



## Prevalence of vitamin D and calcium deficiency among population of southern region, Libya

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### Abstract

**Background:** Despite the abundance of sunny weather in Libya, vitamin D deficiency becoming one of the most common health problems there. The consequences of low vitamin D levels include an increased risk of some cancers, cardiovascular diseases, and diabetes, which makes it a crucial public health concern.

**Objective:** Our study aimed to study the prevalence of Vitamin D (D) deficiency in the southern region of Libya (Traghen City) and determine the relationship between the prevalence of vitamin D deficiency and calcium levels.

**Methods:** A Cross-sectional study was carried out among 144 patients from private clinic laboratories in Traghen City, between April and July 2023. Vitamin D and calcium levels have been measured. Variables such as age and sex were recorded. Statistical analysis was carried out by using SPSS.

**Results:** A total of 144 patients were included in the study. Female participants were more than male participants in the present study (66.0 %, 34.0 %) respectively. The prevalence of vitamin D deficiency/ insufficient was found to be 54.2% and 27.1% respectively. Our findings indicated that the level of Vitamin D was significantly lower among female (69.5%) patients in comparison to male (24.5%). Low serum calcium levels were observed among the study population (71.5%). A positive correlation was found between low vitamin D levels and calcium deficiency (P= 0.0001).

**Conclusion:** In our study, the prevalence of vitamin D deficiency was found to be 54.2 %. VDD is prevalent in the southern part of Libya, especially among females and this could lead to serious health consequences if the issue is not urgently addressed.

**Keywords:** prevalence, Vitamin D, calcium, vitamin D deficiency.

### انتشار نقص فيتامين د والكالسيوم بين سكان المنطقة الجنوبية، ليبيا

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**الخلفية:** على الرغم من وفرة الطقس المشمس في ليبيا، أصبح نقص فيتامين (د) أحد أكثر المشاكل الصحية شيوعاً هناك. , وتشمل عواقب انخفاض مستويات فيتامين د زيادة خطر الإصابة ببعض أنواع السرطان وأمراض القلب والأوعية الدموية والسكري، مما يجعلها مصدر قلق بالغ الأهمية للصحة العامة.



**الهدف:** هدفت دراستنا إلى دراسة مدى انتشار نقص فيتامين د (د) في المنطقة الجنوبية من ليبيا (مدينة ترغن) وتحديد العلاقة بين مدى انتشار نقص فيتامين د ومستويات الكالسيوم.

**الطرق:** تم إجراء دراسة مقطعية على 144 مريضاً من مختبرات العيادات الخاصة في مدينة ترغن، بين أبريل ويوليو 2023. وتم قياس مستويات فيتامين د والكالسيوم. تم تسجيل المتغيرات مثل العمر والجنس. وتم إجراء التحليل الإحصائي باستخدام برنامج SPSS.

**النتائج:** تم تضمين مجموعه من 144 مريضاً في الدراسة. وكانت المشاركات الإناث أكثر من المشاركين الذكور في هذه الدراسة (66.0%، 34.0%) على التوالي. وجد أن معدل انتشار نقص/نقص فيتامين د هو 54.2% و27.1% على التوالي. حيث أشارت النتائج التي توصلنا إليها إلى أن مستوى فيتامين د كان أقل بشكل ملحوظ بين المرضى الإناث (69.5%) مقارنة بالذكور (24.5%). ولوحظ انخفاض مستويات الكالسيوم في الدم بين مجتمع الدراسة بنسبة (71.5%). تم العثور على علاقة إيجابية بين انخفاض مستويات فيتامين د ونقص الكالسيوم ( $P = 0.0001$ ).

**الاستنتاج:** في هذه الدراسة وجد أن معدل انتشار نقص فيتامين د يبلغ 54.2%. ينتشر مرض VDD في الجزء الجنوبي من ليبيا، خاصة بين الإناث، وقد يؤدي ذلك إلى عواقب صحية خطيرة إذا لم تتم معالجة المشكلة بشكل عاجل.

