

Percentile of Fetal Growth Between Last Menstrual Period (LMP) and 3rd Trimester Ultrasound Pregnancy On Ethnic Minangkabau

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Abstract

BACKGROUND: Fetal growth is a vital determinant of quality of life at birth and is the most important factor for perinatal morbidity and mortality. **OBJECTIVE:** this study is expected to obtain normal data on fetal growth depending on biometric variations based on Minangkabau ethnic. **DESIGN:** Analytical study with cross sectional design **SETTING** Fetomaternal clinic Hospital M. Djamil Padang and Network Hospital in the Department of Obstetrics and Gynecology Faculty of Medicine Andalas University **POPULATION OR SAMPLE:** Pregnant women who came to check their pregnancy at the Fetomaternal clinic at M. Djamil Hospital Padang and a network hospital **METHODS:** Analytical study **MAIN OUTCOME MEASURES:** The multivariate analysis with linear regression, a significant value that the simultaneous measurement of biometric variables (BPD, HC, AC, FL, HL) on the LMP **RESULTS:** 520 pregnant women who came to check at 3rd trimester (28-40 weeks by US). The characteristics of the research subjects were the average age of pregnant women ranging from 21-39 years with the average was 28.49 ± 4.5 years, parity 1 as many as 203 people (46,7%), and the average level of education at senior high school as many as 431 people (82,9%), and there were 123 working pregnant women (42,5%). Based on the Pearson analysis, Correlation between of each variable BPD, HC, AC, FL, and HL to LMP, there is the strongest correlation LMP and AC, which is $r = 0,799$ and the weakest correlation LMP and HL is $r = 0,162$, for all variables is very significant.

TITLE PAGE

FULL TITLE

Percentile of Fetal Growth Between Last Menstrual Period (LMP) and 3rd Trimester Ultrasound Pregnancy On Ethnic Minangkabau

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RUNNING TITLE

Fetal Growth Last Menstrual Period & Trimester 3

ABSTRACT

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MAIN OUTCOME MEASURES The multivariate analysis with linear regression, a significant value that the simultaneous measurement of biometric variables (BPD, HC, AC, FL, HL) on the LMP

RESULTS: Five hundred and twenty pregnant women who came to check at 3rd trimester (28-40 weeks by US). The characteristics of the research subjects were the average age of pregnant women ranging from 21-39 years with the average was 28.49 ± 4.5 years, parity 1 as many as 203 people (46,7%), and the average level of education at senior high school as many as 431 people (82,9%), and there were 123 working pregnant women (42,5%). Based on the Pearson analysis, Correlation between of each variable BPD, HC, AC, FL, and HL to LMP, there is the strongest correlation between LMP and AC, which is $r = 0,799$ and the weakest correlation between LMP and HL is $r = 0,162$, for all variables is very significant (p value $< 0,000$).

CONCLUSIONS The multivariate analysis with linear regression, there is a significant value that the simultaneous measurement of biometric variables (BPD, HC, AC, FL, HL) on the LMP would be 84.6% more significant.

FUNDING : Self-funded

KEYWORDS: fetal growth, last menstrual period, ultrasound, minangkabau ethnic

INTRODUCTION

Fetal growth is a vital thing that determines the quality of life at birth and is the most important factor for perinatal morbidity and mortality.¹ Maternal race and ethnicity are important parameters that distinguish fetal size and birth weight.^{2,3} In one study, there was a difference in the size of infants of European descent, on average 225.5 g heavier than infants of Chinese and 254.6 g heavier than infants of South Asian descent.²

Early manifestations of this phenotype indicate that it is caused by genetics and/or determined through maternal physiological exposure, not as a result of behavior or diet in childhood or later in life.^{2,4,5}

Since ultrasonography (USG) technology was discovered more than 40 years ago, fetal biometry with ultrasound measurements has become a favorable and accurate for estimating the baby's birth weight.^{6,7} As science advances and more approaches to measuring fetuses to determine the estimated birth weight of babies, including the formulas of Jeanty, Aoki, Campbell, and other approaches are being developed.⁸ Pressman et al, stated that the Hadlock formula (BPD, HC, AC, HC, FL) in determining fetal weight for 138 pregnant women was more accurate.^{9,10,11,12}

The multicenter longitudinal studies of the Intergrowth-21 (IN-21) project that presented fetal biometric standards for various populations. The National Institute of child health and human development (NICHD) together with the WHO study, all of these studies form the main basis for a new discussion of standard parameters of fetal growth.¹⁰ Because the multinational studies currently available represent a very limited selection from a varied world population, then it is possible to graph a specific population growth as a solution (e.g population adjusted based on high altitude or regional extreme conditions, economic conditions, technology availability, cultural differences, etc.).^{5,12,13}

Indonesia does not have a reference standard for fetal weight percentiles. As a developing country, with a population of more than 200 million people, ethnic and cultural diversity, there should be a suitable reference standard for us to use, so there is a mistake in managing pregnancies with normal fetuses or need further attention.

