

# Role of Calcium Supplementation in Prevention of Preeclampsia in High Risk Women

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## ABSTRACT

**Objective:** To determine the efficacy of calcium supplementation in prevention of preeclampsia in high risk women.

**Study Design:** Quasi experimental

**Place and Duration of Study:** This study was conducted at the Department of Obstetrics and Gynecology, Civil Hospital, Karachi from June, 2019 to December, 2019 for a period of six months.

**Materials and Methods:** All pregnant women were given 2-gram calcium sachets to take with water after breakfast until delivery. These patients were monitored until they gave birth to check their blood pressure and assess the medication's effectiveness. They were followed up on in the OPD on a regular basis until delivery. SPSS-21 was used to analyze the data. The mean and standard deviation were used to present quantitative data, while frequency and percentage were used to present qualitative data.

**Results:** One hundred and forty-eight patients were included in this research. The patients' average age was 27.2±6.01 years. Calcium supplementation was found to be effective in preventing preeclampsia in 79.05% of high-risk women.

**Conclusion:** Calcium supplementation during pregnancy lowers systolic and diastolic blood pressure and prevents preeclampsia. While calcium supplementation is recommended for pregnant women at risk of preeclampsia, more patient data is needed to confirm calcium's effect on maternal and foetal morbidity.

**Key Words:** Calcium supplementation, Micronutrient supplements, Maternal nutrition, Maternal health, Preeclampsia

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## INTRODUCTION

Prematurity and enhanced perinatal mortality are linked to hypertension during gestation, which is currently one of the leading causes of maternal mortality and morbidity<sup>[1]</sup>.

Pregnancy-induced hypertension (PIH) is defined as blood pressure metrics taken 6 hours apart that are equal to or greater than 140/90mmHg in previously normotensive women after the 20th week of pregnancy and without proteinuria<sup>[2]</sup>.

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Preeclampsia is a clinical syndrome with an unknown aetiology that manifests as hypertension and proteinuria after 20 weeks of pregnancy in previously healthy women. Calcium necessities are elevated during pregnancy and lactation to maintain calcium balance and maternal bone density, as well as to meet foetal growth requirements. A sufficient maternal nutritional status, as well as a sufficient daily intake of micronutrients such as folic acid, vitamins, and minerals, are required for a normal pregnancy outcome<sup>[3,4]</sup>. Several studies have shown that calcium supplementation during pregnancy has beneficial effects on bone mineralization, foetal growth, and the prevention of maternal osteopenia<sup>[5]</sup>.

Preeclampsia can be prevented by taking calcium supplements regularly during pregnancy, according to WHO guidelines<sup>[6]</sup>. The effectiveness of calcium supplementation for the prevention of preeclampsia in populations with low dietary intake and a high risk of preeclampsia has also been questioned by prominent obstetrics professional organizations.<sup>[7]</sup>

According to the WHO, "Calcium supplementation as part of antenatal care is recommended for the prevention of preeclampsia among pregnant women, particularly among those at higher risk of hypertension, in populations where calcium intake is low."<sup>[6]</sup> This strong recommendation is based on moderate-quality

evidence from meta-analyses of randomized clinical trials, which found that calcium supplementation prevented roughly half of all cases of preeclampsia.<sup>[8]</sup> Calcium supplementation has a 59 percent efficacy in preventing preeclampsia in high-risk females, according to Imdad A, et al<sup>[9]</sup>. Calcium supplementation has a 31.6% effect in treating preeclampsia in high-risk women, according to Khaing W, et al.<sup>[10]</sup>

The goal of this study is to see how effective calcium supplementation is at preventing preeclampsia in high-risk pregnant women. Even after the WHO's recommendations, there is no local evidence on this crucial topic. The majority of these studies were conducted on a global scale, and because our environment, genetics, diet, and habits differ from theirs, local data on their significance is inconclusive. The findings of my research will not only provide local evidence, but will also pave the way for future research on this topic.

