



## Vitamin D level and some of its related factors in a sample of women in Misurata city

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### A B S T R A C T

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The city of Misurata is considered one of the sunny areas in North Africa, and several studies have shown the vitamin D deficiency in these areas. The current study aimed to evaluate vitamin D levels in women the city of Misurata and its relationship to some factors that may be related to it. The study community includes 131 women during a four-month period from April to the end of July of the year 2022, and a questionnaire was filled out for the cases of this study to cover the special data (age, marital status, eating some foods, and health status). The vitamin levels were divided into four levels, acute deficiency ,less than 10 nanograms / ml, a deficiency between 10-20 ng / ml, an insufficiency between 21-29 ng / ml, asufficiency level of more than 30 ng / ml, and the results showed that the percentage of vitamin D deficiency in general was 88.5%, and the severe deficiency formed the highest level of vitamin D deficiency At a rate of 38.5%, while the adequate level of vitamin D did not constitute more than 11.5%, and there was a relationship between vitamin D deficiency and pregnancy ( P-value < 0.05), and there was no relationship between vitamin D deficiency, age, sun exposure, some diseases, symptoms, and dietary pattern ( P-value <0.05) .We conclude through this study that vitamin D deficiency constituted a large proportion among women in the city of Misurata

### 1 Introduction:

Vitamin D is one of the essential vitamins responsible for the balance of minerals in the body, especially calcium and phosphorus, and it is one of the fat-soluble vitamins [1].It is found in some foods and is produced by the skin when it is exposed to direct sunlight. When it enters the body, it is not in the active form and is called hydroxyvitamin. Ultraviolet B rays affect cortisone in the skin and forms raw vitamin D. The blood transports it to the liver to be activated into hydroxyvitamin D (hydroxyvitamin D 25 DOH), and this compound has a direct effect on most of the body's cells that receive it and convert it into the active

vitamin compound, and part of it is transported to the kidneys to be activated into 1-25 hydroxyvitamin [2].

The importance of vitamin D lies in maintaining adequate levels of calcium in the blood, healthy bone mineralization, and dental health. It has a role in regulating inflammation and strengthening immunity [1]. unlight-induced vitamin D synthesis in the skin accounts for about 80% of obtained vitamin D.This vitamin D production by sunlight exposure is particularly efficient in individuals with low levels of skin melanin . And diet makes a relatively small contribution to vitamin D status.[ 3] Vitamin D can be obtained from natural foods (e.g. oily fish, eggs ), vitamin D-fortified food (e.g. vitamin D-fortified milk and orange juice) or vitamin D supplements.[4]

Population studies in most countries of the world have shown that vitamin D levels are very low in countries that are exposed to sunlight for a long period of the year, and the incidence of infection among women is higher than that of men [5]. There are many reasons why a large number of women are exposed to a deficiency in vitamin D levels, including: The most important of them are: obesity, pregnancy, lack of sufficient exposure to the sun, use of sunscreen, poor absorption in the intestines, dark-skinned women, age, and neglecting to focus on food sources of vitamin D [6].

Vitamin D deficiency is considered a major health problem as it is widespread in all age groups and genders, and approximately one billion people in the world suffer from its deficiency. In addition, approximately 50% of the world's population does not have a sufficient amount of vitamin D in the body [7]. Its deficiency has been linked to an increased risk of developing several health problems, such as breast, colon, and prostate cancers, diabetes, autoimmune diseases, eczema, asthma, arthritis, nervous system diseases, and cardiovascular diseases [8]. Vitamin D deficiency has also been linked to an increased risk of premature birth and preeclampsia in pregnant women. [9].

Therefore, vitamin D deficiency is considered a silent disease that can lead to serious diseases or annoying symptoms and make a person bedridden. Herein lie the objectives of this study, which are: assessing vitamin D levels in women in the city of Misurata. Knowing the age groups most vulnerable to vitamin D deficiency, and knowing the relationship between vitamin D levels, general health status, and diet.

### Literature Review:

A study of the relationship between vitamin D status and health among German adults was conducted in 2008 by Hintzpeter *et al* [10], and they observed a significant decrease in serum 25OHD levels in women with high blood pressure, cardiovascular disease, and insulin-treated diabetes, as well as in men with insulin-treated diabetes compared to uninfected participants.

