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EXPLORING THE ASSOCIATION BETWEEN PREGNANCY SPACING, HISTORY OF DIABETES MELLITUS, AND OBESITY WITH THE INCIDENCE OF PREECLAMPSIA AT BULELENG DISTRICT HOSPITAL, BALI

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Abstract

Preeclampsia is a pregnancy complication that remains a major cause of maternal and infant morbidity and mortality; identifying risk factors that contribute to its occurrence is necessary. This study is novel in that it simultaneously analyzes the relationships among pregnancy spacing, diabetes mellitus, and obesity and the incidence of preeclampsia, and finds an opposite direction of the obesity relationship compared with most previous studies. This study aims to analyze the relationship between pregnancy spacing, diabetes mellitus, and obesity with the incidence of preeclampsia in pregnant and maternity mothers at Buleleng District Hospital. The Research method used is an observational-analytic case-control design, using medical record data for the period 2023–2024, with a sample size of 130 respondents: 65 preeclampsia cases and 65 controls without preeclampsia. Data analysis was performed univariately and bivariately using Fisher's Exact Test and Chi-Square with a significance level of P-value < 0.05. The results showed that pregnancy spacing was significantly associated with preeclampsia incidence (P-value = 0.000), whereas diabetes mellitus was not (P-value = 0.492). Obesity showed a significant association with the incidence of preeclampsia, with an inverse relationship (P-value = 0.000). The conclusion of this study is that pregnancy spacing is a major risk factor for preeclampsia, while diabetes mellitus was not significantly associated, and obesity showed a significant inverse relationship; thus, regulating pregnancy spacing is an important strategy in efforts to prevent preeclampsia

Keywords: Diabetes mellitus; Obesity; Preeclampsia; Pregnancy spacing.

INTRODUCTION

Preeclampsia is a pregnancy complication that significantly contributes to high maternal morbidity and mortality rates worldwide. This condition is characterized by hypertension after 20 weeks of gestation, accompanied by proteinuria or target organ dysfunction, and remains a major challenge in maternal health care (1,2). The World Health Organization (WHO) reports that globally, there are approximately 2.8–11.2 million cases of preeclampsia each year. In Indonesia, preeclampsia ranks first as a cause of maternal death, accounting for approximately 33% of deaths, indicating that this problem remains a serious public health issue (3,4).

In Bali Province, particularly Buleleng Regency, the incidence of preeclampsia remains quite high and is a leading cause of obstetric referrals. Data from the Bali Provincial Health Office in 2023 showed hundreds of cases of preeclampsia, with Buleleng Regency contributing

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significantly. Preeclampsia not only increases the risk of serious complications in the mother, such as kidney failure, pulmonary edema, and preterm labor, but also impacts the fetus in the form of intrauterine growth restriction, oligohydramnios, and an increased risk of perinatal morbidity and mortality. Furthermore, preeclampsia has long-term implications for maternal health, as a history of preeclampsia is known to increase the risk of cardiovascular disease later in life, including chronic hypertension, heart disease, and stroke (5)(6).

Various risk factors are known to play a role in the development of preeclampsia, both internal and external. Internal factors frequently associated with preeclampsia include pregnancy spacing, a history of diabetes mellitus, and obesity (7). Non-ideal spacing of pregnancies, whether too close or too far apart, can disrupt the mother's physiological recovery. Pregnancy with too short an interval can occur when the mother's biological reserves have not yet recovered optimally. At the same time, pregnancy with too long an interval can cause the mother's immunological condition to revert to that of the first pregnancy, which puts the risk of placental disorders. Several studies have reported a link between pregnancy spacing and the incidence of preeclampsia, although the results obtained still show variation (8,9).

Diabetes mellitus during pregnancy, whether pre-existing or presenting as gestational diabetes, is also associated with an increased risk of preeclampsia. Chronic hyperglycemia and insulin resistance can trigger oxidative stress, systemic inflammation, and endothelial dysfunction, which play a role in the pathogenesis of preeclampsia (10). However, several studies have shown that optimal blood glucose control and proper pregnancy monitoring can reduce the risk of preeclampsia. These differing findings indicate that the role of diabetes mellitus in the incidence of preeclampsia requires further study, particularly in the context of different healthcare settings (11).

