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Original Research

Variables Affecting the Weight and Length of Newborn Infants

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Abstract

Indonesia continues to face the issue of stunting. Infants with a body length of less than 48 cm and a body weight of less than 2500 grams are susceptible to stunting. This study aimed to examine the variables that impact the weight and body length of neonates. This research was characterized as observational analytic, utilizing a cross-sectional approach. The population comprises mothers who gave birth in Tulungagung Regency in 2021. The research sample consists of mothers who met the inclusion criteria for maternal pregnancies, including high-risk and got assistance from health cadres during pregnancy. The sample also includes the babies born to these mothers. The data was gathered by testing hemoglobin levels, stature, mass, mid-upper arm circumference, and the length and weight of newborn infants. The data were subjected to analysis using multiple linear regression tests. The maternal weight gain during pregnancy and mid-upper arm circumference had the potential to impact the body length and weight of the baby. Meeting the appropriate nutritional requirements during pregnancy enhances the nutritional well-being of expectant mothers, enabling them to offer optimal nourishment for their developing fetuses and promoting proper growth and development.

Keywords: Maternal Health, Height, Weight, Newborn, Infant, Stunting

INTRODUCTION

The baby's weight and body length at birth determine the child's subsequent growth (Rokhimawaty A et al., 2009). Every newborn is expected to have a normal body weight, namely 2500-3999 grams, and an average body length of 48-52 cm (Kurnia, 2024). Unfortunately, not all babies are born in such conditions. Newborn babies who have a birth weight of less than 2500 grams (LBW) and a body length at birth of less than 48 cm can have a severe impact on both the baby's health and the incidence of stunting (Ernawati et al, 2013).

Stunting is due to intrauterine growth retardation experienced by infants in this disease. Intensive care is required to support the baby's growth and development. Failure to keep up with growth might result in stunting. Stunting refers to a condition of impaired physical growth that might have negative effects on a child's brain development and cognitive abilities (Rohmawati I et al, 2022). The prevalence of stunting must be reduced to meet WHO guidelines. In Indonesia, the incidence of stunting still has not met the expected target. The issue remains a top priority, receiving significant focus and requiring prompt resolution.

The incidence of stunting in the world is based on data from the World Health Organization or WHO (2021), which states that the incidence of stunting reached 22% or 149.2 million in 2020. In 2020, the national stunting rate was 26.92%, which exceeds the standard set by the World Health Organization. In East Java, the prevalence of stunting was 25.6% according to data from the East Java Health Service in 2020. In Tulungagung, according to the data from the weighing month of 2020, there were 2,901 cases, which accounted for 5.51%. (Yohanes, 2021). Even though this prevalence is lower when compared with the national level prevalence, hard work is still needed to achieve zero stunting

Stunting occurs because children experience chronic malnutrition, which starts in the womb, and only becomes apparent after the child is 24 months old (Rohmawati I et al, 2023). Children are predicted to experience stunting, which can be seen from the baby's physical condition when he is born, especially his weight and body length. Several efforts are needed To prevent stunting; for example, children born with a body length of less than 48 cm and a weight of less than 2500 grams must receive intensive care so that the brain can develop optimally by changing people's behavior in parenting patterns (Marni et al, 2021), providing psychosocial stimulation (Wirjatmadi, 2021), and nutrition appropriate to the child's condition (Kusfriyadi, M. K., & Nabilah, D. F., 2022). In addition, it is necessary to make attempts to identify the factors responsible for the occurrence of infants with a body length below 48 cm and a weight below 2500 grams at birth.

It is more advantageous to prevent chronic malnutrition during pregnancy rather than addressing it once the infant is identified as stunted. The primary determinants that directly contribute to fetal chronic malnutrition are maternal health deficiencies during pregnancy, as evidenced by measurements of upper arm circumference, hemoglobin levels, and body mass index derived from the mother's weight and height values. Additionally, the absence of proper antenatal care facilities, inadequate care and feeding practices, and insufficient health facilities and infrastructure also play a significant role (Fatima S et al, 2020). Based on the data above, this research aims to analyze the factors that influence newborn babies' weight and body length.

METHODS

This research was conducted using an observational analytic approach, specifically utilizing a cross-sectional design. The population consisted of mothers who gave birth in Tulungagung Regency in 2021. The research sample included mothers who met the inclusion criteria for maternal pregnancies, including high-risk pregnancies, and had received assistance from health cadres during pregnancy. The sample had 58 respondents. The independent variables in this study were the mother's HB level, height, weight, and Mid-Upper Arm Circumference. In contrast, the dependent variables were the body length and weight of the newborn.