**MATERIALS AND METHODS**

This research took place over a six-month period, from June to December 2019. On Doppler ultrasound, a total of 148 patients had a uterine artery pulsating index greater than 1.1 and at least one of the following factors: h/o preeclampsia in previous pregnancies on medical record or Chronic hypertension on medical record or BMI > 30 Kg/m<sup>2</sup> or Family history of hypertension were included in the study using a non-probability consecutive sampling technique if the eligibility criteria were met. If the incidence efficacy of calcium supplementation in preventing preeclampsia in high-risk women is 31.6%<sup>10</sup>, the margin of error is 5%, and the level of confidence is 95%, then a sample of at least 148 patients is required. Women between the ages of 18 and 40, gestational age of 20 weeks on LMP, and parity of 0 to 4 were eligible. Women with h/o diabetes on medical records, h/o renal disease on medical records, or h/o parathyroid disorder on medical records were excluded.

A detailed history was taken, including age, parity, current history, and previous history of any medical disorder. During the examination, the patient's weight, height, and blood pressure were measured. Every visit, a standard manual sphygmomanometer was used to check blood pressure. Any woman who had a BP reading of more than 140/90 mm hg six hours apart was offered a 24-hour proteinuria test to quantify protein in urine through laboratorial analysis. All pregnant women were given 2-gram calcium sachets to take with water after breakfast until delivery. These patients were monitored until delivery to ensure that the medication was working properly. They were followed up on in the OPD on a regular basis until delivery.

Blood pressure of 140/90 mmHg (on two occasions at least 6 hours apart) and proteinuria of 300 mg/24 hours were considered positive signs of preeclampsia. No

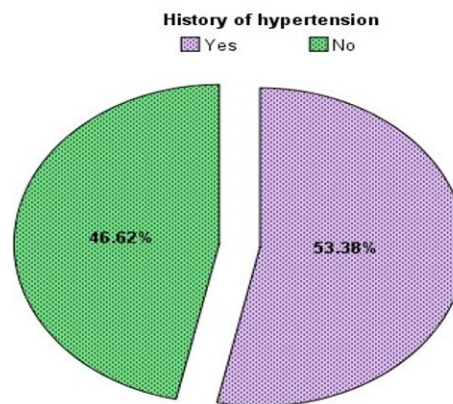
preeclampsia during pregnancy was defined as efficacy. For quantitative variables such as age, parity, weight, height, and BMI, the mean and standard deviation were presented. For qualitative variables like history of chronic hypertension, family history of hypertension, or previous history of pre-eclampsia, and efficacy, frequency and percentage were calculated. Stratification was used to control effect modifiers such as age, parity, BMI, history of hypertension, family history of hypertension, or previous history of pre-eclampsia. The chi square test was used after stratification, and p 0.05 was considered statistically significant.

**RESULTS**

A total of 148 high risk patients were included in this study. The average age of the patients was 27.21±6.01 years. Similarly mean parity, weight, height and BMI of the patients are also reported in table 1. History of hypertension was observed in 53.38% women figure 1. Family history of pre-eclampsia was found in 75(50.68%) as shown in figure 2. Family history of hypertension was also observed in 99(66.89%) as presented in figure 3. Efficacy of calcium supplementation in prevention of preeclampsia in high risk women was 79.05% (117/148) as presented in figure 4. Efficacy of calcium supplementation was not statistically significant with respect to age groups, parity, patients who had history of hypertension and history of pre-eclampsia but it was statistically significant with family history of hypertension table 2.

