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Factors Influencing Preeclampsia In Pregnant Women: Literature Review

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ABSTRACT

Introduction: Preeclampsia is a pregnancy complication characterized by hypertension and proteinuria. This disease typically manifests at a gestational age exceeding 20 weeks. Preeclampsia may result in maternal mortality. Preeclampsia is influenced by multiple variables, including a history of hypertension, obesity, lifestyle habits, exposure to tobacco smoke, and caffeine intake. This study aimed to discover the factors influencing preeclampsia in pregnant women.Method: The method used in the study was a literature review by analyzing literature published in scientific journals registered with Google Scholar and PubMad from 2020-2024. Results:13 articles have revealed that factors associated with the incidence of preeclampsia include a history of hypertension, obesity, exposure to cigarette smoke, caffeine consumption, and balanced nutrition.**Conclusion**:Factors influencing the incidence of preeclampsia include a history of hypertension, obesity, exposure to tobacco smoke, caffeine use, and nutritional balance.**Suggestion:**the factors that cause preeclampsia that have been discovered can be used to prevent and overcome the problem of preeclampsia in pregnant women.

Keywords: Preeclampsia, Hypertension, Obesity, Cigarette Smoke

INTRODUCTION

Indonesia's maternal mortality rate (MMR) reached 4,129 in 2023, according to data from the Maternal Perinatal Death Notification (MPDN), a maternal death reporting system implemented by the Ministry of Health. This is an increase compared to 2022, which was 4,005. The maternal mortality ratio per 100,000 births The maternal mortality rate was approximately 305 in January 2023. This figure places Indonesia in the ASEAN region with the second-highest maternal mortality rate. According to the National Medium-Term Development Plan (RPJMN), the target maternal mortality rate (MMR) in Indonesia for 2024 is 183 per 100,000 live births. However, Indonesia's MMR remains higher than other ASEAN countries.

To achieve the SDG target of reducing maternal mortality to less than 70 per 100,000 live births by 2030, we need to do better. The maternal mortality rate (MMR) in Central Java is lower than the national MMR. Central Java recorded 183 cases, in line with the target of 183 cases per 100,000 live births in the National Medium-Term Development Plan (RPJMN).(Ministry of Health of the Republic of Indonesia 2024). Direct obstetric death (or direct maternal death) is death caused by obstetric complications during pregnancy (pregnancy, childbirth, and postpartum), and from intervention, negligence, incorrect treatment, or from a series of events resulting from one of these factors.(WHO 2025).

Hypertension and proteinuria are hallmarks of preeclampsia, appearing in pregnant women after the 20th week of pregnancy. Preeclampsia is a condition that can occur in pregnant women, women about to give birth, or women who have just given birth. Proteinuria, hypertension, and high blood pressure are hallmarks of this condition.

Preeclampsia is sometimes accompanied by seizures and coma.(Sagita 2020)Preeclampsia can cause premature birth, oliguria, stillbirth, fetal growth restriction, and oligohydramnios, thus increasing morbidity and mortality. Preeclampsia is believed to occur due to fetoplacental abnormalities that cause abnormal spiral artery development, placental ischemia, hypoxia, and oxidative stress. Preeclampsia can also be caused by health problems such as high body fat, malnutrition, insufficient blood flow to the uterus, and genetic factors.(shah A. Karrar, Daniel J. Martingano 2024).

Preeclampsia is often caused by several causative factors, which can be categorized into internal factors (such as maternal age, obesity, parity, pregnancy spacing, family history, previous occurrence of preeclampsia, stress and anxiety, and history of hypertension) and external factors (including exposure to cigarette smoke, antioxidants, sodium, monosodium glutamate, education level, history of antenatal care, caffeine intake, and the influence of maternal nutrition).(CUNNINGHAM et al. 2014)From these factors, researchers took into account a history of hypertension, exposure to cigarette smoke, caffeine consumption, and the mother's nutritional intake.

