

Excessive Weight Gain During Pregnancy: Association with the Risk of Preeclampsia and Gestational Diabetes Melitus

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ABSTRACT

Weight gain during pregnancy is an important indicator that influences maternal and fetal health. Excessive gestational weight gain (EGWG) has been associated with an increased risk of obstetric complications, including preeclampsia and gestational diabetes. This study aims to analyze the relationship between excessive weight gain during pregnancy and the incidence of preeclampsia and gestational diabetes mellitus (GDM) in pregnant women in the third trimester at Dr. H. Koesnadi Bondowoso General Hospital. This study used an observational analytical design with a cross-sectional approach and involved 140 pregnant women selected through a purposive sampling technique. Data were obtained through structured interviews, anthropometric measurements, and medical records, then analyzed using the Chi-square test. The results showed a significant association between excessive weight gain and the incidence of preeclampsia ($p = 0.012$) and gestational diabetes ($p = 0.004$). Women who exceeded the recommended weight gain limits were at a higher risk of developing these complications compared to those with normal weight gain. These findings emphasize the importance of controlling weight gain through routine monitoring and nutritional education during pregnancy. In conclusion, excessive weight gain is an important risk factor that needs attention in antenatal care services to prevent serious complications in pregnant women.

Keywords: Excessive Weight Gain, Preeclampsia, Gestational Diabetes Melitus



INTRODUCTION

The Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) are key indicators for evaluating a country's well-being and reflect the overall health status of the population. High infant mortality rates are often correlated with maternal health during pregnancy, maternal and family knowledge of the importance of prenatal care, the role of health workers and the availability of healthcare facilities (Aminudin et al., 2019) .

In Indonesia, maternal mortality rates (MMR) reached 4,129 deaths in 2023, an increase compared to 4,005 deaths in the previous year. Based on Maternal Perinatal Death Notification (MPDN) data as of January 26, 2024, the three main causes of maternal death in 2023 were non-obstetric complications (35.2%), hypertension during pregnancy, childbirth, and the postpartum period (26.1%), and obstetric hemorrhage (17.6%). The majority of deaths occurred in hospital facilities (91.2%) (Statistics, 2024) .

Preeclampsia is a multisystem disorder of pregnancy characterized by widespread endothelial dysfunction, resulting in high blood pressure and target organ damage in the second half of pregnancy (Tangren et al., 2018) . Preeclampsia, or hypertension during pregnancy, is a condition in pregnant women with blood pressure $\geq 140/90$ mmHg (Sutiati Bardja, 2020) . Preeclampsia is a severe pregnancy complication and occurs in approximately 3-8% of all pregnancies. The prevalence of preeclampsia in developed countries ranges from 1.3-6% and in developing countries from 1.8-18%. In Indonesia, the incidence of preeclampsia is around 5.3% or 128,273 per year (Najmia et al., 2022). Furthermore, preeclampsia remains the leading cause of maternal mortality in Indonesia, accounting for 26.9% (Sari et al., 2023) . Preeclampsia can cause several diseases, namely complications during pregnancy, one of which is gestational diabetes mellitus.

Gestational diabetes mellitus is one of the obstetric complications influenced by many factors, including obesity, age, a family history of diabetes, and a history of giving birth to large babies. Complications resulting from gestational diabetes mellitus include increased caesarean section (C-section), macrosomia, preeclampsia, hypoglycemia, premature birth, and others (Ris Natalia et al., 2020) . One of the main risk factors for gestational diabetes is a high Body Mass Index (BMI) (Ris Natalia et al., 2020) . BMI is a measure used to determine whether a person has a healthy weight, based on the ratio between weight and height. Several previous studies have shown that women with a higher BMI before or during early pregnancy have a greater risk of developing gestational diabetes (Saifullah et al., 2022) .

Weight gain during pregnancy is an important indicator in monitoring maternal and fetal health. The World Health Organization (WHO) and the Institute of Medicine (IOM) have established weight gain limits based on pre-pregnancy body mass index (BMI). Excessive gestational weight gain (EGWG) has been shown to increase the risk of obstetric complications (Silvani & Fatmawati, 2024) . Uncontrolled or excessive maternal weight gain can result in many high pregnancy risks, including gestational diabetes, preeclampsia, postterm pregnancy, emergency cesarean section,

elective cesarean section, postpartum hemorrhage, pelvic infection, urinary tract infection, wound infection, macrosomia, and stillbirth (Pratamaningtyas & Kristianti, 2020) .

