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The relationship of the body mass index of pregnant women and the baby's birth weight

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Abstract

Birth weight is the first weight a fetus or baby obtains after birth. A baby's birth weight is an indicator of future health status. Overall, an estimated 15% to 20% of all births worldwide are low birth weight, representing more than 20 million births annually. Body Mass Index before pregnancy can be considered an indicator of the mother's nutritional status, and maternal nutritional status can reduce placental-fetal blood flow and inhibit fetal growth. This study aims to determine the relationship between the body mass index of pregnant women and the birth weight of the baby. comparative research with a cross sectional approach at the Simomulyo Public Health Center. The population of this study is all mothers who gave birth to live babies in 2022. The sample for this study was taken using a total sampling of 72 people. The independent variable is the body mass index of the pregnant woman, while the dependent variable is the baby's birth weight. Data was taken from secondary data from medical records for 2022. The analysis test used Kruskall Wallis with a significance level of 0.05. Research shows that the majority of mothers who have a normal BMI give birth to 51 babies with a normal weight (70.83%), mothers with a thin BMI give birth to babies with a low birth weight as many as 4 (5.56%), mothers with a high BMI give birth to normal babies. 15 people (20.83%) and mothers with obese BMI gave birth to 1 normal baby (1.39%) and 1 large baby (1.39%). The results of the analysis using Kruskall Wallis obtained a value of $p = 0.000$ ($p < 0.05$). There is a relationship between the body mass index of pregnant women and the birth weight of the baby.

Keywords: Body Mass Index; Baby's Birth Weight; Pregnancy; Pre-pregnancy; Nutritional Status

1. Introduction

Birth weight is the first weight a fetus or baby obtains after birth. The World Health Organization further defines the following categories: very low birth weight: less than 1,000 grams (up to and including 999 grams), very low birth weight: less than 1,500 grams (up to and including 1,499 grams), low birth weight: less than 2,500 grams (up to and including 2,499 grams). A baby's birth weight is an indicator of future health status. Low birth weight (LBW) is one of the most common adverse effects of pregnancy. Low Birth Weight (LBW) is an indicator of public health problems which have many factors including long-term malnutrition, poor health and poor health services during pregnancy (1) . Low birth weight is also included in a series of global nutrition monitoring indicators which are also included in the WHO Global reference list containing 100 core health indicators (1). Low birth weight continues to be a significant public health problem globally and has both short-term and long-term impacts. Overall, an estimated 15% to 20% of all births worldwide are low birth weight, representing more than 20 million births each year (2). The global target is to reduce 30% of babies with low birth weight by 2025. This means a relative reduction of 3% per year between 2012 and 2025 and a reduction from around 20 million to around 14 million babies with low birth weight (2). The incidence of stunting in Indonesia reaches more than the global average, namely 31.0% (3). Babies born with LBW are 1.74 times more likely to experience stunting than babies born with normal weight (4,5). Fulfilling nutritional needs during pregnancy and/or the fetus is the basic capital for a child's growth and development at a later age. Fulfillment of nutrients for fetal growth

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depends on the consumption of nutrients, nutritional status and health of the pregnant mother. Apart from nutritional factors, the growth and development of the fetus in the womb is also influenced by the psychosocial factors of the pregnant mother (1).

Body Mass Index (BMI) is a simple tool for monitoring the nutritional status of adults, especially those related to underweight and overweight. Body Mass Index is very important to identify whether a woman is too thin, normal or fat. BMI before pregnancy can be considered as an indicator of maternal nutritional status, and maternal nutritional status can reduce placental-fetal blood flow and inhibit fetal growth (6). The nutritional status of pregnant women is very important because it can indicate the welfare of the mother and fetus. A healthy mother will give birth to a healthy baby, and a malnourished mother is at risk of giving birth to a malnourished baby. Obesity before pregnancy increases the risk of macrosomia and low birth weight (LBW) and fetal growth restriction (FGR)(7). The risk profile shows that the risk of abnormal birth weight increases for BMI values that are at the upper limit of the normal BMI range. The results obtained demonstrate the multidirectional effects of obesity on fetal growth and emphasize the need to continue seeking interventions to normalize the nutritional status of women planning pregnancy to improve child health (7). Overweight and obesity in mothers before pregnancy is associated with the risk of LBW, VLBW and ELBW, whereas underweight was associated with a higher risk of LBW and a lower risk of ELBW. Paternal pre-pregnancy overweight and obesity were associated with a higher risk of LBW and VLBW, whereas underweight was associated with a lower risk of LBW (6).

