



BODY MASS INDEX AND HYPERTENSION IN PREGNANT MOTHER

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ABSTRACT

The incidence of hypertension in pregnancy is still a big concern in health care setting. This condition can cause further complication that could endanger mother and fetal condition. Hypertension in pregnancy can lead to cardiovascular disease, diabetes, cerebrovascular diseases, and death. There are several factors affecting hypertension on pregnant wome, including overweight and obesity. BMI can be used to identify nutritional status as well as to monitor weight gain in pregnant mother. This study was aimed to identify the relationship between BMI and hypertension in pregnancy. The data collection was conducted on 104 pregnant women in Primary Health Care, East Jakarta. BMI was calculated by using body weight and body height. While hypertension was identified through an increase in blood pressure measurement whereby systole was above 140 mmHg and diastole was above 90 mmHg. The data was analyzed using chi square test with significance level $p < 0.05$. The result of the study showed that there was a significant relationship between BMI and hypertension on pregnant women ($p < 0,001$). Monitoring of BMI is critical in pregnant mother particularly on those who have high BMI. It is important that all health care professionals provide significant efforts to manage obesity and to overcome hypertension on pregnant women to reduce the morbidity and mortality on pregnant women.

Keywords: BMI; Hypertension; Pregnant women

INTRODUCTION

Hypertension in pregnancy is one of the most important problems faced by public health because it is a major cause of maternal and fetal morbidity and mortality. Hypertension in pregnancy is defined as a condition whereby the systolic blood pressure is above 140 mmHg or the diastolic blood pressure is above 90 mmHg (Luger, 2023). This type of hypertension in pregnant women called gestational hypertension. This is the mildest type of hypertension that usually appears after 20 weeks of gestation,

without any protein finding in the urine. Many studies have shown that hypertension in pregnancy is associated with risk short-term and long-term cardiovascular events (Laksono, 2022). Patients with hypertension in pregnancy experience increased in arterial stiffness index and experience more chronic hypertension compared with those who do not have hypertension in pregnancy. In addition, hypertension in pregnancy associated with coronary artery diseases, heart failure, and aortic stenosis mitral regurgitation (Stuart et al., 2018).

The prevalence of hypertension in pregnancy was increased in 2017 to 2019 about 10.8% to 13.0%, respectively (Ford, 2023). The incidence of hypertension in pregnancy increased globally from 1990 to 2019 was 10,92%. Approximately 6–8% of cases of hypertension in pregnancy causes maternal and fetal morbidity and mortality. Meanwhile the prevalence of chronic hypertension increased from 2.0% to 2.3% (Ford, 2023). The death caused by hypertension in 2019 was about 27,83% (Wang et al., 2021). In Indonesia, in 2019, the number of cases of hypertension in pregnancy reached 1,066 cases, which was the second highest case after bleeding that reached 1,280 cases and the rest was infection which was 207 cases (Kemenkes RI, 2019).

Many factors influence the occurrence of hypertension in pregnancy, one of which is uncontrolled weight gain. Increased body weight during pregnancy is associated with the accumulation of adipose tissue in the skin (Lopez-Jaramillo et al., 2018). Increase in weight gain in pregnant women during their pregnancy is normal. This occurs to support the development of fetus in the womb. The increase in body weight caused by the growth of baby, placenta, amniotic fluid, breast and blood volume (Lopez-Jaramillo et al., 2018). Weight gain in pregnant women also can be influenced by various factors, especially nutritional intake, maternal metabolism, physical activity of the mother, and anthropometric status of the mother at the start before pregnancy. However, the increase in body weight in pregnant women should be monitored to ensure their health during pregnancy. Obesity in pregnant women is considered one of the risk factors that most often triggers health problems in the mother and fetus (Meilani, 2023). Obesity is a risk factor for metabolic syndrome which is associated with an increased risk of various non-communicable diseases (NCD). Obese pregnant women have a high risk of experiencing pregnancy complications and fetal outcome. It is because people with

obesity will affect metabolic processes, respiratory processes, and all organ work can be affected by obesity, especially blood circulation (Lopez-Jaramillo et al., 2018). Compared with women of a healthy pre-pregnancy weight, obese women are at increased risk of miscarriage, gestational diabetes, preeclampsia, venous thromboembolism, induced labor, caesarean section, complications of anesthesia, wound infections, and problems with breastfeeding (Huang et al., 2021).

The normal increase in weight during pregnancy is the increase in weight according to the recommendation from ministry of health. The cut off point of body weight increase is important to ensure the normal range of body weight increase during pregnancy (Isnaniar, 2019). BMI is one of the anthropometric measurements with the ratio of body weight and height for nutritional status assessment (Hanum, 2018). An increase in BMI is closely related to the occurrence of mild hypertension and or pre-eclampsia. As BMI can be used to monitor hypertension and other possible complication in pregnancy, therefore a routine BMI monitoring is critical.

