World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Correlation between vitamin D intake with level of 25-hydroxy vitamin D serum maternal

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World Journal of Advanced Research and Reviews, 2023, 18(02), 652–656

Publication history: Received on 22 February 2023; revised on 08 April 2023; accepted on 10 April 2023

Article DOI: https://doi.org/10.30574/wjarr.2023.18.2.0554

Abstract

Vitamin D deficiency is a health problem that is of concern at this time. During pregnancy, vitamin D is associated with fetal growth and development, wherein the 25(OH)D level of the fetus is completely dependent on the mother's supply. This study aims to examine the relationship between vitamin D intake and maternal serum 25(OH)D levels.

This research uses a cross-sectional design. Data collection was carried out in samples at Hermina Hospital, BMC and Army Hospital in June-December 2022. The sampling technique used consecutive sampling, totaling 40 term pregnant women. Data collection was carried out by taking maternal blood. Data on vitamin D intake were obtained from interviews using the FFQ questionnaire. Maternal serum was examined using the ELISA method at the Unand Biomedical Laboratory. The test used is *Pearson* correlation

The results showed that the mean intake of vitamin D and levels of 25(OH)D in maternal serum were 16.54 ± 2.99 mcg, 14.74 ± 4.93 ng/ml. The relationship between vitamin D intake and maternal serum 25(OH)D levels with a value of r=0.379 was significantly ρ=0.016.

The conclusion of this study was that the correlation between vitamin D intake and maternal serum 25(OH)D levels was significantly correlated

Keywords: Vitamin D intake; Maternal; 25-hydroxy vitamin D; Pregnancy

1. Introduction

Vitamin D is a prohormone that plays a role in the absorption of calcium in the inte stine [18]. Vitamin D has two molecular forms, namely vitamins D2 (ergocalciferol) and D3 (cholecalciferol) [14]. In the body, vitamin D undergoes two hydroxylation processes. The first hydroxylation will form 25 hydroxy vitamin D (25(OH)D) which is assisted by the 25 hydroxylase enzyme in the liver, while the second hydroxylation occurs in the kidney with the help of the enzyme 1-(alpha) hydroxylase to form 1,25 hydroxy vitamin D (1, 25 (OH)D) [3]. The level of 25(OH)D circulating in the blood is often used as an indicator of vitamin D status, because of its high concentration and greater half-life compared to 1,25(OH)D [15].

On the Asian continent, vitamin D deficiency is more common in South Asia and Southeast Asia. The prevalence of vitamin D deficiency in South Asia is 70% and in Southeast Asia varies greatly, namely 6-70% in all age groups including toddlers, school children, pregnant women and adult men (Herrmann et al., 2017). In Indonesia, the prevalence of vitamin D deficiency is 90% [17]. Bardosono's research (2016) showed a very high vitamin D deficiency reaching 90% in 143 pregnant women [2]. Research by Aji, et al found a prevalence of vitamin D deficiency of 82.8% [1].

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Deficiency of vitamin D in pregnancy can increase the occurrence of preeclampsia, gestational diabetes, premature labor, fetal growth retardation, spontaneous abortion, and low birth weight babies [4]. Research by Sathish et al (2016) found that vitamin D deficiency in pregnant women increases the risk of babies born with low weight and also affects the baby's length, head circumference and chest circumference [19].

Vitamin D comes from vitamin D intake and skin exposure to sunlight [5]. Exposure of the skin to sunlight will form vitamin D3 which is the main source of vitamin D in the body, but vitamin D intake is also necessary because it will form vitamins D2 and D3 which are only found in intake of foods containing vitamin D [3]. Foods that contain vitamin D consist of salmon, tuna, shitaki mushrooms, canned sardines, cod liver oil, egg yolks, butter, orange juice, yogurt and cow's milk [16].

2. Material and methods

The type of research used in this research is observational analytic with cross sectional design. This research starts from June to December 2022 with no. Ethics 2937/UN.16.02.D/PP/2022. The subjects of this study were 40 term pregnant women with inclusion criteria of normal term pregnant women who were willing to be research subjects. Exclusion criteria for pregnant women who have chronic diseases (hypertension, DM, liver, kidney, etc. The research location is Hermia Hospital, Bunda BMC Padang Hospital, Dr. Reksodiwiryo. Intake of vitamin D using the Food Frequency Questionnaire (FFQ) questionnaire conducted by enumerators. Maternal serum was examined using the ELISA (Diagnostic Biochem Canada) method at the Andalas University Padang Biomedical Laboratory. The test used in this study is the Pearson correlation test.

