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Original Article

Evaluation of Vitamin D Status among Populations in Tobruk City, Libya

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ABSTRACT

Background. *Vitamin D deficiency (VDD) has pandemic proportions worldwide. Numerous studies have reported high prevalence of VDD in the sunniest areas of the world, such as Near East and North Africa (NENA) including Libya. To contribute to the body of evidence, measurement of vitamin D status on Libyan population at Tobruk region was conducted.* ***Methods****. A total of 568 cases (169 males and 399 females) aged 0 to >40 years were tested for vitamin D level. Serum 25(OH)D was analysed using ECLIA assay by Cobas machine e 411. The associations of the levels of 25(OH)D3 with gender, and age groups were assessed throughout using the Chi-square test on SPSS software.* ***Results.*** *The results showed that the participants with VDD (< 20 ng/L) recorded the highest percentage (52.1%), followed by those with insufficient level (20-50ng/L) (46.3%) while those with high level or adequate (> 50 ng/L) were found the lowest percentage (1.6%). The results revealed a significant correlation (X2=23.28; P<0.01) between the age group and vitamin D level. Moreover, the results revealed that the youngest participants (0–20 years) recorded the highest percentage (59.3%) of optimum level of vitamin D, while those oldest ones with age group as 21-30 years, 31-40 and >40 years have the highest frequencies (60.6, 56.2 and 57.5% respectively) of low level of vitamin D. The results revealed that more than half of population in Tobruk city may have low vitamin D level.* ***Conclusion****. The situation calls for multi-sectoral actions and public health initiatives to address dietary and lifestyle habits. sunlight exposure may enhance vitamin D level.*

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INTRODUCTION

Vitamin D is a fat-soluble vitamin that occurs in two forms that are equally well utilized in the body. Vitamin D2 (ergocalciferol) is produced commercially by ultraviolet (UV) irradiation of the plant sterol ergosterol; vitamin D3 (cholecalciferol) is formed by the action of sunlight on the precursor 7-dehydrocholesterol in the skin. The human body utilizes both forms of vitamin D by hydroxylating first the 25-position in the liver and then the 1α-position in the kidney, producing the biologically active 1α,25-dihydroxycalciferols [1,2]. Vitamin D plays crucial role in calcium absorption, bone mineralization, calcium and phosphorus homeostasis, hormonal release, nerve conduction, and neuromuscular function [3]. The serum concentrations of 25-hydroxyvitamin D (25(OH)D) represents top clinical indicator of vitamin D availability which considers a sign of sunlight exposure, diet, and supplements. The normal value of vitamin D in adults arranged from 30 to 100 ng/ml with insufficient level at (20-50ng/L) and high level or adequate (> 50 ng/L whereas vitamin D deficiency (VDD) at concentrations below (20 ng/mL) [4,5].

Vitamin D deficiency (VDD) is still a highly prevalent disorder. It is estimated that ~1 billion people have deficient level of vitamin D, in spite of foods fortified with vitamin D and wide supplement intake [6]. VDD is widespread in the whole world as well as predominant in the Middle East (more than 50% of the population is VDD [7].

Severe VDD in adults leads to osteomalacia while in children leads to rickets, defective bone mineralization, increased bone turnover, increased risk of fractures, impaired reproductive function, and production of gonadal hormone that may affect other organs, e.g., gastrointestinal and renal calcium handling, and bone function [8].

In the critical care condition, VDD has been associated with adverse outcomes such as infections, longer length of stay, acute kidney injury, and higher mortality [9]. It is important for a country to know the determinants of vitamin D level of the population. The information can be used in designing health promotion programs to optimize vitamin D level at population level. This will prevent indiscriminative use of vitamin D supplementation and thereby reduce the additional cost that patients have to bear [10]. So, the main objective of this work was to evaluate the vitamin D status among populations in Tobruk city in Western Libya.

METHODS

Data Collection

A cross sectional study was designed to investigate vitamin D deficiency (VDD) status in Tobruk city, Libya. This study was performed on 568 participants (169 males and 399 females) at Ibn Rashid Laboratory, Tobruk, Libya to help collecting data related to vitamin D deficiency (VDD) over a period of one year from January 2020 to December 2020.

Blood Sample Collection and Laboratory Analysis

About 5 milliliters of blood were collected by trained technicians. This was done under the supervision and guidance of the primary care physicians. Blood tubes were preserved in a cooler or refrigerator immediately. The time of preservation was not less than 30 minutes and did not exceed four hours before the technicians centrifuge them. The centrifugation process was done for about half an hour at 3000 RPM at 4°C. Following that, the technicians immediately separated the serum from the whole blood and freeze them at - 20°C. This was done at the biochemistry Unit at the at Ibn Rashid laboratory, Tobruk, Libya. The 25-hydroxyvitamin D levels were measured by ECLIA assay by Cobas machine e 411. The level was considered as deficient (< 20 ng/ml), inadequate (20 – 50 ng/ml) and adequate (>50 ng/ml) [4,5].

