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THE IMPACT OF CHRONIC HYPERTENSION, KIDNEY DISORDERS, AND EMPLOYMENT STATUS ON PREECLAMPSIA IN MAKASSAR

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ABSTRACT

Preeclampsia is a serious pregnancy complication characterized by hypertension and organ dysfunction, especially the kidneys, which usually appear after 20 weeks of gestation. In Indonesia, preeclampsia is one of the leading causes of maternal and fetal morbidity and mortality. The high maternal mortality rate in this country requires a deeper understanding of the risk factors for preeclampsia in order to formulate more effective and targeted prevention strategies. This study aims to identify the main risk factors for preeclampsia in pregnant women in the Pampang Health Center working area, Makassar City, and to evaluate the influence of these factors on the incidence of preeclampsia. This study used a cross-sectional design involving 200 pregnant women, consisting of 100 women with preeclampsia and 100 without preeclampsia. Taken systematically from medical records for the period 2021 – 2023. Data were collected from medical records and confirmed through interviews if necessary. Data analysis used the Chi-square test with $p < 0.05$. The main findings show that a history of preeclampsia, chronic hypertension, renal impairment, autoimmune conditions, and maternal employment status are significant risk factors for preeclampsia. Working mothers with chronic hypertension had a higher risk of preeclampsia (81.8%) compared to non-working mothers (30.1%). This study highlights the importance of intensive monitoring for mothers with high-risk factors. Working mothers are more susceptible to stress and hypertension, increasing the risk of preeclampsia. A history of autoimmune and renal impairment also shows a strong association with preeclampsia. History of preeclampsia, chronic hypertension, renal impairment, autoimmune conditions, and maternal employment status are significant risk factors for preeclampsia. Recommendations include intensive monitoring, education and support for pregnant women, especially those who work, and further longitudinal studies for a clearer causal relationship. Objective medical validation is needed for subjective variables to improve data accuracy.

Kata Kunci:

Preeklampsia;
Hipertensi kronis;
Gangguan ginjal;
Autoimun;
Ibu bekerja

ABSTRAK

Preeclampsia adalah komplikasi kehamilan yang serius yang ditandai dengan hipertensi dan disfungsi organ, terutama ginjal, yang biasanya muncul setelah usia kehamilan 20 minggu. Di Indonesia, preeklampsia menjadi salah satu penyebab utama morbiditas dan mortalitas pada ibu serta janin. Tingginya angka kematian ibu di negara ini menuntut pemahaman yang lebih mendalam mengenai faktor risiko preeklampsia, guna merumuskan strategi pencegahan yang lebih efektif dan tepat sasaran. Penelitian ini bertujuan untuk mengidentifikasi faktor-faktor risiko utama preeklampsia pada ibu hamil di wilayah kerja Puskesmas Pampang, Kota Makassar, serta mengevaluasi pengaruh dari faktor-faktor tersebut terhadap kejadian preeklampsia. Penelitian ini menggunakan desain cross-sectional dengan melibatkan 200 ibu hamil, terdiri dari 100 ibu dengan preeklampsia dan 100 tanpa preeklampsia. diambil secara sistematis dari rekam medis periode 2021 – 2023. Data dikumpulkan dari catatan medis dan dikonfirmasi melalui wawancara jika diperlukan. Analisis data menggunakan uji Chi-square dengan $p < 0,05$. Temuan utama menunjukkan bahwa riwayat preeklampsia, hipertensi kronis, gangguan ginjal, kondisi autoimun, dan status ibu bekerja merupakan faktor risiko signifikan untuk preeklampsia. Ibu bekerja dengan hipertensi kronis memiliki risiko preeklampsia lebih tinggi (81,8%) dibandingkan ibu yang tidak bekerja (30,1%). Studi ini menyoroti pentingnya pemantauan intensif bagi ibu dengan faktor risiko tinggi. Ibu bekerja lebih rentan terhadap stres dan hipertensi, meningkatkan risiko preeklampsia. Riwayat autoimun dan gangguan ginjal juga menunjukkan hubungan kuat dengan preeklampsia. Riwayat preeklampsia, hipertensi kronis, gangguan ginjal, kondisi autoimun, dan status ibu bekerja adalah faktor risiko signifikan untuk preeklampsia. Rekomendasi meliputi pemantauan intensif, edukasi dan dukungan bagi ibu hamil, terutama yang bekerja, serta studi longitudinal lanjutan untuk hubungan kausal yang lebih jelas. Validasi medis objektif diperlukan untuk variabel subyektif guna meningkatkan akurasi data.

