Correlation between Gestational Weight Gain in the Second and Third Trimester and Preeclampsia Risk: A Study From Indonesia

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Abstract

Introduction: Many studies have proposed that pre-pregnancy body mass index and higher gestational weight gain (GWG) during pregnancy are risk factors for preeclampsia incidence. However, most of those studies give attention to total GWG during pregnancy to the risk of preeclampsia, not in a specific trimester.

Aim: To examine whether abnormal gestational weight gain in the second and third trimester correlated with the incidence of preeclampsia

Methods: This cross-sectional study was conducted in a public health centre, in Surabaya, Indonesia, between October 2018 and October 2019. The samples were 63 pregnant women in the second and third trimester. The variable observed was gestational weight gain (GWG) each week during the second and third trimester compared to their pre-pregnancy body mass index (BMI) using the Institute of Medicine (IOM) standards and preeclampsia incidence. Statistical analysis used was Fisher's Exact Test and Chi-Square Test with a significance level of 5%.

Results: There were 11 and 52 samples in the second and third trimester, respectively. Abnormal weight gain was recorded in 54% of samples in the second trimester and 57% of the preeclampsia third-trimester samples. Moreover, preeclampsia was diagnosed in 83.3% and 60% samples with abnormal weight gain in the second trimester and third trimester. Statistical analysis showed abnormal weight gain in the second and third trimester related to preeclampsia with P-values 0.015 and 0.0001.

Conclusion: Abnormal gestational weight gain in the second and third trimester was correlated to preeclampsia.

Keywords: *preeclampsia, abnormal, gestational weight gain*

Introduction

Preeclampsia and other pregnancy hypertensive disorders are still significant problems in maternal health services. It can affect 10% of pregnancies and cause maternal morbidity and mortality in the world[1,2]. This condition also occurs in Indonesia; preeclampsia/ eclampsia cases are still the most significant cause of maternal death and tend to increase from year to year. This can have long-term adverse effects on the health of the mother and the outcome of pregnancy[3].

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Many studies have shown that body mass index (BMI) before pregnancy, and a tremendous increase in GWG during pregnancy are risk factors for preeclampsia[4,5]. Excessive gestational weight gain (GWG) is associated with increased maternal and neonatal complications, including hypertensive disorders of pregnancy, fetal macrosomia, and increased cesarean delivery rate[6,7].

However, most of the existing studies only looked at total GWG during pregnancy with preeclampsia risk. These results are broad bias because pregnant women with preeclampsia are more likely to develop oedema during pregnancy than normal pregnant women. Of course, this will have an impact on a very significant increase in GWG. Other studies suggest that the correct management of GWG that occurs in early pregnancy can reduce the risk of developing hypertension in pregnancy[6].

Effective treatment remains a considerable challenge[8]. GWG management in the second and third trimester of pregnancy is a potential target for interventions to reduce preeclampsia risk. Alternatives that can be taken are to manage in the field of prevention[9,10]. Based on the above background, this study aims to determine whether abnormal pregnancy weight gain in the second and third trimesters is associated with preeclampsia incidence. This study's results are expected to be a reference for improving the quality of maternal health services.

Methods

This observational analytical study was done using a cross-sectional approach on 63 pregnant women in the second and third trimester in a public health centre, Surabaya using medical records, the study was conducted between October 2018 and October 2019. The Human Research and Ethics Committee approved the trial for Basic Science and Clinical Research Dr Soetomo Academic Medical centre Hospital, Faculty of Medicine Universitas Airlangga Surabaya.

The sample consisted of all pregnant women in the 2nd and third trimesters who had antenatal care at Public Health Center Surabaya with several inclusion criteria, such as (1) 20 weeks gestational age or above; (2) had an antenatal care at least two times in the 2nd trimester; (3) had an antenatal care at least two times in the 3rd trimester; and (4) there is a record of prepregnancy body mass index (BMI). Multiple pregnancies were excluded from this study. Simple random sampling was applied to the sampling technique.