Previous research found a relationship between obesity and the incidence of preeclampsia in pregnant women at the Gandus Community Health Center in Palembang. This was found with an odds ratio of 19.368, meaning that obese pregnant women were 19.368 times more likely to experience preeclampsia than non-obese pregnant women. Researchers assumed that some respondents experienced preeclampsia because some pregnant women consumed high-calorie foods during pregnancy, which caused an increase in protein in the urine. Excessive salt accumulation in the body causes edema in the hands and feet (Marissa, 2022) . In addition, previous research explained a significant relationship between body mass index and gestational diabetes mellitus. The results of this study indicate that women with a high body mass index tend to experience insulin resistance, which can increase the risk of gestational diabetes mellitus (Ridiana et al., 2025) .

Several studies have suggested that weight gain exceeding the IOM recommendations increases insulin resistance, systemic inflammation, and endothelial dysfunction, which further contribute to the development of GDM and preeclampsia. However, many pregnant women in Indonesia do not fully understand the limits of healthy weight gain, thus increasing the risk of pregnancy complications. This study aims to analyze the relationship between excessive weight gain during pregnancy and the risk of preeclampsia and gestational diabetes at Dr. H. Koesnadi General Hospital, Bondowoso . Using a sample of pregnant women in their third trimester, these findings strengthen existing empirical evidence on the importance of monitoring weight gain in preventing pregnancy complications and highlight the need for more intensive nutrition education during pregnancy.

MET HODS

This study used an observational analytical approach with a cross-sectional design, aiming to analyze the association between excessive weight gain during pregnancy and the risk of preeclampsia and gestational diabetes. This study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines, which ensure methodological transparency, completeness, and consistency in the description of study design, participant selection, variable definitions, data collection, and statistical analysis.

The study population included all third-trimester pregnant women who underwent antenatal care examinations at Dr. H. Koesnadi Bondowoso General Hospital during the period January–March 2025. The sample was selected using a purposive sampling technique with inclusion criteria including pregnant women without a history of chronic hypertension, no pre-pregnancy diabetes mellitus, and a gestational age of at least 28 weeks . Exclusion criteria in this study included pregnant women with multiple pregnancies (e.g., twins), a history of chronic hypertension or pre-pregnancy diabetes mellitus, and incomplete or unverifiable medical record data, as these conditions could potentially affect the validity of the exposure assessment and study outcomes. The sample in



this study was based on considerations of sample adequacy to detect relationships between variables, referring to the prevalence of pregnancy complications and the feasibility and availability of data at the study site with a total of 140 people. Primary data were obtained through structured interviews and anthropometric measurements based on weight gain records in the KIA book, while secondary data were obtained from medical records related to the diagnosis of preeclampsia and gestational diabetes.

In this study, weight gain during pregnancy was defined as the difference between maternal weight at the end of the third trimester and pre-pregnancy weight. This weight gain was then classified based on the Institute of Medicine (IOM) recommendations based on pre-pregnancy Body Mass Index (BMI). Preeclampsia in this study was defined based on a clinical diagnosis by a medical professional recorded in the medical record, with the criteria being systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg appearing after 20 weeks of gestation. GDM was defined based on laboratory test results recorded in the medical record, namely screening tests or oral glucose tolerance tests (OGTT) during pregnancy, which showed blood glucose levels exceeding the diagnostic thresholds used in healthcare facilities.

Data analysis was conducted in several stages, starting with checking the completeness of the data, grouping variables according to the Institute of Medicine (IOM) standards, and then determining the categories of normal and excessive weight gain. Preeclampsia and gestational diabetes were determined based on medical diagnoses by healthcare professionals. The Chi-square statistical test was used because this study aimed to examine the relationship between two categorical variables with a significance level of 0.05. The results were then presented in the form of a frequency distribution table and analyzed descriptively to determine whether there was a relationship between excessive weight gain during pregnancy and the risk of preeclampsia and gestational diabetes.

