

The Relationship Between Pre-Pregnancy Body Mass Index and the Incidence of Preeclampsia in Primigravida at Cibabat Regional Hospital

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Abstract

Objective: This study investigates the association between pre-pregnancy body mass index (BMI) and the incidence of preeclampsia in primigravida women.

Methods: This cross-sectional study includes women who delivered at Cibabat General Hospital between 2023 and 2024. Pre-pregnancy BMI (kg/m²) was classified according to WHO categories: underweight (less than 18.5), normal (18.5 – 22.9), overweight (23.0 – 24.9), obese class I (25.0 – 29.9), and obese class II (≥ 30.0). The Spearman-Rho correlation coefficient was employed to analyze the relationship between pre-pregnancy BMI and the incidence of preeclampsia.

Result: Our study demonstrated that, among 217 participants, 159 (73.3%) experienced preeclampsia. The proportion of women with an overweight/obese BMI who have preeclampsia is higher (36%-38%) compared to those with normal BMI (19%) and underweight BMI (15%). The Spearman-Rho correlation coefficient suggested a positive correlation between pre-pregnancy BMI and the incidence of preeclampsia ($r = 0.367$; $p < 0.001$), indicating that an increased BMI is statistically associated with an increased risk of preeclampsia.

Conclusion: A BMI is associated with an increased risk of preeclampsia in primigravida women.

Key words: Body mass index; Preconception Education; Primigravida

Hubungan antara Indeks Massa Tubuh Sebelum Kehamilan terhadap Kejadian Preeklamsia pada Ibu Primigravida di RSUD Cibabat

Abstrak

Tujuan: Penelitian ini bertujuan untuk menilai hubungan antara IMT pra-kehamilan dan insiden preeklamsia pada ibu primigravida.

Metode: Penelitian ini menggunakan desain penelitian potong lintang dan melibatkan ibu primigravida yang menjalani persalinan di RSUD Cibabat pada periode 2023 hingga 2024. IMT partisipan sebelum kehamilan dikategorikan berdasarkan standar WHO: berat badan kurang (< 18.5), normal (18.5 – 22.9), berat badan berlebih (23.0 – 24.9), obesitas tipe 1 (25.0 – 29.9), dan obesitas tipe 2 (≥ 30.0). Data kemudian dianalisis lebih lanjut menggunakan metode *spearman-rho correlation coefficient* untuk menentukan korelasi antara IMT pra kehamilan dan kejadian preeklamsia.

Hasil: Hasil penelitian menunjukkan, dari 217 partisipan pada penelitian ini, 73,3% diantaranya mengalami kejadian preeklamsia. Proporsi preeklamsia tampak lebih tinggi pada partisipan dengan berat badan berlebih/obesitas (36–38%) dibandingkan dengan partisipan dengan IMT normal (19%) dan IMT kurang berat badan (15%). Hasil uji *spearman-Rho correlation coefficient* menunjukkan korelasi positif antara IMT pra-kehamilan dan kejadian preeklamsia ($r = 0,367$; $p < 0,001$), mengindikasikan peningkatan IMT sebelum kehamilan berhubungan dengan risiko preeklamsia.

Kesimpulan: Peningkatan IMT pra-kehamilan berhubungan dengan peningkatan risiko preeklamsia pada wanita primigravida.

Kata kunci: Edukasi prakonsepsi; Indeks massa tubuh; Primigravida

Introduction

Preeclampsia is a pregnancy-specific hypertensive disorder that typically occurs after 20 weeks of gestation, characterized by new-onset hypertension accompanied by proteinuria or signs of organ dysfunction.¹ It remains a significant cause of maternal and perinatal morbidity and mortality, particularly in developing countries. Globally, preeclampsia affects approximately 2–8% of pregnancies. In Indonesia, it is one of the leading causes of maternal death, accounting for 33% of maternal mortality. In 2023, the country reported a maternal mortality rate of 189 per 100,000 live births.^{2,3}

The risk factors for preeclampsia are multifactorial. Nulliparity (primigravida) is a well-established risk factor, likely due to a lack of immunological adaptation to paternal antigens. A high pre-pregnancy body mass index (BMI) is another significant contributor.^{2,4} A study by Sun et al. reported that overweight and obese women had a three- to fourfold increased risk of developing preeclampsia compared to women with a normal BMI.⁵

Several biological mechanisms have been proposed to explain this association, including chronic inflammation, oxidative stress, insulin resistance, and endothelial dysfunction—all of which impair placental vascular function.^{4,5} These findings support the hypothesis that elevated pre-pregnancy BMI significantly increases the risk of preeclampsia. A meta-analysis by Ulhaq et al. further supports this association, indicating that the odds of developing preeclampsia are nearly five times higher among overweight and obese women.⁶

As a referral hospital in West Java, RSUD Cibabat manages many high-risk obstetric cases. The increasing trend of obesity among women of reproductive age emphasizes the need to analyze the association between BMI and preeclampsia. Therefore, our study

aims to explore the relationship between pre-pregnancy BMI and preeclampsia at RSUD Cibabat during 2023–2024. The results could support early risk screening and prevention efforts through preconception weight management.

