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The Relationship Between Antenatal Care Examination Results and The Incidence of Preeclampsia in Pregnant Women

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ABSTRACT

Maternal mortality is a significant health issue that remains a concern in Indonesia. The commonly used indicator for maternal mortality is the maternal mortality rate (MMR), which serves as the primary measure of the success of maternal health programs. One of the major contributing factors to maternal mortality is preeclampsia, and a factor influencing the incidence of preeclampsia is antenatal care visits. This is a quantitative study using an observational analytic design with a case-control approach. The sampling method used is purposive sampling. The sample size is 184, consisting of 92 cases and 92 controls that meet the inclusion and exclusion criteria. Data analysis was conducted using univariate and bivariate analysis with the chi-square test. Based on the chi-square statistical test results, the following P-values were obtained: $0.098 < 0.05$ for the age variable, $0.761 < 0.05$ for the parity variable, $0.000 > 0.05$ for the blood pressure variable, $0.001 > 0.05$ for the BMI variable, $0.014 > 0.05$ for the urine protein variable, and $0.300 > 0.05$ for the ANC visit frequency variable. The conclusion of this study is that there is a relationship between antenatal care examination results, namely blood pressure, maternal BMI, and maternal urine protein, and the incidence of preeclampsia. However, there is no relationship between age, parity, and the frequency of ANC visits and the incidence of preeclampsia at RSKD Ibu dan Anak Siti Fatimah Makassar from January 2020 to December 2022.

Keywords: Antenatal care; Preeklampsia;ANC

INTRODUCTION

The maternal mortality rate (MMR) is the primary indicator used to assess the success of maternal health programs. Maternal mortality is a significant health issue that receives considerable attention in Indonesia. The maternal mortality rate also serves as an indication of the healthcare system's capabilities, the quality of education, the capacity of healthcare services, socio-cultural factors, the overall health quality within a community, and the barriers to accessing healthcare services. (Kemenkes RI, 2020; Setyawati & Widiasih, 2018)

According to the World Health Organization (WHO), the maternal mortality rate in 2017 was 295,000 cases, which is 35% lower than the 451,000 cases recorded in 2000.

Approximately 810 mothers die every day due to childbirth and pregnancy-related complications. The annual maternal and child mortality rates in Indonesia have not yet met WHO targets, a situation influenced by mothers' adherence to antenatal care. (Rosdianah et al., 2022; World Health Organization, 2024)

Collected from the family health program records of the Ministry of Health, the number of maternal deaths was recorded as 7,389 in 2021, compared to 4,627 in 2020 in Indonesia. This shows an increase from the 2019 figure of 4,221 maternal deaths. (Kemenkes RI, 2021). In 2020, maternal deaths were mainly caused by hemorrhage, accounting for 1,330 cases, hypertension in pregnancy (including preeclampsia-eclampsia) with 1,110 cases, and circulatory system disorders with 230 cases. Globally, almost 300,000 women die due to preeclampsia, and over 500,000 infant deaths are attributed to preeclampsia. (Ahmed et al., 2017)

The maternal mortality rate in South Sulawesi in 2021 was 195 cases, with the leading causes being hemorrhage (44 cases), hypertension in pregnancy (41 cases), and infection (6 cases). (Kemenkes RI, 2021)

Maternal mortality remains a critical health issue in Indonesia, with the numbers rising each year: 4,221 deaths in 2019, increasing to 4,627 in 2020. The government has been working to reduce these numbers, including by implementing antenatal care for pregnant women, recommending at least four check-ups during pregnancy to prevent and detect potential complications for both mother and fetus. One such complication is preeclampsia, a pregnancy-induced hypertension occurring after 20 weeks of gestation, characterized by edema and proteinuria. Preeclampsia can lead to severe complications for both mother and child, including death. Given these concerns, this study aims to investigate the relationship between antenatal care outcomes and the incidence of preeclampsia in pregnant women.

MATERIALS AND METHODS

This study is quantitative research using an analytical observational design with a case control approach, aiming to link antenatal care examination results with the incidence of preeclampsia in pregnant women at RSKD Ibu dan Anak Siti Fatimah Makassar from January 2020 to December 2022.

