

Article

## Identification of Vitamin D Status in Pregnant Women in Terms of Consumption of Foods Containing Vitamin D and Sun Exposure at Pekauman Health Center in Banjarmasin

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**Abstract:** High vitamin D deficiency in pregnant women and still high obstetric complications treated in Banjarmasin city in 2023 as many as 1537 pregnant women or 20% of the 2550 estimated pregnant women with obstetric complications, most complications occur during pregnancy, namely 1582 people (58%) increased compared to the previous year. This study aims identify vitamin D status in pregnant women in terms of food consumption intake containing vitamin D and sun exposure at the Pekauman Banjarmasin Health Center. This study is a *descriptive* study with a total sample of 59 pregnant women TM1 and II using *Proposive Sampling* technique. *The instruments* in this study used the *Food Frequency Quesinairre* (FFQ) questionnaire and the sun exposure questionnaire. The results of the study of vitamin D status in terms of food consumption intake containing Vitamin D in pregnant women who were not fulfilled (100%), while the vitamin D status in terms of sun exposure from work (20.34%), exposure time 11.00-hours 14.00 (6.78%), uncovered body parts (23.73%), and not using body protection (23.03%). Based on the results of the research conducted, it can be concluded that the adequacy of Vitamin D from food consumption and sun exposure is still far from the adequacy standards needed by pregnant women.

**Keywords:** Pregnant Women, Vitamin D Diet, Sunlight Exposure and Vitamin D Status

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### 1. Introduction

Pregnancy is a time of various physiological changes in the body. During this period, vitamin D plays a major role as an *immunomodulator* (improving the function of the immune system), not as a calcium regulating factor as when not pregnant, although it still maintains this function. The nutritional needs of pregnant women in the form of *macrominerals* and *microminerals* must be fulfilled during pregnancy. One of the *micromineral* needs that mothers need during pregnancy is vitamin D [1]. Nutritional adequacy during pregnancy will affect the condition of the fetus in the womb, non-optimal food intake will result in impaired fetal growth in the womb [2].

The role of vitamin D during pregnancy is very important, as expectant mothers should have sufficient vitamin D reserves in their body during pregnancy until lactation. Pregnant women are advised to have a vitamin D status check in early pregnancy to determine their vitamin D status. This can be done by measuring serum 25(OH)D levels in the blood [3].

Özdemir et al (2011)[4]explained that pregnant women who experience vitamin D deficiency need to monitor the level of vitamin D status in the first trimester to the second trimester, so that vitamin D deficiency can be corrected. According to research conducted by Donel et al. (2023) in the journal [5] found that pregnant women should take vitamin D

supplements at doses of 400, 2000, and 4000 IU daily starting from 12 weeks of gestation. This is reinforced by research conducted by Ayu Purnama Sari and Islamy, 2020 [6] explaining that during pregnancy there is an increase in vitamin D requirements compared to normal and recommended vitamin D supplementation during pregnancy as much as 4000 IU / day. The main source of vitamin D apart from food or supplements is (10%) and is most effectively obtained through exposure to UVB sunlight (90%). Therefore, it is recommended to provide information early in pregnancy regarding the importance of the role of vitamin D during pregnancy, this becomes a strong foundation during pregnancy. Therefore, the intake of vitamin D fulfillment during pregnancy is very important based on knowledge and attitudes that are good and sufficient in pregnant women will underlie good behavior in fulfilling vitamin D intake during pregnancy so that maternal vitamin D during pregnancy is sufficient.

Fat-soluble vitamin D is one of the most common types of vitamin found in animal foods and is also found in the sun. The vitamin affects bones the most. Vitamin D aids in calcium metabolism and bone mineralization [7] One of the active forms of vitamin D, *calcitriol* functions to aid bone hardening by ensuring that calcium and *phosphorus* are available in the blood so that they can be deposited during the bone hardening process. Pregnant women who take vitamin D tablets regularly can reduce the chances of pregnancy *Preeclampsia*, *Premature Labor*, *Gestational Diabetes*, *Low Birth Weight*, and *Fetal growth restriction* thus reducing the chances of stunting [8].

