ORIGINAL RESEARCH

THE RELATIONSHIP BETWEEN WEIGHT GAINS DURING PREGNANCY WITH THE RISK OF PREECLAMPSIA

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ABSTRACT	Keywords
Pregnancy is a physiological process, however a normal pregnancy can develop into pathology. WHO estimates that 15% of pregnant women develop complications. Preeclampsia is a pregnancy complication that can harm the mother and the baby. Gestational weight gain during pregnancy can result from overweight or pregnancy obesity, which is a risk factor of preeclampsia. The goal of this literature review is to determine correlation between gestational weight gain and the risk of preeclampsia. This research methodology employed a Systematic Mapping Study, in which the article is selected based on the protocols and filters determined at the outset. The articles were investigated between 2016 and 2020 using the Google Scholar, PubMed, and DOAJ databases. The total population of 311 research articles and 7 sample articles that describe the correlation of gestational weight gain and the risk of preeclampsia. 57% of 7 articles indicated that pregnant women had excessive weight gain, 71% of 7 articles indicated that women with preeclampsia have gestational weight gain and 43% of 7 articles indicated that there is a correlation between gestational weight gain and the risk of preeclampsia. Midwives are expected to improve the quality of antenatal care services to prevent preeclampsia by providing preeclampsia information and education, as well as screening for early detection.	**Keywords: Obesity, pregnancy and preeclampsia**

INTRODUCTION

Obesity is the fifth leading cause of death worldwide. (Gupta et al., 2015) did a study in the United States during the time of urban age and discovered that 24.5 percent of women aged 20-44 years are overweight and 23 percent are obese. Excessive eating of red meat, whole grains, desserts, sweet taste, and potatoes, according to research conducted by (Okube & Omandi, 2019), may contribute to long-term weight gain. Weight is regarded to be optimal if it has the most favorable impact on health. According to research conducted by (Weitzner et al., 2020) bodyweight Preeclampsia is linked to excessive consumption in pregnant women. Another research found. (Ellenga Mbolla et al., 2014) Studies in a large obstetric population found that a sample of overweight and obese people had a higher risk of prenatal, intra-partum, postpartum problems, and preeclampsia. Obesity during pregnancy is linked to greater morbidity in both the mother and the fetus, according to the study.

Pregnancy is a physiological process, but even a healthy pregnancy can develop into a pathology. Every pregnancy has the potential to be dangerous to the mother. According to the World Health Organization (WHO), approximately 15% of all pregnant women will experience complications that can be life-threatening, such as preeclampsia (Megasari, 2013). The presence of specific hypertension (at least 140 mmHg systolic or 90 mmHg diastolic on two examinations 15 minutes apart) caused by pregnancy accompanied by other organ system disorders at gestational age greater than 20 weeks is the initial indication of preeclampsia. According to WHO, cases of preeclampsia are seven times more common in developing countries than in developed countries. Preeclampsia affects 1.3 percent to 6 percent of women in developed countries, while it affects 1.8 percent to 18 percent of women in developing countries. In Indonesia, the incidence of preeclampsia is 128,273/year, or about 5.3 percent. (Poli, 2013). Preeclampsia is one of the pregnancy complications. If not treated immediately, it can be harmful to both the mother and the baby. Preeclampsia is one of the leading causes of maternal and fetal death, with a relatively high incidence (Prawirohardjo, 2014). Globally, after bleeding, hypertension in pregnancy (HDK) is the second leading cause of maternal death, followed by infection, prolonged/obstructed labor, and abortion. With an estimated 62,000-77,000 deaths per year, hypertensive disorders in pregnancy account for nearly 18 percent of maternal deaths worldwide. In 2010, an estimated 287,000 maternal deaths occurred, the majority of which occurred in Africa (from 1 in 3800 in developed countries to 1 in 39 in Sub-Saharan Africa) (Marasing et al., 2021). Maternal mortality in Indonesia fell from 390 to 305 per 100,000 live births between 1991 and 2015. However, it fell short of the target set by the Millennium Development Goals (MDGs), which is 102 per 100,000 live births in 2015. Meanwhile, the 2015 SUPAS results show that maternal mortality is three times higher than the MDGs target. The leading causes of maternal death in 2019 were bleeding (1,280 cases), hypertension in pregnancy (1,066 cases), infection (207 cases), and others (Kemenkes RI, 2020). MMR in East Java in 2019 was 968, with HDK as the leading cause, accounting for 162 deaths. While the MMR in Jember in 2019 was 50, HDK was the second cause, accounting for 10 deaths after bleeding and 14 deaths.

