# Differences in serum magnesium levels, folic acid, and infant outcomes in severe preeclampsia: A literature review

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# Differences in serum magnesium levels, folic acid, and infant outcomes in severe preeclampsia: A literature review☆

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ABSTRACT

*Objective:* The purpose of this systematic review is to review studies on serum magnesium, folic acid levels in severe preeclampsia and see the impact of a mother with preeclampsia on her baby. Several studies have shown magnesium deficiency and folic acid to be a factor causing preeclampsia which also affects infant outcomes.
*Method:* The method used is an electronic database that has been published through the PubMed and Science Direct online libraries. Keywords used for article searches are based on study questions.
*Results:* From 4 articles as a whole discussion preeclampsia. The most common risk factor for preeclampsia is obesity followed by chronic hypertension and diabetes. The incidence of prematurity is also higher in preeclampsia patients. Mothers with preeclampsia have a worse prognosis for mothers and babies compared to normal pregnant women.
*Conclusion:* Preeclampsia still a public health problem because of its high incidence rate. Various countries have conducted research related to magnesium and folic acid associated with preeclampsia, this can be a material for consideration and early detection of the incidence of preeclampsia so that prevention and treatment of preeclampsia can be done earlier.



## Introduction

Severe preeclampsia is a complication that occurs in pregnancy. Severe PE is characterized by hypertension where systolic blood pressure ≥160 mmHg and/or diastolic blood pressure 110 mmHg with proteinuria ≥300 mg/day.[1] If not handled properly, severe preeclampsia can develop into serious complications that can endanger the mother and fetus. Complications that can occur in the mother are HELLP syndrome, eclampsia, pulmonary edema, Disseminated intravascular coagulation (DIC), kidney disorders, abruption of the placenta, and can even result in maternal death. In the fetal complications that occur are low birth weight (LBW), premature birth, asphyxia, even perinatal death. Whereas in neonatal can experience neonatal respiratory disorders namely neonatal respiratory distress syndrome (NRDS), pneumonia, and low APGAR scores.[2–4] The number of cases of preeclampsia in Indonesia reaches 128,273 or around 5.3% every year.[5]

Preeclampsia is very closely related to low levels of certain micronutrients. Some micronutrients that are important during pregnancy are folic acid and magnesium. Folic acid plays a role in reducing plasma homocysteine concentrations in pregnant women, homocysteine plays a role in maternal endothelial dysfunction by reducing nitric oxidation and oxidative stress. High homocysteine levels can damage blood vessels and also cause blood vessel blockage. Magnesium plays an important role in neurochemical transmission and peripheral vasodilation. High and low levels of magnesium in the body have an impact on heart stimulation and vascular tone, contractility, and reactivity. Low magnesium levels are associated with metabolic syndrome, type 2 diabetes, hypertension, and cause a decrease in blood flow to the brain and cerebral vasospasm.[6–8]

Various studies on serum magnesium and folic acid levels associated with preeclampsia and the link between preeclampsia mothers and infant outcomes have been carried out in various countries including Indonesia. This is an effort in handling and prevention as early as possible. Therefore, this literature review aims to look at differences in serum levels of magnesium, folic acid in

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**Table 1**
Characteristics, instruments and selected study results.

| Author | Purpose | Population | Instrument | Study design | Result |
|---|---|---|---|---|---|
| Benfateh et al. (2018) | To study the epidemiology of preeclampsia and identify risk factors and poor maternal and fetal prognosis factors | Mothers with preeclampsia with or without edema and/or patients with one or more complications | Medical record | Retrospective cohort | Risk factors that are often found are obesity, chronic hypertension, diabetes, abortion, age <24 years and >34 years, and perinatal death. Better prenatal care and early diagnosis can reduce the incidence of preeclampsia. |
| Gumay et al. (2015) | Analyzing the relationship of severe preeclampsia with fetal outcomes | Patients who deliver with severe preeclampsia and their babies who have complete medical record data on fetal outcomes. | Medical record | Cross-sectional | There is a significant relationship between severe preeclampsia with SGA (small for gestational age), moderate to severe asphyxia and prematurity. |
| Tavana and Hosseinmirzaei (2013) | To measure magnesium levels in preeclampsia and control groups since early pregnancy | Pregnant women with 18–22 weeks gestation | Colorimetry and use of Xylidl Blue | Cross-sectional | Magnesium levels in women with preeclampsia are lower than normal pregnant women. Examination of magnesium levels should be considered a predictive factor for preeclampsia during the first evaluation of pregnancy |
| Wen et al. (2016) | Assess the effect of folic acid supplementation on pregnancy on the risk of preeclampsia. | Pregnant women with less than 20 weeks' gestation | | Prospective cohort | Supplementation of folic acid in pregnancy can reduce the risk of preeclampsia in pregnant women, especially in women who have a high risk of developing preeclampsia. |

