

The Effect Of Giving Calcium As An Effort To Prevent Preeclampsia: A Literature Review

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Abstract: Preeclampsia is a pregnancy disorder accompanied by hypertension and proteinuria. Efforts to prevent preeclampsia can be made with medical prevention, namely, meeting the calcium needs of pregnant women. This research aims to determine the effect of giving calcium to prevent preeclampsia. The method used in the literature review is a systematic mapping study obtained from 3 databases, namely Pubmed, Garuda, and Google Scholar, using inclusion and exclusion criteria. Key term used in searching literature: "Calcium for prevention of preeclampsia." from 10 journals, it was found that the correct dose of calcium and timing of giving calcium to pregnant women was found and that calcium had an effect on preventing preeclampsia. Data analysis techniques use Synthesize or compare. Conclusion: Mothers are advised to consume calcium because it can lower blood pressure. By reducing blood pressure in pregnant women, calcium can prevent the occurrence of preeclampsia, especially in pregnant women who have hypertension or a history of preeclampsia.

Keywords : Calcium, preeclampsia, pregnancy

INTRODUCTION

Preeclampsia is a pregnancy disorder accompanied by hypertension and proteinuria. Preeclampsia can affect maternal morbidity and mortality worldwide. Preeclampsia is an increase in blood pressure that begins to appear after more than 20 weeks of gestation, characterized by the results of a blood pressure examination and the presence of protein in the urine; the body also experiences edema or swelling (1–4). Calcium requirements increase during pregnancy. Apart from being crucial for maternal and fetal bone health, adequate calcium intake can reduce the incidence of hypertension during pregnancy, reduce the risk of preeclampsia, and prevent premature birth (5). Lack of calcium intake will increase parathyroid hormone (PTH), causing an increase in intracellular calcium. An increase in intracellular calcium will cause vascular smooth muscle to experience vasoconstriction, which causes blood pressure to become higher. Increased blood pressure during pregnancy is a risk of preeclampsia (6). Calcium supplementation during pregnancy prevents a decrease in serum calcium levels, which results in a reduction of intracellular calcium concentration, which will stimulate vasodilation and reduce smooth muscle contractility. Vascular function changes are crucial in controlling vascular resistance and blood pressure (7). Vasoconstriction can also cause dysfunction of the glomerular capillary endothelium, resulting in increased urinary protein excretion and decreased plasma protein levels. As a result, the mother will experience edema and, over time, will experience preeclampsia (8).

During pregnancy, the need for calcium is higher because it replaces the mother's calcium reserves to form new tissue in the fetus. Apart from being essential for maternal and fetal bone health, adequate calcium intake can reduce the incidence of hypertension during pregnancy (6). This study aimed to determine the effect of giving calcium to prevent preeclampsia by identifying the dose of calcium given to pregnant women when giving calcium is started.

METHODE

The research design used in this research is a literature study. The type of literature review used is Traditional Literature Review. Researchers need to explore various literature, both primary literature such as books and the latest scientific journals, which contain the views and theoretical assumptions used by

experts. Researchers searched through many of these library sources and then read them and looked for theories that they felt were in sync and could be used to answer problems.