3. Results and discussion

The research subjects were of healthy reproductive age, with most of them being highly educated, not working and having a good number of pregnancies. The average intake of vitamin D is in the adequate category, the average maternal serum levels are in the insufficiency category can be seen in table 1.

Table 1 Maternal Characteristics

Characteristics	**n**	**%**
Age		
20-35	35	87.5
>35	5	12.5
Education		
Junior High School	2	5
Senior High School	12	30
PT	26	65
Occupation		
Unemployed	15	37.5
Employed	25	62.5
Parity		
Primipara	10	25
Multipara	28	70
Grandemultipara	2	5
Total	40	100

Table 2 Maternal Vitamin D Intake, 25(OH)D Maternal Serum

Variable	n	Mean ± SD
Vitamin D Intake (mcg)	40	16.54±2.99
25(OH)D Maternal Serum ng/ml	40	14.74±4.93

Table 3 The Association of Vitamin D Intake with 25(OH)D Maternal Serum

	Vitamin D Intake (mcg)	
	r	p
25(OH)D Maternal Serum ng/ml	0.379	0.016*

*pearson

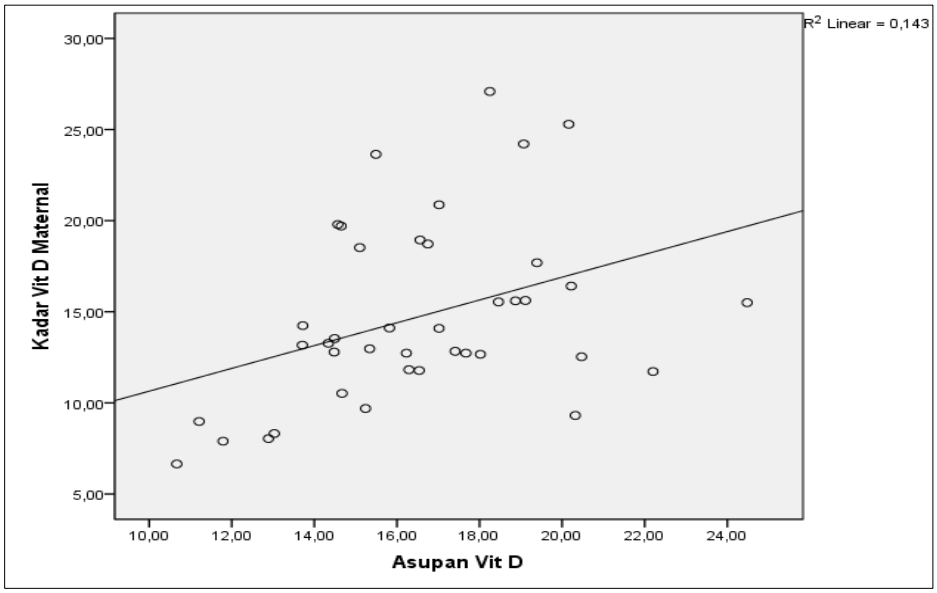

Figure 1 The Association of Vitamin D Intake with 25(OH)D Maternal Serum

3.1. The Association of Vitamin D Intake with 25(OH)D Maternal Serum

This study shows that the average intake of vitamin D in pregnant women is 16.54 ± 2.99 mcg. The need for vitamin D for pregnant women is based on the nutritional adequacy rate, which is 15 mcg [12]. So it can be concluded that the average intake of vitamin D in pregnant women is in the sufficient category. Vitamin D comes from vitamin D intake and skin exposure to sunlight. Low intake of foods that contain vitamin D such as fatty fish, milk, and fortified foods will result in vitamin D deficiency.

