Borneo Nursing Journal (BNJ)
Volume 8, Nomor 2, Tahun 2026, Halaman 1105-1113 P-ISSN: 2685-5054
https://bnj.akys.ac.id/BNJ E-ISSN: 2654-8453

The Relationship Between Body Mass Index (BMI) and the Incidence of Preeclampsia Among Third-Trimester Pregnant Women at Tiron Public Health Center, Kediri Regency

Errina Febrianti[1] , Koekoeh Hardjito[2], Rahajeng Siti Nur Rahmawati[3], Eny Sendra[4]
[1-4] Politeknik Kesehatan Kemenkes Malang
Corresponding Author: errinafebrianti8@gmail.com

Abstract

Preeclampsia is a pregnancy complication and a leading cause of maternal morbidity and mortality worldwide. One risk factor often associated with preeclampsia is pre-pregnancy Body Mass Index (BMI). This study aimed to analyze the relationship between BMI and the incidence of preeclampsia among third-trimester pregnant women at the Tiron Public Health Center, Kediri Regency. A quantitative study with a cross-sectional design was conducted. The sample consisted of 44 third-trimester pregnant women selected through simple random sampling from a population of 77. Data were obtained from maternal and child health records, blood pressure measurements, and proteinuria examinations. Results showed that most respondents had a normal BMI (50%), followed by overweight (25%), obesity (15.9%), and underweight (9.1%). Preeclampsia was identified in only one respondent (2.27%), who was classified as overweight. Statistical analysis yielded a p-value (0.425) α >(0,05) indicating no significant relationship between BMI and preeclampsia incidence. The absence of a significant association may be related to the predominance of normal BMI respondents and the identification of only one preeclampsia case.

Keywords: Body Mass Index; Preeclampsia; Third Trimester Pregnant Women

1. INTRODUCTION

Pregnancy is a complex physiological process that may be accompanied by several complications, one of which is preeclampsia. Preeclampsia remains a major contributor to maternal and perinatal morbidity and mortality in both developed and developing countries. According to the World Health Organization (2025), preeclampsia affects approximately 3–8% of women who give birth worldwide, while hypertensive disorders of pregnancy were responsible for around 42,000 maternal deaths globally in 2023. This burden indicates that preeclampsia remains an important public health problem requiring early detection, appropriate risk assessment, and adequate antenatal care.

In East Java Province, the maternal mortality ratio increased slightly from 93.00 per 100,000 live births in 2022 to 93.73 per 100,000 live births in 2023, with 499 maternal deaths recorded. Based on ICD-10 maternal mortality classification, the leading causes of maternal death included hypertensive disorders during pregnancy, childbirth, and the puerperium, obstetric hemorrhage, and non-obstetric complications (Dinas Kesehatan Provinsi Jawa Timur, 2023). In 2024, the maternal mortality ratio in East Java decreased to 82.56 per 100,000 live births, with 484 maternal deaths recorded across 37 districts and municipalities. The most common causes of maternal death were non-obstetric complications, followed by hypertensive disorders during pregnancy, childbirth, and the puerperium, and obstetric hemorrhage (Dinas Kesehatan Provinsi Jawa Timur, 2024).

A similar pattern was observed in Kediri Regency. The maternal mortality ratio decreased from 87 per 100,000 live births in 2010 to 57 per 100,000 live births in 2023, with maternal deaths declining from 36 cases in 2010 to 10 cases in 2023. The leading causes of maternal death were heart disease and preeclampsia, each accounting for approximately 30% of deaths, followed by hemorrhage and other causes (Dinas Kesehatan Kabupaten Kediri, 2023). In 2024, Kediri Regency recorded 548 cases of preeclampsia across all public health

centers, decreasing from 631 cases in 2023. However, Tiron Public Health Center reported the highest number of preeclampsia cases among 36 public health centers, with 44 cases in 2024, increasing from 34 cases in 2023 (Dinas Kesehatan Kabupaten Kediri, 2024). A preliminary study conducted at Tiron Public Health Center on August 15, 2025, also found 13 cases of preeclampsia from January to August 2025, including two cases in August.

