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ARTICLE

THE ROLE OF BODY MASS INDEX, HEMOGLOBIN LEVELS IN WOMEN GIVING BIRTH TO NEONATAL WEIGHT

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ABSTRACT

Maternal nutritional status is monitored with BMI and is also one of the factors that have an impact during pregnancy. Poor nutrition before and during pregnancy leads to decreasing hemoglobin levels and low birth weight infants. Gestational weight gain is an important predictor of adverse maternal and neonatal health outcomes. This study aims to determine the correlation between hemoglobin levels and BMI of mothers giving birth to the weight of newborns at the Puskesmas Kebumen II, Kebumen District. This research used a retrospective study with medical record data collected from January to April 2022. This research involved 50 patient mothers giving birth at Puskesmas Kebumen II, Kebumen District. The data were analyzed by the Pearson correlation coefficient test. The results are BMI and newborn weight (p = 0.061, r = 0.367), hemoglobin levels, and newborn weight (p=0.852; r= -0.025). There was no correlation between BMI and hemoglobin levels to newborn weight at Puskemas Kebumen II, Kebumen District.

Keywords: BMI; Hemoglobin; Low Birth Weight; Newborn

АБСТРАКТ

Состояние питания матери контролируется с помощью ИМТ и также является одним из факторов, оказывающих влияние во время беременности. Плохое питание до и во время беременности приводит к снижению уровня гемоглобина и рождению детей с низкой массой тела. Гестационный набор веса является важным предиктором неблагоприятных исходов для здоровья матери и новорожденного. Цель данного исследования - определить корреляцию между уровнем гемоглобина и ИМТ рожениц и весом новорожденных в Puskesmas Kebumen II, район Кебумен. В данном исследовании использовалось ретроспективное исследование с данными медицинской карты, собранными с января по апрель 2022 года. В исследовании приняли участие 50 пациенток, родивших в Puskesmas Kebumen II, район Кебумен. Данные были проанализированы с помощью теста коэффициента корреляции Пирсона. Результаты: ИМТ и вес новорожденного (p = 0,061, r = 0,367), уровень гемоглобина и вес новорожденного (p = 0,852; r = -0,025). В Puskemas Kebumen II, Кебуменский район, не было обнаружено корреляции между ИМТ и уровнем гемоглобина и весом новорожденного.

Ключевые слова: ИМТ; гемоглобин; низкий вес при рождении; новорожденный

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INTRODUCTION

Pregnancy is an important period in a mother's life because, during pregnancy, she has to prepare herself to welcome the birth of her baby. A healthy and physically perfect mother with sufficient body weight[1].

Nutritional status can affect the health of pregnant women. Poor nutrition before and during pregnancy leads to low birth weight (LBW) infants, impaired brain growth and development, anemia in newborns, susceptibility to infection, miscarriage, etc. Women with low nutritional status (low BMI) have an impact on LBW, while women with excessive nutritional status (obese BMI) have a high risk of miscarriage, operative delivery, preeclampsia, thromboembolism, perinatal death, and macrosomia[2].

Gestational weight gain is an important predictor of adverse maternal and neonatal health outcomes. Insufficient weight gain is associated with increased risks of preterm birth and delivery of a low-birth-weight infant, whereas excessive weight gain is associated with increased risks of gestational hypertension, preterm birth, delivery of a high-birth-weight infant, and cesarean delivery[3].

Increased large gestational age (LGA) risks were also found for mothers with type 2 diabetes and gestational diabetes not treated with insulin, especially in combination with prepregnancy overweight or obesity that were stronger for type 2 diabetes than gestational diabetes[4].

Wijayanti & Pangestu reported that mothers with an underweight BMI have 2.524 times the high risk of having an LBW infant when compared to mothers with a normal BMI. And then, mothers with anemia have a 16.646-fold higher risk of having an LBW infant when compared to mothers without anemia[5].

The Ministry of Health of the Republic of Indonesia reported that the proportion of LBW in Indonesia from 2019 to 2021 has significantly decreased. The proportion of LBW in 2019 was 3.4%, in 2020 it was 3.1%, and in 2021 it was 2.5%. The condition of LBW babies can be triggered by several factors, including the mother's conditions during pregnancy (adolescent pregnancy, malnutrition, and pregnancy complications), twins, fetal abnormalities or congenital conditions, and intrauterine growth restriction[6]. LBW infants have a greater risk of being stunted and suffering from diabetes, hypertension, and heart disease as adults[7].

The Central Java Provincial Health Office reported that the prevalence of LBW in Central Java fluctuated from 2017-2021. The proportion of LBW in 2017 was 4.4%, in 2018 it was 4.3%, in 2019 it was 4.7%, in 2020 it was 4.3%, and in 2021 it was 4.6%. The proportion of LBW in Kebumen District is 5.4%[7]. Puskesmas Kebumen II also reported that the proportion of LBW in 2020 was 5.4%. It decreased until 2021, when it was 5.3%[8].

