

Study the major factors that lead to Vitamin D deficiency in pregnant women In Al-Marj city during the period from June 2023 to October 2023

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Abstract

This study aimed to determine the major factors that lead to Vitamin D deficiency in pregnant women in Al-Marj city

The study was conducted at Al-Marj Educational Hospital, Al Manara Clinic, Alhilalal'ahmar Clinic and Al - Marwa Clinic. The data was collected by using questionnaire and direct interview with pregnant women 119, in addition to using medical record. Their ages (20 years-43 years). Data was collected during the period from June 2023 to October 2023.

Data of the questionnaire were analyzed using software program statistical package for social sciences (SPSS). The major factors that significantly associated with Vitamin D deficiency in pregnant women in this study were aging, lack of exposure to sunlight, low vitamin D dietary, Obesity, dark skin, calcium absorption disorder and its relationship to vitamin D.

Keyword: vitamin D, Calcium, Phosphorus, Dietary behavior, Body Mass Index, Life style, sun exposure.

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ملخص البحث:

هدفت هذه الدراسة إلى تحديد العوامل الرئيسية التي تؤدي إلى نقص فيتامين د لدى النساء الحوامل في مدينة المرج، أجريت الدراسة في كل من مستشفى المرج التعليمي، عيادة المنارة، عيادة الهلال الأحمر، عيادة المروة. تم جمع البيانات باستخدام الاستبيان والمقابلة المباشرة مع النساء الحوامل 119، بالإضافة إلى استخدام السجل الطبي. أعمارهم (20 سنة - 43 سنة). تم جمع البيانات خلال الفترة من يونيو 2023 إلى أكتوبر 2023. وقد تم تحليل بيانات الاستبيان باستخدام برنامج (SPSS) كانت العوامل الرئيسية التي ارتبطت بشكل كبير بنقص فيتامين د لدى النساء الحوامل في هذه الدراسة هي الشيخوخة، وقلة التعرض لأشعة الشمس، وانخفاض فيتامين د في النظام الغذائي، والسمنة، والبشرة الداكنة، واضطراب امتصاص الكالسيوم وعلاقته بفيتامين د.

الكلمات المفتاحية:

الشيخوخة، اضطراب امتصاص فيتامين د والكالسيوم، البدانة، البشرة الداكنة، قلة التعرض لأشعة الشمس، ومؤشر كتلة الجسم.

INTRODUCTION

Vitamin D plays a crucial role in maintaining overall health throughout one's life. (Atkins *et al.*, 2007). In the early 20th century, vitamin D was recognized as a crucial nutrient for skeletal development. Today, its metabolic processes and its role in bone health are well understood. (Atkins *et al.*, 2007; Morris *et al.*, 2010) Vitamin D plays a key role in the absorption of calcium and phosphate in the intestines, the reabsorption of calcium in the kidneys, and the suppression of

parathyroid hormone secretion. These actions contribute to bone cell maturation and mineralization, promoting healthy skeletal growth and development from early life. (Holick, 2004; Atkins *et al.*, 2007). The active form of vitamin D, 1,25-dihydroxyvitamin D, helps regulate calcium absorption in the intestines, supports the mineralization of bone tissue, and is crucial for muscle function. (Holick *et al.*, 2011; Wacker & Holick 2013; Mansur *et al.*, 2022).

Vitamin D is found in foods like cod liver oil, fish, eggs, fortified products, and supplements. It can also be synthesized by the skin when exposed to sunlight. (Holick, 2007).

Several factors influence serum vitamin D levels, including age, skin color, sunlight exposure, diet, living location, physical activity, and obesity. Additionally, certain conditions like malabsorption disorders, liver dysfunction, and kidney disease can impact vitamin D status. (Holick, 2004).

Vitamin D (calciferol) is a fat-soluble nutrient that is transformed into a hormone in the body through the action of sunlight. (Richer & Pizzimenti, 2012).

Vitamin D is available in various forms, such as D1, D2, D3, D4, and D5. The two most important forms are vitamin D2 (ergocalciferol) and vitamin D3 (cholecalciferol), both of which are commonly used in food fortification and supplements. (Holick, 2005). Vitamin D3 (Cholecalciferol), which is formed through the action of Ultra Violet (UV)

light on 7-dehydrocholesterol (provitamin) in the skin (vitamin D2) Ergocalciferol (provitamin) in plants, that is manufactured by the action of sunlight. (Holick, 2003).