The variables measured were gestational weight gain in the 2nd and third trimester and the incidence of preeclampsia. The diagnosis of preeclampsia was following the 2014 ISSHP criteria that (1) the blood pressure is by 140/90 mmHg or more and (2) there are one or more organ disorders that previously did not exist but then appeared in or after 20 weeks of pregnancy[11]. The increase of body weight was assessed by calculating the average weight gain in one month reported in the medical record when the respondents performed an antenatal care (ANC) examination, then compared to the weight gain based on The Institute of Medicine (IOM) recommendation and prepregnancy BMI[9]. The recommended weight gain for pregnant women in the second and third trimester, which is underweight, normal, overweight, and obese BMI, was 0.44-0.58; 0.35-0.50; 0.23-0.3; and 0.17-0.27 kilograms per week.

Statistical analyses were carried out using the Fisher's Exact Test and Chi-Square Test with a significance level of 5% of the SPSS program. Abnormal GWG was determined to be abnormal, increasing gestational weight gain outside of the IOM recommendation was deficient or excessive weight gain.

Results

Out of the 63 respondents, 17.5 % were in the 2nd trimester and 82.5% in the 3rd trimester. Forty-five per cent of respondents were diagnosed with preeclampsia in the 2nd trimester while 38.5% were diagnosed in the 3rd trimester.

Characteristics of Respondents

Characteristics of pregnant women in this study are presented in Table 1. Women aged over 35 years,

Nulliparous women and pre-pregnancy BMI >30 (obese) were more likely to develop HDP.

Table 1. Characteristics of Respondents and the Incidence of Preeclampsia

Characteristics	Preeclampsia Status				Total	
	Yes		No			
	n	%	n	%	n	%
Age						
< 20 years-old	2	40	3	60	5	100
20-35 years-old	16	34	31	66	47	100
> 35 years-old	7	63.6	4	36.4	11	100
Parity						
Primiparous	8	47.1	9	52.9	17	100
Multiparous	17	37	29	63	46	100
Pre pregnancy BMI*)						
Underweight	1	25	3	75	4	100
Normal	6	27.3	16	72.7	22	100
Overweight	9	37.5	15	62.5	24	100
Obese	9	69.2	4	30.8	13	100
Gestational Age						
≤34 weeks	16	39	25	61	41	100
>34 weeks	9	40.9	13	59.1	22	100

*) BMI: Body mass Index, Underweight (<18,5 kg/m^2), Normal (18,5-24,9 kg/m^2), overweight (25,0-29,9 kg/m^2), Obese (>30 kg/m^2)

Second Trimester Weight Gain and Preeclampsia Incidence

The table below presents that out of a total of 63 respondents, 11 respondents were in the 2nd trimester; 83.3% of them had abnormal weight gain and experienced preeclampsia (p = 0.015, CC = 0.64).

Table 2. Second Trimester Weight Gain and Preeclampsia Incidence

GWG at Second Trimester	Preeclampsia				Total		P value*	CC
	Yes		No					
	n	%	n	%	n	%		
Abnormal	5	83.3	1	16.7	6	100	0.015	0.64
Normal	0	0	5	100	5	100		

GWG: Gestational Weight Gain, CC: Correlation Coefficient
*Fisher exact test (p<0.05)

Third Trimester Weight Gain and Preeclampsia Incidence

Likewise, 60% of respondents in the 3rd trimester with abnormal weight gain (deficient and excessive) had preeclampsia (p-value = 0.0001, CC 0.45).

Table 3. Third Trimester Weight Gain and Preeclampsia Incidence

GWG at Third Trimester	Preeclampsia				Total		P value*	CC*
	Yes		No					
	n	%	n	%	n	%		
Abnormal	18	60	12	40	30	100	0,0001	0.45
Normal	2	9.1	20	90.9	22	100		

GWG: Gestational Weight Gain, CC: Correlation Coefficient
* Chi Square test (P <0.05)

Discussion

This study proves that one of the risk factors for preeclampsia is maternal age, where at the age of more than 35 years, there have been changes in tissues and reproductive organs. Previous studies have shown that preeclampsia is more common in women of advanced maternal age. Furthermore, it is also an independent risk factor for adverse outcomes in first-time mothers with preeclampsia[1,5].Sixty-nine percent of respondents who experienced obesity before pregnancy were known to have preeclampsia. Obesity is a risk factor that has been widely investigated for the occurrence of preeclampsia[12,13]. Systematically reviewed by Ren et al., it also mentioned that pregnant women who had an excessive BMI before pregnancy had a higher risk factor in getting preeclampsia, high BMI before pregnancy had twice the risk of preeclampsia[9]. Excess fat in obese pregnant women increases oxidative stress, stimulating an inflammatory response and accelerating endothelial vascular damage resulting in preeclampsia manifestations. In other words, high BMI before pregnancy can increase oxidative stress, which then will stimulate the inflammatory response and accelerate endothelial damage[1,14].

