalled LNMP were significantly different from estimate by ultrasound parameters; HC and AC. The mean difference of gestational by LNMP and FL was - 0.29, ($p= 0.053$) and LNMP and BPD was - 0.22($p= 0.155$) these were statistically insignificant. Mean gestational age by LNMP had statistically significant difference from SFH. The mean differences between gestational ages by certainly recalled LNMP with SFH and parameters of ultrasound with their statistical test results were presented in table 2 below.

Table2. Mean difference between GA by LNMP with SFH and US parameters and results of statistical significance test at Gandhi Memorial Hospital, Addis Ababa, Ethiopia, 2016.

Pairs	Variables	Paired difference				
		Mean (in weeks)	Standard deviation	95% confidence interval	t- test value	p- value
Pair 1	GA LNMP-GAFL	- 0.29	1.95	(- 0.57, 0.003)	-1.95	0.053
Pair 2	GALNMP-GABPD	- 0.22	2.04	(-0.52, 0.08)	-1.43	0.155
Pair 3	GALNMP-GAHC	2.49	2.42	(2.12, 2.86)	13.32	0.000
Pair 4	GALNMP-GAAC	2.57	2.23	(2.23, 2.91)	14.92	0.000
Pair 5	GALNMP-GASFH	1.47	2.40	(1.12,1.83)	8.13	0.000
Pair 6	GALNMP-GA by composite US	1.13	2.01	(0.82,1.43)	7.23	0.000

GALNMP- gestational age by LNMP, GAFL-gestational age by FL, GABPD-gestational age by BPD, GAHC-gestational age by HC, GAAC- gestational age AC, GASFH-gestational age by SFH.

The mean gestational age estimated by SFH had 1.76 weeks difference from FL and 1.69 weeks difference from BPD. The mean gestational age by SFH had nearly 1 week difference from gestational age by HC and AC. SFH estimate had only 0.39 week difference from estimate by composite of FL, BPD, HC and AC. But these all differences were statistically significant ($p \leq 0.05$). The detail of mean difference between SFH and ultrasound measurement were described in table 3 below.

Table3. Mean difference between GA SFH and US parameters, and results of statistical significance test at Gandhi Memorial Hospital, Addis Ababa, Ethiopia, 2016.

Pairs	variables	Paired Differences				
		Mean (in weeks)	Standard Deviation	95% Confidence Interval	t-test value	p- value
Pair 1	GASFH- GAFL	-1.76	1.65	(-2.0, -1.52)	- 14.18	.000
Pair 2	GASFH-GABPD	-1.69	1.52	(- 1.92, -1.47)	-14.80	.000
Pair 3	GASFH-GAHC	1.01	1.77	(0.74, 0.27)	7.40	.000
Pair 4	GASFH-GAAC	1.01	1.70	(0.83, 0.34)	8.26	.000
Pair 5	GASFH-GA composite	- 0.36	1.44	(-0.58, - 0 .14)	-3.22	.002

GAFL-gestational age by FL, GABPD-gestational age by BPD, GAHC-gestational age by HC, GAAC- gestational age AC, GASFH-gestational age by SFH, GA composite - gestational age by all four ultrasound measurement

The correlation analysis of four parameters of US shown BPD and FL had stronger correlation ($r=0.94$). Abdominal circumference and head circumference are also strongly correlated ($r=0.90$). SFH had stronger correlation with all ultrasound measurement than LNMP. The detail of Pearson correlation analysis among LNMP, SFH and US measurements described table 4 below.

Table 4. Correlation between gestational age by US parameters; FL, BPD, HC and AC at Gandhi Memorial Hospital, Addis Ababa, Ethiopia, 2016.

	GA by LNMP	GA BY SFH	GA BY FL	GA by BPD	GA by HC	GA by AC	GA by Composite US
GA by LNMP(n= 176)	1.00	0.70**	0.82**	0.79**	0.67**	0.74**	0.79**
GA by SFH (n=176)	0.70**	1.00	0.84**	0.86**	0.74**	0.76**	0.84**
GA by FL (n=176)	0.82**	0.84**	1.00	0.94**	0.83**	0.88**	0.96**
GA by BPD(n=176)	0.79**	0.86**	0.94**	1.00	0.87**	0.87**	0.97**
GA by HC (n=168)	0.67**	0.74**	0.83**	0.87**	1.00	0.90**	0.93**
GA by AC(n=168)	0.74**	0.76**	0.88**	0.87**	0.90**	1.00	0.95**
GA by composite US (n=168)	0.79**	0.84**	0.96**	0.97**	0.93**	0.95**	1.00

** . Correlation is significant at the 0.01 level (2-tailed).

The number of pregnant mothers whose expected date of delivery (EDD) lies within different week from actual date of delivery were shown in table 5 below. The number of mothers gave birth within one week period of expected date by LNMP were 93 (52.84%), FL were 67 (38.06%), BPD were 59 (33.52%), HC were 34 (20.24%) and AC were 27 (16.07%).