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INTRODUCTION

Preeclampsia is a serious and common pregnancy complication characterized by hypertension and organ damage, especially the kidneys, that occurs after the 20th week of pregnancy. This condition is a significant cause of maternal and fetal morbidity and mortality (Wainstock et al., 2020) worldwide, including in Indonesia. Given the high maternal mortality rate in Indonesia, which is still a major health problem, a thorough understanding of the risk factors for preeclampsia is essential to formulate effective prevention strategies. According to data from the Indonesian Ministry of Health 2021, hypertension in pregnancy, including preeclampsia, contributes a significant portion of maternal mortality. The incidence of preeclampsia in Indonesia ranges from 2% to 8% of total pregnancies, meaning thousands of pregnant women are affected each year. This figure shows the need for special attention to identifying and treating risk factors contributing to this condition.

Research shows that several factors can increase the risk of preeclampsia in pregnant women in Indonesia. These factors include Maternal Age, Medical History, Obesity, Multiple Pregnancies, Pregnancy Spacing, and Socioeconomic Status. Maternal Age: Pregnant women who are under 20 years old or over 35 years old have a higher risk of developing preeclampsia (Brown et al., 2018; Sheen et al., 2019). Personal and Family Medical History: Women with a history of preeclampsia in a previous pregnancy or who have family members with a similar history are at greater risk of developing preeclampsia (Boyd et al., 2013). Underlying Health Conditions: Medical conditions such as chronic hypertension, diabetes mellitus, and kidney disease before pregnancy contribute significantly to an increased risk of preeclampsia (Yang & Wu, 2022). Obesity: High Body Mass Index (BMI) before pregnancy is a strong risk factor for preeclampsia (Abraham & Romani, 2022; Poniedziałek-Czajkowska et al., 2023). Multiple Pregnancy: Women who are carrying twins or higher risk of developing preeclampsia (Chantanahom & Phupong, 2021; Wang et al., 2021). Pregnancy Spacing: A very short or very long interval between pregnancies can affect the risk of preeclampsia (Cho et al., 2021; Hutcheon et al., 2019). Socioeconomic Status: Low socioeconomic status is often associated with limited access to quality prenatal care, which can increase the risk of preeclampsia (Nicholls-Dempsey et al., 2023; Ross et al., 2019; Silva et al., 2008).

Understanding the risk factors for preeclampsia in Indonesia is essential for developing effective interventions to prevent and manage this condition. This study aims to explore the main risk factors for preeclampsia in Indonesia and suggest appropriate preventive measures. Thus, the results of this study are expected to contribute to reducing maternal morbidity and mortality rates and improving the overall health of pregnant women in Indonesia. So, this study aims to identify the main risk factors for preeclampsia in pregnant women in Indonesia and assess the influence of these factors on the incidence of preeclampsia. By understanding the risk factors for preeclampsia comprehensively, it is hoped that more effective and efficient health policies can be implemented to protect the health of pregnant women and fetuses in Indonesia.

Indonesia has implemented various programs to prevent preeclampsia, a severe pregnancy complication that can endanger the mother and fetus. These efforts include Routine Pregnancy Check-ups (Antenatal Care); this examination aims to detect early risk factors for preeclampsia and other pregnancy complications. At each ANC visit, health workers screen to identify preeclampsia risk factors, such as medical history, blood pressure, and urine tests. Early detection allows for more effective treatment. Education and Counseling for pregnant women regarding the signs and symptoms of preeclampsia. This education is delivered through integrated health posts, community health centres, and other health facilities. Calcium Supplementation for pregnant women with low calcium intake: the government recommends a minimum of 1 gram of calcium supplementation per day to prevent preeclampsia, especially in high-risk groups. Improving Access and Quality of Health Services, the government continues to improve access and quality of health services for pregnant women through the

National Health Insurance (JKN) program and increasing the capacity of health workers to handle preeclampsia. Through a combination of these programs, Indonesia seeks to reduce the incidence of preeclampsia and improve the safety of mothers and babies during pregnancy and childbirth.