**Table No.1 Descriptive Statistics of the Patients (N=148)**

Variables	Mean	Std. Deviation
Age (Years)	27.21	6.01
Parity	1.61	1.27
Weight (kg)	70.04	12.11
Height (cm)	161.84	9.72
BMI (kg/m <sup>2</sup> )	26.83	4.79



**Figure No.1: History of Hypertension of Patients (N=148)**

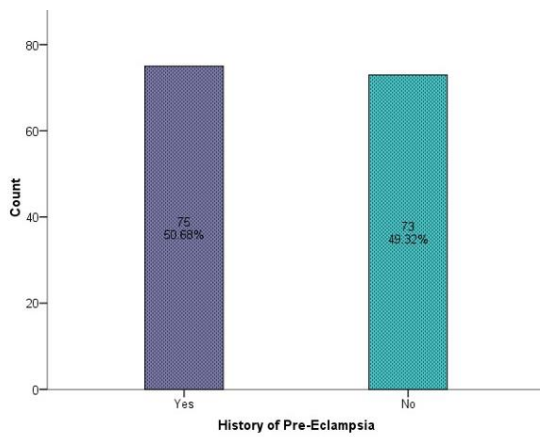


Figure No.2: Family History of Preeclampsia (N=148)

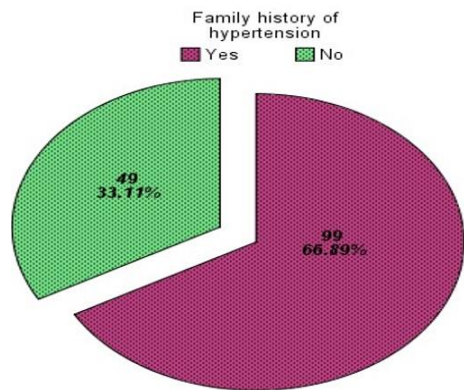


Figure No.3: Family History of Hypertension (N=148)

Table no.2: Efficacy of calcium supplementation in prevention of Preeclampsia in high risk women

Effect Modifiers	Efficacy of Calcium Supplementation		P-value
	Yes	No	
<b>Age Groups (Years)</b>			
≤ 20 Years	26(86.7%)	4(13.3%)	0.09
21-30 Years	55(83.3%)	11(16.7%)	
>30 Years	36(69.2%)	11(16.7%)	
<b>Parity</b>			
0	28(80%)	7(20%)	0.788
1-2	62(80.5%)	15(19.5%)	
3-4	27(75%)	9(25%)	
<b>H/o Hypertension</b>			
Yes	64(81%)	15(19%)	0.53
No	53(76.8%)	16(23.2%)	
<b>H/o Preeclampsia</b>			
Yes	59(78.7%)	16(21.3%)	0.907
No	58(79.5%)	15(20.5%)	
<b>Family H/o Hypertension</b>			
Yes	85(85.9%)	14(14.1%)	0.004
No	32(65.3%)	17(34.7%)	

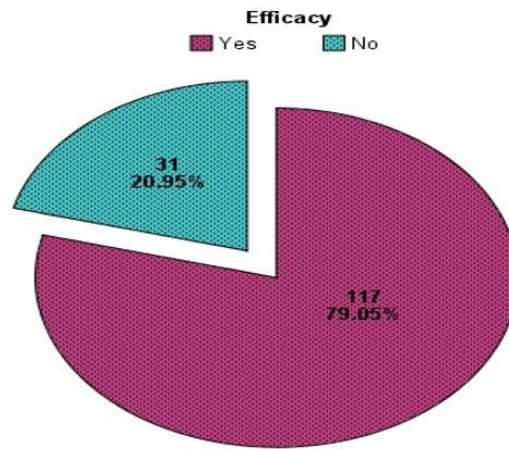


Figure No.4: Efficacy of Calcium Supplementation in Prevention of Preeclampsia in High Risk Women (N=148)

## DISCUSSION

After 20 weeks of pregnancy, preeclampsia is defined as a new onset of high blood pressure with proteinuria and/or end-organ or utero-placental dysfunction. It's one of the leading causes of maternal-fetal morbidity and mortality all over the world [11]. Preeclampsia and eclampsia affected 4.6 percent and 1.4 percent of all pregnancies, respectively [12]. In developed countries, the incidence was around 3.4 percent [13], whereas in developing countries, it ranged from 1.8 percent to 16.7 percent [13,14]. In low and middle-income countries, preeclampsia or eclampsia is responsible for 10% to 15% of maternal deaths [15], whereas in developed countries, it is responsible for one in every 100,000 live births [16]. It was also linked to life-threatening adverse outcomes in both the mother and the foetus (e.g., placental abruption, preterm delivery and hemolysis, elevated liver enzymes, and low platelets (HELLP) syndrome, etc.) [17].