Table5. Number of deliveries occurred within one, one to two, two to three and above three weeks difference from predicted date by each at Gandhi Memorial Hospital, Addis Ababa, Ethiopia, 2016.

		Within one week of actual date of delivery	One week to two weeks of actual date of delivery	Two weeks to three weeks of actual date of delivery	Above three weeks of actual date of delivery
LNMP	Frequency	93	44	23	16
	percentage	52.84%	25.00%	13.07%	9.08%
FL	frequency	67	37	34	38
	Percentage	38.06%	21.02%	19.32%	21.59%
BPD	frequency	59	43	35	39
	percentage	33.52%	24.43%	19.88%	22.15%
HC	frequency	34	30	44	60
	Percentage	20.24%	17.86%	26.19%	35.71%
AC	Frequency	27	41	47	53
	percentage	16.07%	24.40%	27.98%	31.54%

6. DISCUSSION

This study compared three methods; LNMP, SFH and unit ultrasound measurement with composite ultrasound parameters. Ultrasound measurement in late pregnancy had lesser quality than early performed ultrasound measurement. But using composite US measurements improve its quality. The composite estimate of BPD, AC, HC and FL has shown 8% improvement in predictive accuracy of early pregnancy and up to 28% improvement in late pregnancy (24).

The paired t-test showed mean difference of gestational age determined by SFH, recalled LNMP and ultrasound parameters had statistically significant difference ($p = 0.000$). This finding was consistent with research done on dating gestational age by last menstrual period, symphysis-fundal height, and ultrasound in urban Pakistan that showed significant differences in the mean GA estimates obtained by the three methods for Pakistan women (7).

Current study showed mean difference between LNMP and US was higher than mean difference between SFH and US. This shows SFH was good alternative measurement in absence of ultrasound than LNMP. This result is in line with other study showed paired mean differences of the LNMP with the early ultrasound scan were higher than mean differences of the SFH with the early ultrasound scan. This implied SFH was more useful than the LMP in the absence of an early ultrasound (25).

The Paired sample t-test showed GA by SFH has statistically significant difference from GA by both LNMP and ultrasound measurement ($p < 0.05$). This result is not in line with other study done on assessment symphysis-fundal height as means to gestation age determination in second half of pregnancy that shown there is no significant difference of gestation age by SFH and ultrasound (20). The sensitivity of SFH was 93.1% and ultrasound was 97.9%. There is also no significant difference in the margin of error between the true gestational ages obtained by the two methods (SFH 15-41days Vs ultrasound 15-33days (20). The discrepancy between the above result and current study was mainly due to subjects of this research were only third trimester pregnancy. During late third trimester engagement of fetus decreases fundal height (26).

The mean gestational age estimated on the basis of LNMP was higher than mean gestational age by AC and HC ultrasound measurements and composite of all measurements. This is consistent with other study that showed LNMP over estimate GA than US, i.e. the fetuses were usually smaller at ultrasound examination than expected by LNMP (10).

The mean difference of gestational age by LNMP and HC was 2.49 weeks. There was statistically significant difference in gestational age estimated by LNMP and HC. The mean difference of GA by LNMP and AC was 2.57 weeks. This also shows there was significant difference in between LNMP and AC ($p = 0.000$). This result was in line with other research shown FL and BPD were equally accurate individual parameters but AC and HC were least accurate individual parameters in comparison with LNMP during second and third trimester (1).

The mean difference of GA between LNMP and BPD was - 0.25 weeks which is statistically insignificant ($p=0.155$). This result is consistent with research done on assessment of length of human pregnancy as calculated by ultrasonographic measure of the fetal biparietal diameter that concluded the mean pregnancy length calculated from ultrasonically measured biparietal diameter was 280.6 days, a figure that corresponds well with Naegele's rule 280 days (29).

The mean difference of gestational age between LNMP and FL was - 0.29 weeks which was statistically insignificant ($p = 0.053$). This is consistent research done on estimation of fetal age by ultrasound in second and third trimester shown there is no significant difference between GA by LNMP and GA by FL ($p=0.533$) (27)

The comparative study of ultrasound parameters in second & third trimester shown ultrasound parameters; HC and AC had no significant difference from gestational age and they have statistically significant correlation (23). This was consistent with result of current study that showed statistically significant correlation between GA by HC and AC with GA by composite of four ultrasound parameters.