A previous study recorded GWG could change throughout pregnancy and challenge separate weight gain due to oedema or weight gain due to rising adiposity. Oedema is the normal picture in normotensive pregnancies, but it is more often in preeclampsia, which might have an impact in higher weight gain during pregnancy and is noted as overestimation of excessive GWG on Preeclampsia. So it is hard to see whether increased oedema in patients with preeclampsia causes a higher weight gain or whether higher weight gain due to preeclampsia[15]. However, patients with gestational hypertension should have less chance to have oedema because there is no protein urine on gestational hypertension, so the weight gain is more likely adiposity[16].

Another study on increasing weight gain in early pregnancy stated that oedema is rare to occur in early pregnancy, so excessive weight gain at this stage is correlated with oedema. Thus it suggests that GWG predicts the development of preeclampsia. However, research on weight gain in early pregnancy and the risk of preeclampsia is sparse. Only one study from Macdonald-Wallis C et al. examined weight gain during early pregnancy and proved that GWG in early pregnancy is a risk factor for preeclampsia and gestational hypertension[6]. They recorded that excessive weight gain during the first 18 weeks of pregnancy was associated with risks of developing preeclampsia and gestational hypertension. More study is needed to prove the relationship between weight gain in early pregnancy and preeclampsia risk[10].

Our study proved that abnormal weight gain, excessive and deficient weight gain, increases risk factors for developing preeclampsia in the second or third trimester. Many studies, as discussed above, show that excessive weight gain correlates with preeclampsia. Endothelial activation is the impact of various stimuli are oxidative stress and inflammatory mediators. Elevated lipids, mostly fatty acids, may have a direct effect on endothelial function. These could have a beneficial or detrimental effect. Failure to push non-esterified fatty acids into insulin resistance will reduce endothelium-mediated vasodilatation[12].

However, only a few studies discussed the effect of short weight gain on risk of preeclampsia occurrence. One of the old journals in 1976, Davies et al., stated that undernutrition was beginning to be considered more critical than over-nutrition; they published a study of 180 preeclampsia women in Jerusalem using dietary recall to get a diet assessment. The preeclampsia diagnosis included patients with hypertension and proteinuria or oedema. They compared 180 preeclampsia women with 360 concurrent normal women. Lower intake of energy, fats and protein was shown in preeclampsia women than in control women. However, further investigation indicated that it was due to illness, so proposed it would be secondary to the disease rather than causal[17]. Another study by Clausen et al., examined 3771 Norwegian women on dietary intake using food questionnaires in 17–19 weeks gestation. This study showed that higher energy intake in preeclampsia women and early-onset preeclampsia was the highest[18].

Our study results proved that excessive weight gain would increase the risk of preeclampsia occurrence and deficient weight gain and increase preeclampsia risk. This is supported by Clausen and Davies studies. Even though it is challenging to conclude from these studies, increasing energy and carbohydrate intake observed in women who later develop preeclampsia may be due to population differences. Another study showed that low protein intake is correlated with the risk of preeclampsia[19], but no studies indicated that lower protein intake increase risk to develop preeclampsia. Trials of protein supplementation recorded no preeclampsia incidence reduction[20].

Conclusion

Gestational Weight Gain (GWG) is a critical indicator in monitoring pregnant women's nutritional health. Deficiency or excessive increase can be abnormal and may cause some complications to arise in pregnancy. This study showed that abnormal gestational weight gain (GWG) in the second and third trimester was associated with preeclampsia. GWG management in the second

and third trimester of pregnancy is a potential target for interventions to reduce preeclampsia risk.

Conflict of Interest: The authors declared there were no competing interests in the study.

Ethical Approval: This research was declared an ethical pass test by the Ethics Committee of Dr. Soetomo General Hospital, Surabaya East Java Indonesia.

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