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ANALYSIS OF FACTORS AFFECTING HYPERTENSION IN PREGNANCY

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ABSTRACT

Hypertensive disorders of pregnancy remain a major global public health concern and are among the leading causes of maternal morbidity and mortality, particularly in developing countries. The increasing incidence of hypertension in pregnancy highlights the importance of identifying modifiable and non-modifiable risk factors to support effective prevention strategies. This literature review aimed to analyze and synthesize factors associated with the incidence of hypertension in pregnancy, with a particular focus on maternal, medical, and psychosocial determinants. This study employed a descriptive–analytic literature review guided by the PECO framework (Population, Exposure, Comparison, Outcome). A systematic search was conducted using international and national databases, including Google Scholar, Garuda, Sinta, PubMed, and ScienceDirect. Articles published between 2020 and 2025 in Indonesian or English were considered. Inclusion criteria were full-text primary studies with analytic designs (cross-sectional, case–control, or cohort) that reported associations with hypertension in pregnancy. Of 20 identified articles, five met the eligibility criteria and were included in the final analysis. The findings revealed that hypertension in pregnancy is associated with multiple factors, including maternal age, parity, diabetes mellitus, interpregnancy interval, body mass index, personal history of hypertension, family history of hypertension, and psychological stress. Although some studies reported inconsistent results for certain variables, most evidence supports the multifactorial nature of hypertension in pregnancy. In conclusion, understanding these risk factors is essential for improving early detection and preventive interventions. The results of this review are expected to contribute to strengthening maternal health strategies and reducing complications related to hypertension in pregnancy.

Keywords: Hypertension; Pregnancy

1. INTRODUCTION

The incidence of hypertension in pregnancy has increased globally from 16.30 million cases in 1990 to 18.08 million cases in 2019, representing a total increase of 10.92% over that period. However, the number of deaths due to hypertension in pregnancy was approximately 27.83 thousand in 2019, showing a decrease of 30.05% compared to 1990. Based on incidence and prevalence rates, the number of deaths and years lived with disability (YLD) were mainly found in the 25–29 age group, followed by the 30–34 and 20–24 age groups. Meanwhile, the lowest

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incidence rate was observed in the 25–29 age group and was higher in the youngest and oldest age groups (Maria, 2023).

According to the 2021 Indonesian Health Profile data, maternal mortality in Indonesia is still dominated by three main causes of death: hemorrhage, hypertensive disorders of pregnancy (HDP), and infection. In Indonesia, hypertensive disorders of pregnancy rank as the second leading cause of maternal death after hemorrhage. Severe preeclampsia is the leading cause within the category of hypertensive disorders of pregnancy, resulting in complications that can lead to maternal death. The proportion of hypertensive disorders of pregnancy in Indonesia continues to increase, with nearly 30% of maternal deaths attributed to hypertensive disorders of pregnancy, making it one of the most common causes of maternal death in Indonesia after hemorrhage (Ministry of Health of the Republic of Indonesia, 2021).

The number of maternal deaths in Indonesia decreased from 4,226 to 4,221 in 2018-2019. In 2019, the leading causes of maternal deaths were bleeding (1,280 cases), hypertension during pregnancy (1,066 cases), and infection (207 cases) (Kementerian Kesehatan Republik Indonesia, 2021). The prevalence of hypertension in pregnancy in Indonesia recorded 8,341 cases (1.51%) of pregnant women among all women aged 15–54 years. The prevalence of hypertension among pregnant women was 1,062 cases (12.7%). Of the 1,062 cases of pregnant women with hypertension, 125 cases (11.8%) had been diagnosed with hypertension by health workers. This indicates that hypertension is a common health problem during pregnancy and can cause complications in 2–3% of pregnancies (Masriadi, 2022).