METHOD

This study aims to identify risk factors for preeclampsia in pregnancy by considering socio-demographic aspects and the density of pregnant women with a significant history of preeclampsia in the Pampang Health Center Work Area, Makassar City.

Type of Research

This study uses an analytical observational design with a cross-sectional study approach. This design was chosen because it allowed observation of independent and dependent variables simultaneously at one point, making identifying risk factors for preeclampsia easier.

Place and Time of Research

The study took place in Pampang Makassar Community Health Center from 2021 to 2023. This study was conducted for two months, from December 2023 to January 2024. All procedures for this study have obtained ethical approval with the Protocol number SK: 674/STIKES-NH/BAU/X/2023, valid from December 16, 2023 to January 18, 2024.

Population and Sample

The study population consisted of pregnant women who experienced preeclampsia in 2021 – 2023 and pregnant women who did not experience preeclampsia during the same period. The minimum sample size was 200 pregnant women, consisting of 100 pregnant women who experienced preeclampsia and 100 pregnant women who did not experience preeclampsia, who were systematically selected from the list of medical records of preeclampsia cases from 2021 to 2023.

Data Collection

The data used in this study were secondary data taken from the medical records of patients diagnosed with preeclampsia. All data listed in the medical records were recorded and documented accordingly, and incomplete or other required data were confirmed to the patient via WhatsApp message if needed.

Measurement of independent variables in the form of socio-demographic factors such as age, education level, employment status, parity, medical history, twin pregnancy, chronic hypertension, type 2 diabetes mellitus or gestational diabetes, kidney disorders, autoimmune, obesity, and history of LBW births, identified through secondary data recording. Determination of the diagnosis of preeclampsia as a dependent variable was also based on patient medical record data. Sampling as a comparison group, namely pregnant women who did not experience preeclampsia, followed the same systematic sampling procedure as determining the case sample. Still, the matching process has not been applied in this study. Determination of the minimum sample size uses a Raosoft sample calculator with a 5% margin of error, 95% confidence interval, 50% response distribution, and a total population at risk of preeclampsia of 373 mothers, so the minimum sample obtained was 190. But, we have increased it to 200 with a comparable proportion between cases and controls.

Data Analysis and Processing

To see the relationship between research variables, the Chi-square test and its derivatives were used according to the feasibility of the test. A value of $\rho < 0.05$ determines significant differences. This analysis aims to identify risk factors in discrete categories.

RESULT

Descriptive data provide insight into the characteristics of the pregnant maternal population. Most women are in the childbearing age of 20 – 35, accounting for 74.0% of the sample, while those aged below 20 and above 35 represented 2.5% and 23.5%, respectively. Educational attainment shows

a significant trend towards higher education, with 84.0% completing secondary school and another 9.5% holding a bachelor's degree.

Tabel 1. Characteristics of Research Subjects (n = 200)

Characteristics	Value	Percentage
Mother's Age		
< 20	5	2.5
20 – 35	148	74.0
> 35	47	23.5
Level of Education		
Elementary School	1	0.5
Junior High School	12	6.0
High School	168	84.0
Bachelor's Degree	19	9.5
Parity		
Nulipara	64	32.0
Primipara	36	18.0
Multipara	100	50.0
Status		
Working Mother	72	36.0
Housewife	128	64.0
History of Preeclampsia		
Yes	79	39.5
No	121	60.5
History of Chronic Hypertension		
Yes	37	18.5
No	163	81.5
History of DM		
Yes	38	19.0
No	162	81.0
History of Kidney Disorders		
Yes	61	30.5
No	139	69.5
History of Autoimmune		
Yes	12	6.0
No	188	94.0
History of Abortion		
Yes	23	11.5
No	177	88.5
History of Low Birth Weight		
Yes	7	3.5
No	193	96.5
Twin Pregnancy		
Twins	6	3.0
Single	194	97.0
Pre-Pregnancy BMI		
Normal	119	59.5
Obesity	81	40.5
Pregnancy Weight Gain		
Exceeds BMI Threshold	75	37.5
According to BMI Threshold	125	62.5