Food sources that lack vitamin D intake are caused by low vitamin D content such as milk, *fortified* foods and the tendency to reduce high-fat food ingredients, limited availability of foods containing vitamin D and limited purchasing power of people towards food sources rich in vitamin D because these vitamin D source foods are relatively expensive such as tuna, salmon, mushrooms, eggs, sardines, mackerel, milk, youghurt, butter, and cod liver oil In addition, exposure to sunlight is very important during pregnancy, it is recommended to get adequate sun exposure for 15-30 minutes at 09:00 am/day to increase vitamin D production 9.00 am/day increases vitamin D production [9].

Data on the high prevalence of vitamin D deficiency in pregnant women in some countries are: South Korea 77.3%, Tokyo, Japan 89.5%, Beijing 96.8% and Turkey 90.3%, Saudi Arabia 90.5%, Iran 67%. In 2019, Woon et al in their research entitled *Vitamin D Deficiency during Pregnancy and Its Associated Factors Among Third Trimester Malaysian Pregnant Women* conducted research using the *Mother and Infant Cohort Study (MICOS)* method on 535 pregnant women at clinics in Selangor and Kuala Lumpur Malaysia from November 2016 to January 2018 with the results showing that 42.6% of pregnant women were vitamin D deficient.

Indonesia is a country that has a tropical climate that is illuminated by the sun throughout the year. According to research by Elly et al, 2021 [10] of 143 pregnant women in Jakarta showed a very high vitamin D deficiency, reaching 90% so that it can be concluded that pregnant women living in equatorial tropical countries do not guarantee their vitamin D status. Factors associated with vitamin D deficiency are dietary intake, supplements, physical activity, dressing style, sunscreen use, employment status.

Based on data from the Banjarmasin City Health Office, the coverage of obstetric complications treated in Banjarmasin city in 2023 was 1537 pregnant women or 20% of the 2550 estimated pregnant women with obstetric complications, the most complications occurred during pregnancy, namely 1582 people (58%) increased compared to the previous year, with the highest number of obstetric complications in 2023 being anemia 1107 pregnant women, *Preeclampsia / Eclampsia* 86 people, *Diabetes Militus* 25 people, Hemorrhage 20 people, other causes 18 people [11] This can be overcome by the program of giving blood supplement tablets and vitamin D to pregnant women, given simultaneously during pregnancy and starting as early as possible because nutritional inadequacies of vitamin D and iron together during pregnancy can cause a high risk of

anemia, the results of research in the United States show that vitamin D affects iron metabolism and modulates hepsidin production, on the other hand iron has been shown to modify the expression of fibroblast growth factor 23 (FG23) which is a hormone that regulates vitamin D metabolism [5].

The mortality rate in mothers has also increased with the highest number of causes of death in 2023,[12] namely hypertension disorders 5 people, bleeding 5 people, heart and blood vessel disorders 3 people, infection 1 person and others 5 people, efforts to reduce maternal mortality can be done by ensuring that every mother is able to access quality maternal health services by providing health services for pregnant women . One of them is by screening vitamin D levels in pregnant women as an early effort to prevent the onset of pregnancy disorders that can be triggered by low vitamin D status in pregnant women, because measuring plasma vitamin D levels as a screening for vitamin D deficiency and insufficiency is not a routine examination performed by mothers during pregnancy, thus screening can be included as a routine pregnancy examination program as early detection of pregnancy complications [13].