The number of maternal deaths in South Sulawesi Province in 2017 was 149 cases. On average, maternal deaths in South Sulawesi occurred due to delays in recognizing danger signs and making decisions within families, delays by birth attendants in referring patients, and delays in providing adequate treatment, which were supported by limited facilities, infrastructure, and competent human resources in health facilities. The distribution of causes of maternal deaths in South Sulawesi Province in 2016 was as follows: hemorrhage accounted for 62 cases (41.61%), hypertensive disorders of pregnancy for 32 cases (21.48%), and infection for 3 cases (4.03%) (Dinas Kesehatan Provinsi Sulawesi Selatan, 2017).

Previous research conducted by Tiara et al. (2023) entitled *"Factors Associated with the Incidence of Hypertension in Pregnant Women"* showed a significant relationship between maternal age and the incidence of hypertension in pregnancy, with a p-value ≤ α (0.003 < 0.05). There was also a significant relationship between parity and the incidence of hypertension in pregnant women, with a p-value ≤ α (0.010 < 0.05). In addition, a significant relationship was found between a history of hypertension and the incidence of hypertension in pregnant women, with a p-value ≤ α (0.000 < 0.05) (Tiara, 2023).

These findings are supported by a study conducted by Rintisiati et al. (2024) entitled *"Risk Factors for the Incidence of Hypertension in Pregnancy at the Muslimat Mother and Child Hospital, Jombang"*, which showed a relationship between maternal age, history of hypertension, and nutritional status with the incidence of hypertension in pregnancy. However, no relationship was found between parity, hyperplacentosis factors, and comorbid diseases with the incidence of hypertension in pregnancy (RIntisiati, 2024).

Based on the background described above, hypertension is a life-threatening disease, especially for pregnant women. Therefore, this study aims to conduct a literature review to identify factors associated with the incidence of hypertension in pregnancy.

2. METHODS

This study employed a literature review method with a descriptive–analytic design, aiming to analyze and synthesize risk factors associated with the incidence of hypertensive disorders in pregnancy. The main framework used to guide the searching and selection process was PECO (Population, Exposure, Comparison, Outcome).

The search strategy was conducted electronically within a strictly defined publication period, from 2020 to 2025, using a combination of the following keywords: *(factors OR factor) AND (hypertension OR hypertensive disorders) AND (pregnant women)*. This comprehensive search utilized five major databases: Google Scholar, Garuda, Sinta, PubMed, and ScienceDirect.

The inclusion criteria were articles published in Indonesian or English, available in full-text PDF format, and, most importantly, primary studies with an analytic research design (such as case–control, cohort, or cross-sectional studies) that explicitly reported associations or risks related to hypertension in pregnancy. Conversely, the exclusion criteria included articles published in languages other than Indonesian or English, articles without accessible full-text versions, secondary studies (such as review articles or case reports), and studies primarily focusing on management or treatment.

Following a stepwise selection process based on these criteria, 5 eligible articles were identified and analyzed from a total of 20 articles initially retrieved.

3. RESULTS AND DISCUSSION

From the search conducted across scientific databases, a total of 20 articles were identified. After applying the inclusion and exclusion criteria, 5 articles met the eligibility requirements and were selected for analysis, as they contained explanations of the factors associated with the incidence of hypertension in pregnancy.

Table 1. Factors Associated with Hypertension in Pregnancy

No	Title	Author	Method	Result
1	Analysis of Risk Factors for the Incidence of Hypertension in Pregnant Women	Dinda Anggini Marnita, Neno Fitriyani Hasbie, Rinto Hardianto, Fonda Octaningsih Shariff, 2024.	The type of research was quantitative with an analytic observational design using a case–control study approach. This study utilized secondary data in the form of medical records of pregnant women. The research sample consisted of 332 pregnant women at Rajabasa Indah Community Health Center, Bandar Lampung.	The results of the risk factor analysis influencing the incidence of hypertension in pregnant women showed that maternal age had a p-value of 0.040 using the chi-square test; parity had a p-value of 0.007 using Fisher's exact test; a previous history of hypertension had a p-value of 0.000 using the chi-square test; and a family history of hypertension also had a p-value of 0.000 using the chi-square test.

