Association between Preeclampsia and Preterm Labor at Raden Mattaher Jambi Hospital from 2021–2023

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Abstract
Objective: This study aims to determine the association between preeclampsia and preterm labor at Raden Mattaher Jambi Hospital.
Methods: This study uses an observational analytic method with a cross-sectional. Data collection techniques using purposive sampling. Data were obtained from the medical records of all laboring mothers who met the inclusion and exclusion criteria.
Result: There is an association between preeclampsia and preterm labor at Raden Mattaher Jambi Hospital from 2021 to 2023, with a p-value of <0.001 ($p<0.05$) and an odds ratio (OR) of 5.904. Most cases of mothers with preeclampsia occur between the ages of 20 and 35 years, with the highest education level being Senior High School. The most common employment status is unemployment, and most mothers are first-time mothers (primipara).
Conclusion: Mothers with preeclampsia had a 5.904 times greater risk of preterm labor compared to those without the condition.

Keywords: Preeclampsia, Preterm Labor, Pregnant Women, Maternal Risk, Cross-sectional.

Hubungan Preeklampsia Terhadap Persalinan Preterm di RSUD Raden Mattaher Jambi Tahun 2021−2023

Abstrak
Tujuan: Penelitian ini bertujuan untuk mengetahui hubungan preeklampsia terhadap kejadian persalinan preterm di RSUD Raden Mattaher Jambi.
Metode: Penelitian ini menggunakan metode analitik observational dengan pendekatan *cross-sectional*. Teknik pengumpulan data menggunakan *purposive sampling*. Data diperoleh dari rekam medis seluruh ibu bersalin yang memenuhi kriteria inklusi dan eksklusi.
Hasil: Terdapat hubungan preeklampsia terhadap kejadian persalinan preterm di RSUD Raden Mattaher Jambi tahun 2021 - 2023 dengan nilai p-value <0,001 ($p<0,05$) dengan OR 5,904. Kasus ibu preeklampsia sebagian besar terjadi pada usia 20 - 35 tahun, dengan pendidikan terakhir terbanyak Sekolah Menengah Atas (SMA), status pekerjaan terbanyak tidak bekerja, dan sebagian besar adalah ibu yang pertama kali bersalin (primipara).
Kesimpulan: Ibu preeklampsia berisiko 5,904 kali lebih besar mengalami persalinan preterm dibandingkan dengan ibu yang tidak mengalami preeklampsia.

Kata kunci: Preeklampsia, Persalinan Preterm, Ibu Hamil, Risiko Kehamilan, *Cross-sectional.*

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Introduction

Maternal Mortality Rate (MMR) refers to the number of deaths resulting from pregnancy, childbirth, and the postpartum period, serving as a reference to the health of women. According to UNICEF, the global MMR in 2020 was approximately 287,000, equating to 223 deaths per 100,000 live births. SP2020 Long Form data shows that the MMR in Indonesia was recorded at 189 per 100,000 live births. The Ministry of Health of the Republic of Indonesia (KEMENKES RI) reported that maternal deaths in 2022 were around 4,005, which increased to 4,129 cases in 2023. Meanwhile, infant mortality was reported at 20,882 cases in 2022, rising to 29,945 cases in 2023.[1]

According to the World Health Organization (WHO), approximately 75% of maternal deaths result from pregnancy-related hypertension, preeclampsia or eclampsia, hemorrhage, infection, prolonged labor, delivery complications, and unsafe abortion.[2] Pregnancy-related hypertension is one of the most common complications faced by pregnant women globally, with an estimated prevalence of 7-10% among all pregnancies. In 2018-2019, hypertension during pregnancy accounted for 1,066 out of 4,226 maternal deaths in Indonesia.[3] Data from the Basic Health Research (RISKESDAS) for Jambi Province in 2018 indicated that the proportion of disorders and complications in pregnant women was 19.20%, with 2.24% of pregnant women experiencing hypertension.[4]

The International Society for the Study of Hypertension in Pregnancy (ISSHP) defines preeclampsia as hypertension with a systolic pressure above 140 mmHg or a diastolic pressure above 90 mmHg based on two measurements taken 4 to 6 hours apart. This condition occurs after 20 weeks of gestation and is accompanied by proteinuria exceeding 300 mg/day. In addition to high blood pressure and proteinuria, significant findings that become clinical features include thrombocytopenia, liver dysfunction, uteroplacental dysfunction, and pulmonary edema. Preeclampsia is classified into mild and severe. Mild preeclampsia is characterized by a systolic blood pressure greater than 140 mmHg and a diastolic blood pressure greater than 90 mmHg, measured after 20 weeks of gestation, with proteinuria of at least 300 mg in 24 hours or more than +1 using a dipstick. In contrast, severe preeclampsia is identified by a systolic blood pressure exceeding 160 mmHg and a diastolic blood pressure exceeding 110 mmHg, with proteinuria greater than 2 g in 24 hours or more than +2 on a dipstick, often accompanied by cerebral or visual disorders such as headache, visual disturbances, mental disorders, and stroke. Patients with severe preeclampsia may also experience epigastric or right upper quadrant abdominal pain, as well as pulmonary edema and cyanosis.[5]