Based on data obtained from preliminary studies conducted by researchers at the Pekauman Health Center in 2023 there were 47% of high-risk pregnant women and 22% of pregnant women with *complications* from 1085 pregnant women, some of the risks and *complications* are *Preeclampsia* as much as 8.6%, *Abortion* as much as 7%, Low Birth Weight as much as 14.5% and *Intra Uterial Fetal Death* as much as 1.1%, pregnant women with pre eclampsia at the Pekauman Health Center increased from the previous year, namely with an incidence of 0.79%. Besides that, the results of question and answer sessions to some pregnant women during pregnancy checks at the Pekauman Health Center are still rare and some have never consumed food and supplements containing vitamin D and have never sunbathed on a daily basis during pregnancy. In addition, the results of question and answer sessions with several pregnant women during pregnancy examinations at the Pekauman Health Center are still rare and some have never consumed foods and supplements containing vitamin D and have never sunbathed every day during pregnancy and spend more time indoors.

Based on the description above, the importance of vitamin D status for pregnant women in terms of food consumption intake and supplements as well as adequate sun exposure during pregnancy is still limited in Pekauman Health Center and there is still a lack of attention to assessing vitamin D status in pregnant women when providing midwifery care, therefore the researcher is interested in identifying how is vitamin D status in pregnant women in terms of food consumption intake containing vitamin D and sun exposure?

## 2. Materials and Methods

This research is a *descriptive* study that uses a *survey* or *exploratory* approach. This research was conducted at the Pekauman Banjarmasin Health Center work area. The population used in this study were all pregnant women who made Antenatal Care (ANC) visits in the last 3 months with a total of 143 pregnant women. The sample used in this study was 59 respondents, sampling using the *Porposive Sampling* Technique with Inclusion and Exclusion criteria determined by the researcher.

The data collection instruments used in this study were the *Food Frequency Questionnaire (FFQ)* which contains a list of food ingredients, drinks and supplements containing vitamin D and the Sun Exposure Questionnaire to see the length of time and duration of the subject's exposure to sunlight through the type of work, exposure time, style of dress and use of body protection.

### 3. Results

#### 1. Description of Research Location

Pekauman Health Center was established in 1974 and has a working area of 28 Km<sup>2</sup>. Pekauman Health Center is one of the health centers located on Jalan K.S Tubun No.1, Pekauman Village, South Banjarmasin District. The Pekauman Health Center's working area consists of five villages, namely Pekauman, West Kelayan, South Kelayan, South Basirih and Mantuil, with boundaries:

- a. The north is bordered by West Banjarmasin Subdistrict
- b. South of the border with Banjar Regency
- c. West of the border with Barito Kuala Regency
- d. The east is bordered by Kelurahan Kelayan Dalam [11].

#### 2. Intake of Foods that contain Vitamin D

Based on the results of the research conducted, the results of food consumption intake containing vitamin D in pregnant women were obtained, the calculation of the results of food consumption intake containing vitamin D is calculated / day on the *Frequannaire Questionairre questionnaire* (FFQ) using the converted household size. The following are the results of the study:

Based on Table 1, the results of identifying vitamin D status from food consumption containing vitamin D in pregnant women, out of 59 respondents, the fulfillment of vitamin D  $\leq 600$  IU was 59 (100%) respondents, thus it can be seen that the fulfillment of vitamin D in pregnant women has not been fulfilled.

**Table 1.** Intake Results Consumption of foods containing vitamin D.

Vitamin D Intake	F	%
Met > 600 IU	0	0
Not Met $\leq 600$ IU	59	100
Total	59	100

#### 3. Sunlight Exposure

Based on the results of the research conducted, the results of sun exposure in pregnant women were obtained, the calculation of the results of sun exposure / day on the Sun exposure Questionnaire with assessment indicators based on the type of work, exposure time, style of dress and use of personal protective equipment. The following are the results of the research conducted :

Based on Table 2, the results of the identification of sun exposure from work, exposure time, dressing style and the use of body protection in pregnant women, it can be seen that out of 59 respondents, there were 12 (20.3%) pregnant women who worked and 47 (79.7% ), pregnant women who were exposed to sunlight at 11:00-14.00 as many as 4 (6.8%) and < 11 / > 14.00 hours as many as 55 (93.2%), pregnant women who cover certain body parts as many as 45 (76.3%) and pregnant women who do not cover certain body parts as many as 14 (23.7%), pregnant women who use body protection as many as 46 (78%) pregnant women and pregnant women who do not use body protection as many as 13 (22%) pregnant women.