No	Title	Author	Method	Result
2	Factors Associated with Hypertension in Pregnant Women	Syamraini Silda, Ana Mariza, Sunarsih, 2020.	This study was a quantitative study using a cross-sectional design with a prospective approach. The sampling technique applied was accidental sampling. The sample consisted of all pregnant women who visited the community health center during the study period, totaling 80 pregnant women from May 20 to July 24, 2019. Data were collected using observation sheets and interviews. The analysis of associations was conducted using the chi-square test.	The results showed that out of 80 pregnant women, 36 (%) experienced hypertension, while 44 (%) did not experience hypertension. Most respondents were in the high-risk age group, totaling 46 women (57.5%). The majority of parity was in the non-risk category, with 43 women (53.75%). Most respondents were not obese, totaling 46 women (57.5%), and the majority had no previous history of hypertension, with 52 women (65%). Bivariate statistical analysis indicated that maternal age (p = 0.029), parity (p = 0.000), obesity (p = 0.000), and history of hypertension (p = 0.000) were significantly associated with the incidence of hypertension in pregnant women. Therefore, it can be concluded that maternal age, parity, obesity, and history of hypertension are factors associated with hypertension in pregnancy.
3	Factors Related to Hypertension in Pregnancy	Shinta Novelia, Yenny Aulya, Wendya Nidsy Revita, 2023.	This study employed an analytic method with a cross-sectional study design. The sample consisted of 190 pregnant women. The sampling technique used was simple random sampling. The research instrument was medical record data. Data were analyzed using the chi-square statistical test..	The results showed that there were significant associations between maternal age (p = 0.001), employment status (p = 0.003), parity (p = 0.009), pregnancy interval (p = 0.003), history of diabetes mellitus (p = 0.038), obesity (p = 0.017), and history of hormonal contraceptive use (p = 0.044) with the incidence of hypertension in pregnancy. Overall, significant relationships were found between maternal age, employment status, gravida status (parity), pregnancy interval, history of diabetes mellitus, obesity, and history of hormonal contraception with the occurrence of hypertensive disorders in pregnancy. It is expected that health care providers deliver health education to anticipate complications during pregnancy, and that women

No	Title	Author	Method	Result
				follow and implement the health education provided.
4	FACTORS AFFECTING WITH THE PREVALENCE OF HYPERTENSION IN PREGNANCY: SCOPING REVIEW	Siti Yuriah, Farida Kartini, 2022.	This scoping review utilized the following databases: PubMed, Wiley Online Library, and ProQuest. Search results that met the inclusion criteria were subsequently analyzed and synthesized into articles. The study applied the Joanna Briggs Institute (JBI) framework, and the synthesis method used PEOS (Population, Exposure, Outcome, Study design) transformation.	Out of 108 articles identified based on titles and abstracts, 9 articles met the inclusion and exclusion criteria. Five factors were identified as influencing hypertensive disorders of pregnancy, namely heredity/family history, maternal age, parity (number of pregnancies), multiple pregnancy (twin gestation), and body mass index (BMI).
5	Factors Associated with the Incidence of Hypertension in Pregnant Women at the Sungai Dareh Community Health Center, Dharmasraya Regency	Julia Kontesah, Reni Fitria, Astuti Ardi Putri, 2023.	The study employed a correlational research method with a cross-sectional design, involving a population of 240 pregnant women. The sampling technique used was accidental sampling, resulting in a sample of 38 pregnant women. Bivariate analysis was conducted using the chi-square test.	The results of this study showed that most respondents were of high-risk age (55.3%), had no history of hypertension (63.2%), had non-risk parity (92.1%), experienced mild stress (31.6%), and did not have hypertension (60.5%). Statistical test results indicated that there was no significant relationship between maternal age and the incidence of hypertension in pregnant women (p-value = 0.635 > 0.05). There was a significant relationship between a history of hypertension and the incidence of hypertension in pregnant women (p-value = 0.002 < 0.05). There was no significant relationship between parity and the incidence of hypertension in pregnant women (p-value = 0.145 > 0.05). However, there was a significant relationship between stress and the incidence of hypertension in pregnant women (p-value = 0.034 < 0.05).