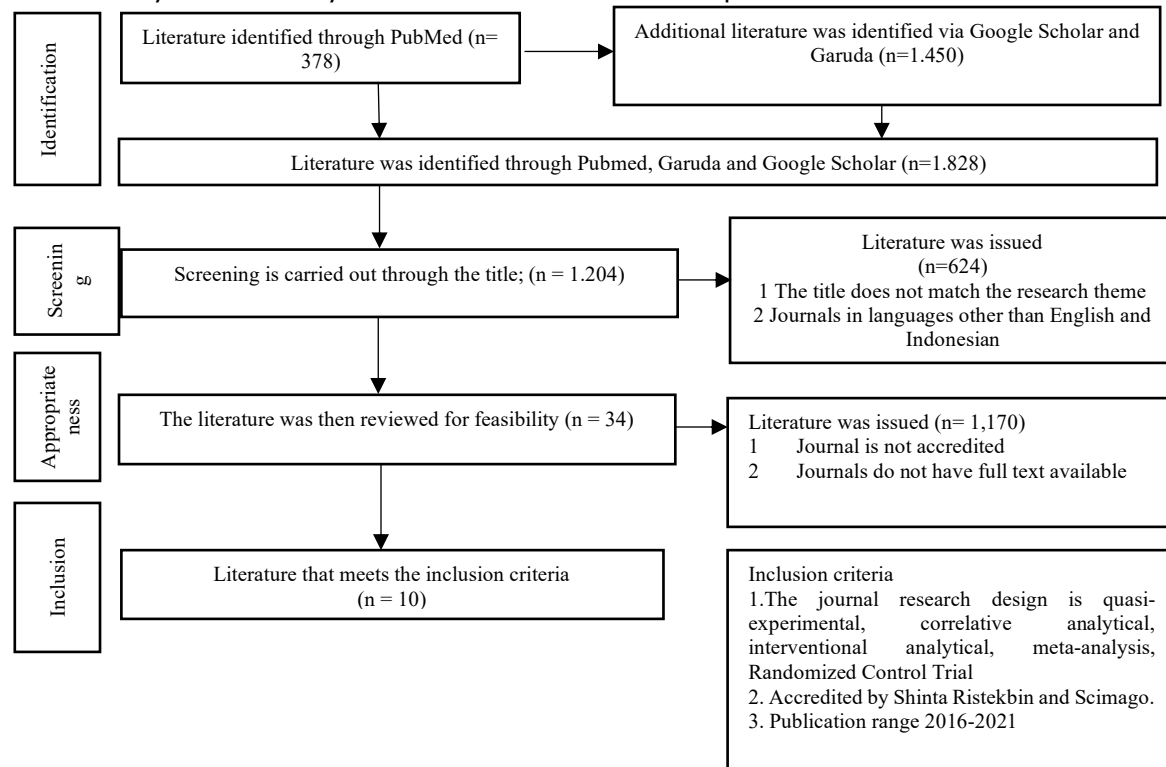


Figure 1. Flow Diagram of Trial Selection Process for Literature Review

RESULT AND DISCUSSION

A literature study entitled The Effect of giving calcium to prevent preeclampsia found ten articles/research journals. The ten research journals consist of 7 national journals and three international journals. Most research journals used correlative analytical, interventional analytical, descriptive-analytical, quasi-experimental, literature review, and prospective cohort designs. The ten studies that contributed to this research are as follows:

Table 1. Year of Journal Publication

| Publication Year Category | n | % |
|---------------------------|-----------|------------|
| 2017 | 1 | 10 |
| 2018 | 2 | 20 |
| 2019 | 4 | 40 |
| 2020 | 2 | 30 |
| 2021 | 1 | 10 |
| Total | 10 | 100 |

According to the table above, it can be seen that almost half of the highest percentage of publications in 2019 were from 4 journals, with a rate of 40%.

Table 2. Research Design

| Research design | n | % |
|--------------------------|-----------|------------|
| Correlative analytics | 1 | 10 |
| Interventional analytics | 1 | 10 |
| Descriptive analytics | 1 | 10 |
| Quasi eksperiment | 3 | 30 |
| Literature review | 3 | 30 |
| Prospective cohort | 1 | 10 |
| Total | 15 | 100 |

Based on the table above, it can be seen that almost half of the research designs used in the journals found were Literature review and Quasi-Experimental in 3 journals with a percentage of 30%.

Table 3. Accredited, Reputable Journals

| Authenticated, reputable journal | n | % |
|----------------------------------|-----------|------------|
| Sinta | 7 | 70 |
| Scimago | 3 | 30 |
| Total | 10 | 100 |

Based on Table 4.1.1.4 above, it can be seen that most of the journals found are accredited journals by Sinta Ristekbrin.