severe preeclampsia and see the effects of preeclampsia on their babies.

## Method

Keywords for article searches are identified based on research questions. The keywords consist of severe preeclampsia; magnesium; folic acid; baby's output. The PubMed and ScienceDirect Library is sought for relevant studies to explore serum levels of magnesium, folic acid, and infant outcomes in mothers with severe preeclampsia.

## Results

Following the article inclusion criteria identified in the search were 47 articles. Then the particles are filtered out in the last ten years and the complete articles out of 10. Then filter out duplicate articles and articles that are relevant to the research objective of 4 articles.

Four articles reviewed were carried out in various countries including France, Iran, Canada, and Indonesia. Of the 4 articles selected, each article discusses the relationship between preeclampsia and fetal output, folic acid, and magnesium as well as risk factors for preeclampsia. Characteristics of selected studies are presented in Table 1. Two articles discuss the administration of folic acid and magnesium in preeclampsia mothers where it was found that preeclampsia mothers had lower levels of folic acid and magnesium than those in normal pregnant women.[6,9–11]

Two articles discuss the effects of preeclampsia on the mother and fetus and risk factors for preeclampsia. The impact of preeclampsia that can occur in the mother is HELLP syndrome, eclampsia, pulmonary edema, disseminated intravascular coagulation (DIC), kidney disorders, abruption of the placenta, and can even result in maternal death.[12] Mothers with preeclampsia can increase the risk of cardiovascular disease, including chronic hypertension, stroke, coronary artery disease, diabetes and kidney disease later in life.[13] Severe preeclampsia can also have an impact on perinatal outcomes. Perinatal outcomes that often occur are LBW, IUGR, asphyxia, fetal distress, premature birth, even death.[12,14]

## Discussion

From 4 articles as a whole discussion preeclampsia. Benfateh et al. explained the risk factors most often found in preeclampsia are obesity followed by chronic hypertension and diabetes. Patients with preeclampsia under the age of 24 are more at risk of eclampsia, while patients aged >34 years are more at risk for acute kidney failure, acute pulmonary edema. The incidence of prematurity in this article is also higher in preeclampsia patients. Mothers who have preeclampsia have a poor maternal and infant prognosis compared to normal pregnant women.[15] Gumay et al. explained that women with severe preeclampsia had a 6.92 times SGA chance, severe asphyxia 7.2 times, mild–moderate asphyxia 2.48 times, and 3.3 times prematurity than normal pregnant women.[16] Preeclampsia is very closely related to low levels of certain micronutrients. Some micronutrients that are important during pregnancy are folic

acid and magnesium. Tavana et al. explained magnesium levels in preeclampsia mothers were lower even earlier in pregnancy than in the control group.[9] Low serum magnesium levels can result in increased calcium associated with increased vascular contraction thereby increasing vascular tone. Increased vascular tone thickens the walls of blood vessels causing an increase in blood pressure.[17] Besides magnesium, folic acid also plays a very important role during the pregnancy period. Wen et al. explained the lower incidence of preeclampsia in the group given folic acid supplementation than the group without folic acid supplementation.[6] Giving folic acid supplementation during pregnancy planning and pregnancy is not only beneficial for fetal growth and development but is also useful for the prevention of preeclampsia especially in women who have a high risk of preeclampsia.

## Conclusion

At present preeclampsia is still a public health problem due to its high incidence rate. This is one of the main causes of maternal and fetal morbidity and mortality. Various countries have conducted research related to magnesium and folic acid associated with preeclampsia, this can be a material for consideration and early detection of the incidence of preeclampsia so that the prevention and treatment of preeclampsia can be done earlier.

## Conflict of interest

The authors declare no conflict of interest.

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