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Original Research Article

Association of Body Mass Index for Pre-pregnant Mothers and Weight Gain during Pregnancy with the Outcome of Baby's Birth Weight

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Abstract

Pre-pregnancy mother's body mass index plays a role in increasing or decreasing maternal weight. Maternal body mass index is a prominent indicator for the nutritional status of pregnant women who can be at risk of increasing the occurrence of births with low birth weight babies. This study aims to analyze the relationship between pre-pregnancy body mass index and the occurrence of low birth weight babies at Abdul Moeloek General Hospital Bandar Lampung, Indonesia. This study uses an observational analytic research design with a cross sectional approach. The population in this study were all post-partum mothers who gave birth at the Abdul Moeloek Regional Hospital in Bandar Lampung and involved a sample of 79 respondents who were taken using the consecutive sampling technique. Sampling was carried out based on inclusion and exclusion criteria that met the research criteria until the desired number of samples was met. Analysis of the research data is the chi-square test and logistic regression test. The results showed that the two independent variables, namely the pre-pregnant mother's body mass index and weight gain during pregnancy, had a significant relationship to the baby's birth weight. The significance of body mass index is p-value=0.004 and the significance of weight gain during pregnancy is p-value=0.000. Thus the body mass index of pre-pregnant women and weight gain during pregnancy can affect low birth weight babies at Abdul Moeloek Hospital Bandar Lampung.

Keywords: Body mass index, weight gain during pregnancy, baby's birth weight.

INTRODUCTION

Pre-pregnancy body mass index is a factor in a healthy pregnancy (Lisonkova *et al*., 2017) and identifies when a woman is at risk of having a difficult pregnancy caused by excessive or insufficient weight gain (Aji *et al*., 2022). Obesity and underweight during preconception can directly affect the development of maternal health (Rastogi *et al*., 2015). In recent years, the pre-pregnancy body mass index for women of childbearing age has shown an increasing trend in developed countries (S. Kim *et al*., 2007; Wang *et al*., 2021). The pregnancy risk assessment monitoring system revealed that obesity before conception increased from 22% to 69.3% when compared to 10 years ago in the United States (S. Kim *et al*., 2007).

In the United States about a quarter of women are obese (³ 30 kg/m^2) at fertilization and this number is increasing (Deputy *et al*., 2018). Obesity in the pre-pregnancy period is known to increase the risk of neonatal outcomes that can harm pregnant women and gestational morbidity, such as premature birth, cesarean delivery, hypertensive disorders, and gestational diabetes mellitus (Chen *et al*., 2022; S. Y. Kim *et al*., 2014; Kong *et al*., 2019; Rastogi *et al*., 2015; Santos *et al*., 2019; Sun *et al*., 2020). Although pre-pregnancy obesity has received more attention, mothers with a lean body index (<18.5 kg/m^2) during conception can also increase the risk of bleeding, obstetric shock, and other serious complications that can be experienced by the mother (Frey *et al*., 2022; Lisonkova *et al*., 2017; Mrema *et al*., 2018; Schummers *et al*., 2015). Pregnant women should try to increase or decrease appropriate body weight during pregnancy, because body weight is very influential and important for fetal growth (Aji *et al*., 2022).

The nutritional status of the expectant mother is believed to be a good factor during pregnancy as well as long-term outcomes that can harm the baby and mother (Sun *et al*., 2020). Pregnancy outcomes such as

birth weight, length and head circumference are vital indicators of the general health of newborns (Hadush *et al*., 2017; Tiruneh & Teshome, 2021). Low birth weight has been found to contribute around 60-80% of neonatal mortality (Ministry of Health RI, 2013), postneonatal and morbidity (Fajriana & Buanasita, 2018; Leonard *et al*., 2020). Body weight before pregnancy is very important from a health perspective for both mother and baby (Puspita, 2019). An increase in energy and nutrients during pregnancy is needed for the growth and development of the fetus, the increase in the size of the uterine organs, changes in composition, and the metabolism of the mother's body (Samiatulmilah, 2018). Pre-pregnancy nutritional status has a large influence on the baby's birth weight (Ningrum & Cahyaningrum, 2018).

Several researchers conducted research related to pre-pregnant mother's body mass index, (Wojcicki, 2011) conducted a literature review of pre-pregnancy body mass index and initiation and duration of breastfeeding, (Aji *et al*., 2022) through a cohort study on pregnant women in Indonesia related to body mass index and gestational weight gain on pregnancy outcomes, (Łoniewska *et al*., 2022) conducted a prospective study regarding the effect of pre-pregnancy body mass index and maternal weight gain during pregnancy on healthy child weight during 2 years of child's life. Thus the purpose of this study was to determine the relationship between pre-pregnant mother's body mass index and the incidence of low birth weight babies at Abdul Moeloek General Hospital, Bandar Lampung.