Table 4. Literature Search Results

| No | Title, Author, Year of Publication | Method | Analysis Results | Conclusion | Data Based, URL |
|----|--|---|---|---|---|
| 1 | Title: The Relationship Between Parity, Pregnancy History, And Calcium Intake With Severe Pre-Eclampsia Author: Diah Andriani Kusumastuti, Rusnoto, Siti Alfiah Publication Year: 2019 Journal Name: Journal of Nursing and Midwifery Science | Design : Correlative Analytics Sample: 30 pregnant women Instrument: Questionnaire Analysis: Univariate and Bivariate Analysis | (p value = 0.009) There is a relationship between calcium intake and the incidence of severe pre-eclampsia in Japanese health centers. | There is a relationship between calcium intake and the incidence of severe pre-eclampsia | Google Scholar, http://repository.urecol.org/index.php/proceeding/article/view/702 |
| 2 | Title: The Effect of Giving Calcium on Reducing Blood Pressure in Preeclamptic Mothers at the Negara Building Health Center, Negara Ratu Health Center, And the Batu Nangkop Community Health Center, North Lampung Regency Writers: Eva Nauli, Devi Kurniasari, Vida Wira Utami Publication Year: 2020 Journal Name: Midwifery Journal | Design: Interventional analytics Sample: 40 pregnant women with TM II and TM III preeclampsia Analysis: Univariate and bivariate analysis | The results of statistical tests in the intervention group using the paired sample t-test at $\alpha = 0.05$ showed a p value of $0.000 < 0.05$ for systolic and diastolic blood pressure in preeclamptic mothers after being given calcium | The observation results showed that respondents who were given calcium supplementation of 2x500 mg, in the third and fourth weeks of the show significant reduction in blood pressure with an average of 120 mmHg for systolic blood pressure | Garuda https://core.ac.uk/download/pdf/322563490.pdf |

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|---|--|---|---|---|---|
| | | | supplementation | and 77.5 mmHg for diastolic blood pressure as well accompanied by disappearance of edema and reduction proteinuria | |
| 3 | Title: Effect of Calcium Administration on Reducing Blood Pressure in Pregnant Women History of Preeclampsia Author: Meldawati Publication Year: 2020 Journal Name: Health Dynamics Journal of Midwifery and Nursing | Design: Quasi Experimental Sample: 30 pregnant women with a history of TM II and TM III preeclampsia Instrument: Questionnaire Analysis: Univariate and Bivariate Analysis | Based on the research results, it shows that there is a decrease in blood pressure before and after giving calcium using the Paired T test, a pValue of .000 < 0.05, which means it is significant. | There was a decrease in blood pressure before and after calcium administration | Google Scholar https://ojs.dinamikakesehatan.unism.ac.id/index.php/dksm/article/download/581/462 |
| 4 | Title: Correlation of Calcium Administration Time and Compliance Calcium Consumption With High Risk Events Pre-Eclampsia in Pregnant Women in the Community Health Center Work Area Ciputat Author: Reni Nofita, Friska Rezaputri Anjansari Publication Year: 2018 Journal Name: Indonesian Journal of Midwifery | Design: descriptive analytics Sample: 88 pregnant women Instrument: questionnaire Analysis: univariate and bivariate analysis | There is a significant relationship between adherence to calcium consumption and the incidence of high risk of preeclampsia with a p value of 0.012 | There is a relationship between adherence to calcium consumption and a high risk of preeclampsia. Due to compliance with taking calcium during pregnancy it can decrease High risk of preeclampsia 3 times more than pregnant women who do not obedient | Garuda http://jurnal.unw.ac.id:1254/index.php/ijm/article/view/39 |
| 5 | Title: Changes in Blood Pressure with Calcium Consumption in Pregnant Women History of Preeclampsia Author: Irmayanti, Devianti Tandiallo, Fitriana Ibrahim Publication Year: 2021 Journal Name: Indonesian Midwifery Scientific Journal | Design: Quasi experimental. Sample: 30 pregnant women TM II and TM III Instrument: Questionnaire Analysis: paired T test | The research shows changes in pressure of blood of pregnant women before and after giving calcium for 8 weeks with dose 3x500 mg/day. From 30 samples of pregnant women as many as 13 pregnant women were hypertensive and 17 with normal blood pressure. | Consume calcium regularly and appropriately can reduce systolic blood pressure pregnant women with a history of preeclampsia with pressure high blood pressure and can control pressure blood of pregnant women with a history of preeclampsia normal blood pressure. | Scholar http://journals.stikim.ac.id/index.php/jiki/article/view/938 |
| 6 | Title: Effect of Adherence to Modified Calcium Tablet Supplementation on | Design: Quasy experiment | The results of the study showed that there were | There were differences in changes in calcium levels and blood | Google Scholar https://ejournal.stitpn.ac.id/index.php/palapa/article/view/56 |