Conde-Agudelo and Belizean discovered that the frequency of preeclampsia in pregnancy was 2.6 percent in the lean female population (BMI 19.8) compared to 10.1 percent in the obese female population (BMI > 29.0) in their cohort study of 878,680 pregnancies (POGI, 2016). The findings of (Wantania, 2013), Showed that the BMI at risk group was four times more likely to develop preeclampsia than the normal BMI group (OR= 4.32 95 percent CI= 1.15-16.12), while the obese BMI group was five times more likely to develop preeclampsia than the BMI group. Group with normal BMI (OR= 5.06, 95 percent CI= 1.46-12.67). Preeclampsia was nearly three times more likely in the high weight gain group than in the normal weight gain group (OR=2.53, 95 percent CI= 0.99-31.81). According to the findings of this study, there is a link between maternal BMI and weight gain during pregnancy and preeclampsia.

Based on the description above, it is clear that excessive weight gain or obesity during pregnancy can trigger the occurrence of hypertension in pregnancy, including aggravating the symptoms of preeclampsia; it can also increase the risk of gestational diabetes, macrosomia in infants, premature birth or miscarriage, and other abnormalities. In infants, it is congenital.

Preeclampsia can be prevented by improving focused antenatal care and detecting the risk of preeclampsia in primary care settings. Monitoring weight gain and adjusting diet during pregnancy are two actions that can be taken to help prevent other complications. Based on the foregoing, the author wishes to conduct a Literature Review study titled "The Relationship of Body Weight during Pregnancy with the Incidence of Preeclampsia." It is hoped that the findings of the study will help to increase public awareness of pregnancy complications.

METHOD

Design of Research This literature review employs a Systematic Mapping Study, in which articles are chosen in predetermined stages using protocols and filters that were established at the outset. Populations of the study are pregnant women with diabetes and/or chronic hypertension. Literature Tracing Steps (Flow Chart): The research topics investigated were Weight Gain during Pregnancy and Preeclampsia, Literature search was obtained by formulating PEOS technique, The key words "weight gain during pregnancy" AND "preeclampsia" and "gestational weight gain" AND "preeclampsia" were obtained as filters based on the PEOS formula to assist researchers in finding articles that match the topic being studied, Literature search by searching for articles online obtained from Google Scholar, PubMed and DOAJ databases, The articles obtained are then screened through inclusion and exclusion criteria, The next step is to determine the eligibility of articles based on Sinta (S1,S2,S3) and Scopus (>60) indexed journal standards. The obtained articles will then be reviewed or reviewed.

The findings of collected research articles from journals are presented in chronological order, beginning with the most recent and gradually regressing to earlier years. The author examines the similarities and differences in the research results from each article during the process of analyzing the literature study to determine whether the research results support or contradict the existing theory. This Systematic review's data is analyzed and presented in the form of tables and narratives that cover all aspects of the literature studied. The researcher, year of publication, article source (journal name, ISSN number, URL address), data base, article title, and research method are all listed in the table (research design, population, sample, sampling technique, research time place, research variables, data analysis, results), Conclusion and Research.

RESULTS

A. Tabel.4.1 Identifying the Incidence of Preeclampsia

Article no / Article Author 1	Article 1 Pierre- Yves Robillard et al,	Article 2 Chi-Nien Chen et al,	Article 3 Martin Simko et al,	Article 4 Min Ren et al,	Article 5 Wenjia Yang et al,	Article 6 Yawen Shao et al,	Article 7 Lisa Chasan-Taber et al,	Conclusion
PE incident	There were 603 late onset preeclampsia from 57,703 women who recorded weight gain. 59% excess weight gain, 24% inadequate weight gain and 16% adequate/normal weight gain.	There were 108 preeclampsia out of 19,052 total sample. 63% excess weight gain, 27% adequate/normal weight gain and 10% inadequate weight gain.	There were 120 cases of preeclampsia from 7101 respondents, 46 cases with normal weight gain, 46 cases with excessive weight gain and 28 cases with inadequate weight gain.	Not explained	There were 21 cases of preeclampsia from 1102 respondents. 6 cases with weight gain <12kg, 5 cases with weight gain of 12-15kg, 3 cases with weight gain of 15-18 kg, and 6 cases with weight gain 18 kg	There were 347 cases of preeclampsia from 9863 respondents. Of the 221 who had a normal initial BMI, 156 were overweight, from 46 who had a thin initial BMI, 27 were overweight, and from 80 who had an initial overweight/obese BMI, 69 were overweight.	There were 36 cases of preeclampsia from 1359 respondents. 73.5% with excess weight gain, 14.7% with less weight gain and 11.8% with normal weight gain	The majority >50% of cases of preeclampsia occur in women with excess weight gain above the IOM guidelines