RESULTS

1. The Relationship Between Excessive Weight Gain and Preeclampsia

Based on table 1. the results of the identification of the relationship between weight gain in pregnant women and the incidence of preeclampsia were obtained, with normal weight gain and preeclampsia occurring in 22 people (13.5%), while in the group with normal weight gain, only 10 out of 80 people (12.5%) experienced preeclampsia. After being analyzed using the Chi Square test, a p-value of 0.012 was obtained, so the p-value of $0.000 < \alpha < 0.05$. It can be concluded that there is a relationship between weight gain in pregnant women and the incidence of preeclampsia at Dr. H. Koesnadi Bondowoso Hospital :

Table 1. Relationship between Excessive Weight Gain and Preeclampsia

Weight Gain	Preeclampsia	No Preeclampsia	Total	p-value
Excessive	22	38	60	0.012
Normal	10	70	80	

2. The Relationship Between Excessive Weight Gain and Gestational Diabetes

The results of the study also showed a significant relationship between excessive weight gain during pregnancy and the incidence of gestational diabetes at Dr. H. Koesnadi Bondowoso General Hospital . Of the 60 pregnant women who experienced excessive weight gain, 18 (30%) were diagnosed with GDM. In contrast, in the group of pregnant women with normal weight gain, only 6 out of 80 (7.5%) experienced GDM. A p-value of 0.004 indicates a highly significant relationship between the two variables. Descriptively, this figure shows that mothers with excessive weight gain have a more than threefold risk of developing gestational diabetes compared to mothers with controlled weight gain.

Table 2. Relationship between Excessive Weight Gain and Gestational Diabetes

Weight Gain	GDM	No GDM	Total	p-value
Excessive	18	42	60	0.004
Normal	6	74	80	

DISCUSSION

1. The Relationship Between Excessive Weight Gain and Preeclampsia

The results of the study showed that pregnant women with excessive weight gain during pregnancy were more likely to experience preeclampsia than those with normal weight gain. Of the 60 mothers with excessive weight gain, 22 developed preeclampsia, while in the normal weight gain group, only 10 of the 80 women developed preeclampsia. A p-value of 0.012 indicates a statistically significant association between excessive weight gain and the incidence of preeclampsia. Practically, these findings suggest that the greater the deviation of weight gain from the IOM recommendations, the higher the risk of the mother experiencing hypertensive complications during pregnancy, particularly preeclampsia.

Other studies have shown that obesity before pregnancy increases the risk of preeclampsia by 1.8 times (Shao et al., 2017) . Compared to women with a BMI of 21, the risk of preeclampsia is 2.1 times greater in women with a BMI of 26 and 3 times greater in women with a BMI of 30 (Wang et al., 2022) . In addition , previous research has found clinically that pregnant women with weight gain exceeding the IOM recommendations have a 2.67 times greater chance or possibility of experiencing preeclampsia compared to pregnant women whose weight gain does not exceed the IOM recommendations (Hidayati & Mada, 2025) . Research by Sari et al. (2023) confirms that factors such as nutritional status and hypertension during pregnancy are important determinants of the incidence of preeclampsia in health care facilities. These findings strengthen the results of this study that being overweight during pregnancy is an important risk factor for preeclampsia (Sari et al., 2023) .

Pathophysiologically, excessive weight gain during pregnancy, which is generally associated with increased body fat mass, increases systemic inflammation and oxidative stress, which impacts vascular endothelial dysfunction. This endothelial dysfunction plays a major role in the pathogenesis of preeclampsia, characterized by vasoconstriction, increased peripheral vascular



resistance, and impaired placental perfusion (Ecker et al., 2019) . Mothers with a high BMI or excessive weight gain tend to have higher levels of adipokines and proinflammatory cytokines (e.g., TNF- α , IL-6), thus triggering impaired blood pressure regulation and target organ damage (Sutiati Bardja, 2020) . Uncontrolled excessive weight gain is also often associated with sodium and fluid retention, thereby exacerbating edema and blood pressure, which are clinical characteristics of preeclampsia. Thus, this pathophysiological theory supports that EGWG may increase the risk of preeclampsia through inflammatory and vascular mechanisms.

Based on the results and existing theories, researchers assume that the incidence of preeclampsia in respondents with excessive weight gain at Dr. H. Koesnadi Bondowoso General Hospital is not only influenced by biological factors, but also by a high-calorie, low-fiber diet, and a lack of physical activity during pregnancy. Researchers also suspect that some mothers with excessive weight gain already have other risk factors such as a history of hypertension or excessive pre-pregnancy nutritional status (overweight/obesity), so that when entering pregnancy and experiencing EGWG, the risk of preeclampsia becomes even higher. Therefore, interventions that emphasize nutritional education, dietary management, and weight monitoring from the beginning of pregnancy are very important to reduce the incidence of preeclampsia.

2. The Relationship Between Excessive Weight Gain and Gestational Diabetes

The results of the study showed a significant association between excessive weight gain during pregnancy and the incidence of gestational diabetes (GDM). Of the 60 pregnant women who experienced excessive weight gain, 18 (30%) were diagnosed with GDM, while in the group with normal weight gain, only 6 of 80 (7.5%) experienced GDM. A p-value of 0.004 indicates a highly significant association between the two variables. Descriptively, these findings illustrate that mothers who experience weight gain above the recommended values have a more than threefold increased risk of developing GDM compared to mothers whose weight is controlled. This indicates that controlling weight gain during pregnancy is an important strategy in preventing GDM.