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| | <p>Calcium Levels and Blood Pressure in Pregnant Women</p> <p>Writers: Dhany Dahniarti, Irfan Idris, Nasrudin Am</p> <p>Publication Year: 2018</p> <p>Journal Name: Journal of Islamic Studies and Educational Sciences</p> | <p>Sample: 30 pregnant women TM II and TM III</p> <p>Analysis: Paired T Test</p> | <p>differences in pressure in pregnant women between the intervention and control groups with a value of $p=0.000$ ($p<0.05$).</p> | |
| 7 | <p>Title : Calcium and Vitamin D Supplementation for Prevention of Preeclampsia: A Systematic Review and Network Meta-Analysis</p> <p>Author: Win Khaing, Sakda Arj-Ong Vallibhakara, Visiri Tantrakul, Orawin Vallibhakara, Sasivimol Rattanasiri, Mark McEvoy, John Attia and Ammarin Thakkinstian</p> <p>Publication Year: 2017</p> <p>Journal Name: Nutrients</p> | <p>Design: literature review</p> <p>Sample: 28,000 women</p> | <p>Research results show that calcium supplementation can reduce the risk of preeclampsia.</p> | <p>There is an effect of calcium administration on preeclampsia</p> <p>Pubmed https://www.mdpi.com/2072-6643/9/10/1141</p> |
| 8 | <p>Title: Calcium Supplementation in Pregnant Women to Reduce the Incidence of Preeclampsia in Developing Countries</p> <p>Author: Ria Gustirini</p> <p>Publication Year: 2019</p> <p>Journal Name: Midwifery Journal</p> | <p>Design: literature review</p> <p>Sample: 13 research journals.</p> | <p>A subgroup analysis for the incidence of preeclampsia with a dose of <2 g/day compared with a dose of 2 g/day showed that the effect was more pronounced and statistically significant in the study using a dose of 2 g/day compared with the group using a dose of <2 g/day</p> | <p>There is an effect of calcium administration on preeclampsia. This shows that the dose is The most effective calcium supplement during pregnancy is 2g/day and given starting from 20 weeks of pregnancy, the amount of calcium is given in the form two tablets of 500 mg each are consumed twice a day</p> <p>Garuda https://jurnal.unimus.ac.id/index.php/jur_bid/article/view/4246</p> |
| 9 | <p>Title : The association between calcium supplements and preeclampsia and gestational hypertension: a systematic review and meta-analysis of randomized trials</p> <p>Authors: Xiaotong Sun, Huijuan Li, Xiyang He,</p> | <p>Design: Systematic review</p> <p>Sample: 28,492 pregnant women</p> <p>Analysis: Chi-square</p> | <p>Research shows that calcium supplements have a certain effect in preventing preeclampsia and gestational hypertension, but there is no direct</p> | <p>There is an effect of calcium administration on preeclampsia</p> <p>Pubmed https://www.tandfonline.com/doi/abs/10.1080/10641955.2019.1593445?journalCode=ihip20</p> |

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| <p>Meixuan Li, Peijing Yan, Yangqin Xun, Cuncun Lu, Kehu Yang & Xuehong Zhang Publication Year: 2019 Journal Name: Hypertension in Pregnancy</p> | <p>comparison of different doses of calcium supplements for preeclampsia and gestational hypertension. Subgroup analysis showed all three doses of calcium supplements could reduce the risk of preeclampsia, and differential protective effects were still evident in the high-risk population.</p> | |
| <p>10 Title : The Effect of Supplementation of Calcium on Prevention of Pre- Eclampsia in Pregnant Women at Kuta Baro Community Health Aceh Besar Center, Indonesia Writer : Anita Anita, Nurlaili Ramli Publication Year: 2019 Journal Name: Open Access Macedonian Journal of Medical Sciences</p> | <p>Design: prospective cohort Sample: pregnant women with a gestational age of more than 25 weeks, totaling 60 participants, 30 people as the intervention group and 30 people as the control group. Analysis: chi-square</p> | <p>There was a significant change in the average blood calcium levels before and after being given calcium supplements in the intervention and control groups ($p < 0.05$). Calcium supplementation for pregnant women at the Kuta Baro Community Health Center can prevent preeclampsia.</p> <p>There is an effect of calcium administration on preeclampsia</p> <p>Scholar https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6490500/</p> |

Efforts to prevent preeclampsia can be done using medical prevention. In populations suspected of being calcium deficient, giving calcium reduces the possibility of preeclampsia, given calcium: 1500-2000 mg/day (9). Calcium supplementation is needed by pregnant women, in line with the theory that calcium supplementation intake of 1500-2000 mg/day is recommended for the prevention of preeclampsia for all pregnant women, especially those at high risk (history of preeclampsia in previous pregnancies, diabetes, chronic hypertension, disease kidney disease, autoimmune disease, or multiple pregnancies) (10).