A study was also conducted by Abdulkader and Al-Sffar in 2021 [11], on 100 obese women whose ages ranged from 20-50 years in a sample of Iraqi women. They found that only two women out of 100 had sufficiency levels of vitamin D.

A study conducted by Saasaa [12] to evaluate vitamin D levels in a sample of healthy Syrians in Damascus in 2010 showed that vitamin D deficiency was 97% of 304 people, and the deficiency in females was less than in males.

In a study of vitamin D deficiency and factors associated with it in a sample of Iraqi pregnant women and newborns conducted by Obaid and Hussein in 2021 [13], the percentage of vitamin D deficiency in mothers was 96.6%, compared to 86.4% in newborns, and vitamin D levels and weights were positively associated in newborns and mothers.

A study conducted by Jumma in 2019 [14] to compare the level of vitamin D in women with diabetes and those without diabetes and its association with age and seasonal variation showed that the level of vitamin D decreases in women with diabetes compared to healthy people.

In a study of vitamin D deficiency and its relationship to back pain, fatigue, and improving mood in a sample of adults in Iraq, by Al-Joudy and Khalef in the year 2022 [15], the results showed that the women were mostly suffering from fatigue and headaches, and 25% were suffering from hair loss.

Subasinghe *et al* (2019) [16] studied sun exposure and vitamin D status among healthy women in Sri Lanka, concluding that vitamin deficiency was only 6.1% and was higher in women exposed to sunlight.

## 2 Materials and methods :

**Study design:** This study was conducted on 131 women, from the city of Misurata. Samples were collected over four months from the beginning of April to the end of June 2022. The participants were divided into 4 age groups, Group (1)15-25, Group (2)26-36, Group (3)37-47, Group (4) above 47. and vitamin D levels were distributed into 4 groups: Group 1: more than 30 ng/ml (vitamin D sufficiency), Group 2: between 21-30 ng/ml (vitamin D insufficiency). Group 3: between 10-20 ng/ml (vitamin D deficiency). Group 4: less than 10 ng/ml (acute deficiency).

**Data collection:** Information was collected using a questionnaire to cover data on age, gender, marital status, exposure to the sun, intake of certain foods, and some symptoms and chronic diseases, after obtaining ethical approval from them to use their samples for scientific research.

**Blood sample collection:** A sample of venous blood was drawn using sterile syringes and transferred to an anticoagulant tube. The serum was separated by centrifugation at 4000 rpm for 10 minutes, using a Cebas (e) 411 or Icome device, then 25-hydroxyvitamin D was titrated.

**Statistical program:** The data was analyzed statistically using (SPSS) program, and the results were considered meaningful and statistically significant if the P-value was <0.05, using the CHI-SQUARE test. In

accordance with recognized scientific and statistical principles and foundations.

### 3 Results and Discussion:

This study is centered around knowing the level of vitamin D in women in the city of Misurata (Libya), and the factors that may play a role in its deficiency. Through the results, we have obtained, we can prove or deny the relationship between vitamin D deficiency by age, diet pattern, and social and health status.

#### Classification of sample members according to vitamin D level:

The results obtained showed a statistical significance for low levels of vitamin D among individuals in the study sample [p-value = 0.000]. The number of women

Table (1) shows the distribution of sample members according to vitamin D level:

Status	Number (%)	$\chi^2$	p-value
acute deficiency	50(38.5%)	24.817	0.000
deficiency	43(32%)		
insufficiency	23(18%)		
sufficiency	15(11.5%)		
Total	131(100%)		

suffering from vitamin D deficiency reached 88.5%, and this percentage includes very acute deficiency, deficiency, and insufficiency, where very acute deficiency constituted the highest percentage, 38.5%, while people with a sufficiency vitamin D level constitute only 11.5% of the total. As shown in table (1). The results of this study were similar to what was done by Abumhdi *et al.*, 2019 in Al-Ajailat [17], where acute deficiency constitutes the highest percentage, 39.26%, and another study in Tripoli by Al-Graiw in 2020 [18], where acute deficiency constituted the highest percentage 50.8%. Despite the greater availability of daily sunlight in Africa and the Middle East, people living in these regions often suffer from vitamin D deficiency [19].