The instruments used were Easy Touch HB, microtia, adult scales, Lila ribbon, infantometer, and baby scales. Data analysis includes univariate, bivariate, and multivariate. Univariate analysis to determine the characteristics of continuous data, which are described in n, mean, SD, minimum, and maximum. The relationship between each variable analyzed was determined by data analysis using the multiple linear regression test technique, with a confidence level of $\alpha = 0.05$.

RESULTS

Respondent characteristics were presented in minimum, maximum, mean, and standard deviation analyses. This aims to determine the average score of HB levels, height, weight, and *Mid-Upper Arm Circumference*, as well as body length and weight of newborn babies compared to the maximum assessment score.

Table 1. Description of research variable data average HB levels, height, maternal weight gain during pregnancy and *Mid-Upper Arm Circumference* as well as body length and weight of newborns

Variable	n	minimum	maximum	mean	SD
Mother's HB level	58	10	15.3	12.3	1,063
Mother's height	58	142	168	153	5,390
Maternal weight gain during pregnancy	58	2	21	9.36	4,170
Mid-Upper Arm Circumference	58	21	45	27.9	4,093
Baby's body length	58	45	52	49.03	1,450
Baby's weight	58	2,300	4,500	3,132	4,272

Based on Table 1, it is known that the average HB level is 12.3 g/dL, the average maternal height is 153 cm, the average maternal weight gain during pregnancy is 9.36 Kg, the average *Mid-Upper Arm Circumference* is 27.9 cm, the average body length at birth is 49 cm. The weight of newborns is 3,132 grams.

Based on Table 2, the mother's weight gain during pregnancy can affect the baby's body length at birth, which was statistically significant with a p-value of 0.002 and a Correlation Coefficient of 0.390 with an Adjusted R Square of 0.170.

Table 2 provides information that HB levels, maternal height, maternal weight gain during pregnancy, and maternal mid-upper arm circumference contribute to Baby Body Length by 17%. If viewed partially, only the increase in maternal weight during pregnancy is related to the length of the newborn, although the strength of the relationship is low, namely 0.390.

The mother's weight gain during pregnancy was statistically significant and has a moderate relationship of 0.472 with the baby's birth weight with a p-value of 0.002 and a weak relationship of 0.378 with the mother's upper arm circumference with a p-value of 0.030. Adjusted R Square is 0.261 (Table 3).

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Table 2. HB levels, height, maternal weight gain during pregnancy, and *Mid-Upper Arm Circumference* partially affect the body length of the newborn.

	Baby Body Length	Coefficient	SE	t	p-value	Correlation Coefficient
Step 1	Mother's height	0,014	0,041	0,111	0,912	-0,110
	Maternal weight gain during pregnancy	0,353	0,053	2.764	0,008	0,390
	Mid-Upper Arm Circumference	0,125	0,044	2,764	0,336	0,319
	HB levels	0,083	0,229	0,970	0,523	0,011
	Constant	45,197				
Step 2	Maternal weight gain during pregnancy	0,369	0,052	2,811	0,007	0,390
	Mid-Upper Arm Circumference	0,227	0,044	1,809	0,076	0,319
	HB levels	0,145	0,224	1,147	0,256	0,011
	Constant	42,236				
Step 3	Maternal weight gain during pregnancy	0,390	0,049	3,172	0,002	0,390
	Constant	47,546				
	Adjusted R Square	0,137				

Table 3. HB levels, height, maternal weight gain during pregnancy, and maternal *Mid-Upper Arm Circumference* partially affect the newborn's weight.

	Baby Weight	Coefficient	SE	t	p-value	Correlation Coefficient
Step 1	Mother's height	0,015	10,186	0,111	0,378	0,080
	Maternal weight gain during pregnancy	0,413	13,158	2.764	0,001	0,472
	Mid-Upper Arm Circumference	0,266	11,013	0,970	0,029	0,378
	HB levels	0,013	57,202	0,643	0,912	-0,174
	Constant	481,175				
Step 2	Mother's height	0,123	9,945	1,080	0,285	0,080
	Maternal weight gain during pregnancy	0,400	12,451	3,368	0,001	0,472
	Mid-Upper Arm Circumference	0,273	10,908	2,294	0,026	0,378
	Constant	396,595				
Step 3	Maternal weight gain during pregnancy	0,396	12,463	3,328	0,002	0,472
	Mid-Upper Arm Circumference	0,265	10,902	2,225	0,030	0,378
	Constant	2065,796				
	Adjusted R Square	0,261				

DISCUSSIONS

Early detection of stunting can be achieved by assessing the baby's weight and length at delivery, which can be influenced by several variables. This study seeks to clarify the impact of hemoglobin levels, mother stature, maternal weight gain during pregnancy, and maternal mid-upper arm circumference on the infant's weight and body length at the time of birth.