Several previous studies related to BMI and hypertension in pregnancy have been conducted in many settings (Chouda, 2020; Isnaniar, 2019; Meilani, 2023). Most of the study showed a significant relationship between BMI and hypertension in pregnancy. However, most of those studies conducted in remote areas. Considering the difference characteristics of the samples and the settings, this study was conducted in Jakarta as the capital city of Indonesia to see the difference of the study.

OBJECTIVE

This study was aimed to identify the relationship between BMI and hypertension in pregnancy on pregnant women in Primary Health Care “M” East Jakarta.

METHOD

This study used descriptive correlational design using cross sectional approach. The accessible population was pregnant mother trimester 2 and 3 who visited Primary Health Care "M" in East Jakarta. Based on the sample calculation using Slovin formula, there were 104 respondents were recruited to participate in this study through convenience sampling technique in April 2019. The inclusion criteria were pregnant mother in trimester 2 and trimester 3, age 25-30 years old, multipara and agreed to join the study. Meanwhile pregnant mothers who had degenerative disease and smoke were excluded in this study. The variables in this study were the BMI and hypertension. The data collection was conducted by using scales and height meter to measure BMI. BMI is calculated through body weight in kilograms divided by the square of body height in meters. BMI is one of the screening methods commonly used to identify weight category: underweight, normal weight, overweight and obesity. In addition, sphygmomanometer was used to measure blood pressure. While the hypertension was identified once the respondents blood pressure found higher than 140 mmHg in systole and higher than 90 mmHg in diastole. The diagnose of hypertension was also confirmed based on the medical diagnose. Bivariat analysis was done using chi square test with significant p value < 0,05.

RESULT

The result of data collection is presented in Table 1. Based on the table, it can be seen that almost half of the pregnant mother (43,3%) had overweight, followed by obesity as many as 26,9 %. Only 24 % of pregnant mother had normal body weight. While 5.8 % of them were underweight.

In the blood pressure measurement, 65,4% of pregnant mothers had hypertension, while the rest were not having hypertension (34,6%). Based on the data presented in Table 1, it can be seen that the most significant number of mothers who had

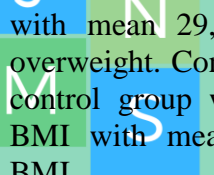
hypertension were those who had overweight which was 39 persons (86,7%). Likewise, those pregnant mother who were obesity, all of them had hypertension (100%). Meanwhile for those who were normal weight, generally they did not experience hypertension (92%). It is only 8 % of pregnant mother who were normal weight who had hypertension.

Based on the statistical analysis using chi square test, it can be seen that p value 0,001 that represents a significant relationship between BMI and hypertension on pregnant women.

DISCUSSION

Along with the main objective of the study, the statistical analysis deployed that there was a significant relationship between BMI and hypertension on pregnant women. This result was similar with some previous studies Febyan & Pemarom (2020) that showed significant relationship between BMI and hypertension with OR 2,602 meaning that pregnant mothers who had BMI with overweight tended to have higher risk of 2,206 times for hypetension compared with those who had BMI normal weight or underweight. Increase in BMI represented with dyslipidemia that will increase serum trigliceryde, low density protein (LDL) and decrease in very low-density lipoprotein (VLDP). This condition will induce oxidative stress and results in endotel system dysfunction as the bacis causes of hypertension (CDC, 2022).

A study conducted by Meilani (2023) in Puskesmas Hutapaung using case control was conducted to identify the difference of BMI of pregnant women with normotesion and hypertension. There were 32 respondents allocated in two groups : 16 mothers who had hypertension and 16 mothers who did not have hypertension. The result of t test showed a significant difference in BMI from the group of pregnant mothers who had normotesion and hypertension. In other word, the case group that consist of pregnant mother who had hypertension tended to have higher BMI



with mean 29,8 that was categorized as overweight. Conversely, pregnant mother in control group who had normotension had BMI with mean 24 that showed normal BMI.

Another study conducted by Chouda (2020) was also showed a similar result. The study was conducted on 197 pregnant women in a primary health care in Samarinda. Pregnant women with overweight was quite high (25,9%) as well as pregnant women with obesity (15,7%). The bivariate statistical test showed a significant relationship between BMI and hypertension in pregnancy. Isnaniar (2019) conducted a study on pregnant women in Pekan Baru to identify the influence of obesity on hypertension. The statistical test showed that there was an influence of obesity and the occurrence of hypertension in pregnant women ($p < 0,013$). Mrema et al. (2018) conducted a cohort study on 46.030 births at the Department of Global Public Health and Primary Care at the University of Bergen Norway. The result showed that 582 pregnancies were affected by preeclamsia whereby overweight and obese pregnant women had higher risk of preeclamsia (aOR (95% CI) 1.4 (1.2 – 1.8) and 1.8 (1.3 – 2.4)), respectively. Meanwhile, pregnant women with underweight had a lower risk (0.7 (0.4- 1.1)).

