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Relationship between Vitamin D Levels and Blood Sugar Levels in Premenopausal Women in Padang City

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ABSTRACT

Background: In premenopausal women, low vitamin D levels result in impaired insulin release from the pancreas and reduce glucose tolerance which causes the body's metabolism to slow down resulting in an increase in body weight which leads to insulin resistance and leads to diabetes mellitus (DM). The incidence of DM is more common in the premenopausal age than in the productive age, the percentage of women experiencing DM is higher than that of men.
Objective: to determine the relationship between vitamin D levels and fasting blood sugar levels in premenopausal women in Padang City.
Research Method: This research was observational conducted in the city of Padang and used cross-sectional design. The study sample was 62 premenopausal women. Measurement of vitamin D levels was carried out by using the ELISA method and fasting blood sugar levels were carried out by using the GOD-PAP method measured by a spectrophotometer. Data analysis was carried out univariate and bivariate using Pearson correlation.
Results: It obtained the average vitamin D level of the respondents was 30.96 ± 10.96 ng/ml. The average fasting blood sugar level of respondents was 107.03 ± 13.74 mg/dl. There was no significant relation between vitamin D levels and fasting blood sugar levels (r= - 0.038, p= 0.769).
Conclusion: There is no significant relationship between vitamin D levels and fasting blood sugar levels in premenopausal women in Padang City.

Keywords: vitamin D levels, fasting blood sugar levels, premenopause.

INTRODUCTION

Every woman will experience physiological processes in her life; the processes are premenopause, menopause, and postmenopause. Menopause is a physiological condition faced by women in their lifetime, where a woman experiences the last period of her menstrual period, because the ovaries no longer produce estrogen. The decline in estrogen occurs gradually, starting at the age range of 40-50 years (premenopause)[1].

In premenopausal women, it is known that the hormone estrogen protects productive women against various cardiovascular diseases such as myocardial infarction or cerebral apoplexy[2]. The cause of the increase cardiovascular disease occurrence in the women experiencing this estrogen deficiency is not all clear; one of the possible causes is because the change in glucose metabolism in the body, especially obstacles in the process of glucose transport due to the insensitivity of insulin receptors in every cell of the body. This condition is commonly referred to as insulin resistance which manifests as high blood sugar levels (hyperglycemia).

Ministry of Health data from the 2018 Basic Health Research has found an increase in the prevalence of diabetes mellitus in Indonesia from 6.9% in 2013 to 10.9%[3]. Data from the International Diabetes Federation (2017)[4] stated that the estimated number of diabetes mellitus in Indonesia is estimated at 10 million, such as conditions in the world, diabetes mellitus is now one of the biggest causes of death in Indonesia. The prevalence of diabetes mellitus in West Sumatra reaches 13% based on a doctor's diagnosis and 18% based on a doctor's diagnosis and symptoms. Data from Dr. M. Djamil General Hospital showed that the number of people with diabetes mellitus increased every year in 2016 amounting to 5900 people. If diabetes mellitus is not treated immediately, this condition can lead to decreased productivity, disability and premature death[5].

Vitamin D has an important role both in glycemic control and even in reducing diabetes complications. The role of vitamin D in reducing blood sugar levels is still not clearly understood, but the most likely mechanisms include the role of vitamin D in the regulation of insulin synthesis and secretion in β pancreatic cells, increasing peripheral and hepatic glucose uptake, and inhibiting inflammation that often occurs in obesity[6].

Vitamin D intake, food intake and physical activity can affect a person's blood sugar levels. Food intake that can affect is the intake of carbohydrates, fats, proteins and fiber. According to Shab-Bidars et al 2015[7], restriction of carbohydrate consumption has an effect on reducing body weight and blood sugar levels in people with type 2 diabetes mellitus. Excessive fat intake has an impact on reducing the amount of adiponectin which can reduce insulin sensitivity, where a study conducted in Japan showed that low plasma adiponectin was associated with insulin sensitivity[9]. Physical activity also affects a person's blood sugar levels, due to its effect on insulin sensitivity.

The increasing prevalence of diabetes mellitus in Indonesia must be definitely prevented. One way to prevent it is to know the factors that influence the occurrence of diabetes mellitus in the community. Based on previous studies, it is stated that sociodemography, behavioral and lifestyle factors as well as clinical or mental conditions affect the incidence of diabetes mellitus. Based on this background, the researchers were interested in examining the relation between vitamin D intake and blood sugar levels in premenopausal women.