Preeclampsia is generally diagnosed after 20 weeks of gestation and is characterized by new-onset hypertension, with systolic blood pressure of at least 140 mmHg and/or diastolic blood pressure of at least 90 mmHg, measured on at least two occasions. Proteinuria is a key diagnostic marker and reflects glomerular involvement; it is commonly defined as urinary protein excretion of at least 300 mg in 24 hours or an equivalent abnormal result on other validated proteinuria assessments (Bertoni & Williams, 2025; Dimitriadis et al., 2023). Preeclampsia may progress to severe maternal complications, including eclampsia, HELLP syndrome, renal dysfunction, hepatic involvement, pulmonary edema, stroke, and other end-organ damage. It is also associated with adverse fetal and neonatal outcomes, such as fetal growth restriction, low birth weight, preterm birth, and perinatal morbidity (Dimitriadis et al., 2023; Putri Ariyan et al., 2022).

Several maternal characteristics have been associated with the development of preeclampsia. Previous studies have reported that maternal age, parity, history of preeclampsia, family history of hypertension, chronic hypertension, diabetes mellitus, renal disease, multiple pregnancy, and obesity may increase the risk of preeclampsia (Asres et al., 2022; Han-idhikul et al., 2026). Among these factors, nutritional status has received considerable attention because it can be assessed easily through body mass index (BMI). BMI is a simple anthropometric indicator used to classify nutritional status, including underweight, normal weight, overweight, and obesity. Although maternal weight naturally increases during pregnancy due to physiological changes such as increased blood volume, fetal growth, placental development, and fat deposition, excessive body weight before pregnancy or excessive gestational weight gain may increase the risk of adverse pregnancy outcomes (Abdi et al., 2025; Zhang et al., 2025).

Maternal overweight and obesity are closely linked to metabolic dysfunction, chronic low-grade inflammation, endothelial dysfunction, insulin resistance, and altered angiogenic balance, all of which may contribute to the pathophysiology of preeclampsia (Lourenço & Guedes-Martins, 2025; Poniedziałek-Czajkowska et al., 2023). Recent studies have shown that women with overweight or obesity before pregnancy have a higher risk of developing preeclampsia, gestational diabetes, labor induction, maternal intensive care admission, and lower rates of normal vaginal delivery (Abdi et al., 2025). In addition, a nonlinear association has been reported between pre-pregnancy BMI, gestational weight gain, and preeclampsia risk, indicating the importance of weight management before and during pregnancy (Zhang et al., 2025).

Antenatal care is essential for early identification and management of preeclampsia risk. In East Java, antenatal care coverage in 2024 remained below the minimum service standard target of 100%, with first-visit coverage at 80.77%, fourth-visit coverage at 77.80%, and sixth-visit coverage at 73.94% (Dinas Kesehatan Provinsi Jawa Timur, 2024). Strengthening integrated antenatal care at public health centers is necessary to improve early detection of pregnancy complications, including hypertension, proteinuria, and abnormal maternal weight gain. Nutritional counseling, regular blood pressure monitoring, BMI assessment, and timely referral are important components of preeclampsia prevention and management (Ronzoni et al., 2025).

Based on the high number of preeclampsia cases at Tiron Public Health Center and the potential contribution of maternal BMI to preeclampsia risk, this study aimed to analyze the relationship between body mass index and the incidence of preeclampsia among third-trimester pregnant women at Tiron Public Health Center, Kediri Regency. The findings are expected to provide local evidence for strengthening antenatal screening and preventive strategies for pregnancy complications.

2. METHOD

This study used an analytical observational design with a cross-sectional approach to examine the relationship between body mass index (BMI) and the incidence of preeclampsia among third-trimester pregnant women. The study was conducted at Tiron Public Health Center, Kediri Regency, from December 22, 2025 to January 14, 2026. The population consisted of 77 third-trimester pregnant women who attended antenatal care services, and 44 respondents were selected using simple random sampling. The inclusion criteria were third-trimester pregnant women attending antenatal care at Tiron Public Health Center and having complete maternal and child health handbook data, including body weight, height, and BMI records. Pregnant women with a history of preeclampsia, kidney disease, or diabetes mellitus were excluded to minimize potential confounding factors.