Obesity is also a significant risk factor, its prevalence continuing to rise and significantly impacting maternal health. Obesity is associated with increased systemic inflammation, impaired lipid metabolism, and insulin resistance, which can impair

trophoblast invasion and spiral artery remodeling. These disturbances lead to suboptimal uteroplacental perfusion and contribute to the endothelial dysfunction characteristic of preeclampsia (12).

Based on a preliminary survey conducted by the author at Buleleng District Hospital, which reviewed the medical records of pregnant and childbirth women for the period 2023–2024, it was found that preeclampsia remains one of the most common diagnoses in obstetric cases treated and referred. The initial survey revealed that several pregnant women with preeclampsia had non-ideal pregnancy spacing, a history of diabetes mellitus, and obesity. These findings indicate that these three factors have the potential to contribute to the occurrence of preeclampsia at Buleleng District Hospital and have not been fully evaluated comprehensively in a single analytical study.

Therefore, it is crucial to examine factors associated with the incidence of preeclampsia, particularly pregnancy spacing, a history of diabetes mellitus, and obesity. This study was conducted at Buleleng Regency Hospital, a referral hospital in North Bali, to analyze the relationship between these three factors and the incidence of preeclampsia. The results are expected to serve as a basis for strengthening preeclampsia screening, prevention, and management strategies, as well as contributing to efforts to reduce maternal and infant morbidity and mortality.

RESEARCH METHOD

This study is an observational analytical case-control study conducted at Buleleng District Hospital, using medical records of pregnant and childbirth women for the period 2023–2024. The sample comprised 130 respondents: 65 cases of pregnant and childbirth women with preeclampsia and 65 controls without preeclampsia, selected using a purposive sampling technique based on inclusion and exclusion criteria. The dependent variable was the incidence of preeclampsia, while the independent variables included pregnancy spacing, history of diabetes mellitus, and obesity. Data were collected using observation sheets, then analyzed univariately and bivariately using the Chi-square test and Fisher's Exact test to assess relationships between variables, with $p < 0.05$ as the level of statistical significance and

the magnitude of risk expressed as an Odds Ratio (OR) with a 95% confidence interval. This Research has obtained ethical clearance from the Medical and Health Research Ethics Committee of the Faculty of Medicine, Al-Azhar Islamic University, Mataram (No. 107/EC-01/FK-06/UNIZAR/VIII/2025).

RESULTS AND DISCUSSION

Results

Table 1. Univariate Analysis Results

Variable	Frequency	
	n	%
Preeclampsia		
High-risk	65	50.0
Not risky	65	50.0
Total	130	100.0
Pregnancy spacing		
High-risk	53	40.8
Low-risk	77	59.3
Total	130	100.0
Diabetes Mellitus		
Diabetes mellitus	9	6.9
Non-diabetic	121	93.1
Total	130	100.0
Obesity		
Obesity	75	57.7
Non-obese	55	42.3
Total	130	100.0

Sources: Secondary Data, 2023-2024

Based on Table 1, of the 130 pregnant and postpartum women studied, 65 respondents (50.0%) were included in the high-risk and non-risk groups for preeclampsia. Fifty-three respondents (40.8%) had a high-risk pregnancy interval, while 77 respondents (59.3%) were in the low-risk category. Most respondents (121, 93.1%) had no history of diabetes mellitus, while 9 (6.9%) had a history of diabetes mellitus. Furthermore, 75 respondents (57.7%) were obese, while 55 (42.3%) were not.