Statistical Analysis

Data were analyzed using IBM SPSS version 22. The associations of the levels of 25(OH)D3 with gender, and age groups were assessed throughout using the Chi-square test.

RESULTS

The results showed that the participants with low level of vitamin or deficiency (< 20 ng/L) recorded the highest percentage (52.1%), followed by those with optimum level or insufficient (20-50ng/L) (46.3%) while those with high level or adequate (> 50 ng/L) were found the lowest percentage (1.6%) (Fig 1). Association between vitamin D level and patient gender was presented in Table 1. The results revealed the significant association ($X2=10.69$; $P<0.01$) between level of vitamin D and participant gender. The females recorded the highest frequency (56.4%) of low level of vitamin D, while the males recorded the highest frequency (56.8%) of optimum level of vitamin D (Fig 2).

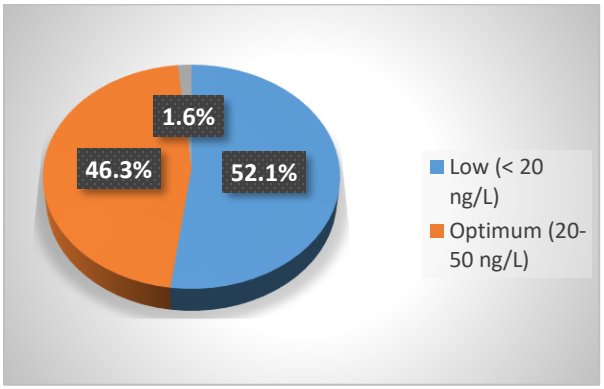

Fig 1. Blood vitamin D level among studied patient

Table 1. Association between vitamin D level and participant gender

Vitamin D level	Gender				Total	
	Female		Male			
	N	%	N	%	N	%
Low (< 20 ng/L)	225	56.4	71	42.0	296	52.1
Optimum (20-50 ng/L)	167	41.9	96	56.8	263	46.3
High (>50 ng/L)	7	1.8	2	1.2	9	1.6
Total	**399**	**100.0**	**169**	**100.0**	**568**	**100.0**

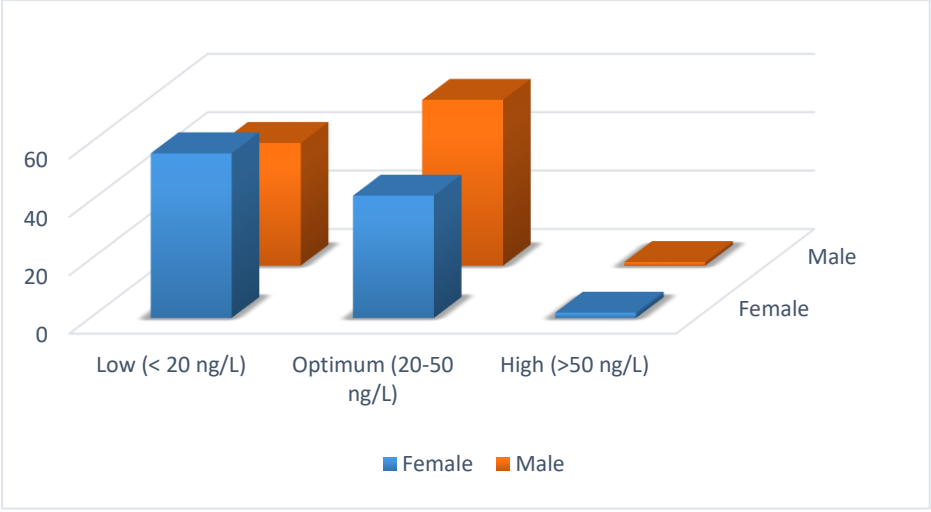

Fig. 2 Vitamin D level among males and females

Table 2 shows the association between level of vitamin D and age group of participants. The results revealed a significant correlation (X2=23.28; P<0.01) between the age group and vitamin D level. Moreover, the results revealed that the youngest participants (0–20 years) recorded the highest percentage (59.3%) of optimum level of vitamin D, while those oldest ones with age group as 21-30 years, 31-40 and >40 years have the highest frequencies (60.6, 56.2 and 57.5% respectively) of low level of vitamin D (Fig 3).