METHOD

This study uses a literature review methodology, by collecting published materials from Google Scholar and PubMed covering the years 2029 to 2024. This study examines factors associated with the prevalence of preeclampsia in pregnant women. The following are the inclusion and exclusion criteria for this study: Journals published between 2020 and 2024, Research articles are journal articles, publications published in Indonesian and English, publications published in full text that focus on the causes of preeclampsia in pregnant women. Exclusion criteria include publications published before 2020, studies using systematic review methodology, meta-analysis, and journals published in Arabic or languages other than Indonesian and English, which specifically discuss factors associated with the prevalence of preeclampsia in mothers during labor and the postpartum period. The following describes the development of the literature search procedure.

RESULTS AND DISCUSSION

No	Judul	Metode	Sampel	Analisis Data	Hasil
1.	Faktor Yang Mempengaruhi Kejadian Preeklamsia Pada Ibu Hamil (Nurul Amalina, Rahmi Sari Kasoema 2022).	Metode cross-sectional pengambilan data primer dengan kuisioner	55 ibu hamil	Analisa *univariat* dan *bivariat* dengan uji *Chi Square*.	Ada hubungan preeklamsia dengan parietas (p=0,002), ada hubungan preeklamsia dengan Riwayat hipertensi (p=0,001), ada hubungan preeklamsi dengan kebiasaan pola makan (p=0,003), ada hubungan preeklamsia dengan paparan asap rokok (p=0,003) dan ada hubugan preeklamsi dengan stress (p=0,004).
2.	Faktor-faktor yang berhubungan dengan kejadian preeklamsia pada ibu hamil (Peratama, Kusumajaya, and Agustin 2023)	Metode cross-sectional, tekhnik pengambilan sampel purposive sampling, pengambilan data primer dengan kuisioner.	98 ibu hamil	Analisa *univariat* dan *bivariat* dengan uji *Chi Square*.	Ada hubungan preeklamsia dengan usia (p=0,000), ada hubungan preeklamsia dengan pengetahuan (p=0,000), ada hubungan preeklamsia dengan obesitas (p=0,007)
3.	Faktor-faktor yang mempengaruhi preeklamsia pada ibu hamil	Metode cross sectional, Teknik pengambilan sampel consecutive sampling	40 ibu hamil	Analisis data bivariat dengan menggunakan chi squere dan data multivariat	Ada hubungan preeklamsia dengan pengetahuan (p=0,036), ada hubungan preeklamsia

	di puskesmas banyu anyar surakarta (Rakhmawati and Wulandari 2021)			menggunakan regresi logistic ganda.	dengan Riwayat hipertensi (p=0,014), ada hubungan preeklamsia dengan kelengkapan ANC (p=0,027), ada hubungan preeklamsia dengan IMT (p=0,013)
4.	Faktor-faktor yang berhubungan dengan hipertensi pada ibu hamil di wilayah kerja puskesmas padang panyang kecamatan kuala pesisir kabupaten nagan raya (Marlina, Santoso, and Sirait 2021)	Metode case control retrospektif, dan observasi pengumpulan data dengan lembar cheklist	94 ibu hamil	Analisa data dengan menggunakan *chi squere*	Ada hubungan preeklamsia dengan riwayat hipertensi (p=0,000), ada hubungan preeklamsia dengan obesitas (p=0,003), ada hubungan preeklamsia dengan kebiasaan minum kopi (P=0,000)
5.	Riwayat hipertensi berhubungan dengan preeklampsia pada ibu hamil (Yulia 2023)	Metode cross sectional dan observasi	119 ibu hamil	Uji statistik yang di gunakan dalam penelitian ini adalah uji *chi square*	Ada hubungan preeklamsi dengan Riwayat hipertensi dengan preeklamsia (p=0,000)
6.	Faktor Risiko Yang Berhubungan	Metode deskriptif dengan cross	51 ibu hamil	Analisa *univariat* dan *bivariat* dengan uji *chi square*.	Ada hubungan umur dengan preeklamsia (p=0,001), ada