Table 4.1 displays the number of articles describing cases of preeclampsia based on the IOM recommendations for weight gain classification. With the same number of responders, four papers explain the majority of cases of preeclampsia that occur in women with excess weight gain, while one article describes cases of preeclampsia in women with normal weight gain. Preeclampsia is a multisystem illness marked by high blood pressure and proteinuria. The widely accepted idea is that spiral artery remodeling failure causes placental ischemia and hypoxia.

This will produce oxidants/free radicals, which will result in endothelial cell failure and preeclampsia (Lalenoh. D.C, 2018) Obese people have high levels of leptin. Leptin contains cytokine-like properties that can activate endothelial cells and raise blood pressure (Wafiyatunisa, 2016) The study by (Robillard et al., 2020) had the most cases of preeclampsia, with 603 cases of preeclampsia investigated, with the majority of them experiencing abnormal weight gain.

The same thing was discovered in a research by (Shao et al., 2017) in which the majority of 347 preeclampsia cases had weight growth that exceeded the IOM limits. According to the findings of (Staff, 2019) women who gained weight during pregnancy were nearly three times as likely to develop preeclampsia than women who gained weight during a normal pregnancy (OR=2.53 95 percent CI= 0.99- 31,81). (Chen et al., 2020) found that the risk of preeclampsia was three times higher in the group with more weight gain compared to the group with normal weight gain (OR=3.17, 95 percent CI=2.04-4.93). According to Shao et al. (2017), overweight/obese women who experienced excess weight increase during pregnancy had a nearly four-fold higher risk of preeclampsia than women who experienced normal weight growth during pregnancy (OR=3.78, 95 percent CI=2.65-5.41). Obesity during pregnancy can be induced by being overweight during pregnancy that exceeds the acceptable growth limit, in addition to being overweight / obese prior to pregnancy.

The findings of the observations from the reviewed articles reveal that the theory and reality are compatible. Preeclampsia is increased by the combination of overweight/obesity before pregnancy and excessive weight gain during pregnancy, which may be attributed to an increase in endothelial cell dysfunction. (Simko et al., 2019) looked at 120 preeclampsia instances and found that whether the respondent's weight gain was almost the same, the rise was normal, excess, or less. This demonstrates that not all women with preeclampsia acquire too much weight. Women who gain weight normally may get preeclampsia.

Apart from being overweight or obese, a number of factors can increase the risk of preeclampsia, including immunological intolerance between the mother and the fetus, which makes preeclampsia more likely in primigravida and primipaternity, a family history of preeclampsia or previous pregnancies, multiple pregnancies, and a history of certain diseases. Preeclampsia is more common in primigravida than in multigravida, according to (Lalenoh. D.C, 2018). This is consistent with the findings of article reviews, which show that the majority of responses are primiparous. Furthermore, smoking during pregnancy can lead to an increase in oxidants/free radicals, oxidative stress, and endothelial dysfunction. Aside from being overweight or obese, a number of factors might impact the likelihood of preeclampsia, including the presence of immunological problems.

Preeclampsia can be caused indirectly by smoking. Table 4.1 displays the responders who are evenly distributed between 2% and 29%. Preeclampsia is more common in women who gain weight, therefore nutritional deficit during pregnancy can raise the risk of getting it. The existence of nutritional inadequacies in antioxidant-rich

foods might increase the quantity of free radicals in the body, leading to endothelial cell malfunction and preeclampsia.

