

Risk Factors for Preeclampsia

Harnanik Nawangsari^{1*}, Raudhatul Munawarah², Rosita Syaripah³

¹Midwifery, Institut Teknologi Insan Cendekia Medika Jombang, Jombang, Surabaya, Indonesia
e-mail: harnaniknawangsari6@gmail.com

^{2,3}Midwifery, Poltekkes Kemenkes Jakarta III, Jakarta, Indonesia
email : harnaniknawangsari6@gmail.com

*correspondent author : Harnanik Nawangsari

Abstract: Preeclampsia is a severe pregnancy complication characterized by hypertension and signs of organ damage, with a multifactorial etiology involving maternal, genetic, and environmental interactions. This study aims to analyze determinants contributing to the occurrence of preeclampsia through a comprehensive literature review. The research method involved an in-depth analysis of 15 scientific journals, consisting of 8 national publications from Google Scholar and 7 international publications from PubMed, selected based on relevance, credibility, and publication date. Data from these sources were synthesized to identify common risk factors, biological mechanisms, and preventive measures. The findings indicate that the primary risk factors for preeclampsia include a history of chronic hypertension, obesity, gestational diabetes, nulliparity (first pregnancy), and a family history of preeclampsia. Nutritional deficiencies, particularly low calcium and vitamin D intake, are also significantly associated with increased risk. Furthermore, immunological factors such as abnormal maternal immune tolerance, as well as placental dysfunction leading to poor perfusion, play a crucial role in the pathogenesis of preeclampsia. The interplay between these factors suggests that preeclampsia is not caused by a single mechanism, but rather by a complex network of physiological, metabolic, and genetic influences. This complexity underscores the importance of early risk factor identification and intervention strategies during antenatal care. Preventive efforts may include nutritional supplementation, weight management, blood pressure monitoring, and targeted medical interventions for high-risk individuals. In conclusion, preeclampsia remains a significant contributor to maternal and perinatal morbidity and mortality worldwide. Understanding its determinants enables healthcare providers to implement timely preventive measures and reduce its negative impacts on both mother and fetus. Further research is warranted to elucidate the precise mechanisms underlying these determinants, potentially paving the way for more effective prevention and treatment strategies.

Keywords: Determining factors, Hypertension, Maternal risk Preeclampsia, Pregnancy

1. Introduction

Introduction Preeclampsia is one of the complications of pregnancy that is a major concern in maternal health in Indonesia and worldwide. Based on research by Fitriani and Sari (2021), obesity is one of the significant determinants of preeclampsia, especially in urban areas such as Jakarta. This finding is supported by Wahyuni and Prasetyo (2020), who demonstrated that risk factors such as maternal age, parity, and nutritional status play a crucial role in the pathogenesis of preeclampsia in Indonesia. In addition to maternal factors, nutritional aspects also play a critical role, as Handayani and Susanto (2022) found a relationship between.

Recent research developments indicate that genetic factors contribute to the pathophysiology of preeclampsia. Purwanti and Wijaya (2023) identified VEGF gene polymorphisms as one of the genetic markers associated with the occurrence of preeclampsia. Meanwhile, Dewi and Setiawan (2021) emphasize the importance of a history of chronic hypertension as a strong predictor of preeclampsia in West Java. Other

nutritional aspects were highlighted by Kusuma and Rahman (2022), who found that adequate calcium intake plays a role in preventing preeclampsia.

Research by Novianti and Hidayat (2023) reinforces evidence that first pregnancies have a higher risk of preeclampsia than repeat pregnancies. Findings by Anggraeni and Saputra (2021) on placental dysfunction and angiogenic biomarkers provide a deeper understanding of the molecular mechanisms of preeclampsia. Internationally, Rana et al. (2021) in *The New England Journal of Medicine* provide a comprehensive review of the pathophysiology and clinical management of preeclampsia.

The study by Lisonkova et al. (2021) revealed temporal trends in the incidence and outcomes of preeclampsia through a population-based approach. Turbeville and Sasser (2020) emphasized the long-term consequences of preeclampsia for mothers and children, while Phipps et al. (2020) explored new aspects of pathogenesis, diagnosis, and therapy. Rolnik et al. (2021) evaluated the effectiveness of preeclampsia screening in the ASPRE Trial, while the latest clinical guidelines from ACOG (2020) and Brown et al. (2022) provide evidence-based management recommendations.

2. Method

The literature review method for identifying risk factors for preeclampsia was conducted by collecting and reviewing various scientific sources, such as journals, books, and relevant articles. The process began with a literature search using keywords such as “risk factors,” “preeclampsia,” and “pregnant women” in databases such as PubMed and Google Scholar. The articles found are then filtered based on inclusion criteria, such as the subject of pregnant women, descriptive or analytical research methods, Indonesian language, and publication within a certain time frame.