	Dengan Kejadian Preeklamsia Pada Ibu Hamil Di RSIA Siti Khadijah 1 Makassar Tahun 2020-2021 (Noor et al. 2024).	sectional dan observasi			hubungan preeklamsia dengan berat badan (p=0,01)
7.	Determinan kejadian preeklamsia di rumah sakit umum dr. Doris sylvanus palangka raya (Tambunan, Arsesiana, and Paramita 2020).	Metode case control pengumpulan data sekunder dengan rekam medik	162 ibu bersalin	Uji statistik yang di gunakan dalam penelitian ini adalah uji *chi square*	Ada hubungan preeklamsia dengan pemeriksaan ANC (p=0,001), ada hubungan preeklamsia dengan riwayat hipertensi (p=0,001), ada hubungan preeklamsia dengan jaminan kesehatan.
8.	Hubungan riwayat hipertensi, riwayat keturunan dan obesitas dengan kejadian preeklamsi pada ibu hamil (Silaban and Rahmawati 2021).	Metode cross sectional,dengan survey analitik, pengambilan sampel dngan metode simple random sampling	1980 ibu hamil	Analisis yang digunakan adalah *univariat* dan *bivariat* dengan menggunakan uji statistika *chi squere*	Ada hubungan preeklamsia dengan Riwayat hipertensi (p=0,000), ada hubungan preeklamsia dengan Riwayat keturunan (p=0,000), ada hubungan preeklamsia dengan obesitas(p=0,000)
9.	Faktor- Faktor Yang	deskriptif analitik Cross-Sectional	99 ibu hamil	Analisis yang digunakan adalah	Ada hubungan preeklamsia dengan

	Berhubungan Dengan Kejadian Preeklamsia Berat Pada Ibu Bersalin di RS Medika Dramaga Bogor (Syamsiah, Putri, and Suciawati 2022).	Purposive Sampling Systematic		*Univariat* dan *Bivariat.*	Riwayat hipertensi pada ibu(p=0,000), ada hubungan preeklamsia dengan usia (p=0,002)
10.	Faktor-Faktor Penyebab Preeklamsia Studi Kasus Rekam Medik di Rumah Sakit Panti Wilasa Citarum Semarang (Djaga, Tampubolon, and Prabowowati 2020).	Kuantitatif deskriptif dengan pendekatan retrospektif Pengambilan dat sekunder	118 ibu hamil	Reduksi data dalam bentuk table	faktor penentu ibu mengala mi preeklamsia melainkan faktor riwayat preeklamsia, riwayat penyakit hipertensi, protein urin positif dan penyakit peyerta saat kehamilan yang menjadi pemicu terjadinya preeklamsia di RS Panti Wilasa Citarum Semarang
11.	*ANALYSIS OF FACTORS RELATED TO PREECLAMSIA INCIDENT ON PREGNANT MOTHER IN*	Metode case control dan Teknik purposive sampling, Pengambilan data dilakukan dengan kuesioner dan data rekam medik	160 ibu hamil	Analisis univariat analisis bivariat menggunakan uji *Chi Square*.	Ada hubungan preeklamsia dengan pengetahuan (p=0,001), ada hubungan preeklamsia dengan kebiasaan makan (p=0,000), ada hubungan preeklamsia

	RSUD DR. CHASBULAH ABDUL MADJID, BEKASI (Fauziah et al. 2022)				dengan stress (P=0,000), ada hubungan preeklamsia dengan aktifitas fisik (p=0,000)
12.	*Assesment of caffeine consumption and maternal cardiometaboli c pregnancy complications* (Hinkle et al. 2021)	Metode studi kohort	2583 wanita	Analisa sekunder *post hoc*	Ada hubungan antara konsumsi kafein dengan kejadian preeklamsia dengan p value (0,001)
13	*The Determinants Of Preeclampsia In Pregnant Women Of Tarakan* (Retnowati 2021)	Observasional analitik kasus kontrol	60 ibu hamil	Analisis yang digunakan *univariat* dan bivariat *Chi Squere*	Ada hubungan antara preeklamsia dengan usia (p=0,001), ada hubungan antara preeklamsia dengan Riwayat hipertensi (p=0,002)

Preeclampsia

Preeclampsia is a medical condition characterized by the onset of hypertension after 20 weeks of gestation, accompanied by proteinuria. This condition affects pregnant women, with the main symptoms being increased blood pressure, swelling (edema), and high levels of protein in the urine. If left untreated, preeclampsia can progress to eclampsia or HELLP syndrome—a serious complication that includes red blood cell damage, elevated liver enzymes, and a low platelet count. This condition poses a life-threatening risk to both the mother and the fetus.(Haslan and Trisutrisno 2022)Preeclampsia is a potentially life-threatening pregnancy complication. This condition can cause various serious consequences, such as intrauterine growth restriction (IUGR), fetal death before or after delivery, and premature birth.(Susanti, Yani, and Yudianti 2022).