Therefore, the authors would like to conduct research to obtain data that are in accordance with fetal growth for the Minangkabau ethnicity. In addition, the authors explain the correlation between several parameters in ultrasound examination with gestational age according to the LMP so that this study is expected to provide results in the form of more parameters, in determining fetal growth.

METHODS

This research is an analytical research using a cross sectional approach determines fetal growth biometry in the Minangkabau ethnic group. The study was conducted in December 2020 at Fetomaternal clinic Hospital M. Djamil Padang and Network Hospital in the Department of Obstetrics and Gynecology Faculty of Medicine Andalas University. The selected sample was pregnant women who came to check their pregnancy at the Fetomaternal clinic at M. Djamil Hospital Padang and a network hospital who meet the inclusion and exclusion criteria. The inclusion criteria are willing to be a research subject, single and intrauterine pregnancy, gestational age 28-40 weeks and normal body mass index (BMI 18.5 - 24.9). The exclusion criteria are fetal anomaly, pregnancy with a history of myoma or cyst disease, hypertension, diabetes mellitus, kidney disease, heart disease, autoimmune (SLE); and pregnancy with a history of smoking and alcohol consumption, drugs, long-term use of drugs such as steroids, anti-hypertensives, insulin, etc. So, the sample collected is 520 samples for each gestational age from weeks 28 - 40.

Sampling was done by consecutive sampling to all pregnant women who came to the fetomaternal clinic at RSUP DR. M. Djamil Padang who met the inclusion criteria and there were no exclusion criteria to meet the number of research subjects. The dependent variable are fetal biometry such as biparietal diameter (DBP), head circumference (HC), abdominal circumference (AC), femur length (FL), humerus length (HL). All of the dependent variables were presented in millimetres. The independent variable was gestational age (GA) presented in weeks.

Univariate analysis was used to determine the description of the dependent and independent variables of the study. The results of this analysis aim to describe the frequency distribution in tabular form. Bivariate analysis using Pearson correlation test because the data distribution was normally distributed. P value <0,05 has a significant correlation. Multivariate analysis using linear regression used to measuring valid variables with p value <0,05. All data were analyzed using a computer program and SPSS.

RESULTS

Five hundred and twenty pregnant women who came to check at 3rd trimester (28-40 weeks by US), the characteristic distribution of subject can be seen in Table 1 below.

The fetal growth between LMP and 3rd trimester ultrasound pregnancy in ethnic Minangkabau can be seen from the table 2.

From table 1, we can see the mean age of subject is in reproductive age. Most of subject have 0 and 1 parity. The level of maternal education is mostly at the SHS level, for the job status of the research subjects, most of them do not work, namely only as housewives.

From Table 2, we can see the normal percentile of biometrics GA according to LMP. The result of fetal biometrics measurements by Ultrasound in each subject for the 3rd trimester of pregnancy to LMP are shown by increasing variability with gestational age for all the five variables.

The chart of normal fetal growth between LMP and 3rd trimester ultrasound pregnancy on ethnic Minangkabau can be seen in the chart 1 below.

The correlation of fetal growth between LMP and 3rd trimester ultrasound pregnancy on ethnic Minangkabau can be seen in the table 3 below.

From table 3 above, it can be seen that the strongest correlation is BPD followed by FL, HC and AC and the lowest is HL, with a very significant level of significance for all variables.

DISCUSSION

MAIN FINDINGS

In this study, there were five hundred and twenty pregnant women who came to check at 3rd trimester that included. The characteristics of the research subjects are the average age of pregnant women ranging from 21-39 years with the average is 28.49 ± 4.5 years, 0 and 1 parity percentage is 33,7% and 46,7%, and the average level of education at senior high school percentage is 82,9%, and there were 123 working pregnant which is equivalent to 42,5%, and can be shown in table 1. All of these factors are part of the significant determinants for fetal growth.