The current study showed that there was stronger correlation between SFH and all ultrasound parameters than that of LNMP and US measurement. This indicates that if SFH was accurately measured it is good proxy to US in estimating gestational age than LNMP. This result is consistent with other study showed that accurate measurement of the symphysis fundal height is reliable method of gestational age assessment in the second half of pregnancy (20).

The correlation analysis showed a strong positive correlation between GA by BPD and FL ($r=0.94$). Gestational age by HC and AC were also strongly correlated ($r=0.90$). This result is consistent with study done on reliability of biparietal diameter and femoral length in estimation the gestational age using ultrasonography among 100 pregnant mothers during 2nd and 3rd trimesters that shown the strong positive correlation between BPD and FL ($r= 0.981$) (11).

Pearson correlation among different ultrasound parameters showed there were significant correlations among all ultrasound parameters. These was consistent with other study that showed BPD, HC, AC, FL are strongly correlated with each other as well as are found to be statistically very highly significant ($P < 0.001$) (23).

According to US prediction of EDD, the number of deliveries occurred within one week duration were by FL; 67(38.06%), BPD; 59(33.52%), HC; 34(20.24%) and AC; 27(16.07%). This indicates that among the four parameters of ultrasound FL and BPD were more accurate in estimating EDD. This shows good reproducibility; those measurements which are more accurate in estimating GA were also accurate in estimating EDD. This result is similar with study done on multiple fetal parameters in third trimester gestational age estimation which shown FL was accurate method to estimate gestational age and EDD during third trimester (18). But it is inconsistent with similar study showed BPD cannot be accurate method for estimation of gestational age after 26 weeks, though before 26 weeks BPD is a reliable parameter and statistically significant (18).

7. CONCLUSION

Mean gestational age estimated by SFH, LNMP and composite of US measurements had statistically significant difference.

The mean GA by SFH under estimate gestation by only 0.36 weeks in comparison with composite US measurement. SFH was better method to estimate gestational age than LNMP.

The BPD and FL were more accurate measurement followed by AC and HC during third trimester in comparison with composite US measurement.

LNMP was least accurate method to estimate gestation in comparison to SFH and US parameters

8. LIMITATION OF THE STUDY

- ✓ Ultrasound examination was done on the pregnant mothers who referred from ANC outpatient department to radiology unit. These subjects may not have similar characteristics with those not referred.
- ✓ Gestational age calculated by LNMP was only from those mothers who are clearly certain for the first day of last normal menstrual period but their certainty is still subjective.

9. RECOMMENDATIONS

Meticulous research that assesses accuracy of SFH and parameters of ultrasound all across total duration of pregnancy with larger sample size should be done.

Since there is scarcity of similar research done in the same setup, it should be repeated in other hospital to see its reproducibility.

It is recommended that antenatal care (ANC) providers can use SFH as means of estimating gestational age than depending up on LNMP during third trimester.

Antenatal care (ANC) providers should use FL or BPD as means of estimating gestational age during third trimester.

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10. ANNEX

10.1 Questionnaire

Date _____

Participant code (Card No.) _____

Patients phone number _____/Alternative phone number _____

Part I - Socio-demographic data

1. Place of Residency A. Addis Ababa B. other, specify _____
2. Educational level
 - A. Cannot write D. Secondary school (9-12 grades)
 - B. Can write E. College and above
 - C. Primary school (up to grade 8)
3. Religion
 - A. Orthodox Christian C. Protestant Christian
 - B. Muslim D. Other, specify _____
4. Occupation
 - A. house wife C. self-employed
 - B. government employed D. other, specify _____
5. Mother Age in year _____

Part II - Obstetric and gynecological question

1. Number of live birth and still birth (Parity) _____
2. Number of pregnancy (Gravity) _____
3. History of irregularity in menstrual cycle A, yes B, No
4. Did you certainly remember your first day of last normal menstrual period (LNMP) in this pregnancy? A. certain B. uncertain
5. If certain for **Q4**, what is your LNMP _____
6. Gestational age by LNMP _____
7. EDD by LNMP _____

Part III – Measurements of Gestational age by different parameters and birth outcome

Table 1:- Symphysis fundal height measurement with its estimated gestation age.

Symphysis fundal height in CM	Estimated gestational age by SFH formula

Table 2:- shows ultrasound parameters with its estimated gestational age and expected date of delivery.