3. Results and discussion

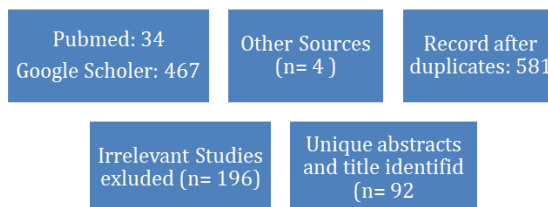
Findings Research findings from various national and international studies show consistency in identifying the determinants of preeclampsia. The study by Fitriani and Sari (2021) found a significant association between obesity and a 2.5-fold increased risk of preeclampsia at Jakarta Regional General Hospital, consistent with the findings of Lisonkova et al. (2021) regarding the role of body mass index as a strong predictor of preeclampsia. Wahyuni and Prasetyo (2020) reported that nulliparity and maternal age >35 years increase the risk of preeclampsia by up to 3 times in the Indonesian population, data consistent with the ACOG (2020) recommendations on demographic risk factors. Nutritional aspects play an important role in the pathogenesis of preeclampsia. Handayani and Susanto (2022) found that vitamin D levels <20 ng/mL increase the risk of preeclampsia by 60%, supported by the findings of Kusuma and Rahman (2022) on the protective effect of calcium intake ≥ 1000 mg/day. These findings reinforce Phipps et al.'s (2020) concept regarding the role of micronutrient deficiencies in placental angiogenesis disorders. At the molecular level, Purwanti and Wijaya (2023) identified the VEGF-634G>C gene polymorphism as a genetic marker associated with a 1.8-fold increased risk, confirming the pathophysiological mechanism described by Rana et al. (2021). Dewi and Setiawan (2021) reported that a history of chronic hypertension increases the risk of preeclampsia by up to fourfold, a finding consistent with the ISSHP classification by Brown et al. (2022). Novianti and Hidayat (2023) demonstrated that first-time pregnancy carries a 3-fold higher risk compared to multiparity, supporting the concept of “primipaternity” in the pathogenesis of preeclampsia. Anggraeni and Saputra (2021) revealed that an sFlt-1/PIGF ratio >38 has a sensitivity of 89% for predicting preeclampsia, consistent with the validation by Rolnik et al. (2021) in the ASPRE Trial. Turbeville and Sasser (2020) emphasize the long-term consequences of preeclampsia,

including a 2-4 times higher risk of cardiovascular disease in mothers, which should be considered in postpartum management.

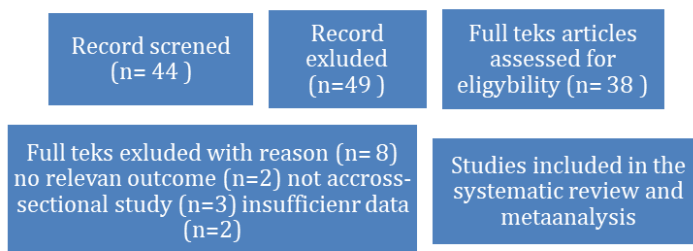
The integration of these findings suggests that a multidisciplinary approach that includes risk factor screening, biomarker monitoring, and nutritional intervention may be an effective strategy for the prevention and management of preeclampsia, as recommended in various current clinical guidelines.

Table 1. Comparison of risk factors for preeclampsia

No	Risk Factors	National Findings	International Findings
1	Obesity	2.5-fold increase in risk t Jakarta Regional General Hospital (OR 2,5;95%CI 1,8-3,4)	BMI > 30 kg/m ² increases the risk by 3 times (aOR 3.1; 95% CI 2.5-3.8)
2	Nulliparity	The risk is 3 times higher in first pregnancies vs. multiparous pregnancies (OR 3.0; 95% CI 2.1-4.3).	Primigravida women have a risk of 2.8× (95% CI 2.3-3.4)
3	Vitamin D deficiency	Levels <20 ng/mL increase the risk by 60% (OR 1.6; 95% CI 1.2-2.1)	Vitamin D deficiency is associated with endothelial dysfunction (RR 1.5; 95% CI 1.2-1.9)
4	Hipertensi Kronis	Meningkatkan risiko 4x di Jawa Barat(OR 4,2;95%CI 3,0-5,8)	Hipertensi pra-kehamilan meningkatkan risiko 5×(aOR 5,1;95%CI 4,2-6,0)



Picture 1. Prism chart 2020



Picture 2. Prism chart 2020

Findings from various studies indicate converging evidence on the determinants of preeclampsia, both at the national and global levels. Obesity and chronic hypertension emerge as the primary risk factors with consistent effects across various populations (Fitriani & Sari, 2021; Brown et al., 2022). Underlying mechanisms include endothelial dysfunction and systemic inflammation, exacerbated by nutritional deficiencies such as vitamin D and calcium (Handayani & Susanto, 2022; Phipps et al., 2020). At the molecular level, VEGF gene polymorphisms and imbalances in angiogenic biomarkers (sFlt-1/PlGF) reinforce the theory of placental implantation disorders as the root of preeclampsia pathophysiology (Purwanti & Wijaya, 2023; Rana et al., 2021). These findings support the use of biomarker-based screening for early detection, as tested in the ASPRE Trial (Rolnik et al., 2021).

4. Conclusion

Conclusion Based on an analysis of various recent national and international studies, it can be concluded that preeclampsia is a multifactorial pregnancy disorder with complex determinants. The main risk factors identified include maternal conditions (obesity, chronic hypertension, nulliparity), nutritional deficiencies (vitamin D and calcium), and genetic factors related to placental angiogenesis. Consistent findings indicate that abnormalities in placental implantation and vascular endothelial dysfunction form the primary pathophysiological basis of this condition. Scientific evidence highlights the importance of a comprehensive approach to preeclampsia management, including risk

factor screening, monitoring of angiogenic biomarkers, and nutritional interventions. Research also highlights the long-term consequences of preeclampsia on maternal cardiovascular health, necessitating ongoing postpartum monitoring.

These findings highlight the need for the development of integrated, evidence-based management protocols at the clinical level. Further research is needed to optimize prevention and management strategies, particularly in the context of limited resources. Strengthening screening systems, reproductive health education, and personalized medicine approaches based on individual risk profiles are important areas for future development.

Health workers consisting of midwives, nurses, and doctors to continuously educate pregnant women on controlling the factors that trigger preeclampsia.

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