

Analysis of Risk Factors and Quality of Antenatal Care (ANC) in Pregnant Women with Preeclampsia in Ajung District, Jember Regency

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Abstract

In 2023 and 2024, Jember Regency had the highest maternal mortality rate (MMR) in East Java. Preeclampsia (PE), a form of hypertension during pregnancy, is the second leading cause of MMR after postpartum hemorrhage. This study aimed to analyze the risk factors and quality of antenatal care (ANC) for pregnant women with preeclampsia at the Ajung Community Health Center in Jember Regency. The study employed a retrospective cohort design. The study sample consisted of 55 pregnant women with preeclampsia from the Ajung Community Health Center between 2020 and May 2025. A two-sample independent t-test was used to analyze differences in risk factors among women with preeclampsia statistically. An ordinal regression test determined the relationship between preeclampsia risk factors and ANC quality. The results revealed 49 cases of preeclampsia occurring at or after 34 weeks of gestation and six cases occurring before 34 weeks. A significant difference was found in maternal age as a risk factor for preeclampsia. Most of the ANC quality in the study sample was very poor (62.5%), with maternal age and mean arterial pressure (MAP) being the main influencing factors. Age-related risk factors differed among pregnant women with preeclampsia, and a relationship was found between maternal age, MAP, and ANC quality.

Keywords: Maternal mortality rate, preeclampsia, antenatal care

Introduction

The World Health Organization (WHO) states that maternal mortality is an indicator used to evaluate a country's health. Indonesia's maternal mortality rate (MMR) remains high compared to other Asian countries. According to data on maternal and infant mortality recorded by the Ministry of Health, Indonesia's national MMR was 4,005 in 2022 and 4,129 in 2023. In 2023, East Java Province had an MMR prevalence of 502, with 50 cases in Jember Regency. In 2024, the figure decreased to 476, with 43 cases in Jember Regency. Jember Regency had the highest MMR in both 2023 and 2024 compared to other regencies/cities in East Java .

The leading causes of maternal mortality are hypertension during pregnancy and postpartum hemorrhage. Meanwhile, the leading causes of mortality in the perinatal group are pregnancy complications (28.3%) and low birth weight (19%) (Kementerian Kesehatan Republik Indonesia, 2020). In Jember District, the most common cause of maternal mortality in 2023 and 2024 was

hypertensive disease occurring during pregnancy, childbirth, and the postpartum period (MPDN, 2024). The Ajung Community Health Center is one of the community health centers in Jember Regency with the highest number of high-risk pregnancy cases, having recorded ten maternal deaths between 2020 and 2024. The most common cause of maternal mortality at the center is preeclampsia (Dinkes Jember, 2024).

Pre-eclampsia (PE) is a complex, multisystemic, pregnancy-related hypertensive disorder that can develop from 20 weeks of gestation until the postpartum period. PE is accompanied by complications such as proteinuria, organ dysfunction in the mother, and uteroplacental dysfunction (Cunningham, 2022). PE is reported to have a prevalence of 1.3%-6% in developed countries and 1.8%-18% in developing countries. In Indonesia, the incidence of PE within one year is 5.3% (POGI, 2016).). PE does not initially present any symptoms or signs, but it can worsen rapidly. If it occurs before 34 weeks of gestation, it can develop into early-onset preeclampsia (EOP); if it occurs at 34



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weeks or later, it can develop into late-onset preeclampsia (LOP). This classification is based on timing, pathogenesis, prognosis, physiology, and clinical implications (Cunningham, 2022).

There are differences in predisposition and outcome between EOP and LOP. EOP is characterized by placental dysfunction, inadequate conversion of the spiral arteries, and insufficient trophoblast invasion, which often result in fetal growth restriction and affect birth weight. In contrast, LOP occurs in the late stages of pregnancy, causing maternal cardiovascular intolerance (Anna et al., 2019). Meanwhile, LOP occurs in the late stages of pregnancy, causing maternal cardiovascular intolerance to pregnancy demands, as well as moderate placental dysfunction and an inadequate blood supply. Additionally, LOP is associated with peripheral vascular resistance, high cardiac output, and is prevalent in cases of fetal macrosomia, multiple pregnancies, and post-term pregnancies (Rybak-Krzyszowska et al., 2023). Anna et al., (2019) identified differences in risk factors between pregnant women with EOP and LOP. This classification is expected to inform screening, prevention, and treatment approaches.