List of US parameters	Measurement in mm	Estimated gestational age	Expected delivery date
Femur length(FL)			
Biparietal diameter(BPD)			
Head circumference(HC)			
Abdominal circumference (AC)			

Table 3-- shows birth outcome such as birth weight in gram, sex, gross features of neonates and gestational age at birth.

Gestational age at delivery	Weight at birth in gram	Birth outcome	Gross congenital anomaly	Sex of new born baby
		Live birth	No	M
		Still birth	yes	F

10.2 Information Sheet

TITLE OF THE STUDY

Dating Gestational Age by Symphysis-Fundal Height, last normal menstrual period and Parameters of Ultrasound in third trimester pregnancy at Gandhi Memorial Hospital, Addis Ababa, Ethiopia.

NAME OF INVESTIGATOR:- Teshome Gensa

NAME OF SPONSOR: Addis Ababa University College of Medicine and Health Sciences

INTRODUCTION

I would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Ask questions if anything you read is not clear or would like more information. Take time to decide whether or not to take part.

THE PURPOSE OF THE STUDY

Primarily the purpose of study is educational as part of a course in masters program. So it helps researcher for partial fulfillment of master program. Secondly the result of research will be used as base line for further related research.

PROCEDURE

To assess accuracy of dating Gestational age by symphysis fundal height and parameters of Ultrasound, your symphysis fundal height measurement and measurement of ultrasound parameters will be recorded. Additionally data of delivery will be recorded from delivery summary in card or through phone call if not available on card.

PARTICIPANTS COMMITMENT

The study will not take extra time than that you spend for your medical evaluation for first time. Without any session in between; date of delivery is taken from your card. But it needs your

commitment to provide your date of delivery through phone call if you gave birth outside study area.

BENEFITS AND RISK OF THE STUDY

The study has no any risk for the mother and her fetus because this study doesn't uses invasive procedures. There is also no benefit that you gain from this study because of your participation

CONFIDENTIALITY

The information collected from this study will be kept confidential. The data collected do not contain any personal information about you except your card number as code to have date of delivery from delivery summary and phone number. No one will link the data you provided to the identifying information you supplied such as card number and phone number.

PARTICIPANTS' RIGHTS

You may decide to stop being a part of the research study at any time without explanation. You have the right to ask that any data you provided can be destroyed.

FOR FURTHER INFORMATION

I, Teshome Gensa, the principal investigator will be glad to answer your questions about this study at any time. If you need to have further information you can contact using the following address.

Persons to contact

1. Teshome Gensa

Cell phone: +251-910686501

Email: teshgen2006@gmail.com

2. Ethical review board of College of Health Sciences, Addis Ababa University, Ethiopia

Phone No - +251-118961396

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የእርግዝና ዕድሜን ለመገመት የሚጠቀሙ የአልትራሳዎንድ ውጤቶች በመጨረሻዎቹ ሦስት ወራት ውስጥ ምን ያህል ትክክል መሆኑን በጋንዲ መታሰቢያ ሆስፒታል፤ አዲስ አበባ፤ ኢትዮጵያ ላይ ማረጋገጥ።

የዋና ተመራማሪው ስም፦ አቶ ተሾመ ጌንሳ

የምርምር ወጭ የሚሸፍነው፦ የአዲስ አበባ ዩኒቨርሲቲ ህ/ጤ/ሳ/ኮሌጅ

መግቢያ

በዚህ ጥናት ተሳታፊ እንድትሆኑ ስጋብዛችሁ ለመሳተፍ ከመወሰናችሁ በፊት ጥናቱ ለምን እንደሚሰራና ከእርስዎ ላይ ምን እንደሚፈልግ በትክክል እንድትረዱ አሳስባለሁ። ጊዜና ትኩረት በመስጠት የሚቀጥለውን መረጃ ያንብቡ። ስታነቡ ግልፅ ያልሆነ ነገር ካለ ወይም የበለጠ መረጃ ከፈለጉ ይጠይቁኝ። ለመሳተፍና ላለመሳተፍ ጊዜ ወስደው ያስቡበት።

የጥናቱ አላማ

በዋናነት የዚህ ጥናት ዓላማ የተመራማሪው የ2ኛ ዲግሪ መመረቂያ ጽሁፍ ሲሆን ከዚህ ጥናት የሚገኘው ውጤት በሆስፒታሉ እና ሌሎች መሰል ሆስፒታሎች ለሚካሄዱ ተመሳሳይ ጥናቶች እንደመነሻ ግብዓት ያገለግላል።

