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The Prevalence of Vitamin D Deficiency in the Qaminis Region, Eastern Libya

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A B S T R A C T

One widespread health issue is the lack of adequate vitamin D. Today, vitamin deficiency is acknowledged worldwide. In addition, increasing the rates hypovitaminosis D in the sunniest places of the world, such as Libya. **Aim:** prese study's objectives were to assess the vitamin D status of the local populace in the Qamin region of astern Libya and investigate the correlations between age and gender wi vitamin D deficiency. **Methods:** In the Qaminis region of Eastern Libya, 135 responden (47 males and 88 females) participated in a cross-sectional study between January 202 and December 2023.An enzyme immunoassay method was used to measure the seru 25(OH) D levels. **Results:** The incidence of vitamin D insufficiency was 74.81% Qaminis town. Vitamin D levels were found to be below normal in 25.18% of th subjects (<30 ng/mL), with 17.03% of them being deficient (<10 ng/mL) and 57.77 being insufficient (10–29.9 ng/mL). Age groups revealed that the proportion of peop with severe vitamin D deficiency was 9.62%, insufficiency was 32.59%, and people wi adequate vitamin D concentrations were 14.81% (26–80). **Conclusion:** Based on the dat it is reveled that populations in Qaminis had a very high frequency of vitamin deficiency.

1. Introduction

Insufficient vitamin D is one common health problem. Vitamin D insufficiency is increasingly recognized globally. Furthermore, raising the prevalence of hypovitaminosis D in the world's sunniest locations, including Libya, which has widely spread among different ages and become a major community health problem (Adnan, 2021);(Salim & Khalid, 2023). Since Mellanby made the initial discovery of vitamin D in 1920, researchers and medical professionals have come to recognize the importance of vitamin D (Holick, 2000).

UVB rays from sunshine cause 7-dehydrocholesterol to be transformed into the fat-soluble vitamin vitamin D. The active form of vitamin D, 1,25 dihydroxycholecalciferol, binds to receptors on target tissues such as the kidney, gut, and bone to maintain calcium homeostasis. This is how it works. In addition to maintaining bone health, vitamin D is essential for the body's extraskeletal biochemical functions, including immunological, cardiovascular, and neuroendocrine system regulation. Furthermore, it performs autocrine activity within cells, aiding in the expression of genes (Heaney, 2008; Anaizi, 2010; Griz *et al*., 2014).

Numerous factors can contribute to vitamin deficiency, such as an indoor lifestyle, high latitudes, dark skin, insufficient skin area exposed to UVB rays, obesity (resulting in an expanded volume of distribution), aging (causing a reduction in photosynthesis), severe liver disease, and chronic kidney disease. (Binkley *et al*., 2007), (Mc Cullough, 2010).

Age, certain disorders, and insufficient sun exposure are all associated with vitamin D deficiency (Holick , 2017); (Bouillon & Carmeliet , 2018). Vitamin D deficiency can lead to rickets (Giustina *et al*., 2019), osteomalacia (Durup *et al*., 2020), and an increased risk of osteoporotic fracture (Bouillon *et al*., 2019). It can also impair bone metabolism and interfere with calcium absorption. According to Trehan *et al* (2017), vitamin D deficiency is also linked to a number of non-skeletal disorders, including cardiovascular ailments, Diabetes (Niroomand *et al*., 2019), multiple sclerosis (Feige *et al*., 2020), depression (Hansen *et al*., 2019), preeclampsia (Fogacci et al., 2020), Parkinson's disease (Rimmelzwaan *et al*., 2016), chronic renal disease

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(Franca *et al*., 2018), and several forms of cancer (Mondul *et al*., 2017).The severity of the coronavirus illness 2019 (COVID-19) has been linked to vitamin D insufficiency, according to recent reports (Munshi *et al* ., 2021).

Seldom can one find vitamin D in food. Cod liver oil, salmon, and tuna are the best sources. Additionally, it's present in trace amounts in cheese, egg whites, and cow liver. These foods typically contain vitamin D in the form of D3 (cholecalciferol) and its metabolite, 25(OH) D3. The absorption of vitamin D is enhanced by exposure to solar radiation. (Kusmiyati *et al*., 2020).

