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# Relationship between Pregnant Woman Obesity Grade-1 and Grade-2 with The Incidence of Preeclampsia

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## Abstract

**Background:** Preeclampsia is a hypertensive disorder that can increase maternal and fetal morbidity and mortality during pregnancy. Pregnant women with obesity are at higher risk of preeclampsia.

**Objective:** To prove the relationship between pregnant women with grade-1 and grade-2 obesity and the incidence of preeclampsia

**Method:** This study used the design of a prospective cohort. The population was pregnant women with obesity who got check-ups in Pregnancy Unit at Wiyung Sejahtera Hospital in Surabaya. This study used a consecutive sampling technique. The samples were pregnant women with BMI ≥ 25 with 34-38 weeks gestational age who signed the consent form. The data were analyzed through the Chi-Square test.

**Result:** The results show that respondents who do not experience preeclampsia are dominated by pregnant women with grade-1 obesity by 70% and grade-2 obesity by 30%. Meanwhile, those who experience preeclampsia are dominated by pregnant women with grade-2 obesity by 75% and grade-1 obesity by only 25%. The results of the Chi-Square test analysis obtain a p-value of 0.007 with an odds ratio of 7,000.

**Conclusion:** Pregnant women classified as grade-2 obesity have a seven times greater risk of experiencing preeclampsia compared to pregnant women with grade-1 obesity.

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## INTRODUCTION

In 2012, the Indonesian Demographic and Health Survey (IDHS) stated that the maternal mortality rate in Indonesia was still high, at 359 per 100,000 live births. In 2013, the most significant cause of maternal death in Indonesia was bleeding, which was 30.3%, followed by hypertension in pregnancy at 27.1%, infection at 7.3%, prolonged labor at 1.8%, and abortion at 1.6 %. From 2010 to 2013, the incidence of hypertension in pregnancy in Indonesia continued to increase[1].

Hypertension pregnancy disorders are a significant cause of increased maternal, fetal, and neonatal morbidity and mortality. In the United States, preeclampsia and hypertensive disorders in pregnancy account for 5-8% of the total birth rate. The incidence rate for preeclampsia in the United States, Canada, and Western Europe, ranges from 2-5% [2]. More than 4 million women across the world develop this disorder every year, and an estimated 50,000–76,000 women and 500,000 infants die of this condition every year [3]. Preeclampsia is a pregnancy-specific disease characterized by new-onset hypertension and proteinuria after 20 weeks of gestation[4].

In pregnant women, being overweight can increase the association with adverse outcomes during the perinatal period for themselves and the fetus[5]. The risk factors for preeclampsia are very diverse, one of which is obesity. According to WHO, obesity is the accumulation of excessive fat in all body tissues evenly, which results in various disorders and diseases such as diabetes, high blood pressure to heart attacks that cause death[6]. In addition to obesity, there are other risk factors associated with preeclampsia, such as age, parity, and diabetes mellitus[7,8,9]. A study states that there is a relationship between BMI and the incidence of preeclampsia[10]. A study says there is an increased risk of antenatal, intrapartum, and postpartum disorders in pregnant women who are overweight or obese[11]. In another study, it was also stated that obesity that occurs in pregnant women in the second and third trimesters increases the risk of preeclampsia[12]. The increased risk of preeclampsia caused by obesity is a possible thing to happen again (reversible). One of the preventions is to make lifestyle modifications that aim to lose weight before pregnancy occurs[13]. Besides being able to cause preeclampsia, obesity in pregnancy can cause gestational hypertension, bleeding after delivery, and even miscarriage[14]. Classification of normal weight (18.5 to <23.0 kg/m$^2$), overweight (23.0 to <25.0 kg/m$^2$), obesity (≥25 kg/m$^2$), class I obesity (25–29.9 kg/m$^2$), and class II obesity (≥30 kg/m$^2$). Then, the criteria for visceral obesity are based on a waist or waist circumference >94 cm (men) and >80 cm (women), or a waist-hip ratio >1.0 (men) and > 0.85 (women)[15]. The formula for calculating BMI is as follows, BMI = $\frac{\text{Weight (kg)}}{\text{Height(m)}]^2}$ [6].