Vitamin D deficiency can be overcome by consuming foods high in vitamin D or vitamin D fortified foods and providing vitamin D supplementation. Hollis et al (2011) research states that pregnant women should consume vitamin D supplements at doses of 400, 2000 and 4000 IU every day, in addition to Vitamin D supplements are also obtained from foods such as egg yolks, fish oil, liver and butter and can also be obtained from sunlight [10].

This study showed that the average maternal serum 25(OH)D level was 14.74 ± 4.93 ng/ml so that it can be concluded that the mean maternal and cord blood 25(OH)D levels were in the insufficiency category. Research by Ilmiawati et al (2020) stated that vitamin D deficiency often occurs in Minangkabau pregnant women because the increased body surface area exposed to sunlight may not be culturally acceptable and vitamin D supplementation needs to be considered in the population [11]. A study by Ghafarzadeh et al (2021) stated that the average maternal concentration was 13 ng/ml and the average cord serum level was 15 ng/ml [4]. The range values determined by the Food and Nutrition Board are deficiency (0-11 ng/ml), insufficiency (12-20 ng/ml) and sufficiency (> 20 ng/ml) [7]. In the body, vitamin D undergoes two hydroxylation processes. The first hydroxylation will form 25 hydroxy vitamin D (25(OH)D)

which is assisted by the 25 hydroxylase enzyme in the liver, while the second hydroxylation occurs in the kidney with the help of the enzyme 1 (alpha) hydroxylase to form 1,25 hydroxy vitamin D (1, 25 (OH)D) [3]. The level of 25(OH)D circulating in the blood is often used as an indicator of vitamin D status, because of its high concentration and greater half-life compared to 1,25(OH)D[15].

The results of the analysis of the relationship between vitamin D intake and maternal serum 25(OH)D levels were moderately correlated and positive with a value of r = 0.379 meaning that the higher the intake of vitamin D, the higher the maternal serum 25(OH)D levels. Statistical test results showed that there was a significant relationship between vitamin D intake and maternal serum 25(OH) levels (ρ = 0.016). This is different from the research by Nurhikmah, Aminuddin and Nasrudin (2020) which states that there is no significant relationship between intake of vitamin D needs and maternal serum 25(OH)D levels. The prevalence of vitamin deficiency can be related to several risk factors, one of which is low intake of vitamin D from food sources, not continuing to take vitamin D supplements during pregnancy and factors inhibiting the production and synthesis of vitamins with the help of sunlight on the skin [20].

Vitamin D deficiency during pregnancy is a serious problem because pregnant women are one of the age groups at high risk, with this condition it is feared that it will be related to the health status of the mother and baby. Pregnant women are often found with a status of deficiency or insufficiency of vitamin D[8]. To determine a person's vitamin D status, 25(OH)D serum levels are measured in the blood. The range values determined by the Food and Nutrition Board are deficiency (0-11 ng/ml), insufficiency (12-20 ng//ml) and sufficiency (> 20 ng/ml) [7].

Low intake of vitamin D in pregnant women comes from foods that naturally contain vitamin D such as salmon, tuna, mackerel and sardines, cod liver oil, egg yolks, beef liver and shrimp. Vitamin D comes from plants such as button mushrooms, formula milk, cereals, biscuits, yogurt, orange juice and margarine [9]. Vitamin D is very important for pregnant women, if vitamin D is sufficient, the efficiency of calcium absorption can reach 30% -40% during pregnancy [6]. Vitamin D plays an important role in fetal growth through its interaction with parathyroid hormone and calcium homeostasis [13].

4. Conclusion

- The average intake of vitamins is in the adequate category, the level of 25(OH)D in the maternal serum is in the insufficiency category
- The relationship between vitamin D intake and maternal serum 25(OH)D levels is moderately correlated and has a significantly positive pattern

Compliance with ethical standards

Acknowledgements

Thanks the Directorate of Research, Technology and Community Service; the Directorate General of Higher Education, Research and Technology; and the Ministry of Education, Culture, Research and Technology of the Republic of Indonesia for funding this research.

Disclosure of Conflict of interest

There is no conflict of interest in this research.

Statement of ethical approval

This study passed the research Ethics Committee of the Faculty od Medicine, with license number 2937/UN.16.02.D/PP/2022

Statement of informed consent

This study the respondents had agreed and signed the informed consent.

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