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The Difference of Vitamin D and Calcium Levels in Preeclampsia and Normal Pregnancy

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ABSTRACT

Background: The incidence of preeclampsia is still high in the world and in Indonesia. In obstetric care, preeclampsia still a big problem and is a cause of increasing maternal and neonatal mortality and morbidity. This research aimed to discover the difference of vitamin D and calcium level in preeclampsia and normal pregnancy.
Methods: The design of this study was cross sectional and conducted in RSUP Dr. M. Djamil Padang and Lubuk Buaya Public Health Center between February 2017 – November 2017. Sample in this research were 25 women with over 20 weeks of pregnancy who are diagnosed with preeclampsia and 25 women with normal pregnancy, gathered using consecutive sampling technic. The vitamin D levels were examined using ELISA and calcium levels using ARSENAZO method. The results were tested for data normality using Shapiro-Wilk, and then the unpaired T-test was performed.
Results: The result of this research showed mean vitamin D levels of 417.42 ± 176.02 pg/mL in preeclampsia and 437.16 ± 165.13 pg/mL in normal pregnancy, with $p > 0.05$. The meancalcium levels were 9.51 ± 1.123 mg/dL and 9.86 ± 0.96 mg/dL in preeclampsia and normal pregnancy, respectively, with $p > 0.05$.
Conclusion: From this research, the author concludes that there were no significant differences of vitamin D in preeclampsia and normal pregnancy, and there were no significant differences of calcium in preeclampsia and normal pregnancy.

INTRODUCTION

According to the World Health Organization (WHO), preeclampsia is still a problem and is acause of increasing maternal and neonatal morbidity and mortality in obstetric care (1). In developed country, hypertension causes 16% of maternal death. This percentage is bigger than three other major cause which are bleeding (13%), abortion (8%), and sepsis (2%) (2). In Indonesia, preeclampsia causes about 27.1% of maternal death (3).

In preeclampsia, deficiency of vitamin D and calcium intake can cause the increase of parathyroid hormone, which increases the serum calcium level, causing the vasoconstriction which then causing vascular resistance and leading to the rise of blood pressure. Vasoconstriction can also cause the disfunction of glomerular capillary endothelium, causing the increase of urinary protein excretion and the plasma protein level will fall. Consequently, the mother will experience oedema and in time will fall into preeclampsia (4). Another study found that low intake of calcium causes the rise of blood pressure by stimulating the release of parathyroid hormone and/or renin which leads to high intracellular calcium level within the vascular of smooth muscle and causes vasoconstriction. The role of calcium supplement in lowering preeclampsia and eclampsia disorders are by

declining the release of parathyroid calcium and intracellular calcium level, leading the decrease of smooth muscle contraction and increasing vasodilatation (5).

Several studies show that vitamin D is somehow connected with calcium (6). Other studies inversely found that there were no connections between vitamin D and calcium levels (7). Considering that there are controversies about vitamin D and calcium roles, the authors aimed to discover the difference of vitamin D and calcium levels in preeclampsia and normal pregnancy.

METHODOLOGY

The study design used in this research were cross sectional, conducted in RSUP Dr. M. Djamil Padang and Lubuk Buaya Public Health Center between February 2017 – November 2017. Sample in this research were 25 women with over 20 weeks of pregnancy who are diagnosed with preeclampsia and 25 women with normal pregnancy, gathered using consecutive sampling technic. Informed consent, data about identity, age, gestational age and parity were obtained through interview. The vitamin D levels were examined using ELISA and calcium levels using ARSENAZO method from venous blood. The results were tested for data normality using Shapiro-Wilk, and then the unpaired T-test was performed. Statistical analysis was conducted using SPSS version 17 (SPSS Inc, Chicago, IL, USA). A p value <0.05 was defined as statistically significant (8).

RESULTS

Table 1. Characteristic of Research Subjects with Preeclampsia and Normal Pregnancy

	Preeclampsia		**Normal Pregnancy**		
Characteristic	**(n = 25)**		**(n = 25)**		***p***
	f	**%**	**F**	**%**	
Parity					
Primiparous	11	47.8	12	52.2	1,000
Multiparous	14	51.9	13	48.1	
History of					
Preeclampsia	14	100	0	0	0,000
Yes	11	30,6	25	69,4	
No					

Chi-square test

Characteristic of research subjects are shown in Table 1. There was no significant difference in parity between preeclampsia and normal pregnant women.