In terms of parity, 50.0% of the women are multiparous and have experienced multiple births. In comparison, 32.0% are nulliparous and have never had a child before, and 18.0% are primiparous and are experiencing their first pregnancy. The vast majority (64.0%) of the women are housewives, compared to 36.0% employed.

Medical history shows that 39.5% of the women have a history of preeclampsia, and a small proportion have chronic hypertension (18.5%) or diabetes mellitus (19.0%). Kidney disorders are highly prevalent, with 55.0% reporting such problems, while only 6.0% have autoimmune disorders. A previous abortion is experienced by 11.5% of the sample, and 3.5% have a history of delivering a low birth weight baby. Twin pregnancies are uncommon, at 3.0%. Regarding pre-pregnancy Body Mass Index (BMI), 59.5% of women are within the normal range, while 40.5% are classified as overweight. A total of 99.0% of women gain 12 kg or more during their pregnancy, indicating significant weight gain among the majority of women. This comprehensive dataset provides a detailed picture of the demographic and health characteristics of the pregnant women surveyed, highlighting common and uncommon conditions in this group.

Table 2. Differences in Weight Gain in Pregnant Women Based on BMI Category

BB Increase	SG	N	Mean	Std. Deviation	Std. Error Mean
BMI	Normal	119	14.092	1.3083	0.1199
	Obesity	81	17.556	1.0840	0.1204

p: 0,903

The average weight gain in mothers with normal nutritional status is 14.0 kg, while the average weight gain in overweight mothers during pregnancy is 17.5 kg. In contrast, the recommended weight gain for mothers with overweight nutritional status is between 7-11.5 kg only, and for obese mothers, it should only be between 5 – 9 kg. Both BMI groups have no significant difference in the average weight gain because both exceed the recommended weight gain threshold during pregnancy.

Table 3 shows the correlation test results of each risk factor with the incidence of preeclampsia. The data shows a significant increase in preeclampsia cases in women over 35 years of age (55.3%) compared to younger age groups but statistically does not show a correlation between age and the incidence of preeclampsia, likewise, with education level and parity. However, multiparous mothers have a higher percentage of preeclampsia (56.0%) compared to nullipara and primipara. This may indicate a correlation, although the p-value is not specifically below 0.05. This study also shows a significant correlation between employment status and preeclampsia, which is very high (81.8%) compared to mothers who do not work (30.1%). This shows that working during pregnancy can be a trigger for stress that contributes to the high rate of preeclampsia. Some medical histories that show a strong correlation with preeclampsia are a history of preeclampsia in a previous pregnancy (82.3%), chronic hypertension (100%), kidney disorders (82.0%), autoimmune history (100%); all have a high prevalence of preeclampsia and a p-value <0.01. However, the autoimmune history referred to in this study was subjectively conveyed by the mother during pregnancy check-ups and not validated by a special clinical examination during data collection. The incidence of preeclampsia in women with diabetes (52.6%) and without diabetes (49.4%) does not show a significant difference, indicated by a p-value (0.719); likewise, with twin pregnancies. There is a higher rate of preeclampsia in twin pregnancies (66.7%) compared to single pregnancies (49.5%), with a p-value of 0.408. Although the number of cases and controls have been the same, several medical histories that generally showed significance in this study show insignificant results. Finally, the risk factor for pre-pregnancy body mass index also shows no significant relationship with preeclampsia. Both pre-pregnancy BMI and weight gain during pregnancy show no significant difference in the incidence of preeclampsia, with p-values of 0.885 and 0.466, respectively. This suggests that BMI and weight gain are insignificant predictors of preeclampsia in this sample.