Based on the results of a preliminary study at the Simomulyo Public Health Center, there were 72 normal births in 2022 and there were 4 babies with low birth weight. Of the 4 babies with low birth weight, it turned out that 100% were born to mothers with a low Body Mass Index. Based on the background above, researchers feel it is necessary to conduct research with the title "The relationship between the body mass index of pregnant women and the birth weight of babies at the Simomulyo Community Health Center, Surabaya, East Java, Indonesia".

2. Material and methods

This research is a comparative study where the researcher wants to analyze the relationship between two variables, namely the body mass index of pregnant women and the weight of newborn babies using a cross sectional approach. The population used was all mothers giving birth at the Simomulyo Public Health Center for the period January - December 2022, totaling 72 people. The research sample was taken from the research population that met the inclusion and exclusion criteria. Inclusion criteria include pregnant women who during their pregnancy underwent 1st trimester Antenatal Care (ANC) at the Simomulyo Public Health Center, term pregnancy (37-40 weeks), and mothers who gave birth normally at the Simomulyo Public Health Center and were recorded in the medical record. Exclusion criteria include women giving birth with diseases/complications such as diabetes mellitus, HBsAg, HIV, Syphilis, preeclampsia and mothers giving birth with multiple pregnancies. This research data collection technique uses secondary data taken from patient medical records. This data collection was carried out when the mother had given birth at the Simomulyo Public Health Center by looking at the birth register and those that met the inclusion criteria. The BMI calculation is carried out by taking secondary data, namely height and weight at the beginning of pregnancy which are recorded in the patient's medical record, while the baby's birth weight is taken from the birth register data at the Simomulyo Public Health Center. After the data is collected, analyze the data to find out whether there is a relationship between body mass index and the weight of the newborn. In this study, to test whether there is a relationship, the data was analyzed using the Kruskal Wallis test.

3. Results and discussion

The research was conducted at the Simomulyo Community Health Center in February-March 2024 using total sampling techniques. The results of this research are presented in 5 parts, namely the demographic characteristics of pregnant women and the weight of newborn babies, the frequency distribution of BMI, the frequency distribution of BBL, the relationship between the body mass index of pregnant women and the baby's birth weight and statistical results.

3.1. Demographic Characteristics of Pregnant Women and Newborn Weight

Pregnant women respondents were mostly aged 20-35 years or not at risk (83.3%), most were not working (75%), most had a high school education (62.5%), most were gravida multiparous (80.8%), all were of term gestational age (100%). There was a significant relationship between maternal age and the incidence of LBW. The mother's age during pregnancy is closely related to the baby's weight. Pregnancy under the age of 20 is a high risk pregnancy because the reproductive system is not yet optimal, blood circulation to the cervix and also to the uterus is still not perfect so this can disrupt the process of distributing nutrients from the mother to the fetus (8). In 2019 in East Java, some mothers

died at the age of less than 16 years, but in 2020 there were no reports of deaths at the age of under 16 years. In 2020, maternal deaths aged over 35 years decreased by 3.81% and aged 17-18 years by 0.09% (9). Risky pregnancies can increase the risk of maternal and infant morbidity and mortality. Maternal deaths under 35 years of age increased significantly in 2020. Based on maternal employment characteristics, the majority do not work (75%). Work cannot be separated from the daily lives of mothers. Based on the characteristics of birthing mothers, the majority (62.5%) had a high school education level (9).

Table 1 Demographic Characteristics of Pregnant Women and Newborn Weight

Characteristics	**LBW (<2500 gram)**		**Normal Birth Weight (2500-4000 gram)**		**High Birth Weight (>4000 gram)**		**TOTAL**	
Age	n	%	n	%	n	%	n	%
< 20 years old	1	25	1	1.5	0	0	2	2.8
20-35 years old	3	75	56	83.6	1	100	60	83.3
≥35 years old	0	0	10	14.9	0	0	10	13.9
TOTAL	4	100	67	100	1	100	72	100
Occupation								
Unemployed	3	75	50	74.6	1	100	54	75
Employed	1	25	17	25.4	0	0	18	25
TOTAL	4	100	67	100	1	100	72	100
Education								
Elementary – Junior high school	3	75	22	32.8	0	0	25	34.7
Senior high school	1	25	43	64.2	1	100	45	62.5
College degrees	0	0	2	3.0	0	0	2	2.8
TOTAL	4	100	67	100	1	100	72	100
Gravida								
Primipara	3	75	11	16.4	0	0	14	19.4
Multiparous	1	25	56	83.6	1	100	58	80.6
TOTAL	4	100	67	100	1	100	72	100
Gestational age								
Aterm	4	100	67	100	1	100	72	100
Postdate	0	0	0	0	0	0	0	0
TOTAL	4	100	67	100	1	100	72	100