Table 2. Bivariate Analysis Results

Variable	Preeclampsia				Total		P-value	OR	95% CI
	High-risk		Not risk						
	n	%	n	%	n	%			
Pregnancy spacing									
High-risk	48	90,6	5	9,4	53	100	0,000	33.882	11.658-98.476
Low-risk	17	22,1	60	77,9	77	100			
Total	65	50,0	65	50,0	130	100			

Variable	Preeclampsia				Total		P-value	OR	95% CI
	High-risk		Not risk						
	n	%	n	%	n	%			
Diabetes Mellitus									
Diabetes mellitus	6	66,7	3	33,3	9	100	0,492	2.102	0.502-8.791
Non-diabetic	59	48,8	62	51,2	121	10			
Total	65	50,0	65	50,0	130	100			
Obesity									
Obesity	22	29,3	53	70,7	75	100	0,000	0,116	0.052-0.260
Non-obese	43	78,2	12	21,8	55	100			
Total	65	50,0	65	50,0	130	100			

Sources: Secondary Data, 2023-2024

The results of the bivariate analysis showed that pregnancy spacing was associated with preeclampsia incidence, with a higher proportion of cases in mothers with high-risk pregnancy spacing compared to low-risk categories. In the diabetes mellitus variable, the incidence of preeclampsia was found to be more common in mothers with diabetes mellitus compared to those without diabetes mellitus. However, this difference did not show a clear trend. Meanwhile, in the obesity variable, the incidence of preeclampsia was found to be more common in pregnant women without obesity compared to pregnant women with obesity, indicating a difference in the distribution of preeclampsia incidence between the two groups.

Statistical tests using Chi Square on the variables of pregnancy spacing and history of diabetes mellitus, as well as the Fisher's Exact Test on the obesity variable showed that pregnancy spacing had a significant relationship with the incidence of preeclampsia ($p = 0.000$; $p < 0.05$) with an Odds Ratio (OR) value of 33.882 and a 95% Confidence Interval (CI) of 11.658–98.476, which indicates that mothers with high-risk pregnancy spacing have a greater chance of experiencing preeclampsia. The diabetes mellitus variable did not show a significant relationship with preeclampsia incidence ($p = 0.492$; $p > 0.05$), with an OR of 2.102 and a 95% CI of 0.502–8.791, indicating no statistical significance. Meanwhile, obesity showed a significant association with preeclampsia incidence ($p = 0.000$; $p < 0.05$), with an OR of 0.116 (95% CI: 0.052–0.260), indicating an inverse association between obesity and preeclampsia.

Discussion

The Relationship Between Pregnancy Spacing and the Incidence of Preeclampsia in Pregnant and Childbearing Women

The results of this study indicate that pregnancy spacing is significantly associated with the incidence of preeclampsia in pregnant women. Women with high-risk pregnancy spacing have a significantly greater chance of developing preeclampsia compared to those with low-risk pregnancy spacing. These findings confirm that pregnancy spacing is a significant risk factor for preeclampsia and requires attention in maternal health services.

Pathophysiologically, a too-short pregnancy interval can prevent the mother's body from fully recovering from the previous pregnancy, including vascular adaptation, nutrient reserves, and endothelial function, all of which are crucial for maintaining optimal placental perfusion. An imbalance in these processes can increase the risk of endothelial dysfunction, a mechanism involved in the pathogenesis of preeclampsia. Conversely, too long a pregnancy interval is also associated with an increased immunological response similar to that of primigravidas, which, under certain conditions, can affect implantation and placental development, thereby increasing the risk of preeclampsia (13).

In the context of healthcare, these findings underscore the importance of spacing pregnancies through family planning education and preconception counseling. Effective education can help couples of childbearing age plan pregnancies with an ideal interval, generally recommended at least two years between births and subsequent pregnancies, to minimize the risk of complications such as preeclampsia. This strategy aligns with a promotive and preventive approach in antenatal care to reduce maternal morbidity and mortality.

This study is in line with the study conducted by Wahyuni et al. (2023) at H. Abdul Manap Regional General Hospital, Jambi City, which found that pregnancy spacing was significantly associated with the incidence of preeclampsia ($p = 0.005$), indicating that pregnancy spacing needs to be taken into consideration in screening for

the risk of preeclampsia in pregnant women (14). In addition, research by Juniarty & Mandasari (2023) found a significant relationship between pregnancy spacing and the incidence of preeclampsia in mothers giving birth at Prabumulih City Hospital with a P-value of 0.000 (15).