Data were collected from maternal and child health handbooks, direct blood pressure measurements using a sphygmomanometer, and urine protein examination performed by laboratory staff. BMI was classified into underweight, normal, overweight, and obese categories, while preeclampsia was determined based on blood pressure and proteinuria findings and confirmed by an authorized physician. Data processing included editing, coding, entry, cleaning, and tabulation. Univariate analysis was used to describe respondent characteristics and variable distributions, while bivariate analysis was performed using the Spearman Rank correlation test to determine the relationship between BMI and preeclampsia incidence. This study received ethical approval from the Health Research Ethics Committee of Politeknik Kesehatan Kemenkes Malang with approval number DP.04.03/F.XIII.31/0160/2026, and all respondents provided informed consent before data collection.

3. RESULT AND DISCUSSION

RESULT

Respondent Characteristics

This study involved 44 third-trimester pregnant women at Tiron Public Health Center, Kediri Regency, during the period from December 22, 2025 to January 14, 2026. Based on data from the maternal and child health handbook, respondent characteristics included maternal age and gravida status.

Table 1. Respondent characteristics based on maternal age

Maternal Age Category	Frequency (n)	Percentage (%)
<20 years	0	0
20–35 years	41	93.19
>35 years	3	6.81
Total	44	100

Table 2. Respondent characteristics based on gravida status

Gravida Status Category	Frequency (n)	Percentage (%)
Primigravida	20	45.45
Multigravida	23	52.28
Grand multigravida	1	2.27
Total	44	100

The results showed that most respondents were aged 20–35 years, with 41 respondents (93.19%). Based on gravida status, most respondents were multigravida, with 23 respondents (52.28%).

Body Mass Index and Preeclampsia Incidence

Table 3. Frequency distribution of body mass index

BMI Category	Frequency (n)	Percentage (%)
Underweight	4	9.1
Normal	22	50.0
Overweight	11	25.0
Obese	7	15.9
Total	**44**	**100.0**

Based on BMI classification, 22 respondents (50.0%) had normal BMI, 11 respondents (25.0%) were overweight, 7 respondents (15.9%) were obese, and 4 respondents (9.1%) were underweight.

Table 4. Frequency distribution of preeclampsia incidence

Preeclampsia Incidence Category	Frequency (n)	Percentage (%)
No preeclampsia	43	97.73
Preeclampsia	1	2.27
Severe preeclampsia	0	0
Total	**44**	**100.0**

Most respondents did not experience preeclampsia, with 43 respondents (97.73%). Preeclampsia was found in 1 respondent (2.27%), while no cases of severe preeclampsia were identified.

Relationship Between Body Mass Index and Preeclampsia Incidence

Relationship between body mass index and preeclampsia incidence among third-trimester pregnant women at Tiron Public Health Center, Kediri Regency presented in table 5. The cross-tabulation between BMI and preeclampsia incidence showed that most respondents in all BMI categories did not experience preeclampsia. All respondents in the underweight, normal, and obese categories were not diagnosed with preeclampsia. Preeclampsia was found only in the overweight category, involving 1 respondent (2.3%). No severe preeclampsia cases were found in any BMI category. The Spearman Rank test showed a p-value of 0.425 ($p > 0.05$), indicating that there was no significant relationship between BMI and the incidence of

preeclampsia among third-trimester pregnant women at Tiron Public Health Center, Kediri Regency.

Table 5. Relationship between body mass index and preeclampsia incidence among third-trimester pregnant women at Tiron Public Health Center, Kediri Regency

BMI Category	Preeclampsia Incidence						Total		p-value
	No Preeclampsia		Preeclampsia		Severe Preeclampsia				
	n	%	n	%	n	%	n	%	
Underweight	4	9.1	0	0	0	0	4	9.1	0.425
Normal	22	50.0	0	0	0	0	22	50.0	
Overweight	10	22.7	1	2.3	0	0	11	25.0	
Obese	7	15.9	0	0	0	0	7	15.9	
Total	**43**	**97.7**	**1**	**2.3**	**0**	**0**	**44**	**100.0**	