Method

A cross-sectional study was performed among all primigravida women who delivered at RSUD Cibabat between 2023 and 2024. Inclusion criteria included: (1) gestational age ≥ 20 weeks, (2) available data on pre-pregnancy height and weight for BMI calculation, and (3) complete medical records. Women with chronic hypertension, pregestational diabetes, other comorbidities affecting blood pressure, or incomplete data were excluded from the study. The sample size was calculated using Slovin's formula, which indicated a minimum of 202 participants. After applying the inclusion and exclusion criteria, 217 eligible participants were included in the final analysis, surpassing the minimum sample size.

The primary independent variable was pre-pregnancy BMI, calculated as weight (kg) divided by height squared (m^2) and categorized according to WHO Asia-Pacific criteria⁷: underweight (< 18.5 kg/ m^2), normal weight (18.5–22.9 kg/ m^2), overweight (23.0–24.9 kg/ m^2), obese class I (25.0–29.9 kg/ m^2), and obese class II (≥ 30.0 kg/ m^2). The dependent variable was the occurrence of preeclampsia, defined according to the criteria established by the American College of Obstetricians and Gynecologists (ACOG)¹ and confirmed by an obstetrician-gynecologist. Data were obtained from secondary sources, specifically patient medical records at the hospital. The variables recorded included maternal age, pre-pregnancy BMI, preeclampsia diagnosis, and other relevant clinical information, such as family history of hypertensive disorders. All data collection was performed systematically

to ensure completeness and accuracy.

Descriptive statistics were used to show the distribution of maternal age, BMI categories, and the occurrence of preeclampsia within the study group. Continuous variables were displayed as mean ± standard deviation, while categorical variables were shown as frequencies and percentages. The association between pre-pregnancy BMI and preeclampsia status was examined using Spearman’s rho correlation test, with a significance level set at $\alpha = 0.05$. The strength of correlations was classified according to standard criteria: $|r| < 0.20$ indicates a very weak correlation, 0.10–0.29 a weak one, 0.30–0.39 moderate, 0.40–0.69 strong, and ≥ 0.70 very strong. All statistical analyses were performed with IBM SPSS version 23.

This study received ethical approval from the local Health Research Ethics Committee of RSUD Cibabat (070/25/Ethical Clearance/RSUD Cibabat/V/2025). Since this study uses secondary data, personal identifiers were not included in the data collection form. All data were kept strictly confidential and used only for the study’s purposes.

Result

Demographic and basic obstetric characteristics of the 217 participating mothers who met the study criteria are shown in Table 1. The average age of the participants was 24.8 ± 5.3 years, with most (76.2%) falling within the optimal maternal age range of 20–35 Years. Additionally, 19.4% of the participants were classified as young maternal (<20 years), while 4.1% were in the advanced maternal age group (over 35 years). Therefore, the study population primarily consisted of young adult mothers.

Pre-pregnancy BMI data indicated the distribution of respondents’ BMI categories before pregnancy (Table 2): 21.2% were classified as underweight (BMI <18.5 kg/

m²), 37.3% as normal (BMI 18.5–24.9 kg/m²), 18.4% as overweight (BMI 25.0–29.9 kg/m²), 16.6% as class I obesity (BMI 30.0–34.9 kg/m²), and 6.5% as class II obesity (BMI ≥ 35.0 kg/m²). This shows that 37.3% of participants had a normal BMI prior to pregnancy, while 41.5% had an excess BMI—either overweight or obese. Additionally, about one in five mothers had an underweight BMI before pregnancy.

Table 1 Characteristics of Respondents by Age Group

| Age Group (Year) | Frequency (n=) | % |
|------------------|----------------|------|
| <20 | 42 | 19.4 |
| 20-35 | 166 | 76.2 |
| >35 | 9 | 4.1 |
| Total | 217 | 100 |

Table 2 Distribution of Pre-Pregnancy BMI among Responders

| BMI Category (kg/m ²) | Frequency (n=) | % |
|-----------------------------------|----------------|------|
| Underweight (<18,5) | 46 | 21.2 |
| Normal (18,5–22,9) | 81 | 37.3 |
| Overweight (23,0–24,9) | 40 | 18.4 |
| Class I Obesity (25,0–29,9) | 36 | 16.6 |
| Class II Obesity ($\geq 30,0$) | 14 | 6.5 |
| Total | 217 | 100 |

Table 3 Distribution of Preeclampsia Incidence

| Preeclampsia Incidence | Frequency (n) | % |
|------------------------|---------------|------|
| Yes | 159 | 73.3 |
| No | 58 | 26.7 |
| Total | 217 | 100 |

Regarding pregnancy conditions, this study specifically assessed the incidence of preeclampsia during the first pregnancy. It was found that among 217 primigravida women, 159 (73.3%) experienced preeclampsia, while

Table 4 The Relationship between Pre-Pregnancy BMI and the Incidence of Preeclampsia among Nulliparous Women

| Variable | Spearman's Rho | BMI | PE Incidence |
|--------------|------------------------------|---------|--------------|
| BMI | Correlation Coefficient (r=) | 1.00 | 0.367** |
| | Sig. (2-tailed) (p=) | 0.0 | 0.0 |
| PE Incidence | Correlation Coefficient (r=) | 0.367** | 1.00 |
| | Sig. (2-tailed) (p=) | 0.0 | 0.0 |

Abbreviation: BMI, Body Mass Index; PE, Pre-eclampsia

58 (26.7%) did not (Table 3). Preeclampsia in this study included all severities, including severe cases. Additionally, the proportion of preeclampsia among obese mothers (Obesity I/II) seems higher (around 36%) compared to mothers with normal BMI (about 19%). The underweight group had the lowest rate of preeclampsia (approximately 15%).