METHOD

This study uses an observational analytic research design with a cross sectional approach. The researcher only observed without treating the object to be studied. The population in this study were all post-partum mothers who gave birth at the Abdul Moeloek Regional Hospital (RSUD) Bandar Lampung in August – October 2021 for three weeks which met the research criteria. The inclusion criteria in this study were for all pregnant women who gave birth at Abdul Moeloek Hospital in Bandar Lampung in August - October 2021, the mother is willing to be a respondent, has a MCH book, and has a normal pregnancy. The exclusion criteria in this study were not willing to become respondents, the babies born were twins, babies who had physical smallpox, the MCH book was not properly recorded or lost, and the mother had a chronic disease.

The sampling technique in this study was consecutive sampling. The sample in this study were all postpartum mothers at Abdul Moeloek Hospital in Bandar Lampung. Sampling was carried out based on inclusion and exclusion criteria that met the research criteria until the desired number of samples was met. The instruments used in this study were data recording sheets, stationery, and medical records or MCH books. Analysis of the research data is the chi-square test and logistic regression test.

RESULTS

Table 1: Frequency distribution of respondents based on baby's birth weight

Baby's Birth Weight (gr)	Frequency	
	n	%
<2500	4	5,1
2500 – 4000	70	88,6
>4000	5	6,3
Total	79	100

Table 1 shows that the majority of respondents, namely 88.6%, gave birth to babies weighing 2500 – 4000 grams and only a small number gave birth with weights <2500 grams (4%) and >4000 grams (5%).

Table 2: Frequency Distribution of Respondents Based on Body Mass Index Pre-Pregnant Mother

Body Mass Index	Frequency	
	n	%
Which (17,0 < 18,5)	16	20,3
Normal (18,5 – 25,0)	37	46,8
Overweight (>25 – 27)	18	22,8
Obesity (>27)	8	10,1
Total	79	100

Based on Table 2, it is known that the pre-pregnant mother's body mass index at Abdul Moeloek Hospital Bandar Lampung is mostly 46.8% of respondents who have a pre-pregnancy body mass index in the normal group and 10.1% of other respondents have a pre-pregnant mother's body mass index. pregnant in the obese group.

Table 3: Frequency Distribution of Respondents Based on Weight Gain for Pregnant Women

Weight Gain	Frequency	
	n	%
Less	26	32,9
Normal	33	41,8
Excess	20	25,3
Total	79	100

Based on Table 3 it shows that the frequency of respondents based on maternal weight gain during pregnancy at Abdul Moeloek Hospital Bandar Lampung, most of the 41.8% of respondents experienced normal weight gain.

Table 4: Analysis of the Relationship between Body Mass Index of Pre-pregnant Mothers and Baby's Birth Weight

Pre-pregnancy BMI	Baby's Birth Weight						Total		*P – Value*
	(<2500 gr)		(2500 – 4000 gr)		>4000				
	n	%	n	%	n	%	n	%	0,004
Less	1	6,3	15	93,8	0	0	16	100	
Normal	2	5,4	34	91,9	1	2,7	37	100	
Excess	1	5,6	15	83,3	2	11,1	18	100	
Obesity	0	0	6	75,0	2	25,0	8	100	

Table 4 is the result of a statistical test using chi-square with a p-value of 0.004 <0.05. This means that there is a significant relationship between the body mass index of pre-pregnant mothers and the baby's birth weight.

Table 5: Analysis of the Relationship between Weight Gain During Pregnancy and Baby's Birth Weight

Weight Gain	Baby's Birth Weight						Total		*P – Value*
	(<2500 gr)		(2500 – 4000 gr)		>4000				
	n	%	n	%	n	%	n	%	0,000
Less	2	7,7	24	92,3	0	0	26	100	
Normal	2	6,1	29	87,9	2	6,1	33	100	
Excess	0	0	17	85,0	3	15,0	20	100	

Table 5 is the result of a statistical test using chi-square with a p-value of 0.000 <0.05. This means that there is a significant relationship between weight gain during pregnancy and the baby's birth weight.

DISCUSSION

Maternal body mass index before pregnancy was categorized into underweight or underweight 17.0 <18.5, normal 18.5 – 25.0, overweight >25 – 27, and obesity >27. Pre-pregnant mother's body mass index is obtained based on the average weekly pregnancy weight gain according to the Institute of Medicine. The results of this study indicate that a normal pre-pregnant mother's body mass index will give birth to a normal baby weight, the results of the statistical test with chi-square get a p-value of 0.004. This means that there is a significant relationship between the body mass index of pregnant women and the baby's birth weight. This research is in line with (Riantika *et al*., 2022) that there is a significant relationship between the body mass index of pregnant women and low birth weight babies. (Endah *et al*., 2017) showed that the results of bivariate analysis showed that pregnant women's BMI was the variable that had the most chance of LBW events with a 2.8 times greater chance of giving birth to LBW babies in mothers with at-risk BMI compared to mothers with no-risk BMI. (Nurhayati & Fikawati, 2016) also showed that there was a significant relationship between pre-pregnancy body mass index and birth weight.