According to recent reports, vitamin D insufficiency was highly prevalent throughout Africa (Mogire *et al*., 2020).Nevertheless, no research has examined the frequency of vitamin D insufficiency in Libya's Qaminis City.Thus, determining the frequency of vitamin D deficiency in Qaminis is crucial. The current study's objective was to assess the vitamin D status of the inhabitants in the Qaminis region of Eastern Libya, paying particular attention to age and gender differences that may be associated with these circumstances.

1 Materials and Methods

Between January 2023 and December 2023, a cross-sectional study was carried out in Qamins, Libya, to look at potential relationships between the health and vitamin D status of young and adults. Data on vitamin D level were examined for 135 male and female Libyans aged 1–26 and 26–80 years, based on samples that were available. The data for the present study was obtained from private clinic (Qaminis Laboratory) in Qaminis city, Libya, to help collecting data related to vitamin D deficiency (VDD).

For the purpose of measuring vitamin D, blood samples were taken from each participant. Using a vitamin D ELISA Kit, the direct ELISA kit approach was used to assess the serum vitamin D levels. Vitamin D sufficiency, insufficiency, and deficiency were defined by the reference value of the employed kit as serum concentrations of less than 30, 10.1–29.9, and >10 ng/mL, respectively.

1.1 Statistical analysis

Data were analyzed using Statistical Package for Social Science (SPSS) version 25. Using the Chi-square test, the relationships between the levels of 25(OH) D3 and age groups and gender were evaluated. At ($p > 0.05$), statistical significance was established.

2. Results

Of the 135 participants, 88 (or 65%) were female and 47 (or 35%) were male. In total, there were 58 participants (42.96%) in the (1-26) age group and 77 subjects (63.25%) in the (26-80) age group. According to Table (1), there were more subjects overall: 53 subjects (60.22%) who were female and 24 subjects (51.06%) who were male among those aged 26 to 80.

***Table (1)**. Frequency and percent of subjects according to gender and age groups.*

Gender	Male		Female		Total	
Age groups.	N	%	N	%	N	%
1-26y	23	48.93	35	39.77	58	42.96
26-80y	24	51.06	53	60.22	77	63.25

In men, the prevalence of vitamin D deficiency was 74.4%, whereas in women it was 75%. In all, 17% of the individuals were evaluated to have severe vitamin D deficiency (~ 10 ng/ml), 57.7% to have insufficient vitamin D deficiency (10.1-29.9 ng/ml), and 25.1% to have adequate vitamin D concentrations (≥30 ng/ml). In male individuals, the estimated prevalence of vitamin D deficiency was as follows: 17% had severe vitamin D deficiency (~ 10 ng/ml), 57.34% had insufficiency (10.1-29.9 ng/ml), and 25.53% had adequate vitamin D concentrations (≥30 ng/ml). According to Table (2) and **figure (1)**, the estimated prevalence of vitamin D deficiency in female individuals was as follows: 17.04% had severe vitamin D deficiency (~10 ng/ml), 57.95% had insufficiency (10.1-29.9 ng/ml), and 25% had adequate vitamin D concentrations (≥30 ng/ml).

Table (2). Frequency and percent of vitamin D levels according to gender.

Parameters	**(N=135)**	**(100%)**
Deficiency (male)	8	17.02
Insufficiency	27	57.44
Sufficiency	12	25.53
Deficiency (female)	15	17.04
Insufficiency	51	57.95
Sufficiency	22	25

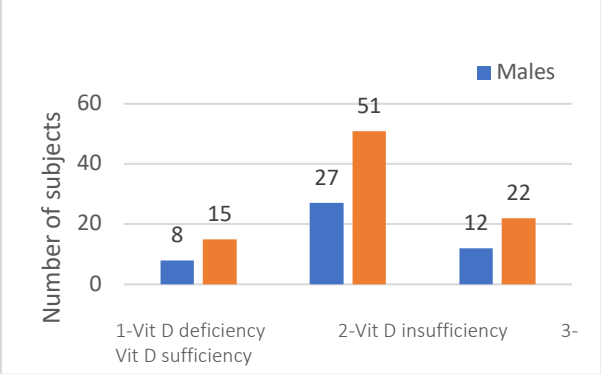

Figure (1). The distribution of subjects according to gender and vitamin D levels

The data presented in Table (3) and **figure (2**) illustrate the subject distribution by age group and vitamin D status. In age groups (1-26) and (26-80), the estimated prevalence of severe vitamin D deficiency (~ 10 ng/ml) was 10 and 13 participants, respectively. In age groups (1-26) and (26-80), the estimated prevalence of insufficiency (10.1-29.9 ng/ml) was 34 and 44 subjects, respectively, whereas the proportion of those with adequate vitamin D concentrations (≥30 ng/ml) was 14 and 20 subjects, respectively.