The early detection and management of risk factors for preeclampsia (PE) and low birth weight (LBW) is carried out during antenatal care (ANC) visits at health facilities, including community health centers (Sungkar & Surya, 2020). However, coverage of quality ANC services in Indonesia still needs improvement. According to the 2016 National Health Survey, 72.5% of women attended K4 visits, while only 2.7% received ANC 10T services which include ten components of antenatal care, namely weight and height measurement, blood pressure check, upper arm circumference measurement (MUAC), fundal height measurement, determination of fetal position and heartbeat, tetanus toxoid (TT) immunization, iron supplementation, laboratory testing, case management, and counseling or health education (Mursyida et al., 2025). Furthermore, only 35.6% of pregnant women have undergone a urine protein test, and only 34.8% have received 90 days of iron supplements (Kementerian Kesehatan Republik Indonesia, 2020).

Although the Ajung Community Health Centre routinely conducts early detection of pre-eclampsia (PE) risk factors during antenatal care (ANC), no studies have analyzed the differences in risk factors between pregnant women with early-onset (EOP) and late-onset (LOP) pre-eclampsia. Additionally, there is no data describing the quality of ANC or the management of pregnant women with PE at the center. The present study aimed to analyze risk factors and the quality of ANC for pregnant women with preeclampsia at the Ajung Community Health Center in Jember Regency.

Method

This study is a retrospective cohort study. It was conducted at the Ajung Community Health Center in Jember Regency from

June to July 2025. The subjects were pregnant women who had experienced preeclampsia or eclampsia between January 2020 and May 2025. Those without complete medical records were excluded. The Kolmogorov–Smirnov test was used to examine the distribution of risk factor data such as maternal age during pregnancy, body mass index, and upper arm circumference. The two-sample t-test was then used to statistically analyse the differences in these risk factors between mothers who experienced early-onset pre-eclampsia (PE) and those who experienced late-onset PE. Ordinal regression test was used to determine if a causal relationship existed between PE risk factors and the quality of antenatal care (ANC).

In this study, the quality of ANC was assessed based on the frequency of visits according to the standard of one visit in the first trimester, two visits in the second trimester, and three visits in the third trimester. Quality was also assessed based on ten standard service components of ANC received by pregnant women (10T) consisting of weight measurement, height measurement, blood pressure measurement, upper arm circumference measurement, fundal height measurement, fetal heart rate measurement, fetal presentation measurement, tetanus immunization, iron tablet administration, laboratory tests, case management, and counseling, contact with a general practitioner or obstetrician, and receipt of ultrasound services in the first and third trimesters (Kementerian Kesehatan Republik Indonesia, 2021). The quality of antenatal care (ANC) is categorized as follows: good if the pregnant woman meets the standard ANC frequency and receives 10T services adequate if the standard frequency is met but some components of the 10T service do not meet the recommended examination time; poor quality if the frequency is in accordance with the standard but some components of the 10T service are not provided to the mother; and very poor if the frequency is not in accordance with the standard and if some components of the 10T service are not provided. The ethical test was carried out at the Health Research Ethics Committee of Dentistry Faculty, Jember University, No. 3084/UN25.8/KEPK/DL/2025 on May, 2025.

Results

A total of 55 cases of preeclampsia were identified in the study sample. Table 1 summarizes the demographic data from the study sample, consisting of 49 cases of late-onset preeclampsia (LOP) and 6 cases of early-onset preeclampsia (EOP). The most commonly reported age group for both the EOP and LOP groups was over 30 years old (see Table 1). Most mothers in the LOP group had completed junior high school, while most mothers in the EOP group had completed high school or college. The majority of mothers in both groups were unemployed or housewives. The majority of husbands in both groups were self-employed.