**الكلمات المفتاحية:** انتشار، فيتامين د، الكالسيوم، نقص فيتامين د

## Introduction

Vitamin D deficiency is a common health problem around the world, including in various regions of Africa. Several studies have determined vitamin D levels in various populations, to provide information on the prevalence and associated factors of deficiency [4], [10]. Vitamin D is a fat-soluble prohormone, the primary function activity of vitamin is to regulate the physiological processes [2], [24]. The two primary types of vitamin D are vitamin D3 or cholecalciferol, which is produced in the skin after exposure to sunshine or ultraviolet light, and vitamin D2 or ergocalciferol, which is derived from plants and foods including mushrooms, fish, and egg yolk [23].

Vitamin D is important for the maintenance of calcium homeostasis and crucial for skeletal health. Vitamin D deficiency is responsible for the development of rickets and osteomalacia in both children and adults, respectively [19], [23]. About 90% of the body's total need for vitamin D is produced by our skin with the aid of sunlight. Vitamin D is indispensable for serum calcium and phosphate levels in the body. As a result, it indirectly enhances how effectively the body performs as a whole. Additionally, it is crucial for immunity, cell growth, and cell differentiation. So, vitamin D is an essential component that the human body needs [2]. Furthermore, vitamin D plays an important role in enhancing physiological processes in both skeletal and extra-skeletal tissues [1], [9].

vitamin D insufficiency (VDI) and vitamin D deficiency (VDD) are associated with various acute and chronic diseases including problems of calcium (Ca) metabolism, autoimmune disorders, cardiovascular disease, some cancers, type 2 and type 1 diabetes



mellitus, and other conditions [9]. Around a billion individuals are thought to be suffering from a vitamin D deficiency or insufficiency on a global scale [24].

The prevalence of VDD in the area has been the subject of studies in neighboring nations. According to a recent study in Qatar, 83% to 91% of people lack enough vitamin D [14]. VDD prevalence in Tunisia was estimated to be 47.6% [14]. These results imply that VDD is a significant public health concern in the area.

According to estimates, the Middle East has a higher rate of vitamin D deficiency than Western nations. A significant meta-analysis revealed that 20–80% of healthy individuals in Middle Easterners are really vitamin D deficient [18]. In Libya, previous studies have indicated that the population is at risk of VDD. One of the studies conducted in Misurata found that 75% of women had vitamin D levels below 50 nmol/L [10]. In addition, a very recent study conducted to study the incident of vitamin D deficiency in Derna city, in the Eastern part of Libya demonstrated that 61% of population suffering from Vit D deficiency [9]. However, there is a lack of specific data on the prevalence of vitamin D deficiency in the region of Traghen south of Libya. With this background, the present study was conducted to study the prevalence of vitamin D deficiency among patients attending private clinics and laboratories in Traghen City of Libya.

## Method

### 1. Study participants

A descriptive cross-sectional study was conducted in Traghen City, a southern area of Libya in the period between April and July 2023 for persons of different age groups and either gender attending private medical laboratories who requested for vitamin D analysis or medical checkups to examine vitamin D and calcium status levels in Libyan population. Data were collected from 144 individuals from 3 to 78 years old willing to participate included in this study, patients on therapeutic doses of Vitamins were excluded previously.

### 2. Data collection

A random sampling collection was performed and 10 ml venous fasting blood samples were collected from individuals participated in this study who filled the criteria. Variables such as age and sex were recorded. Samples were collected in tubes with a clot activator and then centrifuged to be analyzed. The analysis for serum 25 (OH)D was done by using Fluorescence immunoassay (IFA) techniques using I Chroma, or LanSionbio LS 1100 analyzers. Vitamin D level was estimated and defined according to cut-off values; deficient (25(OH)D level < 20 ng/ml, insufficient (25(OH)D level between 20 and < 30 ng/ml), sufficient (25(OH)D level 30-100 ng/ml). Calcium status was tested by a semi-automated single-beam Riele 4040 spectrophotometer, date of calcium status was analyzed according to cut-off values hypocalcemia (< 8.8 mg/dl), normal or optimal ( 8.8-10.6 mg/dl) and hypercalcemia (> 10.6 mg/dl). All technicians are trained, either by qualified trainers or by expert colleagues

### 3. Statistical Analysis

Description and analysis of data were carried using SPSS version 21. All results were coded prior entering into a computer. Chi-square test was performed to test the



association of serum vitamin D with variables and used to determine the statistically significant differences at  $p < 0.05$ .