**Table 2.** Sunlight Exposure.

Sunlight Exposure	F	%
<b>Jobs</b>		
Work	12	20,3
Not Working	47	79,7
<b>Total</b>	<b>59</b>	<b>100</b>
<b>Exposure Time</b>		

11.00-14.00 Wita	4	6,8
Hours <11.00->14.00 Wita	55	93,2
<b>Total</b>	<b>59</b>	<b>100</b>
<b>Dress Style</b>		
Certain body parts are not covered	14	23,7
Certain body parts are covered	45	76,3
<b>Total</b>	<b>59</b>	<b>100</b>
<b>Use of Body Protection</b>		
Not Using Body Protection	13	22
Using Body Protection	46	78
<b>Total</b>	<b>59</b>	<b>100</b>

#### 4. Discussion

##### 1. Intake of Foods that contain Vitamin D

The results stated that the dose of vitamin D in pregnant women was not met, where pregnant women should consume as much as 600 IU / day. Vitamin D is obtained from foods and supplements that contain vitamin D such as salmon, snapper, tuna, eggs, butter, milk, orange juice and cheese. In this study, pregnant women consumed eggs more often. The unmet intake of vitamin D from foods containing vitamin D in pregnant women is associated with a diet in the early period of pregnancy that often experiences symptoms such as nausea and vomiting.

This study uses an inclusion sample with one of the samples, namely trimester I and Trimester II pregnant women, with the number of TM I as many as 17 people and the number of TM II as many as 42 people. In first trimester pregnant women most of them experience nausea and vomiting and are only able to consume limited amounts of food and are more dominant in one type of food so that nutritional intake in early pregnancy is difficult to fulfill and in second trimester pregnant women some of them still experience nausea and vomiting, and some pregnant women have an irregular diet, and do not pay attention to the nutritional intake consumed.

This is in accordance with the theory of Margaret, 2017 [14] in her book explaining that when pregnancy steps on the first trimester, 70 - 85% of pregnant women experience nausea and vomiting. Nausea and vomiting in pregnant women can occur at any time of the day. Mild nausea and vomiting can be relieved through fresh air circulation and avoiding sources of odors that cause nausea and vomiting. In addition, nausea and vomiting can also be treated by avoiding consuming large amounts of fluids in the morning, avoiding an empty stomach, and consuming specific foods that can relieve nausea. The use of iron supplementation can also cause nausea in women. In general, nausea in pregnant women begins to stop after the first trimester, but about 10 - 20% of nausea and vomiting conditions in pregnant women continue throughout pregnancy.

##### 2. Sunlight Exposure

The source of vitamin D is not only from the consumption of foods that contain vitamin D, but vitamin D is also obtained from direct sun exposure to the skin, exposure time, clothing style, and the use of the following body protection exposure:

###### a. Jobs

The results of the study stated that the highest intake of vitamin D from sun exposure in the work indicator with the category of pregnant women not working as many as 47 (79.7%), as for the activities of pregnant women who do not work by spending time at home, going to the market and sunbathing in the morning, going to the parents' house, taking a leisurely walk, going to campus, or just staying in touch with neighbors, using long cotton dastar and wearing a headscarf with an average of (06.00-10.00) in the morning and at (14.30-18.00) in the afternoon with a vulnerable time  $\geq 30$  minutes, while pregnant women who work indoors such as selling groceries, school teachers, as office employees

using long clothes (shirts / castars) made of cotton and using headscarves with an average of (07:00-08:00) when leaving for work and (15:00-17:00) with a vulnerable time  $\geq 30$  minutes, so that to get sun exposure only when heading to work in the morning the average length of exposure is  $\pm 30$  minutes from (07.00-07.30) when leaving for work and at (17:00-17:30) when returning from work, thus it can be concluded that pregnant women who work and pregnant women who do not work together do not get enough sun exposure due to the activities of pregnant women.