Table 1. Sociodemographic Characteristics and Antenatal Care in EOP and LOP

Variable	EOP (N = 6)		LOP (N = 49)		Total (N = 55)	
	n	%	n	%	n	%
Age (years)						
≤ 20	0	0	3	6,1	3	5,5
21-25	0	0	9	18,4	9	16,4
26-30	0	0	10	20,4	10	18,2
31-35	3	50	10	20,4	13	23,6
> 35	3	50	17	34,7	20	36,4
Education						
Elementary School	2	33,3	11	22,5	13	3,6
Junior High School	0	0	20	40,8	20	36,4
Senior High School	2	33,3	12	22,5	14	25,5
College	2	33,3	6	12,2	8	14,5
Husband's Education						
Elementary School	1	16,7	15	30,6	16	29,1
Junior High School	1	16,7	18	36,7	19	34,5
High School	4	66,6	13	26,6	17	30,9
College	0	0	3	6,1	3	5,5
Occupation						
Housewife	4	66,6	44	89,8	48	87,3
Entrepreneur	1	16,7	4	8,2	5	9,1
Teacher	1	16,7	1	2,0	2	3,6
Husband's Occupation						
Self-employed	3	50	20	40,8	23	41,8
Private sector	1	16,7	8	16,3	9	16,4
Civil servant/military/police	0	0	1	2,0	1	1,8
Farmer	2	33,3	8	16,3	10	18,2
Construction worker	0	0	2	4,1	2	3,6
Laborers	0	0	8	16,3	8	14,5
Teachers	0	0	1	2,0	1	1,8
Drivers	0	0	1	2,0	1	1,8
ANC Quality						
Good	0	0	0	0	0	0
Adequate	1	16,6	2	4,1	3	5,45
Poor	2	33,3	15	30,6	17	30,9
Very Poor	3	50	32	65,3	35	63,6
Aspilet Therapy						
Pregnancy Age <16 Weeks	0	0	19	38,7	19	34,5
Pregnancy Age >16 Weeks	4	66,7	5	10	9	16,3

EOP, early onset preeclampsia; LOP, late onset preeclampsia

Table 2. Table of PE Risk Factor Distribution and its relationship with antenatal care quality

Risk Factors for preeclampsia	EOP		LOP		TOTAL		P Value
	n	%	n	%	n	%	
Multiparous with new partner	2	33,3	7	14,3	9	16,4	0.420
Age ≥ 35 years	2	33,3	10	20,4	12	21,8	0.020*
Family history of PE	0	0	4	8,2	4	7,3	0.354
Obesity, BMI >30 kg/m ²	2	33,3	16	32,7	18	32,7	0.170
Nulliparous	0	0	4	8,2	4	7,3	0.240
Previous pregnancy > 10 years	1	16,7	9	18,4	10	18,2	0.602
APS	0	0	7	14,3	7	12,7	0.154
Chronic hypertension	1	16,7	10	20,4	11	20	0.520
Previous preeclamptic pregnancy	2	33,3		44,9	24	43,6	0.233
MAP > 90 mmHg	3	50	22	44,9	25	45,5	0.029*

*Significant < 0,05

BMI, body mass index; APS, Antiphospholipid syndrome; EOP, early onset preeclampsia; LOP, late onset preeclampsia; MAP, mean arterial pressure

The statistical tests in Table 3 revealed a significant difference in average maternal age between the EOP and LOP groups ($p < 0.05$). However, the two groups had no significant difference in body mass index and upper arm circumference ($p > 0.05$). The ANC quality categories for the study sample (Table 1) were as follows: very poor (62.5%), poor (30.4%), and adequate (5.4%).

No pregnant women were classified as having good ANC quality. A significant relationship was found between maternal age, mean arterial pressure (MAP), and ANC quality in pregnant women experiencing EOP and LOP ($p < 0.05$). Based on neonatal results (Table 3), there was a significant difference in birth weight between the LOP and EOP groups ($p < 0.05$).