STRENGTHS AND LIMITATIONS

From Hadlock study, The variability in predicting menstrual age from abdominal circumference measurements is broader than that observed with the fetal biparietal diameter; nonetheless, this measurement can be useful as an adjunct in predicting menstrual age in cases in which the biparietal diameter is technically inadequate or impossible to obtain due to unusual positioning. for growth parameters, including BPD, HC, AC, AND FL. Preliminary experience (unpublished data) suggest that this combination of parameters is more accurate in predicting menstrual age than any single parameter, particularly in 3rd trimester of pregnancy.^{12,21}

At last, all the journals that are included in this study state that there is significant connection between each biometri variable (BPD, HC, AC, FL, and HL) on gestational age according to LMP, whether the relationship is described one by one as we found in several journals, or putting it together entirely to find a significant relationship between all these variables with gestational age according to LMP.

In addition, this study shows that ethnic differences can affect fetal growth, as other external factors can also be associated such as maternal weight, height, age and parity. We thus considered the importance of developing fetal growth curves that account for different maternal and fetal characteristics of different ethnicities.

INTERPRETATION

A Along with this result, based on the study that published by Troe et al, that had examine data of 6044 pregnant women residing in Netherlands (Dutch and Non Dutch ethnics), shows that the average age of Dutch pregnant women in Netherlands is $31.2 \pm 4,5$ years, while the Non Dutch women's average age is 26,1

$\pm 5,4$ years, Dutch women's parity percentage is 58,6% and Non Dutch's is 38,0%, The higher education of Dutch women's percentage is 56,7 %, non Dutch women's is 12,2%.¹⁴ These results confirm significant contribution of educational level, maternal age and parity status even though it has smaller contribution than maternal and parental height and lower gestational age.^{1,2,14,16} From this, we can conclude that nulliparity may not pose a risk to fetal growth.

While the other hand, the other study that performed by Chiara di Gravio et al, about "The Mumbai Maternal Nutrition Project (MMNP)" showed a high incidence of maternal age at a very young age ([?]19 years) and advanced age ([?]35 years), which is the maternal age during pregnancy has been linked to adverse fetal and birth outcomes. Young maternal age is associated with an increased risk of fetal growth restriction, preterm delivery, low birth weight (LBW), small for gestational age (SGA), and neonatal mortality.²⁻⁵ Maternal nulliparity is a risk factor for suboptimal maternal hemodynamic adaptations during pregnancy, which may adversely affect fetal nutrient supply. Children of nulliparous mothers have slower fetal growth rates from third trimester onward and accelerated infant growth rates.¹⁵

In the study of Ferdous F et al, in the Bangladesh, A total of 2678 singleton pregnancies were included in the analyses. The mean (SD) maternal age was 25.9 (5.8) years (range, 14–47 years). One third of the women (33.0%) were nulliparous. Only 68.3% of the women could read and write. The mean (SD) maternal height was 149.9 (5.3) cm. The mean (SD) early pregnancy BMI was 20.1 (2.6) kg/m² and 27.6% of the women were underweight.¹⁶

Mean fetal biometrics in the third trimester compared with gestational age according to LMP in the Minangkabau ethnic at 28 weeks of gestation the variable BPD is 7.37cm and at 40 weeks is 9.54cm. Variable of AC at 28 weeks of gestation was 24.01cm and at 40 weeks is 33.49cm. The result of this study illustrates that there is an increase in variability according to gestational age in all variables.

In the study of Al Marri et al, in the Kingdom of Saudi Arabia, the means BPD values for each week of GA shows growth of BPD values at every level of its week even though the differences with the BPD values of USA, Norway, Australia, Zimbabwe, India, China and Malaysia are not really significant. Thus, these new BPD values made by Al marri are highly recommended to be used by the medical practitioner as the reference range of fetal biometry for Saudi Arabia population, in regards to provide a better healthcare and well being of the maternal and fetuses.^{18,21} In accordance with Al Marri's study in determining the new BPD variable in Saudi Arabia, this study is also an attempt to create a new standard and the value of the new BPD variable that can be used by practitioners in Indonesia especially in the Minangkabau Ethnic, in determining fetal growth.

According to Jhonsons S.L. et al, in his study of "Longitudinal reference charts for growth of the fetal head, abdomen and femur", explained that the length of BPD at 28 weeks is 7,5cm and at 40 weeks is 11,3cm, variable of AC at 28 weeks is 24,0cm and 40 weeks is 36,0cm. Some literature it is stated that there are important differences in body weight, Length and head circumference reported in infants according to ethnicity.¹⁸ This means that there are some differences in the biometric measurements between foreigners and Indonesians also. Which is also tends to conclude that the fetal size of foreigners tends to be larger than Indonesian's, therefore we need more specific data for the size of Indonesians, especially for the Minangkabau Ethnic.