3.2. Frequency Distribution of Body Mass Index of Pregnant Women

Table 2 Frequency Distribution of Body Mass Index of Pregnant Women

Body Mass Index	Frequency	Percentage
Underweight	4	5.56
Normal	51	70.83
Overweight	15	20.83
Obesity	2	2.78
Total	72	100

Based on table 3.2, the Body Mass Index of most pregnant women is in the normal category, 70.83%.

3.3. Frequency Distribution of Infant Birth Weight

Tabel 3 Frequency Distribution of Infant Birth Weight

Body Mass Index	Frequency	Percentage
Low Birth Weight (<2500 gram)	4	5.56
Normal Birth Weight (2500-4000 gram)	67	93.05
Hight Birth Weight (>4000 gram)	1	1.39
Total	72	100

Based on table 3.3, the birth weight of most babies is in the normal category, 93.05%. Body weight is an anthropometric measurement that is always carried out on neonates or newborns.

3.4. The Relationship Between Pregnant Women's Body Mass Index and Baby's Birth Weight

Table 4 The Relationship Between Pregnant Women's Body Mass Index and Baby's Birth Weight

Variable	Low Birth Weight (<2500 gram)		Normal Birth Weight (2500-4000 gram)		Hight Birth Weight (>4000 gram)		TOTAL		P value
Maternal BMI	n	%	n	%	N	%	n	%	
underweight	4	5.56	0	0	0	0	4	5.56	0.000
normal	0	0	51	70.83	0	0	51	70.83	
Overweight	0	0	15	20.83	0	0	15	20.83	
Obesity	0	0	1	1.39	1	1.39	2	2.78	
TOTAL							72	100	

All respondents from pregnant women with a low/underweight BMI gave birth to babies with LBW (100%), all respondents from pregnant women with a normal BMI gave birth to babies with a normal weight of 100%, all respondents from pregnant women with a high/overweight BMI gave birth to babies with a normal birth weight of 100% and pregnant women with an obese BMI gave birth to normal birth weight babies (50%) and large babies (50%).

The analysis test used the Kruskall Wallis test by comparing low, normal, high and obese BMIs. After carrying out the Kruskall Wallis test, the value of p=0.000 (p<0.05) was obtained, from which it can be concluded that in the four BMI categories before pregnancy, there was a significant difference in the weight of the babies born, so it can be concluded that there is a relationship between the body mass index of pregnant women and body weight. baby born. After carrying out the Kruskall Wallis test, a post hoc test was carried out to determine whether there was a relationship between the

body mass index of pregnant women and birth weight and the Sig value was obtained. (0.000) < α (0.05), after the post hoc test was carried out with the Spearman rank correlation test and the correlation coefficient value was obtained showing a positive number of 0.495, it can be concluded that the direction of the relationship between the two variables is in the same direction or positive, meaning the better the mother's BMI value. Before pregnancy, the more normal the weight of the baby born to the pregnant woman will be. Or conversely, the worse the mother's BMI value before pregnancy, the more abnormal the birth weight of the baby will be.

The results of this study are in line with the results of several studies which explain that in women with an average or low BMI, a slight increase in weight during pregnancy can cause fetal growth restrictions resulting in LBW (8). Mothers who have an abnormal BMI have a 8.17 times higher chance of giving birth to a LBW baby compared to mothers who have a normal BMI (10). This occurs due to decreased expansion of blood vessels, thereby increasing inadequate cardiac output and reducing blood flow to the placenta (11). A normal maternal BMI (18.5-24 kg/m2) at the time of conception followed by normal gestational weight gain (10-14 kg) has a major impact on the overall health of the pregnant woman and will result in better obstetric management for Taiwanese woman (12).

Being underweight before pregnancy increases the risk of small for gestational age (SGA) and LBW; being overweight/obesity before pregnancy increases the risk of Large for gestational age (LGA), High Birth Weight (HBW), macrosomia, and overweight/obesity in subsequent offspring (13) . Potential effect modification based on maternal age, ethnicity, gestational weight gain, and the role of gestational diseases should be addressed in future studies (13). Based on several studies, consistent results show a relationship between body mass index and baby's birth weight, but other studies also show the opposite results. There is a study in Japan showing that maternal underweight does not directly impact LBW, this may be due to differences in methodology in each study (14).