የጥናቱ ዘዴ

ለጥናቱ የሚያስፈልጉ የአልትራሳውንድ ውጤቶች እንደ መረጃ ይወሰዳል። በተጨማሪም የወለዱበት ቀን ከህክምና ካርድ ይረጋገጣል። መረጃ በህክምና ካርድ የማይገኝ ከሆነ ወይም የወለዱበት ቦታ ጥናቱ ከሚካሄድበት ቦታ ውጭ ከሆነ ስልክ በመደወል የወለዱበት ቀን ይረጋገጣል

የተሳታፊዎች መስዋእትነት

ለጥናቱ የሚሆነው መረጃ መሰብሰብ ለህክምና መጥተው የሚያሳለፉት ጊዜ ስለሆነ ጊዜዎችን አይሻማም። ነገር ግን ከእርስዎ የሚጠበቀው ከሆስፒታል ውጭ የወለዱ ከሆነ ስልክ ሲደወል የወለዱበትን ቀን በትክክል መስጠት ነው።

የጥናቱ ጉዳትና ጥቅም

ተሳታፊው በዚህ ጥናት ውስጥ በመሳተፋቸው የሚደርስባቸው ምንም አይነት ጉዳት የለም ምክንያቱም የሚሰሩት ስራዎች በሰውነት ላይ ምንም አይነት ጉዳት አያስከትሉም። ተሳታፊው በጥናቱ ተሳታፊ በመሆናቸው በቀጥታ የሚያገኙት ጥቅም የለም።

ሚስጥራዊነቱ

በዚህ ጥናት የሚሰበሰበው መረጃ ሚስጥራዊነቱ የተጠበቀ ነው። መረጃው ላይ ከህክምና ካርድ ቁጥርና ከስልክ ሌላ ማንነትን የሚገልፅ ነገር አይጠቀስም። ማንም ሰው መረጃውን ከግለሰቡ ጋር የሚያገናኝበት ሁኔታ የለውም።

የተሳታፊዎች መብት

በመሳተፍ ላይ እያሉ በማንኛውም ሰዓት የማቋረጥ መብት አለዎት። የሰጡትን መረጃ እንዲመለስ ወይም እንዲጠፋ የመጠየቅ ሙሉ መብት አለዎት።

ለተጨማሪ መረጃ

እኔ ዋና ተመራማሪ ተሾመ ገንሳ በየትኛውም ሰዓትና ቦታ ጥናቱን በተመለከተ የምታነሱትን ጥያቄ ለማስተናገድ ዝግጁ ነኝ። ስለ ጥናቱ ተጨማሪ መረጃ ከፈለጉ የሚቀጥለውን አድራሻ በመጠቀም መጠየቅ ይችላሉ።

1. አቶ ተሾመ ገንሳ

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ኢሜል፡ teshgen2006@gmail.com

2. የጤ/ሀ/ኮ ስነ-ምግባር ኮሚቴ፣ አዲስ አበባ፣ ኢትዮጵያ

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10.3 Consent Form

Code no _____

Information about the study was explained to me by the investigator. I had understood that the objective of this study was to assess accuracy of dating gestational age by symphysis-fundal height, last normal menstrual period and ultrasound parameters such as head circumference, femur length, biparietal diameter and abdominal circumference during third trimester pregnancy. I clearly understood that all the research activities not hurt my health. It also explained to me that I had the right to stop participation at any time.

I agree to participate in the study and hereby approve my agreement with my signature.

Participant signature _____ Date _____

Investigator signature _____ Date _____

በምርምር ለመሳተፍ የፈቃደኝነት መዋዋያ ቅፅ

መለያ ቁጥር-----

ጥናቱን በሚያካሂዱት ሰዎች ስለጥናቱ በቂ መረጃ ተሰጥቶኛል። የዚህ ጥናት አላማም የእርግዝና ዕድሜን ለመገመት የሚጠቅሙ የአልትራሳዎንድ ውጤቶች በመጨረሻዎቹ ሦስት ወራት ላይ ምን ያክል ትክክለኛ እንደሆኑ ለማረጋገጥ ነው። የጥናትና ምርምር ስራዎቹ በጤናዬ ላይ ምንም አይነት ጉዳት እንደማያስከትል በግልፅ ተገንዝቤያለሁ። እንዲሁም በጥናቱ ለመሳተፍ ፈቃደኛ ካለሆንኩ በጥናቱ ለመሳተፍ እንደማልገደድ እና ከጥናቱ መውጣት እንደምችልም ተረድቻለሁ።

በመሆኑም በዚህ ጥናት ላይ ለመሳተፍ የተስማማሁ መሆኔን በፊርማዬ አረጋግጣለሁ።

የተሳታፊው ፊርማ----- ቀን-----

የጥናት አድራጊ ፊርማ----- ቀን-----