In the study conducted by Eva et al. (11), there was an intervention group and a control group. The intervention group was given calcium supplementation at 2x500 mg/day for one month. Respondents were then monitored every week (first-fourth week) to have their blood pressure re-measured to see whether there was a decrease in the mother's blood pressure. Other supporting examinations, such as edema and proteinuria, were carried out in the first and fourth weeks. Observation results showed that respondents

who were given calcium supplementation in the third and fourth weeks showed a significant reduction in blood pressure with a homogeneous average of 120 mmHg for systolic blood pressure and 77.5 mmHg for diastolic blood pressure, accompanied by the disappearance of edema and a decrease in proteinuria. Research on calcium to prevent preeclampsia was also carried out by Nurhaifah et al. (12). This study used a sample of 30 pregnant women with a history of preeclampsia. The pregnant woman was given calcium tablets for eight weeks using a dose of 3x500 mg/day. The pregnant woman's blood pressure was measured once a week for eight weeks. Blood pressure measurements were carried out every Sunday morning using a sphygmomanometer. The study showed changes in blood pressure of pregnant women before and after giving calcium for eight weeks using a dose of 3x500 mg/day. Of the 30 samples of pregnant women, 13 pregnant women had hypertension, and 17 had normal blood pressure. Routine and appropriate calcium consumption can reduce systolic blood pressure in pregnant women with a history of preeclampsia with high blood pressure. They can control the blood pressure of pregnant women with a history of preeclampsia with normal blood pressure.

Based on existing theory, it is stated that the calcium requirements of pregnant women are higher than those of non-pregnant mothers. This calcium requirement is not only for the mother but for fetal growth; pregnant women must get 1500-2000 mg/day of calcium during pregnancy. Pregnant women are also not recommended to consume excess calcium. Pregnant women are at risk of developing kidney stones. The absorption of iron and zinc from the food consumed can also be hampered if pregnant women receive excessive calcium intake. Researchers conducted several studies on the effect of calcium to prevent preeclampsia. The research was carried out on pregnant women who either already had a history of preeclampsia or did not have a history of preeclampsia. When pregnant women get enough calcium, pregnant women who have high blood pressure will experience a decrease. As a result, they are preventing preeclampsia. This shows that the research is based on existing theory. Pregnant women must get calcium every day at the correct dose.

Time to Give Calcium to Pregnant Women

Calcium absorption during pregnancy is better than during non-pregnancy. Pregnant women must get sufficient calcium during their pregnancy, especially in the 3rd trimester. The most effective dose for calcium supplements during pregnancy is 2g/day and is given starting from 20 weeks of pregnancy; the amount of calcium is shown in the form of 2 tablets of 500 mg, each consumed two times a day (10,13).

In a study by Nauli et al. (11) conducted on 40 pregnant women in the second and third trimesters, 20 women in the intervention group were given calcium supplementation at 2x500 mg for one month. Respondents were then monitored every week (first – fourth week) to re-measure blood pressure to see whether there was a decrease in blood pressure in the mother. The observation showed that respondents who were given calcium supplementation in the third and fourth weeks significantly reduced blood pressure. In a study by Irmayanti et al. (12) conducted in pregnant women in the second and third trimesters, respondents were given calcium tablets for eight weeks at a 3x500 mg/day dose. This study showed changes in blood pressure in pregnant women before and after providing calcium for eight weeks. Calcium supplementation during pregnancy is effective in reducing the incidence of pre-eclampsia and the severity of gestational hypertension (1)

As the pregnancy progresses, the mother's calcium requirements increase; calcium is especially needed in the 3rd trimester of pregnancy. According to theory, the most effective calcium is given starting from 20 weeks of gestation. Researchers conducted research on pregnant women in the second and third trimesters (UK 13-40 weeks), and it could be seen that pregnant women who were given calcium had a decrease in blood pressure; this shows that the research is by existing theories. Pregnant women with low calcium intake should be given calcium at a dose of 3x500mg/day so that if pregnant women have sufficient

calcium intake, they will have stable blood pressure levels so that they can prevent hypertension, thereby reducing the risk of preeclampsia and when it is appropriate to give calcium to pregnant women, start when 20 weeks gestation.