1.2. Study Problem:

Vitamin D deficiency in pregnant women is common health problem in Libya. Growing rapidly among Libyans in general. This research focus on the main cause that lead to deficiency of vitamin D in pregnant women. We have seen the need to conduct a study on specific segment that may give a vivid idea of the main causes that lead to the appearance of vitamin D deficiency in pregnant women.

1.3. The importance of study:

Vitamin D deficiency causes many risks to health especially in pregnant women, and has a negative impact on mothers and fetuses, therefore, early intervention and treatment of mothers suffering from vitamin D deficiency during pregnancy prevents damage to the mother and fetus.

1.4. Study Objectives:

This study aims to identify the major factors that lead to vitamin D deficiency during pregnancy and early treatment to avoid complications resulting from it, whether on the mother or fetus. Data may help in developing effective programs to decrease the risk factors that lead to the reduce of vitamin D in Libya.

Methodology

Research design:

The study was designed to identify the major factors that lead to the Vitamin D deficiency in pregnancy women in Al-Marj city using a questionnaire (Appendix1), direct interview with pregnant women and the required test to know the level of vitamin D and calcium.

Sampling method:

The sample of the study included 119 patients of Vitamin D deficiency in pregnant women enrolled in Al-Marj Educational Hospital, Al Manara Clinic, Alhilalal'ahmar Clinic and Al – Marwa Clinic. Their ages were (20-43years).

Data were collected during the period June 2023 to October 2023. The approval was obtained from pregnancy women who suffer from Vitamin D deficiency.

Statistical analysis:

All data collected from 119 of pregnant women in the questionnaire was Statistical analyzed by the statistic program SPSS.

Results and discussion:

This part includes the results that were analyzed to study the variables in 119 pregnant women from obstetrics and gynecology clinics in the city of Al-Marj, where they provided us with health information and analysis.

Table (1) showed that (35.3%) of pregnant women were aged respectively from 20 to 25 years, (30.3%) were from 26 to 31 years, (25.2%) were aged from 32 to 37 years, and (9.2%) of pregnant women were aged from 38 to 43 years. From the results, Pregnant women are at a higher risk of vitamin D deficiency. This is consistent with a study conducted on

465 Saudi females of reproductive age (19-40) years (Holick, 2004). Pregnant women are a unique group, as pregnancy causes subtle changes in their metabolism and endocrine functions. Their nutritional intake must satisfy both their own needs and those required for fetal development. (Kocylowski *et al.*, 2010).

The data in Table (1) also showed the age at menstruation in pregnant women were 10-18 years and this difference had no effect on vitamin D deficiency or increase in pregnant women. We found that the ages at marriage were respectively from 19 to 23 years, from 24 to 28 years and from 14 to 18 years.

Our data consistent with the study that indicated that menstrual age was statistically significantly correlated with vitamin D deficiency (15.7%) of women with vitamin D deficiency had a menstrual age < 13 years compared to (4.4%) at $\geq$ age 13 years ($P < 0.001$) (Villamor *et al.*, 2011). In another study conducted on 465 Saudi females of reproductive age (19-40 years), selected from primary health centers, maximum deficiency was detected, and with bone fractures, bone rotation. Despite differences worldwide, the average age of menstruation at the constant line remained relatively stable between 12-13 years. (ACOG 2006 and Holick 2004).

Table1: Vitamin D deficiency in pregnant women and its association with age group.

Age	Number	%
Present age(year)		
20-25	42	35.3%
26-31	36	30.3%
32-37	30	25.2%
38-43	11	9.2%
Total	119	100%
age at menstruation(year)		
10-12	20	16.8%

13-15	81	%68.1
16-18	18	15.1%
Total	119	100%
age at marriage(year)		
14-18	11	9.2%
19-23	58	48.7%
24-28	44	37.0%
29-33	6	5.0%
Total	119	100%

The data in Table(2) showed that relation between weight loss and vitamin D deficiency in pregnant women , which recorded(42%) of pregnant women were overweight, while showed (27.7%) of pregnant women were normal weights, and (26.1%) of pregnant women had obesity ,also recorded (4.2%) of pregnant women were underweight .The data is consistent with a study that states that relation between vitamin D deficiency and body mass deficiency. (Vandevijvere *et al*, 2012; EL- Syed *et al*, 2013;Yun *et*

al, 2015; Loudyi *et al*, 2016 ; Haile *et al*, 2022). Vitamin D deficiency is independently associated with an increase in regional subcutaneous fat. (Doğan *et al*, 2022). Several studies have proposed that low levels of vitamin D could contribute to an increase in body fat. This is thought to occur due to higher parathyroid hormone levels and an increased calcium flow into adipocytes, which subsequently stimulates lipogenesis. (Pereira-Santos *et al*, 2015).