Hemoglobin (Hb) levels in pregnant women are one of the factors that can affect fetal growth[9]. Anemia during pregnancy affects pregnant women and the fetus. Intrauterine growth disorders occur in the fetus and increase the risk of LBW in infants. In addition, there may be an increased risk of bleeding before and during birth. Severe anemia can cause death for both mother and baby[10].

The proportion of anemia in pregnant women in Indonesia in 2013 was 37.1%, and it continued to increase in 2018 to 48.9%[11]. The proportion of anemia in pregnant women at Puskesmas Kebumen II increased from 17.6% in 2020 to 20% in 2021[8].

Wahyuni et al. reported an association between Hb levels of pregnant women and the incidence of LBW in RSUD Siti Fatimah, South Sumatera ($p = 0.006$). Hb levels of at-risk pregnant women (<10 gr/dL) have a 3.679-times chance of giving birth to LBW babies[12]. Dewvi et al. reported an association between Hb levels of pregnant women and LBW in several Puskesmas Bali Utara ($p = 0.001$). Mothers with Hb levels <11 g/dl have a 6.769 times higher risk of giving birth to LBW babies than mothers with normal Hb levels (≥11 g/dl)[9].

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Kurdanti et al. also reported a correlation between BMI (p = 0.042, r = 0,107) and fundal weight (p = 0.012, r = 0.131) and newborn weight. There was no correlation between upper arm circumference and neonatal weight (p = 0.055, r = 0.101) in RSKIA Sadewa, Yogyakarta[13].

This study aims to determine the correlation between hemoglobin levels and BMI of mothers giving birth and the weight of newborns at Puskesmas Kebumen II, Kebumen District.

MATERIAL AND METHODS

Our research used a retrospective design. The data were obtained from medical record data at Puskemas Kebumen II, Kebumen District, from January to April 2022. This research involved 50 patient mothers giving birth at Puskesmas Kebumen II, Kebumen District, with a total sampling technique. This research was conducted after ethics committee approval from the Health Research Ethics Committee at Universitas Muhammadiyah Purwokerto No: KEPK/UMP/40/VII/2022.

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We analyzed pregnancy weight and height, which were measured during the prepregnancy period. BMIs were analyzed according to the WHO's classifications: underweight (<18.5), normal weight (18.5–24.9), overweight (≥25.0), and obese (≥30).

Neonatal weight was measured one hour after birth on the same day at Puskesmas Kebumen II. The neonates were analyzed according to the classification: low birth weight (<2500 g), normal (2500-3000 g), and macrosomia (>4000 g). The data were analyzed by the Pearson correlation coefficient test.

RESULT

The mean age of the patients was 29.78 ± 5.8 years old. Patients with no history of disease were predominant in our study, with 34 patients (68%). The mean Hb level was 11.728 ± 0.974 g/dL. The mean neonatal weight is 3060 ± 356.428 g. The mean mother's giving birth BMI is 21.9969 ± 3.8921 kg/m2. The details of the subject characteristics are illustrated in Table 1, while the correlation between Hb levels and BMI and newborn weight is illustrated in Table 2

Table 1. The Subject Characteristic

No	Characteristics	Frequency (n)	Percentage (%)	Mean±SD	Median (min-max)
1	Age (y.o)			29,78±5,8	29,50 (19-43)
2	Medical history				
	a. No history	34	68		
	b. Premature rupture of membranes	4	8		
	c. Misscarriage	1	2		
	d. Covid-19	5	10		
	e. Breast abscess	1	2		
	f. Stomachace/ magh	1	2		
	g. Pulmonary Tuberculosis	1	2		
	h. HBaAg	1	2		
	i. Negative eye 4	1	2		
	j. Allergy	1	2		
3.	Hb levels (g/dL)			11,728±0,974	11,60 (9,7-14,4)
4.	Neonatal weight (g)			3060±356,428	3000 (2350-4000)
5.	BMI (kg/m^2)			21,9969±3,8921	21,4163(14,78-29,14)

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Table 2. Correlation between Hb levels and BMI to neonatal weight

	Neonatal weight
Hb levels	p=0,862 r= -0,025
BMI	p=0,061 r= 0,367

Based on Table 2, there is no correlation between Hb levels (p = 0,862 r = -0,025) and BMI (p = 0,061 r = 0,367) and neonatal weight.

DISCUSSION

The mean age of mothers giving birth in our study was 29.78 ± 5.8 y.o. and included in the productive age. Low hemoglobin levels are related to the age of pregnant women and are also related to nutritional needs. Insufficient nutritional needs cause anemia. Pregnant women aged <20 y.o. tend to be less than optimal in terms of emotional and mental instability and are still in their infancy due to the consequences. They lack attention to nutritional intake during pregnancy. Pregnancy at the age of > 35 y.o. is not only related to the decline in organ function and decreased immune system but also to the condition of the pregnant woman's body. This condition has an impact on the lack of production of hemoglobin, which then leads to anemia[14].