Therefore, we can use the BMI value as a benchmark to detect and monitor pregnant women quickly and efficiently. Based on this background, researchers are encouraged to conduct research on the relationship between obese pregnant women in grade-1 and grade-2 with the incidence of preeclampsia at Wiyung Sejahtera Hospital, Surabaya.

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## METHODS

This study used a prospective cohort design by dividing two groups of pregnant women with obesity. The population in this study were pregnant women with obesity who were controlled at the Maternity Clinic of Wiyung Sejahtera Hospital, Surabaya. The sampling technique in this study used the Consecutive Sampling technique. The sample of this study were pregnant women with a BMI of 25 with a gestational age of 34-38 weeks who were willing to be respondents and signed the consent form. This research instrument is primary data obtained from direct observation of pregnant women with obesity in grade-1 and grade-2. The data is taken based on the results of blood pressure and proteinuria examination results from pregnant women, with a total of 36 respondents. The data obtained were then processed using the Chi-Square statistical analysis technique.

## RESULTS

Based on the Table 1, it can be seen that the frequency of respondents in the classification of obesity grade-1 and obesity grade-2 is 18 respondents each, so the number of samples in each group in this study is balanced. At the Table 2, it is known that of the 36 respondents in this study, 20 did not have preeclampsia (55.6%), and 16 others had preeclampsia (44.4%). This shows that the respondents in this study were dominated by patients who did not experience preeclampsia.

**Table 1.** Frequency Distribution of Obesity Classification

| Obesity Classification | Frequency | Persentage (%) |
|---|---|---|
| Grade-1 | 18 | 50,0 |
| Grade-2 | 18 | 50,0 |
| Total | 36 | 100,0 |

Table 2. Frequency Distribution of Preeclampsia Incidence

| Preeclampsia Incidence | Frequency | Percentage (%) |
|---|---|---|
| Not preeclampsia | 20 | 55,6 |
| Preeclampsia | 16 | 44,4 |
| Total | 36 | 100,0 |

Table 3. Relationship between Obesity and the Incidence of Preeclampsia

| Preeclampsia Incidence | Obesity | | p | OR |
|---|---|---|---|---|
| | *Grade-1* | *Grade-2* | | |
| Not preeclampsia | 14<br>70,0% | 6<br>30,0% | 0,007 | 7,000 |
| Preeclampsia | 4<br>25,0% | 12<br>75,0% | | |


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At the Table 3, it can be seen that of the 20 respondents who did not have preeclampsia, 14 of them were classified as obesity grade-1 (70.0%), and six others were included in grade-2 (30.0%). This shows that respondents who do not have preeclampsia are dominated by respondents who are classified as obese in grade-1. While of the 16 respondents who have preeclampsia, 4 of them are included in the classification of obesity grade-1 (25.0%), and 12 others are included in grade-2. (75.0%). This shows that respondents who have preeclampsia are dominated by respondents who are classified as obese in grade-2. The results of the Chi-Square test analysis show a significance value of 0.007 ($p < 0.05$) with an odds ratio of 7,000. This indicates that there is a significant relationship between obesity and the incidence of preeclampsia. Respondents with grade-2 obesity tend to experience preeclampsia seven times greater than respondents with grade-1 obesity.

## DISCUSSION

The study was conducted at the Maternity Clinic of Wiyung Sejahtera Hospital Surabaya to determine the relationship between obesity and the incidence of preeclampsia. The study was conducted from December 2019 to February 2020 on 36 respondents who were pregnant women with a gestational age of 34-38 weeks. The characteristics of respondents in this study can be known based on weight, height, and body mass index (BMI). Body mass index is then classified into two categories, namely obesity grade-1, and obesity grade-2, where the frequency in both categories is balanced with 18 respondents in each category. While the grouping of patients based on the incidence of preeclampsia was divided into two categories, namely respondents who had preeclampsia and respondents who did not experience preeclampsia. As many as 20 out of 30 respondents did not have preeclampsia (55.6%), and 16 others had preeclampsia (44.4%). This shows that the respondents in this study were dominated by patients who did not experience preeclampsia.