DISCUSSION

Body Mass Index Among Pregnant Women

The results showed that among 44 respondents, most pregnant women had a normal body mass index (BMI), with 22 respondents (50.0%). Meanwhile, 11 respondents (25.0%) were classified as overweight, 7 respondents (15.9%) as obese, and 4 respondents (9.1%) as underweight. This finding is consistent with the study by Abdi et al. (2025) in Iran involving 2,930 pregnant women, which reported that the largest proportion of respondents had normal BMI. In that study, 1,921 respondents (65.6%) had normal BMI, followed by 819 respondents (27.9%) with overweight and 190 respondents (6.5%) with obesity. Both studies showed a similar pattern, in which pregnant women with normal nutritional status were the dominant group.

This finding differs from the study by Ahmed et al. (2025) in Rwanda. In a hospital-based cross-sectional study involving 445 pregnant women, the overweight group was reported as the largest proportion, while the normal BMI group accounted for a smaller proportion of respondents. This difference indicates that the distribution of BMI among pregnant women may vary across populations and may be influenced by sociodemographic, geographic, nutritional, and lifestyle factors. Maternal BMI distribution should therefore be interpreted according to the characteristics of the study population and local maternal health context.

Clinically, BMI is an important indicator of maternal nutritional status during pregnancy because it is closely related to maternal metabolic condition and fetal growth. Pregnant women with normal BMI generally have a lower risk of adverse pregnancy outcomes than those with underweight, overweight, or obesity. Eltayeb and Khalifa (2021) reported that higher maternal BMI was associated with increased maternal and neonatal risks, supporting the importance of maintaining BMI within the normal range before and during pregnancy. Abdi et al. (2025) also reported that overweight and obese mothers had higher risks of preeclampsia, gestational diabetes, labor induction, maternal intensive care admission, and lower rates of normal vaginal delivery.

The clinical relevance of BMI is further supported by Zhang et al. (2025), who studied 13,294 pregnant women in China and found a relationship between pre-pregnancy BMI, gestational weight gain, and the risk of preeclampsia. The prevalence of preeclampsia was lowest among women with normal BMI, at 2.85%, and increased among women with overweight and obesity, reaching 6.60% and 16.05%, respectively. After adjustment for confounding factors, overweight women had a 1.68-fold higher risk of preeclampsia, while obese women had a 3.16-fold higher risk compared with women with normal BMI (Zhang et

al., 2025). These findings indicate that weight control before pregnancy and monitoring of gestational weight gain remain important preventive measures, even when most pregnant women in the present study had normal BMI.

Incidence of Preeclampsia

The results of this study showed that most respondents did not experience preeclampsia. Among 44 third-trimester pregnant women, 43 respondents (97.73%) were not diagnosed with preeclampsia, while only 1 respondent (2.27%) had preeclampsia. No severe preeclampsia cases were identified. This indicates that the incidence of preeclampsia in this study was low. This finding is supported by the preliminary report from Tiron Public Health Center in 2025, which showed that only approximately one to two cases of preeclampsia were found within one to two months among pregnant women attending antenatal care services.

This finding is in line with Pangesti et al. (2025), who conducted a study in 38 primary health centers in Banyumas Regency and reported an early-onset preeclampsia incidence of 2.5% among 4,053 pregnant women screened in primary care facilities. This proportion is close to the finding of the present study, suggesting that preeclampsia incidence in primary health care settings may be relatively low when screening and antenatal monitoring are implemented. The low number of preeclampsia cases in this study may also indicate that other risk factors had a stronger influence than BMI alone.

The low incidence of preeclampsia may be related to early screening during antenatal care. Screening from the first trimester allows earlier identification of maternal risk factors, such as previous preeclampsia, chronic hypertension, high mean arterial pressure, maternal age, and obesity. Ronzoni et al. (2025) emphasized that first-trimester preeclampsia screening can identify high-risk pregnant women and support early preventive intervention. Pangesti et al. (2025) also reported that risk-factor screening in primary health care was able to classify pregnant women according to preeclampsia risk, although further improvement of the scoring system was still required.