## Results

In the current study, the number of subjects who had undergone concurrent measurements of vitamin D and calcium levels between April and July 2023 was determined to be 144 respondents.

Table 1: Demographic data of the study group

AGE			
	Age	Frequency	Percent %
Valid	<18 YEARS	13	9.0 %
	18-40 YEARS	64	44.4 %
	> 40 YEARS	67	46.5 %
GENDER			
	Gender	Frequency	Percent %
Valid	FEMALE	95	66.0 %
	MALE	49	34.0 %

Female participants were more than male participants in the present study, out of 144 subjects; (34.0%) were male and 95 (66.0%) were female. The age range was from 3 to 78 years. Among them, 13 (9%) were below the age of 18 years, 64 (44.4%) were from 18-40 years old and 67 (46.5%) were older than 40 years. The demographic details are given in table (1).

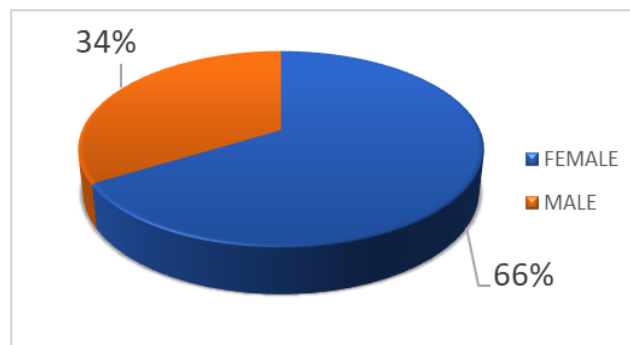


Figure (a): Gender of the study group

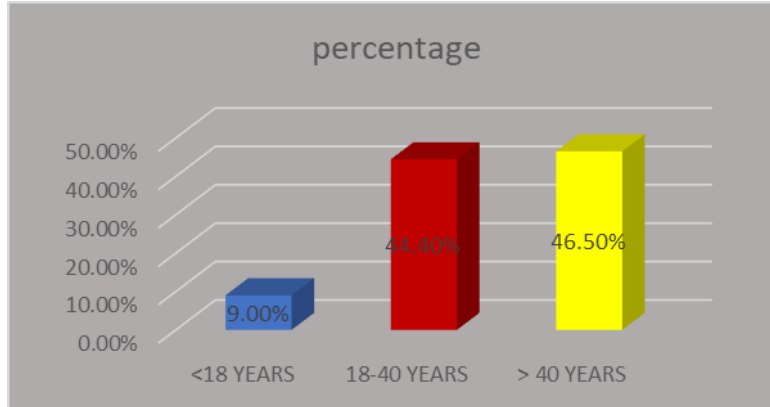


Figure (b): Age of the study group

Table 3. Serum 25(OH)D values

		Vitamin D	
		Frequency	Valid Percent %
Valid	Deficient	78	54.2%
	insufficient	39	27.1%
	Sufficient	27	18.8%

Overall, the estimated prevalence of vitamin D deficiency were as follows: 78(54.2%) were Vitamin D deficient (less than 20 ng/ml), while 39 (27%) of patients were Vitamin D insufficient (20-30 ng/ml), 27 (18.8%) were within the normal value of Vitamin D (sufficient) between 30 ng/ml and 100 ng/ml Table (3).

Table 4: Prevalence of vitamin D deficiency according to gender

GENDER * Vitamin D Crosstabulation							
			Vitamin D			Total	P value
			Deficiency	insufficient	Sufficient		
GENDER	FEMALE	Count % within GENDER	66 69.5%	17 17.9%	12 12.6%	95 100.0%	.001**
	MALE	Count % within GENDER	12 24.5%	22 44.9%	15 30.6%	49 100.0%	

P value at (0.05) considered significant \* -P value <(0.05) considered highly significant \*\*



Significantly, the prevalence of vitamin D deficiency was higher among female 69.5%, had inadequate vitamin D status level compared with men 24.5%, which was analyzed by chi-square test (p-value = 0.001) statistically significant difference was found between men and women Table (4). Participants between 18-40 years showed the highest prevalence of deficiency /insufficiency of Vitamin D (serum 25(OH)D concentrations < 30 ng/ml) at 57.8%.