During pregnancy, normally it leads to significant weight gain and physical changes in pregnant women such as increased blood volume, growth of fetus, and increased body fat as a fulfillment of nutrition for the fetus. However, an increase in adipose tissue results in a buildup of fat in the blood vessels and heart which has the potential to hinder the circulation of vessels in the body and causes hypertension (Luger, 2023).

The concept of pathophysiology of hypertension in pregnant women is not fully understood. Abnormal regulation and production of some molecules causes abnormal development and remodeling of the spiral arteries in deep myometrial tissue. This causes hypoperfusion and placental ischemia (Laksono, 2022). The

other mechanism explained that the role of antiangiogenic factors released by the placental tissue causes systemic endothelial dysfunction that may result in systemic hyperetention (Luger, 2023). In hypertension in pregnancy, there is no invasion of trophoblast cells in the muscle layer of the spiral arteries and the surrounding matrix tissue. The spiral artery muscle layer remains stiff and hard so that the lumen of the spiral artery does not allow it to distend and vasodilate. As a result, the spiral arteries are relatively vasoconstricted and it causes placental hypoxia and ischemia. The impact of placental ischemia causes changes that can explain the pathogenesis of hypertension in subsequent pregnancies (Burton et al., 2019).

Pregnant women who have higher BMI (overweight or obesity) explain an increase in accumulation of excessive fat. This fat accumulation will produce more C Reactive Protein (CRP) and inflammatory cytokines (IL 6) that become an acute phase reactant made in adipose tissue. In addition, visceral fat produces more CRP and inflammatory cytokines thus resulting in more generate oxidative stress. The oxidative stress is results from an increase in free fatty acids and the presence of inflammation.. Oxidative stress at a later stage along with toxic substances circulation can stimulate the occurrence of damage to the vascular endothelial cells called endothelial dysfunction which can occurs over the entire surface of the vascular endothelium. As endothelial dysfunction occurs, there is an imbalance between production substances that act as vasodilators such as prostacyclin and nitric oxide, and vasoconstrictors substances such as endothelium I, thrombosan, and angiotensin II. Therefore, there will be an extensive vasoconstriction of blood vessels and finally lead to hypertension (Laksono, 2022). In further disease development, there is an increase in lipid macrophages production, activation of microvascular coagulation factors (thrombocytopenia), and increased microvascular permeability

(edema and proteinuria) that can be manifested as pre-eclampsia (CDC, 2022). Furthermore, in a study conducted by Riise et al. (2018) explained that pregnant women with gestational hypertension were under risk of cerebrovascular disease (CVD).

The result of this study supports the result of previous studies related to BMI and hypertension in pregnant women and strengthen the concept or theory that explain the impact of obesity which is measured by BMI with the occurrence of hypertension on pregnant women.

CONCLUSION

Implication

Hypertension in pregnancy is a disease that increases the risk of maternal and fetal morbidity and mortality. One of the most contributing factors for hypertension in pregnancy in overweight and obesity that can be represented by BMI. The result of the study showed that there was a significant relationship between BMI and hypertension. Early detection and appropriate antihypertensive management such as regular blood pressure measurement at regular antenatal care visits is necessary. Appropriate postpartum screening and control of cardiovascular risk factors for women with a history of preeclampsia are also considered important to reduce the risk of morbidity and mortality and require multidisciplinary collaboration in the management of hypertension in pregnancy. In addition, pregnant women should monitor weight gain during the pregnancy as well as promote physical activity and active exercise to promote healthy during pregnancy. Meanwhile for pregnant women who have overweight should consider the type and the amount of food consumed to prevent more weight gain.

Limitation

On top of the significant finding of this study, nevertheless, this study has limitations including homogenous sample characteristics, small sample size and non probability sampling method used that cannot be used for generalization.