Table 3. Correlation between Risk Factors and Preeclampsia

Risk Factor	Preeclampsia		Normal		Total		*p-value**	OR 95% CI
	n	%	n	%	N	%		
Mother's Age								
< 20	1	20.0	4	80.0	5	100.0	0.251	0.9 (0.4-1.7)**
20 – 35	73	49.3	75	50.7	148	100.0		
> 35	26	55.3	21	44.7	47	100.0		
Level of Education								
Elementary-Intermediate	93	51.4	88	48.6	181	100.0	0.229	1.8 (0.7-4.8)
High	7	36.8	12	63.2	19	100.0		
Paritas								
Nulipara	30	46.9	34	53.1	64	100.0	0.175	0.8 (0.4-1.6)***
Primipara	14	38.9	22	61.1	36	100.0		
Multipara	56	56.0	44	44.0	100	100.0		
Status								
Working Mother	63	81.8	14	18.2	77	100.0	0.001	10.4 (5.2-20.9)
Housewife	37	30.1	86	69.9	123	100.0		
History of Preeclampsia								
Yes	65	82.3	14	17.7	79	100.0	0.001	11.4 (5.6-22.9)
No	35	28.9	86	71.1	121	100.0		
History of Chronic Hypertension								
Yes	37	100.0	0	0.0	37	100.0	0.001	2.6 (2.1-3.1)
No	63	38.7	100	61.3	163	100.0		
History of DM								
Yes	20	52.6	18	47.4	38	100.0	0.719	1.1 (0.6-2.3)
No	80	49.4	82	50.6	162	100.0		
History of Kidney Disorders								
Yes	50	82.0	11	18.0	61	100.0	0.001	0.0 (0.0-0.1)
No	50	36.0	89	64.0	139	100.0		
History of Autoimmune								
Yes	12	100.0	0	0.0	12	100.0	0.001	2.1 (1.8-2.5)
No	88	46.8	100	53.2	188	100.0		
History of Abortion								
Yes	10	43.5	13	56.5	23	100.0	0.507	1.3 (0.5-3.2)
No	90	50.8	87	49.2	177	100.0		
History of Low Birth Weight								
Yes	5	71.4	2	28.6	7	100.0	0.225	2.5 (0.4-13.5)
No	95	49.5	97	50.5	192	100.0		
Twin Pregnancy								
Twins	4	66.7	2	33.3	6	100.0	0.408	2.0 (0.4-11.4)
Single	96	49.5	98	50.5	194	100.0		
Pre-Pregnancy BMI								
Obesity	40	49.4	41	50.6	81	100.0	0.885	1.0 (0.6-1.8)
Norma	60	50.4	59	49.6	119	100.0		
Pregnancy Weight Gain								
Exceeds BMI recommendations	35	46.7	40	53.3	75	100.0	0.466	0.9 (0.6-1.7)
According to BMI	65	52.0	60	48.0	120	100.0		

*Mann Whitney U Test p<0.05 (data is not normally distributed)

**Dichotomous category; high risk refer to merge between < 20 and > 35; low risk refer to 20-35

***Dichotomous category: high risk refers to the merge between primipara and multipara; low risk refers to nullipara (first pregnancy)

Special note (table 4) for working mothers: the data shows that there is an intercorrelation between working mothers and a history of chronic hypertension. We have tried to conduct a layer analysis between working mothers and those with a history of chronic hypertension with preeclampsia; it is found that working mothers have a risk of chronic hypertension, which in pregnancy then increases the risk of preeclampsia. Among working mothers, 39.0% have a history of chronic hypertension, while

61.0% do not. In non-working mothers, the proportion is smaller, namely 5.7%, who suffer from chronic hypertension, and 94.3% do not experience chronic hypertension. Significant results from several tests show a strong relationship between maternal employment status and the incidence of chronic hypertension. In particular, non-working mothers have a much lower prevalence of chronic hypertension compared to working mothers. In other ways, there is a ten times lower risk for non-working mothers to develop chronic hypertension compared to working mothers.