The samples used in this study consist of case samples and control samples. The case samples include pregnant women diagnosed with preeclampsia, with medical records meeting the inclusion and exclusion criteria. The control samples are pregnant women

who underwent antenatal care, with medical records also meeting the inclusion and exclusion criteria. The inclusion criteria are pregnant women with a gestational age of ≥ 20 weeks, pregnant women diagnosed with preeclampsia at RSKD Ibu dan Anak Siti Fatimah Makassar as recorded in medical records from January 2020 to December 2022, and medical records with clear and complete information (supporting data for this study includes: medical record number, identity, age, parity, antenatal care examination results such as blood pressure, body mass index, and urine protein, as well as frequency of antenatal care visits). The exclusion criteria are women with a family history of preeclampsia/eclampsia, and women with hyperplacentosis conditions such as hydatidiform mole, hydrops fetalis, and large babies.

The instrument for this study is document review using patient medical records, focusing on antenatal care examination results of pregnant women experiencing preeclampsia. The analytical technique used in this research is the chi-square test, assisted by statistical testing software. This study has received ethical approval from the health research ethics committee of Alauddin State Islamic University of Makassar with the number B.358/KEPK/FKIK/XII/2022.

RESULTS

The analysis of Table 1 shows that there are 37 samples with age < 20 years or ≥ 35 years and 147 samples with age 20-34 years. Among the samples aged < 20 years or ≥ 35 years, 23 experienced preeclampsia and 14 did not. Among the samples aged 20-34 years, 69 experienced preeclampsia and 78 did not. The Chi-Square test results show a p-value of 0.098, indicating no significant relationship between age and the incidence of preeclampsia.

Table 1. The Relationship Between Patient Age and the Incidence of Preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar

Age	Incidence of preeclampsia						*P-value*
	Yes		No		Total		
	n	%	*n*	%	*n*	%	
< 20 years or ≥ 35 years	23	12,5	14	7,6	37	20,1	0,098
20 – 34 years	69	37,5	78	42,4	147	79,9	
Total	**92**	**50,0**	**92**	**50,0**	**184**	**100,0**	

The analysis of Table 2 shows that there are 114 samples with risky parity and 70 samples with non-risky parity. Among the samples with risky parity, 56 experienced preeclampsia and 58 did not. Among the samples with non-risky parity, 36 experienced preeclampsia and 34 did not. The Chi-Square test results show a p-value of 0.761,

indicating no significant relationship between parity and the incidence of preeclampsia.

Table 2. The Relationship Between Patient Parity and the Incidence of Preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar

Parity	Incidence of preeclampsia						*P-value*
	Yes		No		Total		
	n	%	*n*	%	*n*	%	
Risky (Parity <2 or >3)	56	30,4	58	31,5	114	62,0	0,761
Not risky (Parity 2-3)	36	19,6	34	18,5	70	38,0	
Total	**92**	**50,0**	**92**	**50,0**	**184**	**100,0**	

The analysis of Table 3 shows There are 84 samples with blood pressure ≤120/80 mmHg, 7 samples with blood pressure 121/81-139/89 mmHg, and 93 samples with blood pressure ≥140/90 mmHg. Among the samples with blood pressure ≤120/80 mmHg, none experienced preeclampsia and 84 did not. Among the samples with blood pressure 121/81-139/89 mmHg, none experienced preeclampsia and 7 did not. Among the samples with blood pressure ≥140/90 mmHg, 92 experienced preeclampsia and 1 did not. The Chi-Square test results show a p-value of 0.000, indicating a significant relationship between blood pressure and the incidence of preeclampsia.

Table 3. The Relationship Between Patient Blood Pressure and the Incidence of Preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar.

Blood pressure	Incidence of preeclampsia						*P-value*
	Yes		No		Total		
	n	%	*n*	%	*n*	%	
≤ 120/80 mmHg	0	0,0	84	45,7	84	45,7	0,000
121/81-139/89 mmHg	0	0,0	7	3,8	7	3,8	
≥ 140/90 mmHg	92	50,0	1	0,5	93	50,5	
Total	**92**	**50,0**	**92**	**50,0**	**184**	**100,0**	

The analysis of Table 4 shows that there are 103 samples with abnormal BMI and 81 samples with normal BMI. Among the samples with abnormal BMI, 63 experienced preeclampsia and 40 did not. Among the samples with normal BMI, 29 experienced preeclampsia and 52 did not. The Chi-Square test results show a p-value of 0.001, indicating a significant relationship between BMI and the incidence of preeclampsia.