The Effect of Giving Calcium as an Effort to Prevent Preeclampsia

Preeclampsia is identified through the presence of hypertension and proteinuria in a pregnant woman who was previously normotensive. Preeclampsia appears in primigravida or multigravida pregnant women. Efforts to prevent preeclampsia can be done using medical prevention. In populations suspected of calcium deficiency, calcium administration reduces the likelihood of preeclampsia. Calcium is an essential mineral for humans; 99% of the calcium in the human body is in the bones. As much as 1% of calcium is in body fluids such as blood serum, body cells, and extracellular and intra-cellular fluids (11). One theory states that as serum calcium levels decrease, intracellular calcium levels become higher, narrowing the smooth muscles in the blood vessels, increasing vascular resistance, and increasing systolic and diastolic blood pressure. Low serum calcium levels can also increase blood pressure by stimulating parathyroid hormone and renin release so that intracellular calcium increases in smooth muscle, which results in vasoconstriction in blood vessels. The role of calcium supplementation in preventing preeclampsia is to avoid a decrease in serum calcium levels, as a result of which intracellular calcium concentrations decrease, which will reduce smooth muscle contractility and stimulate vasodilation (14,15).

The role of calcium in preventing preeclampsia during pregnancy can be explained using low calcium levels or other factors during pregnancy causing an increase in blood pressure. A journal that examines the effects of giving calcium to prevent preeclampsia, namely research conducted by (1) The population in this study was 30 samples. Data collection was carried out using secondary data and primary data. Secondary data, namely the number of pregnant women in the second and third trimesters, was obtained from Puskesmas records. Preliminary data was obtained directly from respondents collected through questionnaires to get data on pregnant women with a history of preeclampsia and blood pressure checks on pregnant women with an account. The results of the analysis of blood pressure data from pregnant women using the Wilcoxon test showed that preeclampsia was found in pregnant women with a history of preeclampsia before and after calcium administration. The result of a 0.000 or <0.05 value is a significant disparity. Thus, it was concluded that after administration of potassium during pregnancy, there was a decrease in blood pressure in pregnant women based on a history of preeclampsia. As a result, calcium is used to prevent preeclampsia. According to research conducted by (12) with the title the relationship Between the timing of calcium administration and compliance with calcium consumption with the incidence of high risk of preeclampsia in pregnant women in the Ciputat Health Center working area, it was explained that pregnant women who were at risk of experiencing preeclampsia among respondents who did not comply with consuming calcium were the most namely (80.9%) compared to respondents who adhered to consuming calcium (56.1%). The statistical test results produced a p-value of 0.012, which means there is a significant relationship between compliance with calcium consumption and the incidence of high risk of preeclampsia in pregnant women in the Ciputat work area in 2016. According to the statistical test, OR = 3,304 and 95% CI = 1,274 - 8,570 are pregnant women. Those who do not adhere to consuming calcium have a 3,304 times greater risk of experiencing preeclampsia, with a lower value of 1,274 and an upper value of 8,570 compared to pregnant women who comply with consuming calcium (12).

Increased blood pressure during pregnancy is a risk of preeclampsia. Preeclampsia can be prevented through several efforts, such as giving calcium to pregnant women. Several studies concluded that there were changes in blood pressure before and after providing calcium to pregnant women. If pregnant women lack calcium intake, it will cause an increase in parathyroid hormone (PTH), generating an increase in intracellular calcium. An increase in intracellular calcium will cause the smooth muscles of blood vessels to

experience vasoconstriction, resulting in higher blood pressure. Increased blood pressure during pregnancy is a risk of preeclampsia. The role of calcium supplementation in preventing preeclampsia is to avoid a decrease in serum calcium levels, as a result of which the intracellular calcium concentration decreases, which will reduce smooth muscle contractility and stimulate vasodilation so that if the mother complies with consuming calcium, it will lower blood pressure, this is expected to prevent preeclampsia, especially in pregnant women who have hypertension and a history of preeclampsia.

CONCLUSION

The results of the review show that three journals stated that calcium can prevent preeclampsia if given appropriately; pregnant women get sufficient calcium of 1500-2000 mg every day; five journals noted that calcium can be given starting at the mother's gestation age of 20 weeks or in the second trimester. In the third trimester, ten journals stated that pregnant women experienced changes in blood pressure before and after being given calcium. In the journal, it is explained that if mothers adhere to consuming calcium, it can lower blood pressure, so there is an effect of giving calcium reducing blood pressure in pregnant women; calcium can prevent the occurrence of preeclampsia, especially in pregnant women who have hypertension or a history of preeclampsia.

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