High blood pressure and calcium intake have been shown to have an inverse relationship in the past [18, 19]. This link has also been shown in a number of epidemiological and clinical studies [18-21], as well as a series of systematic reviews [22-25]. Their findings suggest that calcium supplements (1g/day) may reduce the risk of preeclampsia [26].

As a result, the World Health Organization (WHO) recommends calcium supplementation for pregnant women, particularly those in high-risk populations who consume a low-calcium diet [27].

There has been one previous study of calcium supplementation in early pregnancy [28]. This small RCT assessed calcium and antioxidant supplementation initiated at 8-12 weeks' gestation paralleled with placebo and found declines in pre-eclampsia (two of 29 in the calcium group vs nine of 31 in the placebo group) and miscarriage (zero of 29 vs eight of 31) with the intervention; the outcomes are indicative of a calcium

effect since antioxidants have not been established to lessen pre-eclampsia [29].

Calcium supplementation was found to be 79.05% effective in preventing preeclampsia in high-risk women. Calcium supplementation has a 59 percent efficacy in preventing preeclampsia in high-risk women, according to Imdad A, et al. [8] Calcium supplementation has a 31.6% efficacy in preventing preeclampsia in high-risk women, according to Khaing W, et al. [9,10]

Vitamin D is involved in bone metabolism, calcium and phosphate absorption, and muscle function maintenance [30]. As a result, vitamin D supplementation may be beneficial in preventing preeclampsia. However, systematic reviews of randomized controlled trials (RCTs) [31,32] found no benefit in preeclampsia prevention, whereas two systematic reviews of observational studies [33,34] did. This disparity could be due to confounding bias in the latter or a lack of power in the former. Tang et al. found that calcium supplementation had the same effect in high-risk pregnancy, but not in low-risk pregnancy [35]. Furthermore, the effect of calcium supplementation was significantly beneficial in developing countries but not in developed countries, which was consistent with Imdad et al. [36], who discovered that calcium supplementation was beneficial in developing countries with low calcium intake. As a result, the WHO has recommended that high-risk pregnant women with low calcium intake receive calcium supplementation as part of routine antenatal care to prevent preeclampsia. The results of vitamin D supplementation and calcium plus vitamin D supplementation are also consistent with the findings of the most recent Cochrane review [30]. Although the effects of these supplements may reduce the risk of preeclampsia, more high-quality RCTs are needed to confirm the findings. For preventing preeclampsia, vitamin D may be preferable. The following are some possible explanations for this result: to begin with, adequate vitamin D intake may help to maintain calcium homeostasis, which has an inverse relationship with blood pressure [20], or it may directly suppress vascular smooth muscle cell proliferation [37]. Second, vitamin D may act as an endocrine suppressor of renin biosynthesis and regulate the renin-angiotensin system, which is important in blood pressure regulation. Third, vitamin D may modulate the immune system by balancing T helper cells [37].

## CONCLUSION

Calcium supplementation during pregnancy lowers systolic and diastolic blood pressure and prevents preeclampsia. While calcium supplementation is recommended for pregnant women at risk of preeclampsia, more patient data is needed to confirm calcium's effect on maternal and foetal morbidity.

## Author's Contribution:

Concept & Design of Study:	Diana Kumari
Drafting:	Aruna Kumari Hira
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Final Approval of version:	Farhat Jafri

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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