Table 4. The Relationship Between Pregnant Women's Body Mass Index and the Incidence of Preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar.

BMI	Incidence of preeclampsia						*P-value*
	Yes		No		Total		
	n	%	*n*	%	*n*	%	
Not normal (≤ 18,4 kg/m^2 atau >25 kg/m^2)	63	34,2	40	21,7	103	56,0	0,001
Normal (18,5-25 kg/m^2)	29	15,8	52	28,3	81	44,0	
Total	**92**	**50,0**	**92**	**50,0**	**184**	**100,0**	

The analysis of Table 5 shows that there are 75 samples with positive urine protein and 109 samples with negative urine protein. Among the samples with positive urine protein, 65 experienced preeclampsia and 10 did not. Among the samples with negative urine protein, 27 experienced preeclampsia and 82 did not. The Chi-Square test results show a p-value of 0.000, indicating a significant relationship between urine protein and the incidence of preeclampsia.

Table 5. The Relationship Between Urine Protein Examination and the Incidence of Preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar.

Urine Protein	Incidence of preeclampsia						*P-value*
	Yes		No		Total		
	n	%	*n*	%	*n*	%	
Positif (urine Protein 1+,2+,3+)	65	35,3	10	5,4	75	40,8	0,000
Negatif (urine Protein negatif)	27	14,7	82	44,6	109	59,2	
Total	**92**	**50,0**	**92**	**50,0**	**184**	**100,0**	

The analysis of Table 6 shows that there are 84 samples with ANC visit frequency < 4 times and 100 samples with ANC visit frequency ≥ 4 times. Among the samples with ANC visit frequency < 4 times, 38 experienced preeclampsia and 46 did not. Among the samples with ANC visit frequency ≥ 4 times, 54 experienced preeclampsia and 46 did not. The Chi-Square test results show a p-value of 0.300, indicating no significant relationship between ANC visit frequency and the incidence of preeclampsia.

Table 6. The Relationship Between ANC Visit Frequency and the Incidence of Preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar

Frequency of antenatal care visits	Incidence of preeclampsia						*P-value*
	Yes		No		Total		
	n	%	*n*	%	*N*	%	
< 4 times	38	20,7	46	25,0	84	45,7	0,300
≥ 4 times	54	29,3	46	25,0	100	54,3	
Total	92	50,0	92	50,0	184	100,0	

DISCUSSION

In this study, the P-value for the age variable was found to be $0.098 < 0.05$, indicating that there is no significant relationship between age and the incidence of preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar. This result aligns with a study conducted by Dwi Rahayu in 2020, which reported no significant relationship between age and the incidence of preeclampsia, with a Chi-Square value of $p = 0.072 > 0.05$. However, this finding contradicts the statement by Sarwono, which suggests that extreme ages are a risk factor for preeclampsia. In this study, the majority of pregnant women experiencing preeclampsia were aged 20-34 years, totaling 69 individuals (37.5%). This discrepancy may be due to the limited sample size for ages < 20 years or ≥ 35 years. (Prawirohardjo, 2020)

The study results indicated that there is no significant relationship between parity and the incidence of preeclampsia, with a P-value of $0.761 < 0.05$. This finding is consistent with a study conducted by Vistra Vertisia in 2018, which also reported no significant relationship between parity and the incidence of preeclampsia. However, this contradicts another finding by Vistra (2018), which states that safe parity is 2-3, while risky parity (<1 or >3) poses a higher maternal mortality risk. In this study, the number of preeclampsia cases was almost equal between risky parity (<2 or >3) and non-risky parity (2-3), possibly due to the distribution of the sample, with fewer non-risky parity pregnant women compared to risky ones.