#### Classification of sample members according to age groups and vitamin D level:

The results of the current study showed that there are no significant differences [p-value = 0.398] according to the distribution of sample members according to age groups and vitamin D level, as shown in Table No (2). The majority of age groups that suffer from vitamin D deficiency are those aged 48 and over, at a rate of 100%, which is the highest percentage of deficiency compared to other age groups. And this results agreed with a study by Nasri and Ardalan [20]. The older

groups suffered more from vitamin D deficiency, and they attributed the reason to a decrease in the skin's production of vitamin D with age. And this results contradicted a study conducted by (Zhao *et al.*, 2012) [21], where the age group of 26-36 had the highest percentage of vitamin D deficiency. The reason that this age group may be more deficient or may be due to its being the reproductive age, as both pregnancy and breastfeeding negatively affect vitamin D [21].

Table (2) Distribution of study sample members according to age groups and vitamin D level:

Age	Vitamin D deficiency				sufficiency	Number (%)	p-value
	acute deficiency	deficiency	Insufficiency	Total			
15 - 25	15(51.7%)	8(27.6%)	4(13.8%)	27(93.1%)	2(6.9%)	29(22%)	0.398
26-36	26(40%)	19(29%)	9(14%)	54(83%)	11(17%)	65(50%)	
37-47	6(26%)	9(39%)	6(26%)	21(91%)	2(9%)	23(18%)	
+48	3(21.4%)	7(50%)	4(28.5%)	14(100%)	0 (0%)	14(10%)	

#### Distribution of sample members according to the presence or absence of pregnancy and its relationship to vitamin D level:

As shown in Table No. (3), there is a statistical significance [p-value = 0.002] between the presence or absence of pregnancy and its relationship to the level of vitamin D. It is found that the percentage of non-

pregnant women who suffer from a vitamin D deficiency was 92%, which is higher than the percentage of pregnant women 87% who suffer from a vitamin D deficiency. The reason may be that pregnant women take vitamins and nutritional supplements to maintain their health and the health of their fetuses, based on the consultations and recommendations provided by the doctors who follow up with them

during pregnancy. The results of this study agreed with the results of a study by (Ginde) and others [22], where

the percentage of deficiency in pregnant women was 69% and in non-pregnant women 78%.

Table (3) Distribution of the study sample according to the presence or absence of pregnancy and its relationship to vitamin D level:

Pregnancy or not	Vitamin D deficiency				sufficiency	Number (%)	p- value
	acute deficiency	deficiency	insufficiency	Total			
non-pregnant	47(44%)	37(34%)	15(14%)	99(92%)	9(8.3%)	108(82%)	0.002
pregnant	6(26%)	8(35%)	6(26%)	20(87%)	3(31%)	23(18%)	

**Distribution of the sample according to milk intake, fish intake, and high-fat foods and their relationship to vitamin D levels:**

The results of the study, as shown in Table (4) have shown that there were no significant differences [p-value = 0.311] according to the intake of milk and its derivatives and their relationship to the level of vitamin D. The percentage of vitamin D deficiency was 88% of the total samples who answered yes, while the percentage of those who had a sufficient level was only 12%. The percentage of vitamin D deficiency was slightly higher, at 91%, for samples who answered no. and the percentage of those who have a sufficient level is only 9%. and it also showed that there are no significant differences [p-value = 0.214] between women who eat or do not eat fish and their vitamin D level. The largest group of women who suffer from a deficiency in vitamin D are women who do not eat fish, as their percentage reached 89% , and they have a sufficient level of only 11% of women who do not eat fish. While the percentage of those who eat fish and suffer from a deficiency reached 87% , and the percentage of those who have a sufficient level was 13%.

In this study, body mass index or body fat percentage were not calculated. the results also have shown that the largest group of women who suffer from a deficiency in vitamin D are women who do not eat foods rich in fat, as their percentage reached 97%, and those who have a sufficient level are only 3%.As for those who answered yes, the percentage of deficiency

was 86%, while the percentage of women who had a sufficient level was 14%, and this did not constitute a significant difference [p-value = 0.354], which confirms that there is no effect between eating foods rich in fat in the study sample and the level of vitamin D. That is, eating nutritional foods such as milk and its derivatives, fish, and eating foods rich in fats do not have a significant effect on vitamin D. The reason may be due to not consuming appropriate quantities of it, its poor quality, or long periods of taking it. As for fats, they may have a negative effect, causing obesity, as vitamin D accumulates with fat in the body without benefiting from it, instead of accumulating it in the liver [23] .