The findings of this study are generally consistent with previous research conducted in Indonesian and Southeast Asian populations, although important differences were observed, particularly regarding the role of obesity. The significant association between pregnancy spacing and preeclampsia identified in this study is consistent with multiple studies conducted in Indonesia. Several hospital-based studies have demonstrated that non-optimal interpregnancy intervals significantly increase the risk of preeclampsia, suggesting that inadequate maternal physiological recovery and altered immunological adaptation may contribute to placental dysfunction. These findings indicate that pregnancy spacing is a consistently recognized determinant of preeclampsia risk across different Indonesian populations and healthcare settings.

In contrast, the absence of a statistically significant association between diabetes mellitus and preeclampsia in this study reflects the variability reported in Southeast Asian populations. Although diabetes mellitus is widely recognized as a biological risk factor for hypertensive disorders of pregnancy, its observed effect appears to vary depending on glycemic control, disease severity, screening protocols, and clinical management. Hospital-based studies with relatively small numbers of diabetic pregnancies often report inconsistent findings, suggesting that the relationship may be context-dependent rather than universally uniform.

The most notable difference between this study and previous regional research concerns obesity. Most studies conducted in Indonesia and Southeast Asia report obesity as a significant risk factor for preeclampsia, consistent with established pathophysiological mechanisms involving systemic inflammation, endothelial dysfunction, and impaired placental

perfusion. However, this study found an inverse association, with a lower incidence of preeclampsia among obese women.

Several factors may explain this discrepancy. Differences in sample characteristics, obesity classification methods, and retrospective data sources may influence the observed relationship. Additionally, obese pregnant women may receive closer clinical monitoring, earlier risk detection, and more intensive antenatal management, which could reduce the likelihood of documented preeclampsia. Residual confounding, selection bias, and misclassification of obesity severity may also contribute to the observed protective association.

Overall, while the findings regarding pregnancy spacing are consistent with existing regional evidence and the results for diabetes mellitus reflect previously reported variability, the inverse association between obesity and preeclampsia differs from most Indonesian and Southeast Asian studies. This highlights the importance of considering population-specific characteristics, clinical practices, and methodological factors when interpreting risk patterns in maternal health research.

The Relationship Between Diabetes Mellitus and the Incidence of Preeclampsia in Pregnant and Childbearing Women

The results of the study showed that diabetes mellitus did not have a significant relationship with the incidence of preeclampsia in pregnant women. This was demonstrated by the bivariate analysis, which showed a P-value > 0.05, indicating no statistically significant relationship between diabetes mellitus and preeclampsia. Although the Odds Ratio (OR) indicates that pregnant women with diabetes mellitus are more likely to experience preeclampsia than women without diabetes mellitus, the Confidence Interval (CI) range that crosses 1 indicates that the relationship is not statistically significant.

Theoretically, diabetes mellitus is known to increase the risk of preeclampsia through mechanisms such as chronic hyperglycemia, insulin resistance, oxidative stress, and endothelial dysfunction, which contribute to impaired placental perfusion.

These conditions can trigger hypertension and target organ damage during pregnancy. However, in this study, this association was not significantly demonstrated. This may be due to the relatively small number of pregnant women with diabetes compared to those without diabetes, thus limiting the statistical power to detect an association (16).

Furthermore, the insignificant association between diabetes mellitus and preeclampsia in this study may also be influenced by blood glucose control during pregnancy. Pregnant women with diabetes mellitus who receive proper pregnancy monitoring and glycemic management have a lower risk of complications, including preeclampsia. Optimal medical intervention at Buleleng District Hospital may play a role in reducing the risk of preeclampsia in pregnant women with diabetes mellitus (17).

These results are supported by previous research conducted by Noor et al. (2024) at Siti Khadijah 1 Makassar Women's and Children's Hospital, which stated that there was no relationship between a history of diabetes mellitus and the incidence of preeclampsia in pregnant women (18).

Although most of the literature identifies obesity as an important risk factor for preeclampsia, this study found an inverse association between obesity and the incidence of preeclampsia. This finding should be interpreted with caution and does not necessarily indicate a biological protective effect of obesity against preeclampsia.

