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Estimation Model On Newborn Anthropometry Based On Mid-Upper Arm Circumference (MUAC)

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Abstract

The measurement of MUAC is a way to identify the risk of chronic energy deficiency (CED). Pregnant women with CED are at risk of delivering Low Birth Weight Babies (LBW), short body length babies (stunting). The objective: to analyze the accuracy and estimation prediction of MUAC measurements on Newborn anthropometry. The Method: The design of this study is descriptive korelatiff, with a cross sectional approach. Quota sampling sampling techniques were 30 mothers and newborn babies. The data is secondary data taken from KIA book. Analysis using Spearman rank test and linear regression. Results: The accuracy measurement of MUAC for birth weight was 81.6% (r = 0.903, r2 = 0.816, p value = .0001). The accuracy measurement of MUAC for the birth length of a baby was 45.9% (r = 0.691, r2 = 0.459, p value = 0.0001). Estimation model for a baby's birth wieght : -639,540+139,240 MUAC (cm), Estimation model for noewborn's length : 37,566+0.409* MUAC (cm). The conclusions: Every 1 cm increase in MUAC there is a baby's birth weight gain of 139.240 grams. Each increase of 1 cm of MUAC there is addition of length of newborn baby 0.409 cm.*

Keywords: *Estimation model; mid-upper arm circumference; newborn anthropometry*

Model Estimasi Antropometri Bayi Baru Lahir Berdasarkan Lingkar Lengan Atas (LiLA)

Abstrak

Pengukuran Lingkar Lengan Atas (LiLA) adalah cara untuk mengidentifikasi risiko kekurangan energi kronis (KEK). Wanita hamil dengan KEK berisiko melahirkan Bayi Berat Lahir Rendah (BBLR), bayi pendek tubuh pendek (stunting). Tujuan: untuk menganalisis akurasi dan estimasi prediksi pengukuran LiLA pada antropometri baru lahir. Metode: Desain penelitian ini adalah deskriptif korelatif, dengan pendekatan cross sectional. Teknik pengambilan sampel kuota adalah 30 ibu dan bayi baru lahir. Data adalah data sekunder yang diambil dari buku KIA. Analisis menggunakan uji peringkat Spearman dan regresi linier. Hasil: Pengukuran akurasi LiLA untuk berat lahir adalah 81,6% (r = 0,903, r2 = 0,816, nilai p = .0001). Pengukuran akurasi LiLA untuk panjang lahir bayi adalah 45,9% (r = 0,691, r2 = 0,459, nilai p = 0,0001). Model estimasi untuk kelahiran bayi dengan: -639.540 + 139.240 * LiLA (cm), Model estimasi untuk panjang bayi yang belum lahir: 37.566 + 0.409 * LiLA (cm). Kesimpulannya:

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Setiap 1 cm peningkatan LiLA ada kenaikan berat badan lahir bayi 139,240 gram. Setiap peningkatan 1 cm LiLA ada penambahan panjang bayi baru lahir 0,409 cm.

Kata kunci: model estimasi; antropometri; bayi baru lahir; Lingkar Lengan Atas

PENDAHULUAN

Nutritional status of pregnant women is very important in achieving the welfare of mother and fetus. A healthy mother will deliver a healthy child. The nutritional status of a mother is the main determinant of the quality of human resources, especially since the first 1000 days of life, during pregnancy until the age of 2 years (Ariany DE, 2012). A mother experiencing malnutrition tend to have a risk in giving birth to a malnourished baby. The malnourished fetus since in the womb is also at greater risk for stunting (Ariany DE, 2012).

Nutritional status of pregnant women can be measured through weight gain during pregnancy, height, body mass index (BMI) of pre-pregnancy and mid-upper arm circumference (MUAC) (Karima & Achadi, 2012). MUAC measurement is a way to determine the nutritional status risk of Chronic Energy Deficiency (CED) of a woman of childbearing age (WCA) and is used to monitor changes in the nutritional status in the long term / chronic. The threshold used to determine a pregnant woman at risk for CED is 23.5 cm (Fakier, Petro, & Fawcus, 2017).