Table 2. Association Between Vitamin D Level and Age Group

Age group		Vitamin D level		
		Low (< 20 ng/L)	Optimum (20-50 ng/L)	High (>50 ng/L)
0 – 20 years	N	63	99	5
	%	37.7	59.3	3.0
21 – 30 years	N	77	49	1
	%	60.6	38.6	0.8
31 – 40 years	N	68	53	0
	%	56.2	43.8	0.0
> 40 years	N	88	62	3
	%	57.5	40.5	2.0
Total	N	296	263	9
	%	52.1	46.3	1.6

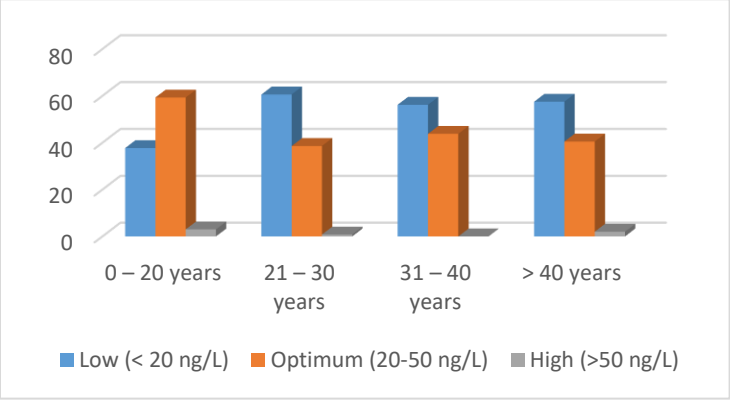

Fig 3. Vitamin D level among different age groups

The effects of patient gender, age group and its interaction on vitamin level were observed on Table 3. The analysis of variance showed that gender and age group of participants significantly influenced the blood vitamin D concentration, while interaction between age group and gender had insignificant (P>0.05) effect. The results revealed that the males had significantly (P<0.05) greater blood vitamin D (22.30±0.80 ng/L) than females (20.48±0.48 ng/L). Also results of mean separation observed that youngest patients (0 – 20 years) had significantly (P<0.05) greater vitamin D (24.51±0.74 ng/L) than those oldest age groups. The interaction results showed the decreasing trend of vitamin concentration from younger males and females to those oldest ones.

Table 3 Effect patient gender and age group on vitamin D level (ng/L)

Age group	Gender				Overall	
	Female		Male			
	N	Mean±SE	N	Mean±SE	N	Mean±SE
0 – 20 years	92	22.59±0.99	75	26.43±1.10	**167**	**24.51^{a}±0.74**
21 – 30 years	99	18.65±0.95	28	20.02±1.79	**127**	**19.83^{b}±1.02**
31 – 40 years	96	20.16±0.97	25	22.31±1.91	**121**	**21.24^{b}±1.07**
> 40 years	112	20.52±0.90	41	19.43±1.48	**153**	**19.97^{b}±0.87**
Overall	**399**	**20.48^{B}±0.48**	**169**	**22.30^{A}±0.80**	**568**	**21.39±0.47**

DISCUSSION

The results showed that the female participants observed highest frequency of low level of vitamin D (Vitamin D deficiency), while the males recorded the highest frequency of optimum level of vitamin D. The analysis of variance results showed that gender and age group of participants significantly influenced the blood vitamin D concentration and males had significantly ($P<0.05$) greater blood vitamin D than females.

Similar findings were previously reported by [11], who found that the most affected participants with vitamin D deficiency were females in Tobruk city. While AlQuaiz [12] found that the males had a higher prevalence rate of vitamin D deficiency compared to female participants. The low vitamin D level (deficiency) between females in the present study may be due to inadequate exposure to sunlight and low intake of milk and milk products. The exposure to sunlight and consume product with vitamin D and food rich in vitamin D can improve vitamin D concentrations [13].

The results revealed a significant correlation between the age group of participants and vitamin D level, and youngest participants recorded the highest percentage of optimum level of vitamin D, while those oldest ones had the highest frequencies of low level of vitamin D. Dissimilar finding was recorded by AlQuaiz [12], who showed that younger adults had a higher prevalence of vitamin D deficiency compared to older participants.

CONCLUSIONS AND RECOMMENDATIONS

Based on our study, it seems that the female and older participants are suffering more than male and younger participants. Inadequate exposure of the skin to sunlight due to changes in lifestyle might be an important and main cause of vitamin D deficiency. The study recommended that the people should consume product with vitamin D and food rich in vitamin D can improve vitamin D status is convincing and treatment for vitamin D insufficiency will be recover overall health problems related to Vitamin deficiency. Further studies are needed to detect the main reason of vitamin D deficiency and to support monitoring the treatment.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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