A simple way to monitor the nutritional status of adults is by assessing BMI or BMI, especially with regard to underweight and overweight. Underweight can increase the risk of infectious diseases, whereas being overweight has the potential to have a risk of degenerative diseases. It is important to maintain a normal weight so as to achieve a longer life expectancy. Low maternal body mass index can be caused by inadequate energy intake and chronic malnutrition. (Ronnenberg *et al*., 2003) In addition, prolonged pre-pregnancy low body mass index conditions will increase the energy needed during pregnancy and the mother will make energy deficits in early pregnancy insufficient to meet the substrate needed to support the growth of fetal tissue. (Gondwe *et al*., 2018) found that babies born to mothers who were underweight or thin

were at greater risk of experiencing stunting babies. (Han *et al*., 2011) conducted a meta-analysis of 78 studies which showed an increased risk of premature birth and low birth weight in thin mothers. (Indarti *et al*., 2021; Lawlor *et al*., 2012) also stated that thin women have an increased risk of low birth weight.

This study also discusses the relationship between weight gain during pregnancy and birth weight, the results show that there is a relationship between the two with a p-value of 0.000. Normal maternal weight gain during pregnancy will give birth to babies with normal weight as well. Mothers who have less than normal weight will be at risk of giving birth to babies with low birth weight (Supariasa *et al*., 2016), (Aji *et al*., 2022) also revealed that pregnant women with excessive weight gain or obesity have a higher risk high to give birth to a low birth weight baby. Research by (Aryani & Annisa, 2019) also found that maternal weight gain during pregnancy is directly related to baby weight and the risk of giving birth to low birth weight will increase with a lack of weight gain during pregnancy. Studies (Thapa & Paneru, 2017) found that the percentage of newborns with low birth weight is more likely to be pregnant women with excess weight or obesity than pregnant women with underweight. Low birth weight is still a major public health problem and is associated with an increased risk of morbidity and mortality of newborns (Amosu & Degun, 2014; Seedidhi & Ponnada, 2017). Research (Sun *et al*., 2020) in his group study with 3172 pregnant women in China found that overweight and excess weight gain during pregnancy are risk factors for low birth weight.

Newborn weight can be affected by the mother's nutritional status (Durrani & Rani, 2011; Ghodsi *et al*., 2021; Gillespie, 2001). Incorrect nutritional intake during pregnancy will have a negative effect on the fetus (Retni *et al*., 2016). Low nutritional intake in pregnant women has a 6.03 times greater risk of giving birth to a baby with low birth weight**.** Pregnant women with poor nutritional status will experience impaired growth and function of the placenta which is reflected in lower placental weight and smaller placental size (Uauy, 2000). Mother's weight that is less or excess than normal weight will make pregnancy risky and can have long-term effects on the child (Waryana, 2010). Maternal weight which is a component of the nutritional status of pregnant women has an influence on fetal growth. Maternal weight gain during pregnancy must be in harmony with the growth and development of the fetus in the womb because maternal weight gain during pregnancy is very influential with fetal growth, which means that abnormal maternal weight gain will result in low final baby weight. The nutritional needs of the mother during pregnancy increase, this is because besides being needed to meet the nutritional needs of the mother, it is also needed for the fetus. Fulfillment of nutrition during pregnancy is also necessary for the preparation of breast milk and the growth and development of the baby.

The nutritional status of pregnant women is very important because it can show the welfare of the mother and fetus. A healthy mother will give birth to a healthy baby, as well as a malnourished mother will be at risk of giving birth to a malnourished baby which can result in birth failure. Mother's nutritional status is a major factor in determining the quality of life of babies born. The nutritional status of pregnant women can be determined by weight gain during pregnancy. If a pregnant woman experiences normal weight gain, then it can be stated that adequate intake of nutrients is needed for the growth and development of the fetus. Ratnasari *et al*., 2015 weight gain during pregnancy can be caused by an increase in the size of various reproductive tissues, the formation of maternal body fat reserves, fetal growth, and metabolic changes.

CONCLUSION

The results of this study indicate that the pre-pregnant mother's body mass index and weight gain during pregnancy have a positive effect on the baby's birth weight at Abdul Moeloek Hospital Bandar Lampung. These findings suggest that there is a need for a better understanding of the importance of maintaining the body mass index of pregnant women with a steady increase in maternal weight during pregnancy. Therefore, the programs implemented are expected to suggest the importance of adequate nutrition during pre-pregnancy and during pregnancy.

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