Approximately 3-5% of all pregnant women worldwide experience conditions that result in more than 60,000 maternal deaths and 500,000 fetal deaths each year. Preeclampsia and eclampsia are hypertensive disorders that pose significant risks to both the mother and fetus. Although the cause of preeclampsia in pregnant women remains uncertain, several contributing risk factors exist, such as age, parity, genetics, and socioeconomic status. According to the 2019 National Institute for Health and Care Excellence (NICE) Guidelines, individuals with a history of hypertensive disease or hereditary conditions, including chronic kidney disease, diabetes, or chronic hypertension, tend to have a higher risk of developing preeclampsia. Meanwhile, women who are primigravida, nulliparous, over 35 years old, and have a body mass index (BMI) >35 are considered to have a moderate risk of developing preeclampsia.[6,7]

According to the WHO, an estimated 13.4 million babies were born preterm in 2020. In 2019, approximately 900,000 children died

due to complications arising from preterm birth. Preterm labor is defined as labor that occurs before 37 weeks of gestation or three weeks earlier than the expected delivery date. Data from the Indonesian Ministry of Health indicate that infant mortality in Indonesia is 17 per 1,000 live births. Indonesia ranks fifth in preterm birth rates, with a significant number of 675,700 cases annually. The proportion of pregnant women who experienced preterm labor, according to the Jambi Province Riskesdas in 2018, was 24.05%. Several factors contribute to this situation, including a history of previous preterm births, carrying twins, uterine or placental abnormalities, a history of recurrent miscarriages, and many instances caused by hypertension during pregnancy.[8]

Research by Eliza et al. (2017) found an association between pregnancy complications, specifically preeclampsia or eclampsia, and preterm labor. Preeclampsia in the mother can lead to preterm birth, oliguria, and even death. For the baby, the impacts include stunted fetal growth, oligohydramnios, and an increased risk of morbidity and mortality. Additionally, another study by Nopalia P et al. (2023) found a similar association between preeclampsia and preterm labor, reporting an odds ratio of 1.893, indicating that mothers with preeclampsia face a 1.8 times higher risk of preterm labor.[9,10]

Raden Mattaher Jambi Hospital is a teaching hospital and the main referral hospital in Jambi Province, which handles various health issues. According to similar research conducted at the Faculty of Medicine and Health Sciences, Jambi University, 121 cases of preeclampsia were recorded at Raden Mattaher Jambi Hospital from 2019 to 2022.[11]. Additionally, the initial data survey of medical records from 2021 to 2023 indicated that out of a total of 1900 mothers giving birth, there were 320 cases of preeclampsia. In 2021, preeclampsia cases were 81, which increased to 96 cases in 2023 and escalated to 143 cases in 2023. This study aimed to determine whether there is a relationship between preeclampsia and the incidence of preterm labor at Raden Mattaher Jambi Hospital from 2021 to 2023.

Method

This study uses an observational analytic method with a retrospective cross-sectional design with a purposive sampling technique and secondary data in the form of medical records. The study population comprised all mothers who gave birth at Raden Mattaher Jambi Hospital from 2021 to 2023 and met the inclusion and exclusion criteria. The inclusion criteria were laboring mothers diagnosed with either preeclampsia or without preeclampsia, provided they had complete medical records. The exclusion criteria included mothers with premature rupture of membranes (KPD), those with a history of previous preterm labor, and those with chronic diseases (such as anemia, chronic kidney disease, congenital heart disease, autoimmune diseases, diabetes mellitus, or chronic hypertension). Data were analyzed using univariate and bivariate methods to determine the relationship between preeclampsia and the incidence of preterm labor, employing the Chi-Square test.

Result

This study uses a purposive sampling technique to sample all mothers giving birth at Raden Mattaher Jambi Hospital from 2021 to 2023. During the study, 247 samples were collected, including 110 preeclamptic mothers and 137 non-preeclamptic mothers.