MATERIALS & METHODS

This is an observational study using a cross sectional study design, which is to see the relation between vitamin D levels and fasting blood sugar levels in premenopausal women in Padang City. This research is part of the research of Prof. DR. dr. DelmiSulastri, M.Sc, Sp.GK. carried out in the city of Padang. Examination of vitamin D levels was carried out at the Biomedical Laboratory, Faculty of Medicine, Andalas University and blood sugar examination was carried out at the Biochemistry Laboratory, Faculty of Medicine, Andalas University. This research was started from August 2017-November 2018.

The research results were statistically processed and the Kolmogorov Smirnov normality test was carried out to see whether the data were normally distributed or not. The variables tested for normality using the Kolmogorov Smirnov normality test were vitamin D levels and fasting blood sugar levels. The data is normally distributed with the value of Asymp.Sig.(2 tailed)> 0.05. Data that are not normally distributed are transformed into data, then tested for normality once again. If the data is still not normally distributed, then the parametric test cannot be carried out, it is replaced with a non-parametric test. The analysis to see the relation between the variable of vitamin D levels (independent variable l) and fasting blood sugar levels (the dependent variable)

is the Pearson correlation statistical test if the data is normally distributed; whereas if the data is not normally distributed, then the Spearman Rank test is performed

RESULT

1. Table 1.1: Frequency Distribution of Respondents' Vitamin D Levels

Vitamin D levels	f	%
Deficiency (< 20 ng/ml)	9	14,5
Insufficiency (21-29 ng/ml)	26	41,9
Sufficiency (30-100 ng/ml)	27	43,5
Total	**62**	**100,0**

Based on Table 1.1, it is known that respondents with vitamin D levels at the level of sufficiency (30-100 ng/ml) were 43.5%.

2. Table 1.2: Frequency Distribution of Respondents' Fasting Blood Sugar Levels

Fasting Blood Sugar Levels	f	%
Normal (≤ 100 mg/dl)	22	35,5
Abnormal (>100 mg/dl)	40	64,5
Total	**62**	**100,0**

Based on Table 1.2, it is known that respondents with abnormal fasting blood sugar levels (> 100 mg/dl) were 64.5%.

3. Table 1.3: Average Vitamin D Levels of Premenopausal Women in Padang City

Variable	f	Average ± SD	Min	Max
vitamin D levels (ng/ml)	62	30,96 ± 10,96	12,70	61,60

Based on Table 5.7, it is known that the average vitamin D level is 30.96 ± 10.96 ng/ml with a minimum value of 12.70 ng/ml and a maximum of 61.60 ng/ml.

4. Table 1.4: Average Fasting Blood Sugar Levels of Premenopausal Women in Padang City

Variable	f	Average ± SD	Min	Max
Blood Sugar Levels (mg/dl)	62	107,03 ± 13,74	91,7	156,2

Based on Table 1.4, it is known that the average fasting blood sugar level is 107.03 ± 13.74 mg/dl with a minimum value of 91.7 mg/dl and a maximum of 156.2 mg/dl.

5. Relation between Vitamin D Levels and Fasting Blood Sugar Levels

The results of the normality test obtained a normal distribution of data. Bivariate analysis using Pearson correlation with results as the table provided below

Table 1.5: Relationship between Vitamin D Levels and Fasting Blood Sugar Levels

Variable	P *value*	r value	r^2value
Vitamin D Level Fasting Blood Sugar Level	0,769	-0,038	0,001

Based on Table 5.9, it can be seen that there is no relation between vitamin D and fasting blood sugar levels (r = - 0.038, p = 0.769). The relation between vitamin D levels and fasting blood sugar levels is clearly seen in the scatter plot below.