Table 4. Correlation between History of Chronic Hypertension and Working Mother Status

Working Mother Status	History of Chronic Hypertension				Total	
	Yes		No			
	n	%	n	%	N	%
Working Mother	30	39.0	47	61.0	77	100.0
Housewife	7	5.7	116	94.3	123	100.0
Total	37	18.5	163	81.5	200	100.0

p<0,001; 10.57, 95%(CI): 4.3 – 25.7

Table 5. Stratification Analysis Between History of Chronic Hypertension, Working Mother Status and Incidence of Preeclampsia

History of Chronic HT		Preeclampsia				Total		OR 95% CI
		Yes		No				
		n	%	n	%	N	%	
There is History	Working Mother	30	100.0	0	0.0	30	100.0	6.8
	Housewife	7	100.0	0	0.0	7	100.0	(3.1-14.8)
	Total	37	100.0	0	0.0	37	100.0	
There is no History	Working Mother	33	70.2	14	29.8	47	100.0	0.6
	Housewife	30	25.9	86	74.1	116	100.0	(0.5-0.7)
	Total	63	38.7	100	61.3	163	100.0	
Total	Working Mother	63	81.8	14	18.2	77	100.0	10.6
	Housewife	37	30.1	86	69.9	123	100.0	(4.4-25.7)
	Total	100	50.0	100	50.0	200	100.0	

p-value <0,001

A layer analysis has been conducted in a cross-tabulation to see how the interaction between these two risk factors in preeclampsia is carried out (Table 5). Both working and non-working mothers (IRT) who have chronic hypertension show a preeclampsia incidence rate of 100%. This indicates that chronic hypertension is a very strong predictor of preeclampsia regardless of its interaction with employment status. In working mothers, 70.2% experience preeclampsia, while 29.8% do not. This significant difference suggests that other work-related factors may contribute to the risk of preeclampsia. In non-working mothers, 25.9% experience preeclampsia, which shows a significant difference compared to working mothers. According to the overall risk, there is more than ten times the risk for working mothers who suffer from chronic hypertension to fall into preeclampsia compared to housewives.

The results of the logistic regression test (backward likelihood ratio) show that the variables included in the final model predicting the risk of preeclampsia are kidney disorders and the interaction between chronic hypertension and maternal employment status. Specifically, the interaction variable between history of chronic hypertension and employment status has a very large coefficient and odds ratio, indicating a strong influence. Yet, the standard error on the kidney disorder variable is very large, indicating instability in this estimate, which may be caused by multicollinearity or the presence of the same amount of data in one effect category, where mothers who have kidney disorders and do not have a history of kidney disorders have the same number of preeclampsia. So, if the kidney disorder variable is eliminated in the analysis, the interaction of chronic hypertension history and maternal employment becomes a predictive determinant of the potential for preeclampsia in pregnancy.

Table 6. Model Fit of Preeclampsia Risk Factors

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 5[a]	Kidney Disorders	23.056	4066.715	.000	1	.995	10304514990.474	0.000	0.0
	History of Chronic Hypertension*Working Mother	1.025	0.377	7.393	1	.007	2.786	1.331	5.831
	Constant	-28.446	4066.715	0.000	1	.994	0.000		

Variables entered on step 1: History of Preeclampsia, History of Chronic Hypertension, Kidney Disorders, History of Autoimmune Disease, Employment Status, Interaction of History of Chronic Hypertension *Employment_Status.