Obesity is a risk factor that has been widely studied for the occurrence of preeclampsia. Obesity triggers the occurrence of preeclampsia through several mechanisms, namely in the form of superimposed preeclampsia, as well as through triggers of metabolites and other micro molecules. The risk of preeclampsia increased by two times for every increase in body weight of 5-7 kg/m2. In addition, it was found that there was an increased risk of preeclampsia with an increase in BMI. Women with a BMI > 35 before pregnancy had a fourfold risk of developing preeclampsia compared with women with a BMI of 19-27. Several studies have also found that women with a BMI < 20 have a reduced risk of preeclampsia. The risk of developing preeclampsia due to a high BMI may be due to its association with an increased risk of developing hypertension[16].

The analysis was carried out using the Chi-Square test to determine the relationship between obesity and the incidence of preeclampsia. The results of the analysis showed that of the 20 respondents who did not have preeclampsia, 14 of them were classified as obese in grade-1 (70.0%), and six others were included in grade-2 (30.0%). This shows that respondents who do not have preeclampsia are dominated by respondents who are classified


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as obese in grade-1. While of the 16 respondents who have preeclampsia, 4 of them are included in the classification of obesity grade-1 (25.0%), and 12 others are included in grade-2. (75.0%). This shows that respondents who have preeclampsia are dominated by respondents who are classified as obese in grade-2. The results of the Chi-Square test analysis show a significance value of 0.007 ($p < 0.05$) with an odds ratio of 7,000. This indicates that there is a significant relationship between obesity and the incidence of preeclampsia. Respondents with grade-2 obesity tend to experience preeclampsia seven times greater than respondents with grade-1 obesity.

The results of this study are in line with the results of studies examining the relationship between obesity in pregnancy and preeclampsia. The results of this study indicate a relationship between obesity in pregnancy and preeclampsia in pregnant women at Prof. RSUP. Dr. R.D. Kandou [17]. Another study conducted at RSUP Dr. M Djamil Padang showed that there was a significant relationship between obesity and the incidence of preeclampsia[10]. In another study, there was a relationship between obesity in pregnant women and the incidence of preeclampsia in the working area of the Puskesmas Kampung Baru, Luwuk City[18].

Lesions of the uteroplacental artery may occur in women with preeclampsia[19,20]. The characteristic of this lesion is the presence of areas of fibrinoid necrosis surrounded by macrophage cells. This situation is similar to the lesions that occur in atherosclerosis. In patients with preeclampsia, fatty deposits can be found in the patient's glomerulus, which is usually called glomerular endotheliosis. Proteinuria may result from these lesions. Kidney damage can also be caused by high levels of LDL and triglycerides in patients. Endothelial lesions in preeclampsia can be affected by changes in the patient's fat metabolism. The level of hypertension and proteinuria in patients is a reflection of the severity of the endothelial damage that occurs[21].

In women with high triglyceride levels, it can lead to a two-fold increased risk of preeclampsia compared to women who have average weight. Fat distribution is also an important factor besides the amount of fat experienced by obese people. Visceral fat is different from subcutaneous fat. C-reactive protein (CRP) and inflammatory cytokines will be produced more by visceral obesity, which can cause an increase in oxidative stress. Increased free fatty acids and the presence of inflammation can also produce oxidative stress. In addition, oxidative stress can also be caused by diet. People with obesity have low levels of antioxidants in the blood. This can be caused by low consumption of antioxidants or consumption of foods rich in carbohydrates and fats that are excessive. Diet patterns like this are more often found in obese people and women who will later develop preeclampsia[22].

The diet pattern of people with obesity is generally low in fiber but high in calories and fat. A low fiber diet can be caused by a lack of consumption of vegetables and fruit and can result in a decrease in antioxidants in the blood, which can increase the risk of preeclampsia. One study stated that the risk of preeclampsia could be reduced through physical activity. Women who do physical activity in early pregnancy can reduce the risk of preeclampsia by 35% compared to women who do not do physical activity in early pregnancy. One example of


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physical activity that can reduce the risk of preeclampsia is brisk walking. This activity can reduce the risk of preeclampsia by 30-35%. In obese women, usually little physical activity can increase the risk of preeclampsia [23,24].

## CONCLUSION

There is a significant relationship between obesity and the incidence of preeclampsia. The increased risk of preeclampsia increases with an increase in BMI. Pregnant women who are classified as obese grade-2 have a seven times greater risk of developing preeclampsia than pregnant women who are classified as obese grade-1.

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