Table 2: Vitamin D deficiency during pregnancy and its association with Body Mass (BMI).

(BMI)	Number	%
weight loss	5	4.2%
weight normal	33	27.7%
Overweight	50	42.0%
Obesity	31	26.1%
Total	119	100%

Table (3) recorded that (51.3%) of pregnant women were housewife, while recorded (48.7%) of pregnant women were employed. Our data consistent with a study that indicated that a high percentage of participants with vitamin D deficiency and inefficiency were engaged in indoor work, those were housewives or did not work. The data is consistent with a study that explains that housewives spend all the time indoors and not to be exposed to sunlight which led to decrease in metabolism and synthesis of vitamin D and an increased risk of osteoporosis. (Holick, 2005).

Data presented in Table (3) showed (68.1%) of pregnant women live in the city, while recorded (31.9%) of pregnant

women live in a village in addition, recorded (55.5%) of pregnant women live in homes, also recorded (44.5%) of pregnant women live in apartments. Moreover recorded (89.9%) of pregnant women live in sunny dwellings, while recorded (2.9%) of their dwellings were not sunny. The data is consistent with a study that showed a comparison between the types of dwellings for both patients and controls that those who live in traditional mud houses they have significantly lower levels of Vitamin D than those occupying villas or apartments. That is exposure to sunlight is necessary to manufacture the vitamin inside the body. (Bird & Reese, 2006; Holick *et al.*, 2011; Al-Faris 2016).

Table (3) showed that (41.2%) of pregnant women exposed to the sun in the period from ten to four in the afternoon, while recorded (24.4%) of pregnant women exposed to the sun in the period before ten in the morning, and recorded (10.9%) of pregnant women exposed to the sun in the period after four in the afternoon. The data is

consistent with reports indicated that Muslim women are compulsory to cover entire body parts and this reduces the probability for pregnant women to get sufficient sunlight, which will then lower vitamin D production in their body .(Holick 2007 ; Tahir Jan & Abdullah 2015; Al-Faris 2016; Tabriziet al., 2018; Haileet al., 2022).

Table 3: Vitamin D deficiency in pregnant women and its association with lifestyle, place residence, type of housing, exposure to the sun and exposure time to sun.

Variable	Number	%
employed women	58	48.7%
Housewife	61	51.3%
Total	119	%100
Place		
The village	38	31.9%
The city	81	68.1%
Total	119	100%
type of housing		

Cont.

Homes	66	55.5%
Apartments	53	44.5%
Total	119	100%
Sunny dwellings		
Yes	107	89.9%
No	11	9.2%

Total	119	100%
sun exposure	Number	%
Yes	90	75.6%
No	29	24.4%
Total	119	100%
time of sun exposure	Number	%
Before ten in the morning	29	24.4%
Between ten in the morning and four in the afternoon	49	41.2%
After four in the afternoon	13	10.9%
Total	119	100%

Table (4) showed that (45.4%) of pregnant women in the second trimester, while recorded (38.7%) of pregnant women in the third trimester and recorded (16%) of pregnant women in the first trimester. These results showed

that vitamin D deficiency in the second trimester, because the second and third trimester one development of bone formation in fetal. (Cavalier *et al*, 2008; Bird & Reese, 2006).

Table 4: Vitamin D deficiency in pregnant women and its association with gestation.

gestation	Number	%
the first trimester	19	16.0%
the second trimester	54	45.4%
the third trimester	46	38.7%
Total	119	100%

Table (5) showed a small percentage (3.4%) of pregnancy women suffer vitamin D deficiency had gestational

diabetes, and recorded (96.6 %) of pregnancy women suffer vitamin D deficiency did not have gestational

diabetes.this does not negate their relation with vitamin D deficiency. Our data inconsistent with several studies noted that vitamin D deficiency was associated with high risk of Gestational diabetes mellitus GDM (Aghajafari *et al*, 2013)