CED incident is one of serious cases because it has a long-term impact and affects the life cycle. CED occurs as a result of an imbalance between energy consumed and released for a long time. The research results showed that mothers experiencing CED was at a risk of delivering LBW baby 4.8 times greater than those with no CED. LBW babies are associated with an increased risk of infant morbidity and mortality, inhibition of cognitive growth and development, and subsequently suffering from chronic later. LBW has a risk of neonatal death almost 40 times greater than babies with normal birth weight, decreased duration of breastfeeding, risk of short body (stunting) in childhood (Eka Nurhayati, 2015). Based on the data of Basic Health Research in 2013, the prevalence of CED in pregnant women aged 15-49 years was 24.2% and in non-pregnant women aged 15-49 years was 20.8% (Dasar, 2013). These results indicate that the prevalence of CED risk in pregnant women is still high. As for Purbalingga district in 2016, a total of 9.35% of CED pregnant women were found. This data also shows that the prevalence of CED risk in pregnant women is still high

METHODS

The research design used was a correlative descriptive research with cross-sectional design. The population in this study were mothers and newborns in the Padamara Primary Health Service Center. The samples were collected by using a quota sampling technique, the number of samples in this study were 30 mothers and newborns who had MUAC measurment. The data analysis used was

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univariate analysis, bivariate analysis to test hypotheses using Spearman rank test, multivariate analysis using linear regression test.

RESULTS AND DISCUSSION

Table 1. The Distribution Of The Nutritional Status Frequency Of Pregnant Women Based On Muac, Birth Weight Of Baby, Birth Length Of Baby In The Area Of Padamara Primary Health Center, Purbalingga Regency

Variable	Mean (± SD)	Median	Min-Maks
MUAC	24.28 (±2.834)	24	20-31
Birth Weight of a baby	2741.67 (±436.894)	2650	2200-3600
Birth Length of a baby	47.50 (±1.676)	47	45-50

From table 1 it can be seen that the average MUAC of mothers is 24.28 (± 2.834) cm, the smallest MUAC is 20 cm, and the largest MUAC is 31 cm. The average birth weight of babies is 2741.67 (± 436.889) grams, the lowest weight is 2200 grams, and the largest is 3600 grams. The average birth length of babies is 47.50 (± 1.676) cm, the shortest length is 45 cm, and the longest is 50 cm.

Table 2. The Correlation And Regression Analysis Of Muac Toward The Birth Length And Weight Of Babies In The Area Of Padamara Primary Health Center, Purbalingga Regency

Variable	R	R2	p value
MUAC+ Baby's Weight (gram)	0.903	0.816	0.0001
MUAC + Baby's Length (cm)	0.691	0.459	0.0001

Based on Table 2, the data shows that the measurement of MUAC on birth weight of babies is 81.6%, while the accuracy of the measurement of MUAC on the birth length of babies is 45.9%.

Table 3. Linear Regression Analysis Model Of Muac Measurement Of Birth Weight And Length Of Babies

Variable	Constanta	B	SE	t	p value
MUAC + Birth Weight of Baby (cm)	-639.40	139.240	12.515	11.126	0.0001
MUAC+ Birth Length of a Baby(cm)	37.566	0.409	0.081	5.065	0.0001

Based on table 3, a measurement model of the nutritional status of MUAC on the birth weight of a baby is obtained:

Birth Weight of a Baby = -639.540+139.240*MUAC (cm)

Fig 1. Model of the nutritional status of MUAC on the birth weight of a baby

This shows that every 1 cm increase there is baby's birth weight gain of 139.240 grams.

Based on Table 3, a measurement model of MUAC nutritional status is obtained on the birth length of a baby:

Birth Length of a Baby = 37.566+0.409*MUAC (cm)

Fig2. Model of MUAC nutritional status is obtained on the birth length of a baby

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This shows that every 1 cm increase there is an addition of baby's birth length 0.409 cm.

MUAC measurement is performed on pregnant women to find out the status of maternal Chronic Energy Deficiency (CED). CED is a condition that shows a lack of energy and protein for a long time. Predisposing factors causing CED are lack of nutrition and the presence of medical factors such as the presence of chronic diseases. CED in pregnant women can be dangerous for both mother and baby, the risk during labour, a weak and tired condition during pregnancy is often experienced by mothers experiencing CED (Ningrum, 2017).

In pregnant women and WCA, the MUAC threshold of <23.5 cm is categorized as risk of CED (Dasar, 2013). This MUAC measurement is done by measuring the mid-upper arm of a pregnant woman who is rarely used by using a MUAC gauge. In this study it can be seen that the average MUAC on mothers is 24.28 (± 2.834) cm, the smallest MUAC is 20 cm, and the largest MUAC is 31 cm. This average shows that the MUAC of mothers is above the normal MUAC threshold of mothers in Indonesia, which is 23.5 cm. This study shows that MUAC has a significant relationship with the birth weight of babies with p value = 0.0001 and has a very strong relationship (r = 0.903). The relationship between MUAC and the birth weight of babies is positively patterned meaning that the greater the MUAC, the greater the birth weight of baby. The accuracy measurement of MUAC for birth weight of a baby is 81.6% (r2 = 0.816), while that of birth weight of other babies was influenced by other variables.