The accuracy of preeclampsia diagnosis is also influenced by the supporting examination used to detect proteinuria. In this study, proteinuria was examined using a urine dipstick test, which provides rapid results but has diagnostic limitations. Gaikwad et al. (2025) reported that urine dipstick testing had low sensitivity, specificity, and overall accuracy compared with 24-hour urinary protein examination. Teeuw et al. (2022) also found that urine dipstick testing had limited accuracy for diagnosing proteinuria among pregnant women suspected of preeclampsia, particularly in excluding disease when the result was negative. Thus, dipstick testing is useful as an initial screening tool but should be interpreted cautiously, especially when clinical suspicion remains high.

Olisa et al. (2024) reported that spot urine protein–creatinine ratio had better diagnostic accuracy than urine dipstick testing for detecting significant proteinuria in preeclamptic women. However, further multicenter studies are still needed to compare spot protein–creatinine ratio with 24-hour urinary protein as the reference standard, particularly in resource-limited settings. In this study, the low incidence of preeclampsia may be influenced by good antenatal monitoring, the relatively low proportion of respondents with high-risk characteristics, and the diagnostic method used for proteinuria detection.

Relationship Between Body Mass Index and Preeclampsia Incidence

The results showed that preeclampsia was found only in the overweight BMI category, involving 1 respondent (2.3%). No preeclampsia cases were identified among respondents in the underweight, normal BMI, or obese categories. The Spearman Rank test showed a p-value of 0.425 ($p > 0.05$), indicating that there was no significant relationship between BMI and the

incidence of preeclampsia among third-trimester pregnant women at Tiron Public Health Center, Kediri Regency.

This finding is consistent with Aziz et al. (2022), who reported no significant relationship between BMI and preeclampsia incidence in a study involving 40 pregnant women, with a p-value of 0.602. Similarly, Kristanti et al. (2023) found that BMI was not significantly associated with preeclampsia, while other factors, including maternal age, parity, pregnancy interval, and previous history of preeclampsia, showed significant associations. These findings indicate that BMI may not act as an independent determinant in all study populations, particularly when the number of preeclampsia cases is small or when other maternal risk factors are more dominant.

Different findings were reported by Rahmadhanti et al. (2022), who found that obesity, previous history of hypertension, and previous history of preeclampsia/eclampsia were significantly associated with preeclampsia among multigravida pregnant women. Han-idhikul et al. (2026) also reported that previous history of preeclampsia, mean arterial pressure ≥100 mmHg at 20–28 weeks of gestation, and the need for two or more antihypertensive agents during pregnancy were associated with superimposed preeclampsia among pregnant women with chronic hypertension. These findings suggest that preeclampsia is multifactorial and may be influenced by maternal, placental, vascular, metabolic, and genetic factors.

The absence of a statistically significant relationship in the present study may be explained by the very low number of preeclampsia cases, the small sample size, and the predominance of respondents with normal BMI. Because only one case of preeclampsia was found, statistical power to detect an association between BMI and preeclampsia was limited. In addition, exclusion of respondents with previous preeclampsia, kidney disease, and diabetes mellitus may have reduced the proportion of high-risk pregnant women in the sample.

Although BMI was not significantly associated with preeclampsia in this study, its clinical importance should not be disregarded. Maternal overweight and obesity remain relevant risk factors for adverse pregnancy outcomes, including hypertensive disorders of pregnancy. Zhang et al. (2025) demonstrated that increasing pre-pregnancy BMI was associated with higher preeclampsia risk, while Lourenço and Guedes-Martins (2025) explained that maternal obesity may contribute to hypertensive disorders through chronic inflammation, endothelial dysfunction, insulin resistance, oxidative stress, and altered angiogenic balance. Therefore, BMI assessment, nutritional counseling, gestational weight monitoring, and regular antenatal care remain important components of preeclampsia prevention.

Overall, this study found no significant relationship between BMI and preeclampsia incidence among third-trimester pregnant women at Tiron Public Health Center. However, the findings should be interpreted cautiously because of the limited sample size and the low number of preeclampsia cases. Future studies with larger samples, prospective designs, and adjustment for confounding factors such as age, parity, previous hypertension, family history, mean arterial pressure, and gestational weight gain are needed to clarify the relationship between BMI and preeclampsia risk.