The data in Table (5) showed that the percentage (16.8%) of pregnancy womenhad gestational blood pressure, while recorded (83.2%) of pregnancywomen did not have gestational blood pressure. Our data is consistent with studies demonstrate that lower circulating 25(OH) D levels are associated with higher blood

pressures (Witham *et al*, 2009). Also recorded that (43.7%) of pregnancy women suffer vitamin D deficiency had anemia, while recorded (56.3%) of pregnancy women suffer vitamin D deficiency did not have anemia the data is consistent with several studies reported a strong association between vitamin D deficiency and anemia during pregnancy. Vitamin D influences Hemoglobin levels through a direct effect on erythropoiesis. Erythroid precursors are directly stimulated by vitamin D suggesting the latter's immense role in erythropoiesis. (Bacchetta *et al*, 201

Table 5: Vitamin D deficiency in pregnant women and its association with variousdisease.

Diseases	Number	%
Gestational diabetes		
Yes	4	3.4%
No	115	96.6%
Total	119	100%
Gestational blood pressure		
Yes	20	16.8%
No	99	83.2%
Total	119	100%
Anemia		

Yes	52	43.7%
No	67	56.3%
Total	119	100%

Data in Table (6) showed (76.5%) of pregnant women practiced breastfeeding, while recorded (23.5%) of pregnant women did not practice breastfeeding. This is an indication that breastfeeding is associated with vitamin D deficiency. The data is consistent with

a study that indicated that breastfeeding depletes vitamin D and calcium from the mother to the infant, which affects the mother's bones later with the length of breastfeeding. (Cumming & Klineberg, 1993; Aghajafari *et al.*, 2018).

Table 6: Vitamin D deficiency in pregnant women and its association with breastfeeding.

Breastfeeding	Number	%
Yes	91	76.5%
No	28	23.5%
Total	119	100%

Data in Table (7) showed that (10.1%) of pregnant women drank fresh milk, and appeared (86.6%) of pregnancy women drank formula milk, while there is (3.4%) of pregnancy women did not drink any milk. The data indicates an association between the type of milk consumed and

vitamin D deficiency. Our data is inconsistent with a study conducted in Africa that concluded that there is an inverse relation between the type of milk and the incidence of vitamin deficiency. (Holick, 2003).

Table 7: Vitamin D deficiency in pregnant women and its association with the type of milk.

type of milk	Number	%
Fresh	12	10.1%
Industry	103	86.6%
No taking milk	4	3.4%
Total	119	100%

The data in Table (8) showed that (48.7%) of pregnant women had dark skin color, while recorded (51.2%) of pregnant women had light skin color. The data is consistent with a study that

found that dark skin does not absorb enough UV rays due to their increased melanin content and is therefore prone to vitamin D deficiency. (Bird & Reese, 2006).

Table 8: Vitamin D deficiency in pregnant women and its association with skin color.

skin color	Number	%
Blond-white	61	51.2%
Brown-black	58	48.7%
Total	119	100%

Table (9) recorded a small percentage (7.6%) of pregnant women had osteoporosis, and recorded (92.4%) of pregnant women did not have osteoporosis. Our data is consistent with

reports indicated a small percentage of pregnant women suffered from osteoporosis, this does not negate their relation with vitamin D deficiency. (Franklin *et al*, 2010).

Table 9: Vitamin D deficiency in pregnant women and its association with osteoporosis.

Osteoporosis	Number	%
Yes	9	7.6%
No	110	92.4%
Total	119	100%

Table (10) showed (63.9%) of pregnant women had calcium deficiency, while appeared (36.1%) of pregnancy women did not have calcium deficiency. Moreover there was (80.7%) of pregnant women had a vitamin D deficiency, while recorded (19.3%) of pregnant women had normal levels of vitamin D. The data is consistent with reports indicated that when decreased levels of vitamin D, calcium absorption is insufficient to meet calcium requirements. Calcium metabolism is

largely controlled by the endocrine system involving parathyroid hormone (PTH) and vitamin D, which operates through a series of homeostatic feedback mechanisms. The quick release of minerals from bones is crucial for maintaining proper ionized calcium levels in the blood. In cases of vitamin D deficiency, bone metabolism is greatly impacted due to a decrease in active calcium absorption. (Holick, 2004; Holick, 2006; Franklin *et al*, 2010).

Table 10: Vitamin D deficiency during pregnancy and its association with calcium level and vitamin D level.