Table 5. Serum calcium values

CALCIUM VLAUES				
		Frequency	Percent	Valid Percent
Valid	Hypocalcemia	103	71.5%	71.5
	Normal	34	23.6%	23.6
	Hypercalcemia	7	4.9%	4.9

Based on calcium levels, subjects were divided into hypocalcemia, normal, and hypercalcemia groups;103 (71.5 %) participants had hypocalcemia, 34 (23.6%) participants had normal calcium levels, and 7 (4.9%) had hypercalcemia (Table 5).

Table 6: Correlation between gender and calcium statute

GENDER * Calcium Crosstabulation						
		CAL			Total	p- value
		HYPO	NORMA L	HYPER		
GENDER	FEMAL E	72	21	2	95	0.060
		75.8%	22.1%	2.1%	100.0%	
	MALE	31	13	5	49	NS
		63.3%	26.5%	10.2%	100.0%	

NS=Not significant

The normal range of calcium in our laboratory was 8.8-10.6 mg/dl whereas the mean + (SD) of calcium in this study was 7.98±1.33 mg/dl. When calcium levels were compared based on gender, no significant difference was observed between the level of calcium of men and women (P value = 0.06) as showed in Table (5).





Table 7. The correlation analysis for vitamin D and calcium

CALCIUM * Vitamin D Crosstabulation					
		Vitamin D			P value
		deficient	insufficient	sufficient	
Calcium	Hypocalcemia <8.8 mg/dl	74 71.8%	27 26.2%	2 1.9%	.0001**
	Normal 8.8-10.6 mg/dl	4 11.8%	12 35.3%	18 52.9%	
	Hypercalcemia >10.6 mg/dl	0 0.0%	0 0.0%	7 100.0%	

P value at (0.05) considered significant \* - P value < (0.05) considered highly significant \*\*

In addition, our results show that 71.8% of study subjects suffering from calcium deficiency with Vitamin D deficiency. There is a highly significant relationship between vitamin D deficiency and calcium (P = 0.0001) as shown in Table (7).

### Discussion

Vitamin D as well as calcium insufficiencies are risk factors for various chronic diseases. Recent studies from Europe, North Africa, Southeast Asia, and the South Pacific region clearly show that low vitamin D levels and inadequate calcium nutrition are significantly prevalent in the general population, and affect both males and females [20]. The results of this cross-sectional study showed the prevalence of Vitamin D deficiency as 54.2%, of insufficiency as 27.1%, and sufficient Vitamin D in 18.8% population.

Our finding in this study in the line with local studies conducted in Libya. On study carried out Benwailed city by Nasef, et al [17], relieved that patients with vitamin D deficiency represent 70.68 % and patients with insufficiency represent 29.32 %. Another study conducted in Benghazi, reported vitamin D deficiency was 76.1%, insufficiency was 15.2% and Vitamin D sufficiency was 8.7% [19]. In Tunis, the finding estimated the prevalence of hypovitaminosis D and vitamin D deficiency were respectively 92.3% and 47.6% [5]. In the United Arab Emirates, 85.4% were vitamin D deficient, 12.5% showed insufficient serum vitamin D level, and only 2.1% had an appropriate level [26]. As a result, Vitamin D deficiency is considered to be a public health problem worldwide. A remarkable gender difference in vitamin D levels was observed in this study, as the prevalence of vitamin D deficiency was significantly higher in females participants (69.5%) than males (24.5%) who had Vitamin D levels below 20 ng/dl. This significant difference in gender is consistent with other publications.

Atia & Arhoma found that 79.4% % of the females to be vitamin D deficient compared to 52% of male participants who had Vitamin D levels below 20 ng/ml [5]. Another finding released by Rumano et al. reported a higher level of vitamin D in males compared to females. The prevalence was higher among females 62% [21]. In contrast, Yammine and Al Adham studied the vitamin D status among adults in United Arab Emirates,



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reported that there is a significant difference between males and females: males had lower serum vitamin D levels than females [26].