4. CONCLUSION

This study concluded that there was no significant relationship between body mass index (BMI) and the incidence of preeclampsia among third-trimester pregnant women at Tiron Public Health Center, Kediri Regency. Among 44 respondents, preeclampsia was identified in only one pregnant woman, who was classified as overweight, while most respondents without preeclampsia had a normal BMI. Although the statistical analysis did not demonstrate a significant association, BMI assessment remains clinically important as part of antenatal care to support early identification of pregnancy-related risks. Health services are encouraged to

strengthen pre-pregnancy and antenatal BMI assessment, monitor gestational weight gain, optimize urine protein screening using dipstick tests according to antenatal care standards, and consider other preeclampsia risk factors such as maternal age, parity, gravidity, family history of hypertension, and previous obstetric history. Pregnant women are advised to maintain an ideal body weight through balanced nutrition, safe physical activity, and regular antenatal visits at least six times during pregnancy. Future studies should involve larger populations, broader study areas, updated population verification before sampling, and research designs such as cohort studies to better estimate the risk of preeclampsia based on BMI and other maternal risk factors.

5. REFERENCES

Abdi, F., Alizadeh, S., Roozbeh, N., Montazeri, F., Banaei, M., Mehrnoush, V., et al. (2025). Prepregnancy overweight and obesity and the risk of adverse pregnancy outcomes. *Scientific Reports, 15*(1), 16846. https://doi.org/10.1038/s41598-025-02113-9

Ahmed, M. I., Bashir, A. O., Hassan, A. A., & Adam, I. (2025). Hemoglobin level, anemia, and obesity among pregnant women in Kigali, Rwanda: A hospital-based cross-sectional study. *Journal of Health, Population and Nutrition, 44*(1), 192. https://doi.org/10.1186/s41043-025-00938-8

Asres, A. W., Daga, W. B., Samuel, S., Adella, G. A., Workie, S. B., & Desalegn, A. (2022). Determinants of preeclampsia among pregnant women in public hospitals of Wolaita and Dawuro zones, Southern Ethiopia: A case-control study. *Women's Health Reports, 3*(1), 964–970. https://doi.org/10.1089/whr.2022.0043

Aziz, M. A., Wibowo, A., Almira, N. L., & Sutjighassani, T. (2022). Relationship of age, body mass index, gravida, and parity in pregnant women with the incidence of preeclampsia. *Indonesian Journal of Obstetrics and Gynecology Science, 2*(2).

Bertoni, I., & Williams, S. (2025). Approach to investigation and management of proteinuria in pregnancy. *Clinical Medicine, 25*(1), 100281. https://doi.org/10.1016/j.clinme.2024.100281

Dimitriadis, E., Rolnik, D. L., Zhou, W., Estrada-Gutierrez, G., Koga, K., Francisco, R. P. V., et al. (2023). Pre-eclampsia. *Nature Reviews Disease Primers, 9*(1), Article 8. https://doi.org/10.1038/s41572-023-00417-6

Dinas Kesehatan Kabupaten Kediri. (2023). *Profil kesehatan Kabupaten Kediri tahun 2023*.

Dinas Kesehatan Kabupaten Kediri. (2024). *Profil kesehatan Kabupaten Kediri tahun 2024*.

Dinas Kesehatan Provinsi Jawa Timur. (2023). *Profil kesehatan Provinsi Jawa Timur tahun 2023*.

Dinas Kesehatan Provinsi Jawa Timur. (2024). *Profil kesehatan Provinsi Jawa Timur tahun 2024*.