Spearman's correlation analysis was performed to assess the relationship between pre-pregnancy BMI and the incidence of preeclampsia (Table 4). The results indicated a positive correlation ($\rho = 0.367$; p -value <0.001) between BMI and the occurrence of preeclampsia. Although the strength of these results is moderate, this finding remains clinically relevant, given that factors other than BMI also influence the incidence of preeclampsia.

Discussion

The current study reported that nearly three-quarters of pregnant women develop preeclampsia. The incidence rate of preeclampsia (73.3%) is relatively high compared to the prevalence in the general population (2.16%).⁸ However, it should be noted that Cibabat Hospital is a referral hospital, which likely results in more preeclampsia cases being managed there.

Our study also confirms the hypothesis that pre-pregnancy maternal BMI is associated with an increased risk of preeclampsia in nulliparous women, as shown by a positive correlation ($r = 0.367$; $p < 0.001$) between pre-

pregnancy BMI and preeclampsia. Although the correlation is moderate, this finding has significant clinical implications, since preeclampsia is a multifactorial condition. This result is in line with previous studies.^{6,9} and current pathophysiological theories on preeclampsia.

The relationship between pre-pregnancy BMI and preeclampsia has been established in previous research. Mao et al. reported that overweight and obese pregnant women have a 2.15-fold and 3.49-fold increased risk of developing preeclampsia, respectively.¹⁰ Similarly, Santos et al. also documented a higher risk of preeclampsia among pregnant women with high pre-pregnancy BMI.¹¹ These individual studies are further supported by a recent meta-analysis by Ulhaq et al., which indicated that overweight and obese pregnant women have significantly greater odds of developing preeclampsia compared to those with normal BMI.⁶ These findings can be explained from a biological perspective, as high BMI in pregnant women promotes a pro-preeclamptic state through systemic inflammation and endothelial dysfunction, characterized by elevated proinflammatory cytokines, oxidative stress, and angiogenic imbalance.¹² The presence of insulin resistance and dyslipidemia, which are commonly observed in overweight and obese individuals, further worsens the condition.¹³ All of the aforementioned factors are believed to contribute to the development of preeclampsia.⁴

Nulliparity has also become an

independent risk factor for preeclampsia, as shown in a study by Duckitt et al.¹⁴ This link is confirmed by a prospective cohort study conducted by Rafiq et al., who found that nulliparous obese women face nearly three times the risk of preeclampsia compared to pregnant women with normal BMI.¹⁵ Several possible explanations for these findings include immune maladaptation,¹⁶ and an altered angiogenic profil.¹⁷ in nulliparous women. Overall, these studies support our observation that the incidence of preeclampsia is higher among nulliparous obese women. Therefore, implementing preconception weight management programs could be an effective way to reduce preeclampsia risk, especially among nulliparous overweight or obese women. It is also interesting to note that the lowest incidence of preeclampsia is found among pregnant women with underweight BMI. These findings are confirmed in a recent meta-analysis, which suggested the protective effect of underweight BMI towards pre-eclampsia.^{6,9} This observed phenomenon may occur due to the development of more efficient placentae in underweight pregnant women compared to those with high BMI status.¹⁸ However, this effect should not be interpreted as an endorsement of having an underweight BMI among pregnant women. As emphasized in the study by Ulhaq et al, underweight women still carry significant maternal-perinatal risks, including anemia, preterm birth, low birth weight, and childhood stunting.⁶ Thus, maintaining a normal BMI remains the optimal nutritional state to minimize both preeclampsia risk and other pregnancy-related complications.

Several methodological limitations should be acknowledged when interpreting these findings. The cross-sectional design of this study inherently restricts our ability to establish a causal relationship between pre-pregnancy BMI and the development of preeclampsia. This analysis did not fully account for important confounding

variables, such as detailed family history of hypertensive disorders or comprehensive socioeconomic status assessments. Additionally, data collection from a single referral hospital may result in selection bias, possibly overestimating the true prevalence of preeclampsia in the general population. Therefore, future research should address these issues by conducting a multi-center prospective cohort study with multivariate analytical approaches to establish stronger associations between pre-pregnancy BMI and preeclampsia.

Conclusion

Our study showed a moderate relationship between pre-pregnancy BMI and preeclampsia in nulliparous women. This further confirmed that nulliparity and being overweight or obese are important risk factors for preeclampsia. Additionally, these results support the need for comprehensive weight management programs as a preventive measure to lower the risk of preeclampsia, especially among nulliparous women who are overweight or obese.

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