In the study of Ferdous F et al, in the Bangladesh, The fetal growth rate declined more in the third trimester than those of the two reference charts. This trend was obvious for the BPD and AC. The average growth per week of the BPD was 34.7 mm up to 20 weeks then 60.8 mm from 21 to 29 weeks and from 30 to 37 weeks, it was 81.7 mm The growth of the AC was 110.0 mm per week up to 20 weeks, thereafter 198.4 mm from 21 to 29 weeks, and then 276.4 mm up to 37 weeks. However, a slightly different growth pattern was observed for the HC and the FL. For the HC, up to 29 weeks, the growth rate was smaller, but in the last trimester, it became larger than those of both international references. The HC growth was 131.4 mm up to 20 weeks and 229.7 mm from 21 to 29 weeks and 306.4 mm up to 37 weeks.¹⁶

The results of this study indicate a correlation of fetal growth between LMP and the variables of BPD, HC,

AC, FL, and HL in the Minangkabau ethnic which can be seen in table 3. There is the strongest correlation between LMP and BPD, $r = 0.86$ and the weakest correlation between LMP and HL, $r = 0.79$. Based on table 3 above, all variables are very significant as evidenced by (p value < 0.05).

In the study of Ferdous F et al, in developed fetal growth charts for a Bangladeshi population. The growth of the biparietal diameter and abdominal circumference was significantly smaller throughout the pregnancy than the reference values (P [?] 0.05). Growth restriction for all the parameters started from the second trimester. Special attention is required to identify the critical time of fetal growth restriction so that appropriate nutrition intervention can be provided at the pre-pregnancy stage and at the early stage of pregnancy. In addition to their usefulness for the assessment of fetal size and growth, these findings suggest the importance of improving the health status of women of reproductive age in developing countries.¹⁶

In the study of Jacquemyn et al, toward Belgians and Non-Belgian (from Turkey and Morocco) Fetal Biometry, shows that there is no significant difference between these three different ethnic groups could be demonstrated for the biparietal diameter ($P = 0.39$). Differences do exist for the head circumference, the abdominal circumference, the femur length and the estimated fetal weight. The use of adapted charts of fetal size for pregnant women of Turkish or Moroccan origin should be considered.^{1,6,19} However, the BPD of Indonesians is very influential on LMP according to the study we have done, due to differences of body genes from European and Mediterranean ethnics when compared to Indonesians. Therefore, HC, AC and FL of European and Mediterranean (Turkish and Moroccan) people have more effect on gestational age according to LMP, especially the FL variable which has the strongest effect compared to other variables, this is due to their height genes which far exceed Indonesian height.

Based on the table 4 and 5, it can be seen that the most appropriate variables for gestational age by LMP are BPD and AC with a value of $P < 0,01$ followed by HC and FL. HL is the most unsuitable variable. and then there is a significant effect between the fetal biometric variable (BPD, HC, AC, FL, and HL) on LMP together while F value $> F$ table. The effects will give more significant result of 84,6%.

Biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL) and actual birth weights (ABW) were also taken in Sudan by Caroline Edward Ayad in her study of "Assessment of Used Formulae for Sonographic Estimation of Fetal Weight in Sudanese Population". This statistical analysis showed significant results at p [?] 0.005 .^{12,20,21} In other words, the study conducted by Caroline in Sudan is concrete evidence of a correlation between fetal biometry and LMP on fetal growth, as we have also done this study on pregnancy in Indonesia especially minangkabau ethnic.

The results of this study are ultimately expected to be standard 3rd trimester intrauterine fetal growth chart in Minangkabau ethnic.

CONCLUSION

There is a significant correlation fetal growth between LMP and 3rd trimester ultrasound pregnancy with variable BPD, HC, AC, FL, HL on minangkabau ethnic.

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DISCLOSURE OF INTERESTS

There is no conflict of interest

ETHICS APPROVAL

This research involves humans as research subjects and the materials used are fetus. The ethical implications of this study follow the provisions of the Declaration of Helsinki and has passed the ethical test number

333/KEPK/2021. All medical matters relating to this research are confidential. Research subjects have the right to refuse to participate in the study if they do not agree.

FUNDING

All research costs and other costs incurred as a result of this research are borne by the researcher.

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