One possible explanation relates to clinical factors and pregnancy management. Obese pregnant women are commonly classified as a high-risk group and therefore tend to receive more intensive antenatal monitoring, including earlier risk screening, closer blood pressure surveillance, and more timely clinical interventions. Such enhanced monitoring may influence the occurrence or documentation of preeclampsia in medical records.

Methodological factors may also have contributed to the observed association. The retrospective use of medical records may lead to misclassification of obesity status, particularly if body mass index was

recorded inconsistently or not categorized according to severity. Selection bias in a referral hospital setting, as well as residual confounding from unmeasured factors such as individual metabolic profile, gestational weight gain, socioeconomic status, or quality of antenatal care, may also influence the results.

Considering these factors, the inverse association observed in this study is more likely to reflect clinical context and methodological influences rather than a direct protective effect of obesity on preeclampsia. Therefore, this finding should be confirmed through prospective studies with standardized obesity measurements and more comprehensive control of potential confounding variables.

The Relationship Between Obesity and the Incidence of Preeclampsia in Pregnant and Childbearing Women

The results of this study indicate a significant association between obesity and the incidence of preeclampsia in pregnant women. However, the direction of the association was inverse, with the incidence of preeclampsia being lower in the obese group compared to the non-obese group. This is demonstrated by the bivariate analysis, with a P-value of <0.05 and an Odds Ratio (OR) of <1, indicating that obesity in this study acted as a protective factor against preeclampsia.

Theoretically, these results differ from the majority of the literature that states that obesity is a risk factor for preeclampsia. Obesity is generally associated with increased systemic inflammation, insulin resistance, endothelial dysfunction, and impaired lipid metabolism, which can affect trophoblast invasion and spiral artery remodeling, thereby increasing the risk of impaired uteroplacental perfusion and preeclampsia. Therefore, the finding of an inverse association in this study warrants critical examination, given the study population's context and characteristics (19).

One possible explanation for these findings is the differences in clinical characteristics and pregnancy management of obese pregnant women. Obese pregnant women tend to receive more intensive pregnancy monitoring, including risk factor screening and closer blood pressure monitoring. Early detection and faster

intervention in this group could potentially reduce the incidence of severe preeclampsia documented in medical records. Furthermore, the possibility that obesity classification based on secondary data from medical records without considering the degree of obesity could also Influence the study results (20).

In the context of healthcare services at Buleleng District Hospital, these results demonstrate that obesity in pregnant women cannot be viewed as the sole risk factor for preeclampsia. A comprehensive risk screening approach requires consideration of a combination of factors, including pregnancy spacing, a history of comorbidities, and routine blood pressure monitoring. These findings also emphasize the importance of individualized risk assessment for each pregnant woman, rather than solely on obesity status.

A retrospective study at Dr. M. Djamil Padang General Hospital, conducted by Rahmayanti & Zahra (2025), reported a significant association between obesity and preeclampsia incidence in pregnant women ($p = 0.000$), indicating that obesity increases the risk of preeclampsia in referral hospital settings (21).

CONCLUSION AND RECOMMENDATION

The incidence of preeclampsia was significantly influenced by pregnancy spacing, with non-optimal intervals increasing risk, while diabetes mellitus showed no significant association and obesity demonstrated an inverse relationship, where obese pregnant women had a lower incidence compared to non-obese women. These findings highlight the importance of incorporating interpregnancy interval into early risk screening during antenatal care, as women with inadequate spacing may require closer monitoring for blood pressure changes and early signs of hypertensive disorders. Although diabetes mellitus was not significantly associated in this study, it remains clinically important and should continue to be routinely screened and managed due to its known impact on pregnancy outcomes. The unexpected inverse association with obesity warrants cautious interpretation, emphasizing that obesity should not be excluded from risk assessment but instead managed through comprehensive

and individualized evaluation. Overall, these results support a risk-based antenatal care approach that integrates reproductive history, metabolic conditions, and clinical monitoring to enhance early detection and management of preeclampsia.

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