DISCUSSION

This study aims to identify risk factors for preeclampsia by involving comprehensive observation of various possible variables that affect the incidence of preeclampsia in pregnancy. Several variables that already have a lot of evidence as predictive of preeclampsia in this study have also been proven, such as a history of previous preeclampsia, a history of chronic hypertension, a history of kidney and autoimmune disorders, and one variable related to the status of working mothers. In this study, mothers with a history of PE have shown a very strong correlation with the occurrence of PE in the current pregnancy. Mothers with a history of preeclampsia (PE) in a previous pregnancy have a significantly increased risk of developing preeclampsia in a subsequent pregnancy compared to women who do not suffer from preeclampsia. Although a history of preeclampsia is a strong predictor of recurrence, the risk for each individual can vary greatly. Mothers with a history of PE should be a top priority in monitoring and preventing pregnancy hazards. There needs to be a prenatal care plan that includes routine monitoring and appropriate preventive measures to manage the risk in subsequent pregnancies (Overton et al., 2022). Autoimmune history in this study also has shown a strong correlation with the incidence of preeclampsia. Autoimmune history in this study has been obtained through the results of anamnesis identification at antenatal visits (Duckitt & Harrington, 2005), which is subjectively based on the mother's confession without any validation in the form of blood tests. The mother's subjective confession of the autoimmune condition she feels reflected her personal experience of real abnormalities. These symptoms are often the first clue to the presence of an autoimmune condition and are very important in the early diagnosis process. However, for the accuracy of the diagnosis, subjective confession must be supported by objective medical examinations, such as tests that detect abnormal antibody activity.

The relationship between autoimmune disorders and preeclampsia (PE) is complex (Lokki et al., 2018). This disorder involves the immune system mistakenly attacking the body's tissues, which can alter the body's immune response and contribute to systemic inflammation (Plowden et al., 2020). The presence of immune system dysregulation plays an important role in developing preeclampsia (Pan et al., 2020). Preeclampsia is characterized by an abnormal immune response to the placenta, often considered a foreign object by the mother's immune system (Xia & Kellems, 2009). Women with autoimmune disorders already have an altered or hyperactive immune system, which may exacerbate this immune response (Angum et al., 2020). Autoimmune diseases are associated with chronic inflammation, impacting blood vessel health (Hedar et al., 2021) and contribute to the development of hypertension, which is a major feature of preeclampsia (Harmon et al., 2016). These specific autoimmune disorders are directly associated with an increased risk of preeclampsia (Collier et al., 2021). This condition causes the immune system to mistakenly attack certain proteins in the blood (Khan & Ghazanfar, 2018; Nemazee, 2017), resulting in increased clotting (Pisetsky, 2023). This can interfere with placental function and blood flow (Roberts & Escudero, 2012), leading to conditions such as preeclampsia. Women with SLE are at increased risk for preeclampsia. SLE's inflammatory nature and its impact on the kidneys and cardiovascular system contribute to this increased risk. Other conditions, such as rheumatoid arthritis or inflammatory bowel disease (Martinez et al., 2024), which involve systemic inflammation and immune system dysregulation, may also increase the risk of preeclampsia. However, the specific mechanisms and magnitude of risk may vary. Studies consistently show that women with certain autoimmune disorders are at increased risk for preeclampsia. This underscores the

importance of comprehensive prenatal care for women with autoimmune conditions, aimed at managing the autoimmune disorder and reducing pregnancy-related risks, such as preeclampsia.

This study also has shown a strong correlation between kidney disorders and the occurrence of PE. Pre-existing kidney disorders in the mother increase the risk of developing preeclampsia (Palma-Reis et al., 2013). Kidney disease affects the body's ability to manage fluids and filter waste, which can complicate the physiological changes of pregnancy (Bramham & Lightstone, 2012; Williams & Davison, 2008) and predispose to preeclampsia (Maruotti et al., 2012). Preeclampsia can potentially worsen kidney function. This can create a cycle where kidney damage contributes to preeclampsia, which in turn damages the kidneys (Dines et al., 2023). Research suggests that the mechanisms linking kidney disorders to preeclampsia may involve increased blood pressure due to fluid overload, altered immune responses, and imbalances in angiogenic factors that affect blood vessel health. The most important thing we highlight in this study is the role and contribution of working mothers to the incidence of Preeclampsia (Oh et al., 2023). Directly, the status of working mothers is not a biological factor that can influence the development of PE symptoms in pregnancy. However, it is a risk predictor for the development of chronic hypertension (Nugteren et al., 2012). The results of the cross-test between the status of working mothers and chronic hypertension significantly correlate with the incidence of PE, showing that there is a strong relationship between chronic hypertension and preeclampsia, where chronic hypertension is a strong risk factor for preeclampsia, regardless of employment status (Jansen et al., 2010). However, working mothers, especially those who do not have chronic hypertension, have a higher risk of developing preeclampsia. This may be due to work stress, physical demands, or lack of opportunity to rest. While mothers who do not work show a much lower prevalence of preeclampsia, this suggests that lifestyle factors associated with not working (such as potentially lower stress levels and more rest) may protect against the risk of preeclampsia during pregnancy. Related to work status with hypertension in the results of a significant correlation test, this may mean that stress or lifestyle differences related to work can contribute to hypertension. Therefore, it is important to consider work status in PE studies, especially those related to chronic conditions such as hypertension.