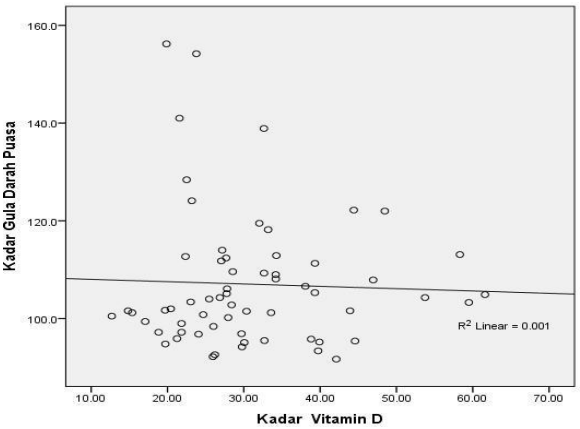

Figure 5.1 Log Correlation between Vitamin D Levels and Fasting Blood Sugar Levels

The correlation analysis in Figure 5.1 shows a negative correlation (r =-0.038) and not significant (p=0.769) between vitamin D levels and fasting blood sugar levels. These results indicate that an increase in vitamin D levels is not accompanied by an increase in fasting blood sugar levels.

DISCUSSION

In this study, there was a correlation between vitamin D levels and fasting blood sugar levels with a weak relation pattern and a negative pattern (r=-0.038, p = 0.769). High levels of vitamin D in this study were not followed by high fasting blood sugar levels. The theory is that high levels of vitamin D are associated with fasting blood sugar levels. The results of this study differ from the theory due to the average respondent (41.9%) with obesity nutritional status (BMI>27.0 kg/m^2). People with a higher BMI have lower levels of vitamin D because vitamin D is absorbed fat-soluble and stored in the body's fat stores for later use. The greater the volume of adipose

tissue, the more likely it is that vitamin D is trapped, so that vitamin D will be low in serum[10 11] .

A similar relation was also revealed by Rohmah N et al. 2017, the results of the average vitamin D level were 4.1 ± 2.2349. Age and blood sugar levels were negatively correlated (r = -0.137, p = 0.245). The study concluded that there is no relation between vitamin D intake and high fasting blood sugar levels because vitamin D does not directly affect fasting blood sugar levels, but affects serum vitamin D first, which serum vitamin D can increase insulin sensitivity[12].

In connection with this study, a recent study in Brazil by Petridis et al (2019) showed a clear relation between vitamin D and glycemic control, suggesting that vitamin D improves insulin sensitivity and improves pancreatic beta cell function. In this cross-sectional study involving 680 Brazilian women aged 35-74 years, the objective was to evaluate the possible association between vitamin D deficiency and increased glycemia. In women who were interviewed, 24 people (3.4%) took vitamin D supplements; it was negatively associated with high blood sugar levels[13].

On the other hand, a study conducted by Lu et al., 2009 in China showed that vitamin D levels were inversely related to fasting blood sugar levels related to age, sex, and body mass index (BMI). Negative correlation between vitamin D levels and the degree of adiposity caused by body mass index. Alkhatatbeh et al., 2018 showed that there was a significant negative correlation between vitamin D levels and fasting blood sugar levels (Luetal.,2009: Alkhatatbehetal.,2018)[14 15].

Research conducted by Park et al., 2016 explained that adequate serum vitamin D can protect pancreatic beta cells and help insulin synthesis and secretion. Thus, increasing the insulin response to an increase in blood sugar. This is related to the role of vitamin D which can increase blood sugar levels[16 17].

Different thing was found by Sintian et al., 2018 confirming that vitamin D supplementation did not have effect on controlling blood sugar levels. However, glucose secretion and insulin sensitivity through regulation of calcium concentration (Ca^{2+}) extracellular and flux through β cell membranes in insulin target tissues[12 18] .

The results of the same study as our research were also carried out by AlSheikh et al., 2019 regarding the role of vitamin D which is not related to the secretory concentration of fasting blood sugar levels19. The same finding was also reported by Nimitphong et al., 2013 in a study of 380 Malay adults (mean age 48.5 years), there was no correlation between fasting blood sugar 25(OH)D levels[19 20 21] .

It is known that vitamin D deficiency in patients with high fasting blood sugar levels (DM) in many countries; it is just that the prevalence and mean values are different which can be caused by differences in geographic location, race, skin color, genetics, BMI, culture and a diet rich in vitamin D. Non-diabetic vitamin D deficiency in Indonesia has an average vitamin D level of 15.57 ng/ml in addition to taking into account Indonesian culture, which is high in wearing hijab and other sun protection[20].

CONCLUSION

There is no relationship between vitamin D levels and fasting blood sugar levels in premenopausal women in Padang City.

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