DISCUSSION

Table 4.2 Identifying the Relationship between Pregnancy Weight Gain and the Risk of Preeclampsia

Article no / Article Author 1	Article 1 Pierre- Yves Robillard et al,	Article 2 Chi-Nien Chen et al,	Article 3 Martin Simko et al,	Article 4 Min Ren et al,	Article 5 Wenjia Yang et al,	Article 6 Yawen Shao et al,	Article 7 Lisa Chasan-Taber et al,	Conclusion
Relationship between pregnancy weight gain and risk of pre-Eclampsia	More than 50% of recorded LOPs are with excess weight gain. Optimal/normal weight gain reduces the risk of LOP (Interaction 0.004<0.05)	63% of cases of preeclampsia with excessive weight gain. The risk of PE was significantly higher in the greater weight gain group than the normal weight gain group (OR=3.17, 95%CI=2.04-4.93)	The incidence of PE and pregnancy weight gain was not significantly related, but women with less weight gain were able to reduce the risk of developing PE (Interaction <0.05)	Women with excess weight gain were more likely to develop PE than women with normal weight gain OR 1.92; 95%CI 1.36-2.72 (Interaction 0.004<0.05)	Increase in pregnancy weight has no significant relationship with the incidence of PE (P_{value} = 0.632> 0.05)	The incidence of PE in all cases >50% experienced excessive weight gain in all BMI groups. Women with an overweight/obese initial BMI with excess weight gain had the highest risk for preeclampsia (OR 3.78, 95%CI 2.65-5.41) although it was not statistically significant (Interaction 0.69>0.05)	73.5% of recorded preeclampsia cases were with excess weight gain. The relationship between the rate of weight gain and the incidence of PE was statistically significant (Interaction 0.03<0.05)	The majority showed an association between pregnancy weight gain and the risk of preeclampsia.

The majority of the studies suggest a link between pregnant weight gain and the risk of preeclampsia, as seen in Table 4.4. Three studies found a link between excessive weight gain during pregnancy and the likelihood of developing preeclampsia. Two studies found no statistically significant link between weight gain and the risk of preeclampsia, while one study found a statistically significant link between excess weight gain and the risk of preeclampsia in pregnant women. (Yang et al., 2017) found no link between pregnancy weight gain and the risk of preeclampsia (P-value = 0.632> 0.05) in their study. Maternal weight gain was found to be favorably associated with macrosomia and adversely associated with neonatal mortality, IUFD, early birth, and low birth weight.

(Simko et al., 2019) found that pregnant weight gain was not significantly connected with the incidence of preeclampsia (P > 0.05) in the same research. Overweight pregnancy weight gain was linked to a higher risk of macrosomia, surgical delivery, and gestational hypertension, although underweight pregnancy weight gain was linked to a lower risk of preeclampsia (P0.05). According to (Taraporevala et al., 2017) findings, chi-square analysis revealed a significant link between increased maternal weight during pregnancy and preeclampsia (P = 0.003). Taber et al. (2017) found that women with excessive weight gain were substantially related with preeclampsia (P-value = 0.03> 0.05) in their study. The findings of Ren et al. (2018)'s meta-analysis show that women with excess weight increase are more likely to have preeclampsia than women with normal weight growth (P-value = 0.004> 0.05).

The study's findings (Robillard et al., 2020) also show that gaining weight during a healthy pregnancy can lower the risk of late-onset preeclampsia (P-value = 0.004> 0.05).

Weight gain during pregnancy is linked to the risk of preeclampsia, according to the findings of research from peer-reviewed journals. Although being overweight or obese during pregnancy is a factor in the majority of preeclampsia cases, it is not the primary cause of the condition. Apart from being overweight or obese during pregnancy, a number of factors can influence the occurrence of preeclampsia, including nutritional deficiency (antioxidants) accompanied by an increase in free radicals in the body, immunological intolerance between mother and fetus, which puts primi-gravida and prim-parity at a higher risk of developing preeclampsia, a family history of preeclampsia, multiple pregnancies.

CONCLUSIONS

Preeclampsia is more common in pregnant women who acquire too much weight, while the risk is lower in pregnant women who gain normal weight or less/below the IOM limits. However, it is not recommended for women to lose weight during pregnancy; instead, pregnant women should change their diet to ensure that weight gain is acceptable and does not become overweight. Before becoming pregnant or planning a pregnancy, obese women should maintain a healthy weight.

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