The majority of mothers giving birth in this study had no history of the disease. Medical history examination is very important for pregnant women because dangerous signs of pregnancy such as vaginal bleeding, headaches, blurred vision, swelling of the face or hands, abdominal pain, and lack of fetal movement are more common in mothers who have a history of the disease (hypertension, HBsAg, HIV, anemia, and others), primiparous and grandemultipara parity, pregnancy interval < 2 years, age < 20 y.o. and > 35 y.o., unhealthy lifestyle, and environmental exposure[15]. Pregnant women with COVID-19 are at higher risk of serious illness, morbidity, and mortality compared to the general population[16].

Psychological conditions, nutritional status, changes in maternal weight, and physical growth have a major influence during pregnancy and also affect to the baby condition. Several factors affect infant weight, including demographic, behavioral and environmental factors, such as medical and biomedical services including maternal weight, maternal height, upper arm circumference, age, parity, hemoglobin level, maternal blood pressure during pregnancy[17].

Higher early pregnancy weight was related to higher hemoglobin levels and a lower risk for anemia. Low early pregnancy weight, or BMI, may be a reflection of poor nutrition intake, including the intake of various micronutrients that are essential for hemopoiesis[18].

Economic status is one of the factors that can affect the nutritional status and hemoglobin levels of pregnant women. They need a lot of nutritional intake during pregnancy, but if economic conditions are not supportive, they get inappropriate nutrition intake, leading to anemia[19].

The results of this study reported that there was no correlation between BMI, Hb levels, and neonatal weight, similar to Nadiah & Yudianti's study, which also reported that there was no relationship between nutritional status (p = 0.149) and anemia (p = 0.891) and the baby's weight born in the Campalagian Nursing Health Center, Polewali Mandar Regency, West Sulawesi[20].

The mean BMI in this study was still relatively normal. Several other factors, as well as psychological, fetal, and placental problems, can affect mothers with a normal BMI when giving birth to their LBW infant. In addition, the placenta has another impact on LBW infants because it affects the food supply to the fetus. Another influencing factor is that women with a normal pre-pregnancy BMI may also have a young fetus due to inappropriate nutritional intake during

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pregnancy. Therefore, mothers who have malnutrition during pregnancy will have a poor impact on their fetus[21].

Zhao et al. study reported that pre-pregnancy weight outside of the normal range is associated with increased risks for adverse birth weight. Overweight and obese women were at increased risk for macrosomia (OR 1.7, 95% CI 1.2–2.6) and LGA (OR 1.7, 95% CI 1.1–2.5) compared with women of normal weight[22].

Anil et al. also reported that women who gained less than 6.53 kg during the second and third trimesters had a three times higher risk of delivering a low birth weight baby with reference to women whose weight gain was 6.53 kg or above (AOR 2.8, CI: 1.6–5.0)[23].

Hemoglobin levels are associated with two to three times the risk of LBW, cesarean delivery, preeclampsia, preterm birth (PTB), and stillbirth. At low Hb levels, the synthesis of corticotropin-releasing hormone induces maternal and fetal stress, which increases the risk of outcomes such as pregnancy-induced hypertension, eclampsia, and premature rupture of membranes. Instead, high Hb levels have been predicted to cause suboptimal placental and fetal oxygen and nutrients supply, increase blood viscosity, and cause inadequate plasma volume expansion, which are associated with maternal hypertension, preeclampsia, and diabetes[24].

Primigravida and multigravida, cesarean section, vaginal birth, low birth weight (LBW), wound infection in chorioamnitis, prematurity, birth weight, and bleeding after delivery are associated with mild or severe anemia in pregnant women. Anemia in pregnant women is caused by iron deficiency (92.8%), thalassemia (0.5%), crescent anemia (2.6%), and others (4%)[25].

CONCLUSION

There was no correlation between BMI and hemoglobin levels and newborn weight. It is necessary to increase public understanding of the importance of routine exercise, periodic evaluation of hemoglobin, and consuming nutritious food and iron tablets, which are helpful for preventing anemia, monitoring fetal development, and maintaining maternal health.

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DECLARATIONS

Author contribution. In this writing, all authors gave the following contributions: Conceptualization and Methodology: Linda Yanuana Fanida Tantowi. Writing and Original Draft Preparation: Dita Pratiwi Kusuma Wardani. Formal Analysis, Resources: Dita Pratiwi Kusuma Wardani. Review and Editing: Kurniawan and Dewi Ambarwati. All authors have read and agreed on the published version of the manuscript.

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