Based on the five selected literature review studies, several factors were identified as being associated with the occurrence of hypertension in pregnancy. These factors are described as follows:

Maternal Age

Of the five journals reviewed, four reported a significant relationship between maternal age and the incidence of hypertension in pregnancy. According to Dinda et al. (2024), Shinta et al. (2023), Siti et al. (2022), and Julia et al. (2023), maternal age is a risk factor for hypertensive

disorders during pregnancy. Age greatly influences pregnancy and childbirth outcomes. The optimal age for pregnancy and childbirth is between 20 and 35 years, during which the female reproductive organs are fully developed and function optimally. In contrast, women under the age of 20 or over 35 years are not recommended to become pregnant or give birth, as pregnancies at these ages carry a higher risk of complications such as miscarriage, labor failure, and even maternal death.

According to a study by Nurfatimah et al. (2020), maternal age is closely related to the development of reproductive organs. A healthy reproductive age, considered safe for pregnancy, ranges from 20 to 35 years. When pregnant women are aged ≤20 years, their reproductive organs are biologically immature and not fully prepared for pregnancy. In addition, this lack of readiness may lead to emotional instability, causing the mother to pay less attention to the fetus. Conversely, in older pregnant women (>35 years), pregnancy risks increase due to a decline in immune function within the reproductive system (Nurfatimah, 2020).

Pregnancy in mothers under 20 and over 35 is a high-risk pregnancy that can lead to complications. Women under 20 have very high iron requirements and limited knowledge about pregnancy, which can contribute to increased blood pressure during pregnancy. Similarly, women over 35 experience a decline in physical condition and a weakened immune system due to physiological changes that can lead to complications during pregnancy (Naibaho, 2021).

However, these findings are not consistent with the study conducted by Syamraini et al. (2020), which reported no significant relationship between maternal age and hypertension in pregnancy. Women aged 30–40 years were found to have a higher likelihood of developing hypertension during pregnancy, but age alone was not the sole determinant. Hypertension in pregnancy, particularly essential hypertension, may also be influenced by emotional and environmental factors.

Parity Factor

Of the five journals reviewed, four reported a significant association between parity and the occurrence of hypertension in pregnancy. According to Dinda et al. (2024), Syamraini (2020), Shinta et al. (2023), and Siti et al. (2022), parity is a risk factor for hypertensive disorders in pregnancy. Parity of two to three is considered the safest, whereas primiparity and high parity are associated with a higher risk of preeclampsia. Primigravida women often experience stress when facing childbirth. Emotional stress in primigravida can increase the release of corticotropin-releasing hormone (CRH) by the hypothalamus, leading to increased cortisol levels. The effect of cortisol is to prepare the body to respond to stressors by enhancing the sympathetic response, including increasing cardiac output and maintaining blood pressure (Windaryani, 2013; Ekasari & Natalia, 2019).

However, these findings are not consistent with the study conducted by Julia et al. (2023), which reported no association between parity and the incidence of hypertension among pregnant women in the working area of Sungai Dareh Community Health Center, Dharmasraya Regency, in 2023. Parity refers to the number of children a woman has delivered, whether live-born or stillborn. Parity greater than three is considered unsafe, while parity of three or fewer is considered safe (Manuaba, 2010).

Hypertension in pregnancy may also be influenced by a history of hypertension. Pregnant women with primiparity who have a previous history of hypertension are more likely to experience hypertension in their current pregnancy. Conversely, multiparous or grand multiparous women with no history of hypertension and who maintain a healthy lifestyle may avoid hypertension during pregnancy. Based on the analysis, hypertension in pregnant women was more commonly

found among those with non-risk parity. This result indicates that the number of pregnant women with non-risk parity was greater than those with risk parity, likely because most respondents were experiencing their second or third pregnancy.