Table 1 shows that the predominant age range among mothers with preeclampsia is 20-35 years with 71 (28.7%) individuals. The highest level of education among mothers with preeclampsia is high school, with as many as 42 (17%) individuals. The most common occupation of preeclampsia mothers is being

Univariate Analysis

Table 1 Characteristics of Preeclampsia Mothers at Raden Mattaher Jambi Hospital in 2021-2023

Variable	Preeclampsia		Not Preeclampsia	
	f	%	*f*	%
Age				
<20 Years	5	2	17	6.9
20-35 Years	**71**	28.7	99	40.1
>35 Years	34	13.8	21	8.5
Education				
Not in School	19	7.7	20	8.1
Elementary School	9	3.6	19	7.7
Junior High School	24	9.4	17	6.9
Senior High School	**42**	17	55	22.3
University	16	6.5	26	42
Job				
Work	27	10.9	22	8.9
No Work	**83**	33.6	115	46.6
Parity				
Primiparous	**68**	27.5	92	37.2
Multiparous	40	16.2	43	17.4
Grandemultiparous	2	0.8	2	0.8

Bivariate Analysis

Table 2. Association between Preeclampsia and Preterm Labor at Raden Mattaher Jambi Hospital from 2021 to 2023

Maternal pregnancy status	Incidence of Labor				Total		P *value*	OR (95% CI)
	Preterm		Aterm					
	f	%	*f*	%	*f*	%		
Preeclampsia	**81**	73.6	29	26.4	110	100	**<0.001**	**5,904** (3,388-10,288)
Not Preeclampsia	44	32.1	93	67.9	137	100		
Total	125	50.6	123	49.4	247	100		

unemployed, accounting for 83 (33.6%) individuals. Most mothers with preeclampsia are first-time mothers (primiparous), totaling 68 (27.5%) individuals.

Table 2 shows the bivariate analysis results using the chi-square test, yielding a p-value of less than 0.001. These findings indicate a significant relationship between preeclampsia and preterm labor. Mothers with preeclampsia are 5.904 times more likely to experience preterm labor compared to those without preeclampsia.

Discussion

Based on the research conducted, the majority of mothers experience preeclampsia between the ages of 20 and 35 years, specifically 71 (28.7%), followed by 34 mothers over the age of 35 and 5 mothers under 20 years of age. This aligns with the research by Khoiriyah U et al. at RSI Muhammadiyah Sumberejo, Bojonegoro Regency (2021), which found that the majority of mothers with preeclampsia were aged 20-35, comprising 43 out of 57 total samples.[12] This finding is supported by research conducted by Izza N et al. at the Jambi City Health Center (2022), which reported 32 mothers aged 20-35, representing 65.3% of the sample.[13]

The research results are not in line with Novianti H's study at Sidoarjo Regional Hospital (2015), which shows that the majority of mothers experiencing preeclampsia are under 20 years or over 35 years old, totaling 34 (73.9%) individuals.[14] Based on the theory that age is a risk factor for preeclampsia, our findings show a lack of alignment. Age closely relates to changes in body functions that can impact a person's health status. The ideal age range for pregnancy is between 20 and 35 years. Within this range, the mother's body is in optimal condition to support pregnancy and childbirth, reducing the risk of complications.

Conversely, pregnancy at under 20 years old or over 35 years old is regarded as a high-risk age for pregnancy complications. Pregnant women under 20 years have a heightened risk of developing preeclampsia, as their uterus is not yet fully mature enough to support pregnancy, which can result in various pregnancy disorders. Meanwhile, pregnant women over 35 years face a significant risk due to degenerative processes that induce structural and functional changes in the blood vessels. These conditions contribute to increased blood pressure, making women more susceptible to preeclampsia.[15,16] The discrepancy between the study results and the theory may occur because the population of mothers giving birth at Raden Mattaher Hospital from 2021 to 2023 is predominantly aged 20-35.

Research indicates that the majority of mothers experiencing preeclampsia have completed their education at the high school level (SMA), with 42 individuals accounting for 17%. These findings align with the study by Trisetyaningsih Y et al. (2018), which revealed that Senior High School (SMA) is the highest level of education for preeclamptic mothers, totaling 24 individuals (49%). In addition, research conducted by Kasriatun et al. in Pati, Central Java, found that 81 high school graduates (50.6%) represented the majority of mothers who experienced preeclampsia.[18]

A low level of education or lack of schooling can influence a person's response to and management of preeclampsia. This relates to the mother's comprehension of the condition. Mothers with higher education tend to have a better understanding of the symptoms, risks, and prevention of preeclampsia compared to those with lower education. Typically, mothers with lower education do not maintain a healthy lifestyle, which may increase the risk of preeclampsia.