Table 3. Differences in PE Risk Factors and Birth Weight between EOP and LOP

Risk Factors	EOP (N = 6)			LOP (N = 49)			p-value
	Min	Max	Mean	Min	Max	Mean	
Upper Arm Circumference	24	42	31,67	22	44	30,082	0,583
BMI (pre-pregnancy)	22	37	28,67	14	39	27,92	0,765
Age (years)	33	44	37,50	17	45	31,04	0,030*
Baby's Birth Weight (gram)	1400	2600	2080,00	1395	4920	2861,00	0,008*

*Significant < 0,05

BMI, body mass index pre-pregnancy

Discussion

Pre-eclampsia (PE) is a complex, multisystemic, pregnancy-related hypertensive disorder that can develop from 20 weeks of gestation until the postpartum period. PE is characterized by complications such as protein in the urine, impaired maternal organ function, and impaired uteroplacental function. Environmental, genetic, and maternal factors include contributing factors (Cunningham, 2022).

Globally, over 300 million women and children suffer from chronic health issues due to pre-eclampsia, including an elevated risk of cardiovascular disease and diabetes mellitus. Additionally, babies may be born prematurely, perinatal death, or have delayed intrauterine growth and development (Dimitriadis et al., 2023). Severe or long-term complications can occur when pre-eclampsia is not treated correctly and progresses to severe pre-eclampsia or eclampsia (Mou et al., 2021). This condition leads to higher mortality and morbidity rates for mothers and fetuses (Chang, Seow, & Chen, 2023).

This study examined 55 pregnant women with preeclampsia. Of these, 49 cases (89.1%) were late-onset (occurring at or after 34 weeks of gestation) and 6 cases (10.9%) were early-onset (occurring before 34 weeks of gestation). The study found that the prevalence of early-onset preeclampsia (EOP) was lower than that of late-onset preeclampsia (LOP) in Ajung District over the past five years. This finding is consistent with previous research by Rahman et al., (2024) which states that EOP has a lower prevalence than LOP.

Early-onset preeclampsia (EOP) is more commonly associated with placental dysfunction, inadequate trophoblast invasion, and inflammatory responses to infections in pregnant women (Rybak-Krzyszkowska et al., 2023). Meanwhile, late-onset preeclampsia (LOP) is more often caused by genetic, cardiovascular, and metabolic predisposing factors in the mother. These factors are associated with maternal vascular dysfunction before pregnancy and include hypertension, diabetes, and obesity. However, this is inconsistent with the results of this study, in which only 19.6% of mothers had a history of hypertension (HT), and none had a history of diabetes mellitus (DM). This discrepancy may be due to the decreased placental perfusion mechanism in PE, which triggers inflammation, an angiogenic factor imbalance, and platelet aggregation. Ultimately, this results in endothelial dysfunction. Therefore, endothelial dysfunction occurs through the PE pathophysiological mechanism and the influence of other risk factors even if the pregnant woman did not previously have a history of HT or DM (Braunthal & Brateanu, 2019).

In this study, there was no significant difference in the effect of

pre-pregnancy weight and Upper Arm Circumference on the occurrence of EOP and LOP ($p > 0.05$). This finding differs from Staff (2019) study which reported that obesity significantly affects early- and late-onset pre both -eclampsia through vascular inflammatory mechanisms. The risk of pre-eclampsia (PE) is three to four times higher for obese pregnant women than for those of normal weight (Ito et al., 2023). Therefore, measuring body mass index (BMI) and controlling weight gain in pregnant women during antenatal care (ANC) is important for preventing early- and late-onset PE. Excessive weight gain during pregnancy (gestational weight gain) can adversely affect the pregnancy (Abraham & Romani, 2022), increasing the risk of PE either independently or in combination (Ito et al., 2023).

Being pregnant at an early age (under 20 years old) or too old (over 40 years old) can also increase the risk of pre-eclampsia. Advanced maternal age (over 35 years) has also been associated with an increased risk of preeclampsia (Salam & Elawam, 2023). Of the research sample, only three participants were under 20 years old (5.5%), 36,4% were over 35 years old, while most were between 20 and 35 years old (58,2%). Statistical analysis revealed a significant difference between maternal age and the occurrence of EOP and LOP ($p < 0.05$). This finding is consistent with previous studies indicating a significant association between maternal age and the type of pre-eclampsia, where mothers under 35 years old are more likely to experience LOP than EOP (Salam & Elawam (2023), Wu, Guo, & Lu, (2023)) .