This is in accordance with research Woo Kinshella in 2022 [8], saying that the lack of sun exposure can be caused by activities that require little to be outdoors such as indoor work. Outdoor work is also at risk of vitamin D deficiency if not balanced with adequate vitamin D dietary intake.

#### **b. Exposure Time**

The results showed that vitamin D intake from sun exposure was highest in the indicator of exposure time with the category of exposure in the morning at 05.00- 10.00 am as many as 41 respondents (70%), in the afternoon at 15.00-18.00 pm 1 respondent (2%) and who did not leave the house at all as many as 14 respondents 24%), with a length of exposure of  $< 30$  minutes as many as 15 respondents (26%) and  $\geq 30$  minutes as many as 30 respondents (51%), most pregnant women were exposed to sunlight with exposure that did not contain vitamin D, namely hours  $< 11$ . Thus it can be concluded that pregnant women who are exposed to the time and length of exposure to the sun do not get enough sun exposure because of the exposure time that does not contain vitamin D.

This is in accordance with the research of Yosephin et al, 2014 [15] which says that the intensity of UVB sunlight is low at 07.00 in the morning, increasing in the following hours until 11.00; after 11.00 this intensity is relatively stable and high until 14.00 to then decrease and at 16.00 reach the same intensity as at 07.00. Research by Holick reported that the exposure time required at an intensity of 1 MED/hour is  $1/4 \times 60$  minutes or equal to 15 minutes [15].

#### **c. Dress Style**

The results showed that vitamin D intake from sun exposure was highest in the category of certain body parts covered as many as 44 respondents 75%), while the body parts that were often covered were the head, legs, arms and hands as many as 35 respondents (23.5%), legs as many as 9 respondents (20.5%), thus it can be concluded that pregnant women do not get enough sun exposure because most sun exposure only hits the arms of pregnant women.

This is in accordance with Yosephin's research, 2014 [15], reporting that sun exposure on the face, arms, and hands can achieve an adequate dose of UVB radiation. When converted into a percentage of body area exposed to sunlight, the minimum area that requires UVB radiation is about 22.5%. More than half of the pregnant women in this study did not receive adequate UVB radiation as the median body area exposed to sunlight was only 18.59%. This study found a significant correlation between the width or percentage of body surface area exposed to sunlight, UVB intensity, and maternal serum vitamin D levels.

#### **d. Use of Body Protection**

The results stated that vitamin D intake from sun exposure was highest in the category of pregnant women who did not use body protection as many as 45 respondents 77%) such as the use of umbrellas, hats and sunscreen, thus it can be concluded that pregnant women who do not get enough sun exposure are caused by not using body protection indoors.

This is consistent with a metaanalysis study looking at sun protective behavior in the American population which reported that there was no correlation between sunscreen use and vitamin D levels. The results of this study are also consistent with the theory that sunscreen use in children, adolescents, and young adults is only slightly likely to be associated with vitamin D levels because they do not use sunscreen according to the

recommended amount and time, unlike adults who use sunscreen for appearance and health so that they are more routine in using [6].

## 5. Conclusion

Based on the findings, it can be concluded that the vitamin D intake from food consumption and sun exposure among pregnant women at the Pekauman Banjarmasin Health Center remains below the recommended levels. All respondents had inadequate vitamin D intake from food, and sun exposure was also insufficient due to factors such as limited time spent outdoors, clothing coverage, and use of body protection. These deficiencies highlight the need for increased awareness and interventions, such as dietary improvements and safe sun exposure practices, to ensure adequate vitamin D levels during pregnancy. Addressing these gaps is essential to reducing pregnancy-related complications and improving maternal and fetal health outcomes.

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