A study conducted by (Spadarella *et al*., 2021), which explored various chemical, physical, biological, and organizational exposures in the workplace and their potential impact on the risk of hypertension among pregnant workers, found that most of the risk factors studied do not produce definite conclusions due to data variability. However, this study has found more consistent evidence supporting a positive association between work stress and the risk of hypertensive disorders in pregnancy (Kehler et al., 2022). One of the causes of data variability in this study is inadequate characterization of workplace exposures (including dose and duration of exposure) and potential intercorrelations with personal factors, especially in the context of pregnant workers.

The condition history of diabetes mellitus in this study does not show a significant relationship. Diabetes does not always cause preeclampsia, although it is recognized as a significant risk factor. The relationship between diabetes and preeclampsia is influenced by several factors, including management of the disease itself and accompanying conditions. Mothers who manage their blood sugar levels effectively through diet, exercise during pregnancy, and medication as needed can reduce the risk of developing preeclampsia (Weissgerber & Mudd, 2015). Regular antenatal visits allow monitoring of potential complications. In addition, access to quality health services can significantly affect outcomes. Genetic predisposition can affect a person's risk of developing preeclampsia (Steinthorsdottir et al., 2020; Tyrmi et al., 2023). Some women with diabetes may have a lower genetic risk of developing preeclampsia; in addition, the risk of PE is exacerbated by other factors such as a history of hypertension, obesity or a previous history of preeclampsia which has been consistently confirmed in this study. Demographic factors such as older maternal age and a history of multiple pregnancies can also increase the risk of PE (Ananth et al., 2013). Conversely, younger women with fewer pregnancies and well-managed diabetes have a lower risk (Pérez Martín & Trobo Marina, 2019). Finally, the type of diabetes (Type 1, Type 2, or gestational diabetes) and its duration can also affect the risk of PE. Type 1 diabetes (Jensen et al., 2004; Persson et al., 2009) with insulin treatment will pose a different risk compared to gestational diabetes that appears during pregnancy and may disappear after delivery (Valdés et al., 2014)

This study has involved various relevant sociodemographic and medical risk factors, providing a comprehensive understanding of the determinants of PE. Yet, some limitations that need to be considered are some variables, such as autoimmune history, are based on subjective reports from

mothers without in-depth medical validation, which could affect the accuracy of the data, no matching has been carried out between case and control groups which could cause potential bias in the analysis, and the cross-sectional design cannot show a definitive causal relationship between risk factors and preeclampsia.

CONCLUSION AND SUGGESTION

This study has found that a history of preeclampsia, chronic hypertension, kidney disorders, autoimmune conditions, and maternal employment status are significant risk factors for preeclampsia. Working mothers have a higher risk of preeclampsia, especially if they also have chronic hypertension. Therefore, pregnant women with high-risk factors need to receive intensive monitoring, education and support during pregnancy, especially those who work, to be aware of stress triggers, especially those related to the work environment. Further studies are needed with a longitudinal approach to identify causal relationships over time by conducting further validation for subjectively identified variables so that data accuracy is controlled. Finally, multivariate analysis should be added to overcome the multicollinearity problem and improve the accuracy of estimating the relationship between variables.

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