Eltayeb, R. A., & Khalifa, A. A. (2021). Impact of maternal body mass index on maternal and neonatal outcomes among Sudanese women. *Cureus, 13*(9), e18365. https://doi.org/10.7759/cureus.18365

Gaikwad, S., Gaikwad, V., & Tiwari, P. (2025). Urine dipstick versus urine protein creatinine ratio for the diagnosis of preeclampsia: A cross-sectional study. *Journal of Clinical and Diagnostic Research, 19*(4), QC05–QC08. https://doi.org/10.7860/JCDR/2025/78031.20920

Han-idhikul, A., Kongwattanakul, K., Komwilaisak, R., Saksiriwuttho, P., Chaiyarach, S., Duangkam, C., et al. (2026). Epidemiology and associated factors of superimposed preeclampsia in pregnant women with chronic hypertension: A retrospective multicenter cohort study. *Journal of Pregnancy, 2026*, 3799170. https://doi.org/10.1155/jp/3799170

Kristanti, R., Sari, Y. N. E., & Suharto, S. (2023). Faktor-faktor yang mempengaruhi kejadian pra eklampsia. *Jurnal Penelitian Perawat Profesional, 5*(3), 1271–1278. https://doi.org/10.37287/jppp.v5i3.1755

Lourenço, J., & Guedes-Martins, L. (2025). Pathophysiology of maternal obesity and hypertension in pregnancy. *Journal of Cardiovascular Development and Disease, 12*(3), 91. https://doi.org/10.3390/jcdd12030091

Olisa, C. L., Nwosu, B. O., Eleje, G. U., Oguejiofor, C. B., Mbachu, I. I., Ogabido, C. A., et al. (2024). Comparison of urine protein–creatinine ratio and urine dipstick test for significant proteinuria in preeclamptic women. *Therapeutic Advances in Reproductive Health, 18*, 26334941241288841. https://doi.org/10.1177/26334941241288841

Pangesti, W., Sasongko, E., Pribadi, A., & Hilmanto, D. (2025). Evaluation of risk factor screening using the Ministry of Health's scoring system for the incidence of early-onset preeclampsia in primary health service. *International Journal of Women's Health, 17*, 4815–4822. https://doi.org/10.2147/IJWH.S521259

Poniedziałek-Czajkowska, E., Mierzyński, R., & Leszczyńska-Gorzelak, B. (2023). Preeclampsia and obesity: The preventive role of exercise. *International Journal of Environmental Research and Public Health, 20*(2), 1267. https://doi.org/10.3390/ijerph20021267

Putri Ariyan, F. A., Sukowati, E. G., & Fatmawati, W. (2022). Preeclampsia correlates with maternal and perinatal outcomes in Regional Public Hospital, Madiun, Indonesia. *Majalah Obstetri & Ginekologi, 30*(1), 24–31. https://doi.org/10.20473/mog.V30I12022.24-31

Rahmadhanti, S., Handaria, D., & Anggraheny, H. D. (2022). Analisis faktor risiko derajat preeklampsia pada ibu hamil multigravida di RSUD RAA Soewondo Pati. *Al-Iqra Medical Journal, 5*(2), 81–87. https://doi.org/10.26618/aimj.v5i2.7630

Ronzoni, S., Rashid, S., Santoro, A., Mei-Dan, E., Barrett, J., Okun, N., et al. (2025). Preterm preeclampsia screening and prevention: A comprehensive approach to implementation in a real-world setting. *BMC Pregnancy and Childbirth, 25*(1), 32. https://doi.org/10.1186/s12884-025-07154-6

Teeuw, H. M., Amoakoh, H. B., Ellis, C. A., Lindsley, K., & Browne, J. L. (2022). Diagnostic accuracy of urine dipstick tests for proteinuria in pregnant women suspected of preeclampsia: A systematic review and meta-analysis. *Pregnancy Hypertension, 27*, 123–130. https://doi.org/10.1016/j.preghy.2021.12.015

World Health Organization. (2025). *Pre-eclampsia*. Retrieved June 28, 2026, from https://www.who.int/news-room/fact-sheets/detail/pre-eclampsia

Zhang, L., Ding, J., Liu, J., Ma, J., Shi, R., Chen, T., et al. (2025). Relationship between prepregnancy BMI and gestational weight gain with preeclampsia: A study based on restricted cubic spline. *BMC Pregnancy and Childbirth, 25*(1), 360. https://doi.org/10.1186/s12884-025-07449-8