This research is consistent with the results of other studies that found a significant association between BMI and gestational diabetes. A study by Smith et al. (2018) showed that women with a BMI ≥ 30 kg/m² had a higher risk of gestational diabetes, similar to the findings of this study. However, some studies showed a less strong association, possibly due to differences in measurement methods or population characteristics . In addition, Lestari et al. (2024) showed that pre-pregnancy BMI and weight gain during pregnancy were associated with third-trimester blood sugar levels, which in turn affected newborn weight. The consistency of results between these studies strengthens the conclusion that excessive weight gain is an important risk factor for GDM (Lestari et al., 2024) .

In theory, excessive weight gain during pregnancy is closely related to an increase in adipose tissue, which plays a role in increasing insulin resistance. Excess fat tissue produces various adipokines and proinflammatory cytokines that interfere with insulin function, requiring the body to maintain normal blood glucose levels. During pregnancy, this condition is exacerbated by

physiological hormonal changes that are diabetogenic (e.g., increased human placental lactogen and other placental hormones), making mothers with excess fat reserves much more susceptible to GDM. High pre-pregnancy BMI and EGWG cause the pancreas's capacity to increase insulin secretion to be inadequate, resulting in hyperglycemia, a clinical manifestation of gestational diabetes (Ridiana et al., 2025). Thus, the insulin resistance theory and the role of adipose tissue explain the strong association between excessive weight gain and the incidence of GDM.

Researchers assumed that pregnant women with excessive weight gain in the study area tended to have a diet high in simple carbohydrates and fat, with low fiber intake and low physical activity. These habits, combined with the hormonal changes of pregnancy, accelerate the development of insulin resistance and ultimately GDM. Researchers also suspected that some mothers had not received early screening for GDM risk factors, such as a family history of diabetes, pre-pregnancy obesity, and a history of giving birth to a large baby, resulting in suboptimal primary prevention. Furthermore, limited time for antenatal care at the hospital may have resulted in inadequate nutrition counseling and weight gain monitoring. Therefore, researchers concluded that efforts to control weight gain during pregnancy through nutrition education, increasing safe physical activity, and structured GDM screening starting in the second trimester are important strategies to reduce the incidence of GDM in the pregnant population.

CONCLUSIONS

The results of the study showed that excessive weight gain during pregnancy was significantly associated with the incidence of preeclampsia and gestational diabetes. Pregnant women who experienced weight gain above the IOM recommendations had a higher risk of developing preeclampsia ($p = 0.012$) and gestational diabetes ($p = 0.004$) compared to women with normal weight gain. These findings indicate that weight control during pregnancy is an important component in efforts to prevent pregnancy complications that can impact the health of the mother and fetus, so that monitoring weight gain needs to be an integral part of antenatal care services.

Overall, the study findings confirm that physiological factors such as increased adipose tissue, insulin resistance, and systemic inflammation play a key role in the mechanisms leading to these two complications. Therefore, health interventions focused on managing nutritional status and promoting healthy lifestyles from pre-conception through the end of pregnancy are essential. This study emphasizes the importance of nutrition education, dietary regulation, and measured physical activity to prevent excessive weight gain and minimize the risk of complications in pregnant women.

Health workers need to increase educational efforts regarding recommended weight gain limits during pregnancy based on pre-pregnancy BMI, and strengthen monitoring of maternal nutritional status at every antenatal care visit. Nutrition counseling, scheduled blood sugar checks, and preeclampsia risk screening starting in the first trimester need to be more intensively implemented to identify high-risk pregnant women as early as possible. Furthermore, developing easy-to-understand educational media—such as booklets, posters, or weight-tracking apps—can help mothers independently manage their weight gain.



Pregnant women are advised to maintain a balanced diet, pay attention to macronutrient and micronutrient needs, and engage in light physical activity as recommended by healthcare professionals. Pregnant women should also raise awareness about the importance of regular check-ups, especially blood pressure and blood sugar levels. Future researchers are advised to include variables such as lifestyle, stress, physical activity, and pre-pregnancy nutritional status for a more comprehensive analysis that can illustrate the factors contributing to excessive weight gain and pregnancy complications.

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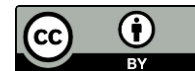
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