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REFERENCES

- Burton, G. J., Redman, C. W., Roberts, J. M., & Moffett, A. (2019). Pre-eclampsia: pathophysiology and clinical implications. *BMJ*, *366*, 12381. <https://doi.org/10.1136/bmj.12381>
- Center for Disease Control and Prevention (2022). High Blood Pressure During Pregnancy. Available at <https://www.cdc.gov/bloodpressure/pregnancy.htm>. Accessed on 23 June 2022. Jam 11:44 WIB.
- Chouda, C. W., P.F (2020). Hubungan Indeks Massa Tubuh Dengan Kejadian Hipertensi Pada Kehamilan. *Borneo Student Research*, *2*(3).
- Febyan & Pamaron, I. B. R. (2020). Tinjauan Faktor Resiko Kejadian Hipertensi Dalam Kehamilan di Rumah Sakit Bhayangkara Denpasar. *Indonesian Journal of Obstetrics & Gynecology Science*, *3*(1).
- Hanum, F. (2018). Hubungan Antara Indeks Massa Tubuh (IMT) Dengan Kejadian Preeklampsia Pada Ibu Hamil Trimester III Di RSUD Wates Kulon Progo Universitas 'Aisyiyah Yogyakarta. J. Yogyakarta.
- Huang, C., Li, J., Qin, G., Liew, Z., Hu, J., Laszlo, K. D., Tao, F., Obel, C., Olsen, J., & Yu, Y. (2021). Maternal hypertensive disorder of pregnancy and offspring early-onset cardiovascular disease in childhood, adolescence, and young adulthood: A national population-based cohort study. *PLoS Med*, *18*(9), e1003805. <https://doi.org/10.1371/journal.pmed.1003805>
- Isnaniar, N., W., and Safitri N. (2019). Pengaruh Obesitas Terhadap Kejadian Hipertensi Dalam Masa Kehamilan Di



- Puskesmas Harapan Jaya Pekanbaru. *Jurnal Photon*, 2(2).
Kementerian Kesehatan Republik Indonesia. (2019). Profil Kesehatan Indonesia tahun 2019. In Pusdatin Kemkes. Health Information Systems.
- Laksono, S., & MAsrie, M.S. (2022). Hipertensi Dalam Kehamilan : Tinjauan Narasi. *Herb-Medicine Journal*, 5(2).
- Lopez-Jaramillo, P., Barajas, J., Rueda-Quijano, S. M., Lopez-Lopez, C., & Felix, C. (2018). Obesity and Preeclampsia: Common Pathophysiological Mechanisms. *Front Physiol*, 9, 1838. <https://doi.org/10.3389/fphys.2018.01838>
- Luger, K. R., & Kight, B.P. (2023). *Hypertension in Pregnancy* StatPearls Publishing LLC.
- Meilani, N., Resti, S.C., Margareth, F. (2023). <meilani 2023 perbedaan IMT pada bumil hiperetnsi.pdf>. *Jurnal Ilmiah Kebidanan*, 10(1).
- Mrema, D., Lie, R. T., Ostbye, T., Mahande, M. J., & Daltveit, A. K. (2018). The association between pre pregnancy body mass index and risk of preeclampsia: a registry based study from Tanzania. *BMC Pregnancy Childbirth*, 18(1), 56. <https://doi.org/10.1186/s12884-018-1687-3>
- Riise, H. K. R., Sulo, G., Tell, G. S., Iglund, J., Nygard, O., Iversen, A. C., & Daltveit, A. K. (2018). Association Between Gestational Hypertension and Risk of Cardiovascular Disease Among 617 589 Norwegian Women. *J Am Heart Assoc*, 7(10). <https://doi.org/10.1161/JAHA.117.008337>
- Stuart, J. J., Tanz, L. J., Cook, N. R., Spiegelman, D., Missmer, S. A., Rimm, E. B., Rexrode, K. M., Mukamal, K. J., & Rich-Edwards, J. W. (2018). Hypertensive Disorders of Pregnancy and 10-Year Cardiovascular Risk Prediction. *J Am Coll Cardiol*, 72(11), 1252-1263. <https://doi.org/10.1016/j.jacc.2018.05.077>
- Wang, W., Xie, X., Yuan, T., Wang, Y., Zhao, F., Zhou, Z., & Zhang, H. (2021). Epidemiological trends of maternal hypertensive disorders of pregnancy at the global, regional, and national levels: a population-based study. *BMC Pregnancy Childbirth*, 21(1), 364. <https://doi.org/10.1186/s12884-021-03809-2>

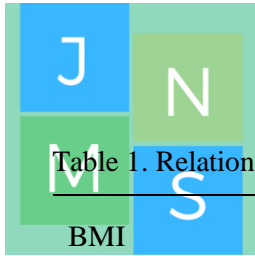


Table 1. Relationship of BMI and hypertension

BMI	Hypertension				Total		P-value
	Yes		No		N	%	
	N	%	N	%			
Underweight	0	0%	6	100%	6	100%	0.001
Normal weight	2	8.0%	23	92.0%	25	100%	
Overweight	6	13.3%	39	86.7%	45	100%	
Obesity	28	100%	0	0%	28	100%	
Total	36	34.6%	68	65.4%	104	100%	