Diabetes Mellitus (DM) Factor

Based on a study conducted by Shintia et al. (2023), mothers who experience insulin resistance prior to pregnancy may undergo vascular damage mechanisms characterized by chronic inflammation, increased atherogenic processes, and prothrombotic activity, which can affect normal vascularization and placentation. Meanwhile, the pathophysiology of hypertension in pregnancy is closely associated with abnormal placentation (Shinta, 2023).

This is in line with research findings showing that there is a relationship between diabetes mellitus in pregnant women and preeclampsia (p-value 0.000). The results obtained a correlation coefficient of 4.742, meaning that mothers with diabetes are 4.742 times more likely to develop preeclampsia than mothers without diabetes (Gustiari, 2022).

Diabetes mellitus (DM), both pregestational and gestational diabetes mellitus (GDM), has been consistently identified as a major independent risk factor for the development of hypertensive disorders in pregnancy (Gustiari et al., 2022). Recent research indicates that pregnant women with a history of diabetes are significantly more susceptible to preeclampsia due to endothelial dysfunction triggered by chronic hyperglycemia (Sudarman et al., 2021). Hyperglycemia causes increased oxidative stress and the release of inflammatory cytokines that damage the lining of blood vessels, ultimately triggering vasoconstriction and increased systemic blood pressure (Harahap, 2023). Furthermore, the insulin resistance that often accompanies diabetes contributes to the activation of the renin-angiotensin-aldosterone system (RAAS), which exacerbates sodium retention and hypertension (Frontiers in Medicine, 2025). The integration between metabolic and vascular disorders shows that strict glycemic management from the first trimester is crucial to reduce cardiovascular morbidity in pregnant women with diabetes (Masriadi, 2022).

However, these findings are not consistent with the study conducted by Anonim et al. (2020), which reported no significant difference in blood glucose levels between the group of pregnant women without preeclampsia and those with preeclampsia, with a p-value of 0.066. This suggests that diabetes mellitus, although a predisposing factor, may not necessarily be a direct cause of preeclampsia and therefore may not always influence its occurrence (Anonim, 2023).

Pregnancy Interval Factor

Based on the study conducted by Shintia et al. (2023), a pregnancy interval of more than five years is associated with a higher risk of developing hypertension during pregnancy. This increased risk is related to advancing maternal age, which leads to degenerative processes and weakened uterine and pelvic muscle function, thereby influencing subsequent pregnancies and delivery outcomes. Women aged over 35 years experience physiological changes due to organ aging, including decreased renal and liver function, increased blood pressure, and a higher prevalence of diabetes mellitus. Consequently, the risk of pregnancy-related diseases such as gestational hypertension increases. In addition, women with a pregnancy interval of less than two years have a twofold higher risk of maternal mortality compared to those with longer interpregnancy intervals (Shintia, 2023).

Body Mass Index (BMI) Factor

Three journals reported a significant association between body mass index (BMI) and the incidence of hypertension in pregnancy, including studies by Syamraini et al. (2020) and Siti et al.

(2022). Overweight and obesity conditions can increase the risk of gestational diabetes and gestational hypertension. Obesity is known to elevate plasma concentrations of C-reactive protein, which plays a role in the etiology of hypertensive disorders of pregnancy and is increased in obese individuals. Furthermore, evidence suggests that obesity impairs endothelial function and induces a systemic inflammatory response associated with atherosclerosis. These mechanisms may contribute to excessive weight gain during pregnancy and increase the likelihood of developing preeclampsia. The risk of gestational hypertension is reported to be 1.8 times higher in overweight women and 3.1 times higher in obese women (Siti, 2022).