The WHO recommends several interventions to prevent preeclampsia (PE), including early and regular antenatal care (ANC) visits; counseling; monitoring of maternal nutrition; and the administration of calcium supplementation and low-dose antiplatelet therapy to pregnant women at high risk of PE (Yasin et al., 2024). However, none of the 55 pregnant women with preeclampsia in this study received ANC according to the standard of one examination in the first trimester, two in the second trimester, and three in the third trimester (Kementerian Kesehatan Republik Indonesia, 2020). Of the samples, 63.35% had very poor quality ANC, 30.9% had poor quality, and 5.5% had adequate quality. No research samples had good-quality ANC. These results differ from those of previous research, that majority of women with preeclampsia, whether early or late onset, receive complete ANC (Natasha, 2023). The number of visits determines the quality of ANC during the first to third trimesters, and by the examinations and case management provided to pregnant women during these visits. The incidence of preeclampsia (PE) is high among women who receive substandard ANC (Mou et al., 2021), due to maternal and environmental risk factors that can be mitigated with proper ANC administration (Razzak & Shivkumar, 2023). In this study, only half of the women received aspirin as preventive therapy for pre-eclampsia. Of those women, 34.5% received aspirin

therapy before 16 weeks of gestation, while 16.3% received it after this point. This suggests that case management during antenatal care (ANC) was not optimal.

This study identified two significant risk factors for preeclampsia ($p < 0.05$) affecting the quality of antenatal care (ANC): advanced maternal age and mean arterial pressure (MAP) greater than 90 mmHg. Maternal age can influence a woman's mindset and awareness of pregnancy symptoms. Women in this age group are generally not in their first pregnancy and have gained knowledge and awareness from previous ANC experiences (Mouhoumed & Mehmet (2021), Abuosi et al., (2024)). Furthermore, pregnant women over 35 are considered high risk and are more likely to seek higher-quality ANC services (Mussa et al., 2023).

Mean arterial pressure (MAP) is an important indicator of blood circulation to the brain. According to research conducted by Zhu et al. (2021) pregnant women with MAP >90 mmHg are at moderate risk for preeclampsia. The study also found an association between increased MAP and the quality of ANC received. Increased MAP is a growing concern for healthcare professionals because it prompts closer monitoring of pregnant women and the provision of preventive therapy to prevent preeclampsia as the pregnancy progresses (Mayrink et al., 2019).

This study found a significant difference in average birth weight between EOP and LOP pregnancies ($p < 0.05$), which is consistent with previous studies (Tedyanto et al., 2025). Fetal growth restriction and low placental growth factors often occur in EOP pregnancies and affect the baby's birth weight (Anna et al., 2019). Women with EOP have worse perinatal outcomes, including lower gestational age at delivery, lower birth weight, and a higher rate of C-sections (Staff, 2019). Abnormal placental factors in EOP result from poor placentation and remodeling of the superficial spiral arteries during the first half of pregnancy. This malformation produces hypersecretion of proinflammatory and antiangiogenic factors into the maternal circulation, leading to the development of preeclampsia. If present in the fetus, this pathology causes problems with the uteroplacental circulation, leading to impaired fetal growth and reduced birth weight (Tedyanto et al., 2025).

This study has two limitations. First, the study was conducted in only one health center. Second, the sample sizes differed between EOP and LOP. The results suggest that screening and management for mothers with preeclampsia risk factors could be implemented more effectively to prevent EOP and LOP. One way to reduce the incidence of EOP and LOP in the future is to improve the quality of ANC to meet standards.

Conclusion

Early-onset preeclampsia (EOP) is less prevalent than late-onset preeclampsia (LOP) at the Ajung Community Health Center. There is a significant difference in birth weight between babies of women with EOP or LOP. The age of the mother during pregnancy is also a significant factor.

Most pregnant women who experienced preeclampsia (PE), whether early or late onset, had poor antenatal care (ANC)

quality. This study sample revealed a significant correlation between maternal age, mean arterial pressure and ANC quality.

Conflict of interest

The authors declare that there are no conflicts of interest relating to this research.

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Author contributions

The first author was responsible for the study's conception, data collection and fieldwork analysis. The second authors contributed to the analysis and interpretation of the data and revised the final manuscript for publication and also gave final approval for publication.

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