Two variables that can impact the weight of newborn babies were maternal weight growth during pregnancy, which has a moderate relationship strength of 0.472, and Upper Middle Arm Circumference, which has a weak link strength of 0.378. The relationship between maternal weight growth during pregnancy and the baby's body length at birth was weak. Pregnant women who follow to a diet suited to meet the nutritional requirements of their baby can provide a prenatal environment that promotes optimal growth and development, including an increase in the baby's body length. One sign of a baby's development is its body length upon birth. Sufficient nutritional requirements during pregnancy can also serve as an indicator of fetal development and viability. Infants with a body length less than 48 cm are susceptible to acquiring this condition. The number of children that are stunted is four times higher at 3 months of age and twice as high at two years of age (Judiono at al, 2023).

Maternal weight gain during pregnancy can have an impact on the newborn's birth weight. According to the findings presented in table 3, there was a moderate correlation between the mother's weight gain throughout pregnancy and the baby's weight at birth. Pregnant women who are underweight are more likely to give birth to newborns with low birth weight (<2500 g) compared to pregnant women of medium weight, overweight, and obese (Zhang D et al, 2019). This shows that the mother's BMI during pregnancy can affect the newborn's weight (Verma P, Prasad JB, 2021). The average increase in maternal weight during pregnancy is between 11.5–16.0 kg (Thorsdottir, 2020). Table 1 shows that the average maternal weight gain is 9.36, which is still in the near-normal range. This causes babies' average weight and body length to be within the normal range, namely 49.03 cm for baby body length and 3.132 grams for newborn baby weight. The mother's nutritional intake influences the increase in maternal weight during pregnancy (Sumiati et al, 2020). Suppose the mother consumes nutrition according to her needs during pregnancy. In that case, the fetus in the mother's womb will automatically receive the necessary nutritional supply, ultimately resulting in the fetus being able to grow and develop optimally. The results of fetal growth and development can be seen immediately after the baby is born by checking the baby's weight and body length (Thurstans S et al, 2021).

Apart from that, maternal weight gain can also be influenced by the psychological condition of the mother during pregnancy. If pregnant women experience stress, then pregnant women need more additional nutrition. Stress can also affect uteroplacental flow, causing the nutritional supply to the fetus to be less than optimal and disrupting its growth and development. This is in accordance with the results of research by Nyklíček I et al (2021) that the stress experienced by mothers during pregnancy can affect the growth and development of the fetus.

Upper Middle Arm Circumference is an index of subcutaneous fat, muscle tissue, protein and, energy reserves, which can indicate the nutritional status of pregnant women (C.M.Ng et al 2019). The average mid-upper arm circumference is 23.5 cm, and if the result is <23.5 cm, then the mother suffers from CED. Table 3 shows that the mother's upper arm circumference has a p-value of 0.030, which means that the mother's upper arm circumference can influence the weight of the newborn even though the Correlation Coefficient is 0.378 or has a weak level of relationship. This is because, based on Table 1, it is known that the average mid-upper arm circumference of mothers in this study was 27.5 cm, which means that, on average, pregnant women have normal nutritional status. Pregnant women with normal nutritional status can influence the baby's birth weight (Ashley A et al, 2021). The findings of this study were consistent with the previous research. In order for the fetus to grow and develop correctly with an average neonatal weight of 3.132 grams, it is important for the mother to maintain a healthy nutritional status and match the dietary demands of her fetus.

CONCLUSIONS

The mother's weight gain during pregnancy and Mid-Upper Arm Circumference influence newborns' body length and weight. To give birth to a baby with a body length of more than 48 cm and a body weight of more than 2500 grams, the mother's weight during pregnancy must increase according to standards and a minimum Mid-Upper Arm Circumference of 23.5 cm. The results of this research can be used to prevent stunting by accompanying pregnant women during pregnancy so that the pregnant woman's weight can increase according to standards and a minimum Mid-Upper Arm Circumference of 23.5 cm. Further research is needed to identify the reasons responsible for pregnant women not gaining weight according to norms, particularly when their Mid-Upper Arm Circumference is less than 23.5 cm.

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