Vitamin D is a fat soluble vitamin and it is plausible that a certain amount of fat in the diet improves its absorption [24] and looking directly at vitamin D absorption, Tangpricha et al. (2003) found no effect of fat content (high fat milk, low fat milk or corn oil) on vitamin D bioavailability [25]. In agreement, Niramitmahapanya et al. (2011) failed to show any relationship between dietary fat content and the response to supplementation [26] . The authors, however, found that fat composition was significantly associated with response to supplementation . The increment in plasma-25(OH)D concentration was negatively associated with poly-unsaturated fatty acids (PUFA, p = 0.038), but positively with mono-unsaturated fatty acids (MUFA, p = 0.016) and with the ratio of MUFA/PUFA (p = 0.014). In contrast, one study showed that treatment with n-3 PUFAs did not affect 25(OH)D concentrations [27].

Table 4: Distribution of the study sample according to milk intake, fish intake, and high-fat foods and their relationship to vitamin D levels:

Milk and its derivatives	Vitamin D deficiency				sufficiency	Total	p .value
	acute deficiency	deficiency	insufficiency	Total			
Non-eaters	10(45%)	9(41%)	1(5%)	20(91%)	2(9%)	22(17%)	0.311
eaters	40(37%)	34(31%)	22(20%)	96(88%)	13(12%)	109(18%)	
<b>Eat fish</b>	acute	deficiency	insufficiency	Total	sufficiency	Total	p .value

	deficiency						
Non-eaters	22(47%)	16(40%)	4(9%)	42(96%)	5(11%)	47(36%)	0.214
eaters	28(34%)	27(33%)	18(22%)	73(89%)	11(13%)	84(18%)	
<b>Foods rich in fat</b>	acute deficiency	deficiency	insufficiency	Total	sufficiency	Total	p. value
Non-eaters	10(34%)	12(41%)	6(21%)	28(96%)	1(3%)	29(22%)	0.354
eaters	40(34%)	31(30%)	17(17%)	88(81%)	14(14%)	102(78%)	

**Distribution of sample members according to sun exposure and its relationship to vitamin D level:**

Table (5) shows us that the largest category of women who suffer from a deficiency in vitamin D are women who are not exposed to sunlight, as their percentage reached 90% , and only 10% of them have a sufficient

level of vitamin D. While the percentage of those exposed to sunlight who suffer from deficiency reached 87% , and only 13% of them have a sufficient level of the vitamin. This did not constitute a significant difference [p-value = 0.454], and the results of this study were in agreement with Binkley et al [28]. The reason for this may be that exposure to the sun is indirect, and at times when the body does not benefit from it and is considered harmful to them.

Table (5): Distribution of sample members according to sun exposure and its relationship to vitamin D level

Sun exposure	Vitamin D deficiency				sufficiency	Number (%)	p- value
	acute deficiency	deficiency	insufficiency	Total			
Unexposed to the sun	24(41%)	16(27%)	13(22%)	53(90%)	6(10%)	59(45%)	0.454
exposed	26(36%)	27(37%)	10(14%)	63(87%)	9(13%)	72(55%)	

**Distribution of sample members according to medical condition and its relationship to vitamin D level:**

The results, as shown in Table (6), indicate that the largest category of women who suffer from a deficiency in vitamin D are women who suffer from diabetes and anemia, at a rate of 100%, meaning that the percentage of women who have a sufficient level of vitamin D is 0% . And the percentage of those who suffer from calcium deficiency is 95%, and finally the percentage of those who do not suffer from diseases is

87%. The result did not constitute any statistical significance [p-value = 0.247], and therefore there is no relationship between women who suffer from diseases

and their vitamin D level. These results differed from a study by Wang et al [29], which conclude that vitamin D deficiency was linked to chronic diseases. And recent studies have also found that Vitamin D is closely associated with cardiovascular diseases, diabetes, cancers, autoimmune diseases, infectious diseases, and others [30, 31].