History of Hypertension

If a pregnant woman's blood pressure reaches 140/90 mm Hg or higher, she is considered to have hypertension. (Ministry of Health of the Republic of Indonesia, 2022). Hypertension triggers various diseases, including stroke, diabetes, and kidney failure. WHO (World Health Organization) statistics show that hypertension in pregnant women is a significant contributor to maternal and fetal morbidity and mortality worldwide.(Arikah, Rahardjo, and Widodo 2020).

Pregnancy is a crucial phase that determines the quality of the baby's health from inception through subsequent growth, while also influencing the mother's condition. Balanced nutrition is defined as a daily menu containing a variety of nutrients in appropriate amounts, along with the principles of dietary variety, physical activity, clean living, and optimal weight management.(Sartika, Wardani, and Ririnisahawaitun 2019).

According to Prawirohardjo (2014), preeclampsia is caused by ischemia affecting the placenta and uterus. Reduced blood circulation to the placenta disrupts its function. During pregnancy, the need for blood flow to the uterus increases sharply, especially in conditions such as hydatidiform mole, hydramnios, multiple gestation, the final trimester of pregnancy, maternal age over 35, or cases of diabetes. When blood perfusion to the uterine wall decreases, certain substances from the placenta or decidua are released, triggering vasospasm of the blood vessels and resulting in hypertension.

This is in line with the research results of Nurul Amalina et al.(Nurul Amalina, Rahmi Sari Kasoema 2022), which shows a relationship between a history of hypertension and the occurrence of preeclampsia in pregnant women. The results of the study from(Rakhmawati and Wulandari 2021),(Marlina, Santoso, and Sirait 2021),(Yulia 2023),(Tambunan, Arsesiana, and Paramita 2020),(Silaban and Rahmawati 2021),(Syamsiah, Putri, and Suciawati 2022),(Djaga, Tampubolon, and Prabowowati 2020), And(Retnowati 2021) also showed the same results that there was a relationship between a history of hypertension and the occurrence of preeclampsia.

Obesity

Overweight and obesity are conditions resulting from excessive fat accumulation that impact health.

One practical and widely used method for identifying overweight and obesity in adults is calculating the Body Mass Index (BMI). BMI is calculated using the formula:

BMI = Body Weight (kg) / (Height (m))²

The calculation results are then rounded to one decimal place to determine the weight classification.(Ocviyanti and Dorothea 2018).

Obesity in pregnancy poses a significant risk of complications for both the mother and the fetus. Early in pregnancy, obesity can increase the risk of miscarriage and birth defects, including neural tube defects, spina bifida, congenital heart defects, and omphalocele. Later in pregnancy, obesity can lead to hypertension, preeclampsia, gestational diabetes, premature birth, and stillbirth.(Lynch et al. 2012).

Researchers found that compared with women with a normal body mass index (BMI), those who were overweight were 5.8 times more likely to develop preeclampsia. However,

preeclampsia was 3.4 times more likely to occur in women with a low body mass index (BMI) compared with women of normal weight. Furthermore, maternal obesity, with a BMI greater than 25.0, had a direct correlation with blood pressure, especially systolic. Obesity can cause the release of inflammatory cytokines from fat tissue cells. These cytokines then damage the systemic endothelium, leading to preeclampsia.(Rana et al. 2019).

The results of this study are in accordance with the findings of Peratama and Agustin(Peratama, Kusumajaya, and Agustin 2023)which shows a relationship between obesity and the incidence of preeclampsia in pregnant women. This is also in line with research results from(Rakhmawati and Wulandari 2021),(Marlina, Santoso, and Sirait 2021), And(Noor et al. 2024), which states that there is a relationship between obesity and the incidence of preeclampsia in pregnant women.

Exposure to cigarette smoke

The prevalence of smoking without considering the environment has resulted in many people being exposed to secondhand smoke, including pregnant women who are more susceptible to health problems. Pregnant women exposed to secondhand smoke can experience up to a fivefold increase in carbon monoxide levels, as well as up to a fourfold increase in nicotine and tar levels in their systems. Stillbirth is more common in pregnant women who actively smoke than in those who passively smoke, although this condition can lead to various pregnancy complications such as abortion, placental abruption, placenta previa, preeclampsia, placental insufficiency, premature birth, fetal abnormalities, and low birth weight.(Choirunnisa et al. 2022).