These findings are consistent with the study conducted by Fitra et al. (2022), which demonstrated a significant relationship between obesity-related BMI and the incidence of preeclampsia among pregnant women at Bhakti Timah Hospital, Pangkalpinang, in 2021. Obesity, defined as excessive fat accumulation in the body, is recognized as the fifth leading global mortality risk factor. Excessive BMI is often associated with insulin resistance and hyperinsulinemia, which can trigger sympathetic nervous system activation and sodium retention in the kidneys, thereby increasing systemic blood pressure (Journal of Clinical Medicine, 2024). Recent epidemiological studies have shown a linear correlation, with each unit increase in BMI being associated with an 8% to 10% increased risk of preeclampsia (Indah et al., 2022).

History of Hypertension Factor

All three analyzed articles indicated a significant association between a previous history of hypertension and the occurrence of hypertension during pregnancy. Studies by Dinda et al. (2024), Syamraini et al. (2020), and Julia et al. (2023) revealed that pregnant women with a prior history of hypertension are at a higher risk of developing gestational hypertension. A history of hypertension increases the risk of preeclampsia by up to fourfold compared to women without such a history. Elevated blood pressure during pregnancy can result in a wide range of outcomes, from mild to severe preeclampsia (Syamraini, 2020).

Women who experienced hypertension in previous pregnancies are more likely to develop recurrent hypertensive disorders in subsequent pregnancies. This is attributable to the role of maternal disease history as a determinant of future pregnancy complications. However, some respondents with a prior history of hypertension did not experience gestational hypertension, which may be attributed to consistent blood pressure monitoring and effective health management (Julia, 2023).

Family History of Hypertension Factor

Two studies, conducted by Dinda et al. (2024) and Siti et al. (2022), reported a significant relationship between family history of hypertension and the incidence of hypertensive disorders in pregnancy. Pregnant women with a family history of hypertension were found to have up to an eightfold increased risk of developing hypertension during pregnancy compared to those without such a history. This association is believed to be influenced by genetic factors contributing to physiological predisposition (Siti, 2022).

Family history of cardiovascular disease further supports the role of genetic involvement in the multifactorial etiology of hypertensive disorders in pregnancy. Genetic susceptibility is often inferred from the presence of hypertension among close relatives. These findings are consistent with a study conducted by Ita et al. (2022), which reported a statistically significant relationship ($p < 0.05$) between family history of hypertension and gestational hypertension at Padang Tepong Public Health Center, Empat Lawang Regency. Genetics plays a role in regulating the vascular system and kidney function, which contribute to blood pressure regulation. Therefore, pregnant women with a family history of hypertension (such as a parent or sibling with

hypertension) tend to have a higher risk of developing hypertension during pregnancy, whether gestational hypertension or preeclampsia (Aminah & Lestari, 2021).

Stress Factor

The study by Julia et al. (2023) demonstrated a significant association between psychological stress and hypertension among pregnant women at the Sungai Dareh Community Health Center, Dharmasraya Regency. The findings indicated that some pregnant women experienced stress, as reflected in questionnaire responses describing irritability over minor issues, excessive energy expenditure due to anxiety, and emotional instability. Stress levels vary across pregnancy trimesters, with higher stress observed as gestational age increases. During the third trimester, fear of childbirth intensifies, which is positively correlated with elevated stress levels (Julia, 2023).

These findings are supported by the study conducted by Ristiani et al. (2024), which identified a significant relationship between stress and hypertension among pregnant women ($p = 0.000$). The results showed that 71.1% of stressed pregnant women experienced hypertension. Stress during pregnancy is commonly associated with concerns regarding fetal health and safety, financial preparation for childbirth, and postnatal care. Additionally, fear of maternal mortality and persistent anxiety may contribute to elevated blood pressure among pregnant women (Ristiani, 2024).

4. CONCLUSION

The five articles reviewed in this literature review conclude that the risk factors contributing to the occurrence of hypertension in pregnancy include maternal age, parity (number of births), diabetes mellitus (DM), interpregnancy interval, body mass index (BMI), personal history of hypertension, family history of hypertension, and psychological stress. The findings of this study are expected to provide significant contributions to the healthcare field, particularly in the development and enhancement of preventive strategies for hypertension in pregnancy.

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