The higher vitamin D levels in men seen in this study might be related to the fact that men spend more time outside, whereas women wear protective clothing and avoid sun exposure. on the other hand, Men work outside more than women do, and they are more likely to be exposed to the sun. As noted in several studies, sunlight exposure and solar radiation serve as our body's main source of vitamin D production through a series of processes that start in the skin.

Omar et al. [18] demonstrated that exposure and those exhibiting negative attitudes toward sunlight and identified factors included duration of sun exposure, type of work, preference for fair skin, use of sunblock, and dress code. These factors resulted in excessive sun avoidance among participants and they could be major contributing factors to the observed high prevalence of VDD in this study. Another study conducted in Qassim, Saudi Arabia showed that study subjects who were exposed to sunlight for a longer duration of time had adequate levels of vitamin D which is statistically significant [16].

In the current study, we observed that 71.5 % % of our study population had low levels of calcium. The calcium level in 103 of the study population was of less than normal range, which may be due to vitamin D deficiency. When calcium levels were compared based on gender, it was found to be no significant difference in the proportion of women (75.8%) compared to men (63.3%) who had hypocalcemia. We found that vitamin D levels were positively correlated with calcium. There is a relationship between vitamin D deficiency and low calcium levels (P= 0.0001).

In the current study, we observed that 71.5 % % of our study population had low levels of calcium. The calcium level in 103 of the study population was of less than normal range, which may be due to vitamin D deficiency. When calcium levels were compared based on gender, it was found to be no significant difference in the proportion of women (75.8%) compared to men (63.3%) who had hypocalcemia. We found that vitamin D levels were positively correlated with calcium. There is a relationship between vitamin D deficiency and low calcium levels (P= 0.0001).

This finding concurs with other studies. In a recent study carried out by the College of Medical Technology, Derna, Libya, there was a direct proportion between vitamin D deficiency and serum calcium deficiency. The study reported that A low admission of calcium and restricted exposure to sun-based bright (UV) light were related to Vitamin D deficiency [9]. Another study conducted in Jeddah, Saudi Arabia reported a positive relationship between low serum calcium and vitamin D deficiency, it also found a direct correlation between vitamin D deficiency and achy bones [11]. Al-Shaikh et al. [4] also assessed the prevalence of vitamin D deficiency and calcium homeostasis in Saudi children and found that vitamin D levels correlated significantly with Calcium level ( $p < 0.001$ ) [4]. Despite all these studies, a study conducted in Pakistan demonstrated there was no significant difference in serum calcium levels when compared with the vitamin D deficiency ( $p = 0.636$ ) [25].

Supporting our findings, evidence reported that the active form, 1,25-dihydroxy vitamin D [1,25-(OH)<sub>2</sub>D<sub>3</sub>] markedly increases the efficiency of intestinal Calcium and





phosphorus absorption. Serum levels of 25(OH) vitamin D below 50 nmol/L are associated with a significant decrease in intestinal Calcium absorption [3]. Vitamin D increases the absorption of calcium and phosphorus in the intestine. About 10 to 15% of dietary calcium and 60% of phosphorus are absorbed without vitamin D. This proportion of absorption rises to 30% to 40% for calcium and 80% for phosphorus in the presence of vitamin D [8]. As a result, Vitamin D enhances calcium absorption in the intestine to maintain adequate serum calcium concentrations and is essential for bone growth.

### Conclusion

Vitamin D deficiency is very prevalent among patients in south Libya. Our study showed that the prevalence of vitamin D deficiency is high in the Libyan population in the southern region despite the southern areas of Libya are being sunny. In addition, our findings showed that Vitamin D deficiency was more prevalent among females than in males. The study population generally had low calcium levels. there is also a positive correlation between Vitamin D deficiency and S. Calcium deficiency.

### Recommendation

It is recommended that awareness about the importance of sparing time for sun exposure must be performed. Furthermore, Health education should be provided regarding the consumption of a diet rich in vitamin D to overcome such low levels of vitamin D in Libya. This suggests conducting investigations about contribution factors in the prevalence of vitamin D deficiency.

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### Conflicts of interest:

There are no conflicts of interest.

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