4. Conclusion

Based on the results of the study, it shows that most of the pregnant women respondents were aged 20-35 years, most did not work, most had a high school education, most were multipara gravidas and all were of term gestational age. The body mass index of pregnant women in the Simomulyo Public Health Center working area, Surabaya is mostly normal. Most newborns in the Simomulyo Public Heath Center working area, Surabaya also have normal birth weight. Studies show that there is a relationship between the body mass index of pregnant women and the birth weight of babies in the work area of the Simomulyo Public Health Center, Surabaya. Further research regarding specific monitoring of pregnant women's weight, other factors that influence pregnant women's weight, other characteristics that may be related to newborn baby weight as well as evaluation studies of maternal weight gain before pregnancy until delivery are needed to find out more specifically the relationship between the two.

Compliance with ethical standards

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Disclosure of Conflict of interest

There is no conflict of interest in this study.

Statement of ethical approval

This study has received ethical clearance approval from the Ethics Committee of the Faculty of Medicine, Universitas Airlangga.

References

[1] WHO. Low birth weight [Internet]. 2024 [cited 2024 Jun 17]. Available from: https://www.who.int/data/nutrition/nlis/info/low-birth-weight

[2] World Health Organization. Low birth weight. WHO/NMH/NHD/145. 2024;

[3] World Health Organization. Levels and trends in child malnutrition. 2023; Available from: http://www.who.int/en/

[4] Oktriyanto, Rahardja MB, Desi NFN, Amrullah H, Pujihasvuty R, Margareth MPN. Determinants of Low Birth Weight in Indonesia. Kemas. 2022;17(4):583–93.

[5] Aryastami NK, Shankar A, Kusumawardani N, Besral B, Jahari AB, Achadi E. Low birth weight was the most dominant predictor associated with stunting among children aged 12–23 months in Indonesia.

[6] Wei J, Wang T, Shu J, Liu Y, Song X, Sun M, et al. Parental pre-pregnancy body mass index and risk of low birth weight in offspring: A prospective cohort study in central China. Front Public Heal. 2022;10.

[7] Lewandowska M. Maternal obesity and risk of low birth weight, fetal growth restriction, and macrosomia: Multiple analyses. Nutrients. 2021;13(4).

[8] Putri A, Pratitis A, Luthfiya L, Wahyuni S, Tarmali A. Faktor Ibu terhadap Kejadian Bayi Berat Lahir Rendah. Higea J Public Heal Res Dev. 2019;3(1):55–62.

[9] Fatmaningrum DA, Anis W, Ardian M, Laksana C. The Impact Of The Covid-19 Pandemic On Maternal Mortality Attributes. Indones J Heal Adm (Jurnal Adm Kesehat Indones [Internet]. 2022 Jun 30 [cited 2024 Feb 23];10(1):70–8. Available from: https://e-journal.unair.ac.id/JAKI/article/view/30105

[10] Fahmi ZY. Body Mass Index Pre-Pregnancy as Risk Factor for the Incidence of Infant with Low Birth weight. J Ilm Kesehat Sandi Husada [Internet]. 2020 [cited 2024 Jun 19];12(2):842–7. Available from: https://akper-sandikarsa.e-journal.id/JIKSH/article/view/412/305

[11] Cunningham. William Obstetric. 23rd ed. Jakarta: EGC; 2014.

[12] Tsai IH, Chen CP, Sun FJ, Wu CH, Yeh SL. Asian Pacific Journal of Clinical Nutritions. 2012 [cited 2024 Jun 19]. p. 82–7 Associations of the pre-pregnancy body mass index and gestational weight gain with pregnancy outcomes in Taiwanese women - PubMed. Available from: https://pubmed.ncbi.nlm.nih.gov/22374564/

[13] Yu Z, Han S, Zhu J, Sun X, Ji C, Guo X. Pre-Pregnancy Body Mass Index in Relation to Infant Birth Weight and Offspring Overweight/Obesity: A Systematic Review and Meta-Analysis. PLoS One. 2013;8(4).

[14] Murai U, Nomura K, Kido M, Takeuchi T, Sugimoto M, Rahman M. Pre-pregnancy body mass index as a predictor of low birth weight infants in Japan. Asia Pac J Clin Nutr [Internet]. 2017 May 1 [cited 2024 Jun 19];26(3):434–7. Available from: https://pubmed.ncbi.nlm.nih.gov/28429908/