Table 2. The Difference of Vitamin D Levels in Preeclampsia and Normal Pregnancy

Serum Level	**Preeclampsia (n = 25)**	**Normal Pregnancy (n = 25)**	***p***
	Mean ± SD	**Mean ± SD**	
Vitamin D (pg/mL)	417.42±176.02	437.16±165.13	0.684

P value obtained from unpaired T-test

Table 3. The Difference of Calcium Levels in Preeclampsia and Normal Pregnancy

Serum Level	**Preeclampsia (n = 25)**	**Normal Pregnancy (n = 25)**	***p***
	Mean ± SD	**Mean ± SD**	

Calcium (mg/dL)	9.51±1.123	9.86±0.96	0.24

P value obtained from unpaired T-test

This research found mean vitamin D levels of 417.42 ± 176.02 pg/mL in women with preeclampsia and 437.16 ± 165.13 pg/mL in women with normal pregnancy, with $p > 0.05$. The mean calcium levels were 9.51 ± 1.123 mg/dL and 9.86 ± 0.96 mg/dL in women with preeclampsia and women with normal pregnancy, respectively, with $p > 0.05$. These results are shown in Table 2 and Table 3.

DISCUSSION

Vitamin D Levels in Research Subjects

From this research, authors found that the mean serum of vitamin D is lower in preeclampsia compared to normal pregnancy which were 417.42 ± 176.02 pg/mL in women with preeclampsia and 437.16 ± 165.13 pg/mL in women with normal pregnancy. From the statistical test we obtain the p value of 0.684, because the value of $p > 0.05$, we concluded that there were no significant difference of vitamin D level in preeclampsia and normal pregnancy (9).

Calcium Levels in Research Subjects

From this research, we found that the mean serum of calcium is lower in preeclampsia compared to normal pregnancy which were 9.51 ± 1.123 mg/dL and 9.86 ± 0.96 mg/dL in women with preeclampsia and women with normal pregnancy, respectively. From the statistical test, we obtain the p value of 0.24. Since the value of $p > 0.05$, we concluded that there were no significant difference of calcium level in preeclampsia and normal pregnancy.

The difference of Vitamin D Levels in Preeclampsia and Normal Pregnancy

Synthesis of 1,25-dihydroxivitamin D increases during normal pregnancy (10). Other than the kidneys, the placenta also produce 1,25-dihydroxyvitamin D by the activity of Cytochrome p450 27B1 (CYP27B1) enzyme, so the production of vitamin D is doubled in third trimester of pregnancy. If the level of 1,25-dihydroxyvitamin D increased, then the absorption of calcium in the intestines will also be increased (11).

Low level of 1,25-dihydroxivitamin D in pregnant women will increase renin and angiotensin receptor II productions, which can cause vasoconstriction of blood vessel, high blood pressure in pregnancy, and leads to preeclampsia (12).

In a study by Frolich, they found lower mean level of vitamin D in hypertensive women compared to normal pregnant women, which are 32.2 pg/mL and 38,6, respectively. (10) The similar result also found by Retnosari et al, which states that mean vitamin D level is lower in preeclamptic women (18.04 ng/mL) compared to normal pregnant women (20.85 ng/mL). Subjects on that research were 38 women who are 20-34 weeks pregnant with preeclampsia as the case group, and 34 normal pregnant women without complication as control group. (11)

Therefore, according to our research, we can conclude that vitamin D level in preeclampsia is lower than in normal pregnancy.

The difference of Calcium Levels in Preeclampsia and Normal Pregnancy

Mean level of calcium in both groups are still in normal limits. Normal level of calcium in both groups are because around 99% of calcium is stored in the bones, while the remaining of 1% are in ionic form within intracellular and extracellular, bound with protein and in complex form with organic ions. Calcium and bone metabolisms are interconnected to one another. Deficiency of serum calcium will stimulate the bones to release calcium (increase bone resorption) to restore the normal level of serum calcium (13).

In the research by Prasetyawan in RSUP Dr. Kariadi Semarang, they found out that mean level of calcium in severe preeclampsia and normal pregnancy are still within normal limits, which were 1.86±0.22 mmol/L in severe preeclamptic women and 2.09±0.23 mmol/L in normal pregnant women (14). Those results are in line with the

research by Sunaryo et al about relationship between serum calcium and urinary calcium levels with blood pressure in preeclampsia, where the mean calcium levels are still within normal limits, which are 7.97±0.37 mg/dL in preeclampsia and 8.82±0.45 mg/dL in normal pregnancy. Subjects of this research were 33 pregnant women with eclampsia as the case group, and 33 normal pregnant women with normal pregnancy as control group (15).

Therefore, according to the result of this research, we can conclude that serum calcium levels are within normal limits in women with preeclampsia and normal pregnancy (16).

CONCLUSION

From this research, the authors found that there were no significant differences of vitamin D in preeclampsia and normal pregnancy, and there were no significant differences of calcium in preeclampsia and normal pregnancy.

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