Level of calcium	Number	%
Deficiency	76	63.9%
Normal	43	36.1%
Total	119	100%
Level of vitamin D	Number	%
Deficiency	96	80.7%
Normal	23	19.3%
Total	119	100%

Conclusion

In conclusion, Although Libya is a country with abundant sunshine most

year, vitamin D deficiency was highly prevalent among second trimester pregnant women. According to our

findings, the prevalence of vitamin D deficiency and insufficiency is especially pregnant women with gestational diabetes, pressure and iron deficiency. Also the study indicated that breastfeeding depletes vitamin D and calcium from the mother to the infant, which affects the mother's bones later with the length of breastfeeding. The sun exposure is important for the formation of vitamin D the housewives spend all the time indoors and not to be exposed to sunlight which led to decrease in metabolism and synthesis of vitamin D and an increased risk of osteoporosis.

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Appendix

Faculty of Arts and Sciences – Al-Marj -University of Benghazi.

A questionnaire for study the risk factor which lead to vitamin D deficiency among pregnant women in the city of Al- Marj

Questionnaire on vitamin D deficiency in pregnant women in the Marj region this study is designed to identify vitamin D deficiency and its effect on pregnant women, knowing that this information will be used for scientific research purposes and will be treated with complete confidentiality, so please cooperate with us in filling out this questionnaire.

Please put a √ inside the box that corresponds to your situation

Personal Data:

Present age: Year

Age at menstruation..... Year

Age at marriage: Year

Anthropometry

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1-Weight..... kg

2-Long..... M

Work:

☐ Employee

☐ Housewife

Place:

☐ Village

☐ City

Type of housing

☐ Apartment

☐ House

Sunny dwellings:

☐ Sunny

☐ Not sunny

Medical history of pregnant women:

Number of pregnancies:

Number of births:

In what month are you pregnant?.....

Bleeding after the previous birth	Yes ☐	No ☐
Bleeding before the previous birth	Yes ☐	No ☐
Caesarean delivery	Yes ☐	No ☐
Anemia	Yes ☐	No ☐
Gestational diabetes	Yes ☐	No ☐
Gestational stress	Yes ☐	No ☐
Born with birth defects	Yes ☐	No ☐
Oversized baby	Yes ☐	No ☐

Have you ever had a child with bone diseases?

☐ Yes

☐ No

If yes, what is the disease?

.....

How many children suffered from this disease?

.....

Have you done family planning?

☐ Yes

☐ No

If yes, what method is used?

Have you breastfed?

☐ Yes

☐ No,

Do you suffer from obesity?

☐ Yes

☐ No

Do you have diabetes?

☐ Yes

☐ No

Do you take medications during pregnancy except for the medications that pregnant women usually take?

☐ Yes

☐ No

If yes, what medications are you taking?

Lifestyle:

Do you follow a specific diet?

☐ Yes

☐ No

If yes, what diet are you following?

☐ Vegetarian

☐ Low fat

☐ Low salts

☐ Many proteins

☐ Low sugars

What kind of milk do you take?

☐ Fresh

☐ Industrial

Sun exposure Are you exposed to the sun?

☐ Yes

☐ No

What time are you exposed to the sun?

Before ten in the morning

☐ between ten and four in the afternoon

☐ after four in the afternoon

How many days are you exposed to the sun each week?

-----days

How long are you exposed to the sun during the day?

-----minutes

How would you describe the color of your skin?

☐ White

☐ Black

☐ Blond

☐ Brown

Medical history of the family:

Osteoporosis	Yes ☐	No ☐
Liver diseases	Yes ☐	No ☐
Diseases of the stomach and intestines	Yes ☐	No ☐
Kidney diseases	Yes ☐	No ☐
Bone diseases	Yes ☐	No ☐
Treatment with cortisone	Yes ☐	No ☐

Physical activity

Please choose one answer per line

How active are you physically?

I rarely first practice any physical activity	Yes ☐	No ☐
I do light or moderate physical activity but not weekly	Yes ☐	No ☐
I do light physical activity weekly	Yes ☐	No ☐
I do moderate physical activity weekly (less than 30 minutes a day)	Yes ☐	No ☐
I do vigorous physical activity weekly (less than 20 minutes a day)	Yes ☐	No ☐
I do moderate physical activity weekly (30 minutes or more per day)	Yes ☐	No ☐
Do vigorous physical activity weekly (20 minutes or more a day)	Yes ☐	No ☐

Laboratory tests:

Vitamin D-----mg/ml

Calcium level----- mg/ml

Thank you for your cooperatio