In theory, a lack of knowledge about health leads to maternal ignorance regarding

the importance of examining and preventing preeclampsia. Education is a process of behavioral change toward the maturity and perfection of human life through personality enhancement. The results indicated that mothers with high and low education levels have the same possibility of developing preeclampsia.[19]

The research results indicate that most mothers with preeclampsia are unemployed, with 83 individuals representing 33.6% of a total of 110. This is in line with a study conducted by Darmadi (2018) at M. Djamil Padang Hospital, which revealed that among 45 preeclamptic mothers, 31 (68.9%) were non-working mothers or housewives.[20] Research by Trisetyaningsih Y et al. (2018) also showed that the employment status of preeclamptic mothers was predominantly non-working, with 20 individuals (40.8%) out of 49 mothers.[17]

According to Nurwijayati E (2019), working mothers who face physical and psychological burdens have a higher risk of developing preeclampsia. Activities both inside and outside the home increase mental strain and can lead to stress, which may trigger excessive heart activity, resulting in increased blood pressure in the mother. Work-related stress affects the body's systems by activating the hypothalamus, prompting the release of hormones such as adrenaline, norepinephrine, and cortisol. As a stress hormone, cortisol elevates blood pressure and affects blood vessels, increasing the risk of preeclampsia.

There are two factors causing stress in mothers: internal and external factors. Internal factors come from the mother, such as psychological burdens, which can affect fetal development according to the level of stress she experiences. Meanwhile, external factors include pressures from outside sources, such as financial problems, family conflicts, arguments with partners, or pressures from social and work environments. Both of these factors significantly contribute to the level of stress that pregnant women feel.[2]

Research shows that most mothers with preeclampsia are first-time mothers (primipara), comprising as many as 68 (27.5%) individuals. These findings are in line with Denantika O *et al*. (2015) at Dr. M. Djamil Padang Hospital, reposting that most mothers with preeclampsia were first-time mothers (primigravida), totaling 38 (46.9%) out of 63 individuals.[22]

In theory, a primigravida has a greater risk of preeclampsia during pregnancy compared to a multigravida because they are exposed to chorionic villi for the first time or to a significantly larger number of chorionic villi. The body's immune response to placental antigens is not yet optimal since the process of blocking antibody formation by HLA-G (Human Leukocyte Antigen G) is still imperfect. This disrupts the trophoblast implantation process in the maternal decidual tissue. Furthermore, primigravida women are more prone to stress due to anxiety about the labor process. This stress triggers the release of the hormone cortisol, which can increase the activity of the sympathetic nervous system. Consequently, there is an increase in cardiac output and blood pressure; these combined immunological and stress factors explain the high susceptibility of primigravida to preeclampsia.[16]

The research conducted indicates a significant association between preeclampsia and preterm labor, with a p-value of less than 0.001. Mothers with preeclampsia have a 5.904-fold increased risk of experiencing preterm labor compared to those who do not have the condition. This study's findings are in line with several other studies on the subject. According to research by Emma L. Davies et al. (2016), which utilized the Chi-Square statistical test, 18.5% of preeclamptic mothers experienced preterm labor. Furthermore, mothers with preeclampsia have a 4.43 times higher likelihood of experiencing preterm

labor than those without it.[23]

In theory, pregnant women with hypertension typically experience only partial or no trophoblastic invasion, resulting in the degeneration of the muscle layer. This degeneration causes stiffness and hampers the ability to distend and vasodilate the vessel wall of the spiral artery. A lack of oxygen and obstruction of blood flow to the fetus leads to failure in spiral artery remodeling due to hypoxia and ischemia in the placenta, which may contribute to premature birth.[24] Another theory regarding preeclampsia and its association with preterm labor involves maternal stress that activates the hypothalamic-pituitary-adrenal axis (HPA axis) and the sympathetic-adrenal medulla nervous system. This activation increases the production of several hormones, including corticotropin-releasing hormone (CRH), adrenocorticotropic hormone (ACTH), norepinephrine, and cortisol in pregnant women.

Stimulus from cortisol increases the production of placental CRH (pCRH), with levels rising continuously until the age of 18 to 20 weeks. pCRH enters fetal circulation, stimulating the activity of the hypothalamic-pituitary-adrenal axis (HPA axis), which leads to enhanced production and secretion of ACTH, cortisol, and androgen dehydro-epiandrosterone sulfate (DHEA-S). Under stressful conditions, pCRH promotes the activity of oxytocin and prostaglandins, which enhance myometrial contractions and stimulate labor. Additionally, increased cortisol accelerates the maturation of neuromuscular and pulmonary organs, while increased DHEA-S levels promote birth and may cause premature labor.[25]

Conclusion

Most cases of preeclampsia occur in mothers aged 20 to 35 years, with an education background of Senior High School. The most common employment status is being unemployed; most are first-time mothers (primiparous).

There is a significant association between preeclampsia and preterm labor; mothers with preeclampsia face a 5.904-fold increased risk of experiencing preterm labor compared to those without preeclampsia.

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