The P-value for the blood pressure variable was found to be $0.000 > 0.05$, indicating a significant relationship between blood pressure and the incidence of preeclampsia at RSKD Ibu dan Anak Siti Fatimah, Makassar. This result supports the statement by Sarwono, which notes that elevated blood pressure is a symptom of preeclampsia. In hypertensive pregnancies, trophoblast cells fail to invade the spiral artery muscle layers, leaving these arteries rigid and unable to undergo distension and vasodilation. (Prawirohardjo, 2020)

The P-value for the body mass index (BMI) variable was found to be $0.001 > 0.05$, indicating a significant relationship between BMI and the incidence of preeclampsia. This finding is consistent with statements from Sarwono and William Obstetric, which identify abnormal BMI or obesity as a risk factor for preeclampsia. It also aligns with research by James M. Robert et al. (2012), which found that overweight and obese women have a higher risk of developing preeclampsia. In overweight and obese pregnant women, there

is an increase in low-density lipoprotein (LDL) and triglycerides. Elevated LDL levels can reduce extravillous cytotrophoblast migration and increase trophoblast apoptosis. High levels of triglycerides and free fatty acids in obesity increase preeclampsia risk through the stimulation of peroxisome proliferator-activated receptor-γ (PPAR-γ). PPAR-γ expression increases in the placenta of preeclamptic pregnancies, hindering trophoblast cell invasion (Lopez et al., 2018). Impaired trophoblast cell invasion in the spiral arteries and surrounding tissues keeps these arteries rigid and unable to dilate, leading to spiral artery vasoconstriction, failed remodeling, reduced uteroplacental blood flow, hypoxia, and placental ischemia. (Díaz-López et al., 2021; Roberts et al., 2011)

The study found a significant relationship between urine protein levels and the incidence of preeclampsia. This finding is consistent with statements from Sarwono and William Obstetric, which note that proteinuria is a symptom of preeclampsia. Proteinuria occurs when elevated blood pressure damages the glomerulus, causing protein leakage. In this study, the number of preeclamptic pregnant women with positive urine protein was higher than those with negative urine protein. Proteinuria was previously used as a marker for organ damage severity in preeclampsia, but since 2014, the International Society for the Study of Hypertension in Pregnancy (ISSHP) and the American Society of Obstetricians and Gynecologists (ASOG) have removed proteinuria from the definitive diagnosis criteria for preeclampsia, broadening the diagnostic criteria. (Dong et al., 2017)

In non-preeclamptic pregnant women, several factors can cause positive urine protein, including superimposed preeclampsia, kidney diseases (e.g., kidney infection, urinary tract infection, acute kidney failure, chronic kidney failure), hypertension, diabetes, malaria, and physiological conditions such as excessive protein intake. Non-preeclamptic pregnant women without proteinuria may have no organ damage related to the urinary tract system, among other factors. (Liu et al., 2021; Sucindrawati et al., 2019)The study found no significant relationship between the frequency of antenatal care (ANC) visits and the incidence of preeclampsia. This finding contradicts Ekasari (2019), who stated that pregnant women who do not regularly undergo ANC are at higher risk for preeclampsia compared to those who do. In this study, more preeclamptic pregnant women had ≥4 ANC visits than those with <4 visits (Ekasari, 2019). Factors contributing to the lack of relationship between ANC visit frequency and preeclampsia include irregular check-ups due to a lack of awareness about the benefits of prenatal care, demographic factors, long distances to healthcare facilities, births assisted by traditional

midwives, and healthcare providers not being present at health facilities when pregnant women seek care. (Ekasari and Silvian Natalia, 2019)

Limitations of this study is This study used only medical record data, which limits the depth of information on antenatal care examination results. Administrative procedures for the research location affected the study's timeline, and there were limitations in the researcher's capabilities and workforce. Another limitation was the lack of investigation into the low-density lipoprotein (LDL) levels of pregnant women, focusing instead on the risk of preeclampsia based on abnormal versus normal BMI.

CONCLUSIONS

From the research findings, it can be concluded that there is a significant correlation between certain antenatal care examination results and the incidence of preeclampsia, specifically blood pressure, maternal body mass index (BMI), and maternal urine protein levels. However, antenatal care examination results that did not show a correlation with the incidence of preeclampsia in this study include maternal age, parity, and the frequency of antenatal care visits.

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