This data is in accordance with the research findings conducted by Nurul et al.(Nurul Amalina, Rahmi Sari Kasoema 2022)which shows a relationship between exposure to cigarette smoke and the occurrence of preeclampsia in pregnant women.

Caffeine consumption

Caffeine is one of the three most widely used psychoactive substances (along with nicotine and alcohol) globally. As a central nervous system stimulant, caffeine plays a role in modulating the neurotransmitters norepinephrine, dopamine, acetylcholine, and serotonin through the following mechanisms: increased norepinephrine production, inhibition of the enzyme phosphodiesterase, and degradation of cyclic adenosine monophosphate (cAMP) at high doses. All of these neurochemical processes occur primarily in the hypothalamus, where caffeine significantly increases dopamine and serotonin levels.(Riansih 2021). Based on the research results of Susana Setyowati(Setyowati 2020)The calculated t-value for caffeinated beverage (coffee and tea) consumption (X2) was 3.464 > 2.045, meaning there was a significant relationship between the variable of caffeinated beverage (coffee and tea) consumption (X2) and the incidence of preeclampsia (Y). This is in line with the results of Hinkle's research.(Hinkle et al. 2021)which shows a relationship between caffeine consumption and the incidence of preeclampsia in pregnant women. The results of the study from(Marlina, Santoso, and Sirait 2021)also stated that coffee consumption, which contains caffeine, is related to the occurrence of preeclampsia in pregnant women.

Balanced Nutrition

Pregnancy is a crucial phase that shapes the health of the fetus and its subsequent development, while also influencing the mother's health. To meet the body's nutritional needs, a balanced diet must include a variety of foods, regular physical activity, a clean environment, and an ideal body weight.(Dwi Fara et al. 2022).

According to the Health Promotion Model theory by Nola J. Pender, it emphasizes the importance of promoting positive nutritional behaviors during pregnancy. Consuming a balanced diet rich in essential nutrients can help reduce the risk of preeclampsia. By understanding beliefs, attitudes, perceived benefits, and barriers to healthy eating, healthcare providers can develop effective interventions to support pregnant women in making healthy food choices (Bahabadi et al., 2020). This is in line with the research findings of Nurul Amalina et al.(Nurul Amalina, Rahmi Sari Kasoema 2022)which shows a relationship between balanced nutrition and the occurrence of preeclampsia in pregnant women.

Maternal nutritional status during pregnancy is significantly correlated with the risk of stunting in children aged 12–59 months, as maternal nutritional status affects fetal growth and birth length. As a preventative measure, health workers are advised to intervene during pregnancy through supplementary feeding programs (PMT) and nutrition education. Furthermore, pregnant women need to increase adequate nutritional intake during pregnancy to minimize the risk of stunting in their children later in life.(Dimas Duwi Saputra 2024).

Based on the research results from(Nurul Amalina, Rahmi Sari Kasoema 2022), And(Fauziah et al. 2022)shows that there is a significant correlation between balanced nutritional consumption patterns and the incidence of preeclampsia in the pregnant woman population.

CONCLUSION

Based on the literature review, a history of hypertension can be a factor in the development of preeclampsia in pregnant women. Obese pregnant women with a BMI >25 are associated with the incidence of preeclampsia. Exposure to cigarette smoke is also correlated with the incidence of preeclampsia in pregnant women. In this study, the mother was a passive smoker. Caffeine consumption including risk factors that can trigger preeclampsia during pregnancy. A balanced diet influences the incidence of preeclampsia. This study found that pregnant women who maintain a healthy diet with balanced nutrition are less likely to experience preeclampsia.

SUGGESTION

Preeclampsia can affect pregnant women with a history of hypertension, obesity, exposure to cigarette smoke, caffeine consumption, and an unhealthy diet; healthcare providers should educate mothers about these risk factors in the future. Future literature reviews are expected to identify more factors that can trigger preeclampsia, thereby reducing the incidence of preeclampsia.

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