Table (6) Distribution of sample members according to medical condition and its relationship to vitamin D level

Diseases	Vitamin D deficiency				sufficiency	Number (%)	p- value
	acute deficiency	deficiency	insufficiency	Total			
nothing	36(34%)	37(35%)	18(17%)	91(87%)	14(13%)	105(80%)	0.247
Calcium deficiency	12(60%)	5(251%)	10(2%)	19(95%)	1(5%)	20(15%)	
diabetic	1(33.3%)	1(33.3%)	1(33.3%)	3(100%)	0(0%)	3(3%)	
Anemia	1(33.3%)	0(0%)	2(66.7%)	3(100%)	0(0%)	3(3%)	

**Distribution of sample members according to the presence of back pain, dental problems, and the presence of depression and its relationship to vitamin D levels:**

The results showed, as in Table (7), that there was no statistical significance [p-value = 0.484] between the presence of back pain and its relationship to the level of vitamin D, as 90% of women who had back pain had vitamin D deficiency, and only 10% had Adequate level of vitamin D.As for the women who did not suffer from back pain, the percentage of deficiency was 85%, and 15% had a sufficient level, and the reason may be due to a deficiency of vitamin D. These results are similar to a study conducted by Sadat *et al.* (32) who concluded that back pain is the most common symptom of vitamin D deficiency.

The results also showed that there is no statistical significance [p-value = 0.370] between the presence of dental problems and its relationship to the level of vitamin D, as we note that the largest group of women who suffer from vitamin D deficiency are women who suffer from dental problems, as their percentage has reached 90%. the reason may be due to vitamin D deficiency, while the percentage of those who do not suffer from dental problems and suffer from deficiency reached 85% , as these results agree with a study by

Botelho *et al* [33], as vitamin D is responsible for the absorption of calcium for tooth mineralization. Its deficiency may negatively affect [33].

The results showed that there is no statistical significance [p-value = 0.204] between the presence of depression and mood swings and its relationship to the level of vitamin D, as the largest category of women who suffer from vitamin D deficiency are women who suffer from depression, as their percentage reached 97% , and only 3% have a sufficient level, while the percentage of those who do not suffer from depression and suffer from a deficiency reached 85% and only 15% have a sufficient level. These results are consistent with a study by Wong *et al.* [34] who concluded that there is a possible relationship between vitamin D deficiency and depression, which is on the rise. It may be due to a complex combination of lifestyle factors and conditions that occur simultaneously. People with depression may have difficulty eating a nutritious, balanced diet and may not consume enough vitamin D [35].

Table (7) Distribution of sample members according to the presence of back pain, dental problems, and the presence of depression and its relationship to vitamin D levels

back pain	Vitamin D deficiency				sufficiency	Total	p .value
	acute deficiency	deficiency	insufficiency	Total			
No back pain	12(29%)	14(34%)	9(22%)	35(85%)	6(15%)	41(31%)	0.484
back pain	38(42%)	29(32%)	14(16%)	81(90%)	9(10%)	90(69%)	
dental problems	acute deficiency	deficiency	insufficiency	Total	sufficiency	Total	p .value
	No dental problems	15(32%)	14(30%)	11(23%)	40(85%)	7(15%)	
dental problems	35(42%)	29(34%)	12(14%)	81(90%)	8(10%)	84(64%)	0.370
depression	acute deficiency	deficiency	insufficiency	Total	sufficiency	Total	p. value
	No depression	33(35%)	29(31%)	17(23%)	79(85%)	14(15%)	
depression	17(%45)	14(37%)	6(15%)	37(97%)	1(3%)	38(29%)	0.204

**4 Conclusion:**

Through this study we conclude the following:

- Although the city of Misrata is one of the sunny cities, vitamin D deficiency in women constitute a large percentage, and severe deficiency is the highest incidence rate compared to deficiency and insufficiency.

- There is a relationship between vitamin D and pregnancy, and the percentage of deficiency in non-pregnant women is greater than in pregnant women.
- There is no relationship between vitamin D and age, eating certain foods, exposure to the sun, back pain, dental problems, and depression.

### Recommendations:

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