The measurement of mid-upper arm circumference (MUAC) to determine the CED status of pregnant woman is obtained, and it has the ability to predict pregnancy outcomes and can be used to monitor nutritional status during pregnancy (Liu, Sowmya, & Khamis, 2018). CED status in the mother describes that the mother has experienced malnutrition in a long period of time, if this happens then the nutritional needs for the growth process of the fetus become obstructed. Measurements between MUAC and the outcome of baby's birth weight in this study were supported by the results of MUAC research on third trimester of mothers as a means of measuring the estimated birth weight of babies in Guatemala. Another study found that MUAC was linearly correlated with the birth weight of a baby and Atalah in 1983 found that the average birth weight of babies in Chilean with MUAC of ≥ 24 cm was 3276 ± 489 grams by comparison 2990 ± 423 grams in women with MUAC of <24 cm (Benítez Brito et al., 2016). In addition, Ningrum's study (2017) explained that pregnant women with status of CED have more possibility about 5.5 times of having LBW than mothers without CED (95% CI; 1.420-21.860).

Mid-upper arm circumference measurement (MEAC) is obtained to determine the CED status. Chronic energy deficiency causes nutrient reserves needed by the fetus in inadequate content so that it can cause both growth and development disorders.

This CED status can predict future outcomes: a mother experiencing CED causes malnutrition problems in her infant while still in the womb in order to give birth a baby with a short body length (Ningrum, 2017).

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In this study showed that the accuracy measurement of MUAC to the birth length of babies was 45.9% (r2 = 0.459), while the accuracy measurement of the birth length of other babies was influenced by other variables. MUAC with the birth length of a baby has a significant relationship (p value = 0.0001) and strong (r = 0.691). The relationship between MUAC and the birth length of a baby is positively patterned meaning that the greater the MUAC, the greater the birth length of a baby.

The results of this study are in line with Ningrum's (2017) study which shows CED pregnant women having a risk of a possible short body length of 6.2 times compared to mothers without CED (95% CI; 1.529-31.377). Furthermore, Imtihatun's study (2012) which showed mothers with CED at risk of giving birth to babies with a short body length of 6.296 times compared to mothers without CED (95% CI; 1.529-31.377).

Based on the model in figure 1, it is found that every increase of 1 cm on a MUAC mother, the birth weight of a baby will increase by 139.240 grams after controlling for other variables. Predictive models prove that there is a relationship between pre-pregnancy BMI and the birth weight of a baby. The results of this study are in line with Ningrum's (2017) research that mothers with CED are at risk of delivering LBW babies that have 5.571 times possibility compared to mothers without CED CI (95% CI; 1.420-21.860). Moreover, the results of this study are in line with the research of Khaula (2012) that mentions CED mothers have a risk of having LBW babies with 6.64 times possibility compared to non-CED mothers. In mothers with malnouristion will experience a decrease of blood volume. This will cause an inadequate cardiac output causing the decrease of blood flow to the placenta. As the consequence, the placenta becomes small and the transfer of food substances from mother to fetus through the placenta decreases resulting in fetal growth retardation (Karima & Achadi, 2012). Therefore, the treatment of pregnant women with CED needs to be done as early as possible to prevent the occurrence of obstacles in the growth of the placenta which is a vital tool needed by the fetus in the womb to receive nutritional intake and oxygen requirements as well as other needs required by the fetus in order to maintain the continuity of growth. Based on the model in figure 2, it was found that every increase of 1 cm on a MUAC mother, the baby's birth length will increase by 0.409 cm. This is in line with Ningrum's (2017) study which explains that mothers with CED are at risk of giving birth to short body length babies that have 6.296 times possibility compared to non-CED mothers (95% CI; 1.529-31.377). This shows that mothers with CED or nutritional problems for a long time are also followed by nutritional deficiencies for a long time when the baby is conceived by the birth length of baby which is short. The results of this study are in line with research from Imtihatun (2012), mothers with CED are at risk of giving birth to babies with short birth length with 6.2 times possibility compared to mothers who are not CED.

CONCLUTIONS

The measurement of MUAC on birth weight of babies is 81.6%, while the accuracy of the measurement of MUAC on the birth length of babies is 45.9%.

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Every 1 cm increase there is baby's birth weight gain of 139.240 grams. Every 1 cm increase there is an addition of baby's birth length 0.409 cm.

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