Table (3). Frequency and percent of vitamin D levels according to age groups.

Vit D Levels	vitamin D deficiency		vitamin D Insufficiency		adequacy of vitamin D	
Age groups	N	%	N	%	N	%
1-26	10	7.40	34	25.18	14	10.37
26-80	13	9.62	44	32.59	20	14.81

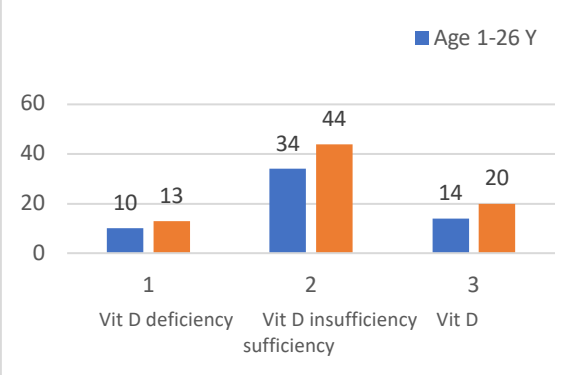

Figure (2). The distribution of subjects according to age groups and vitamin D levels.

Table (4) and **figure(3)** indicate the distribution of male respondents by age groups and vitamin D levels. In age groups (1-26) and (26-80), the estimated prevalence of severe vitamin D deficiency (~ 10 ng/ml) was 4 and 4 participants, respectively. In age groups (1-26) and (26-80), respectively, the estimated prevalence of moderate vitamin D deficiency (10.1-29.9 ng/ml) was 11 and 16 subjects, and the proportion of subjects with adequate vitamin D concentrations (≥30 ng/ml) was 8 and 4 subjects, respectively.

Table (4). Frequency and percent of male subjects according to age groups and vitamin D levels.

Vitamin D levels	vitamin D deficiency		vitamin D Insufficiency		adequacy of vitamin D	
Age groups	N	%	N	%	N	%
1-26y	4	8.51	11	23.40	8	17.02
26-80y	4	8.51	16	34.04	4	8.51

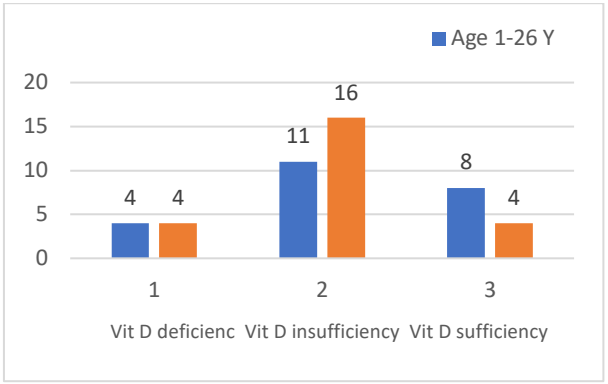

Figure (3). The distribution of male subjects according to age groups and vitamin D levels.

Table (5) and **figure(4)** demonstrate the distribution of female respondents by age groups and vitamin D levels. In age groups (1-26) and (26-80), the estimated prevalence of severe vitamin D deficiency (~ 10 ng/ml) was 6 and 9 participants, respectively. In age groups (1-26) and (26-80), the estimated prevalence of insufficiency (10.1-29.9 ng/ml) was 23 and 28 subjects, respectively, and the proportion of subjects with adequate vitamin D concentrations (≥30 ng/ml) was 6 and 16 subjects, respectively.

Table (5). Frequency and percent of female subjects according to age groups and vitamin D levels.

Vitamin D levels	vitamin D deficiency		vitamin D Insufficiency		adequacy of vitamin D	
Age groups	N	%	N	%	N	%
1-26	6	6.81	23	26.13	6	6.81
26-80	9	10.22	28	31.81	16	18.18

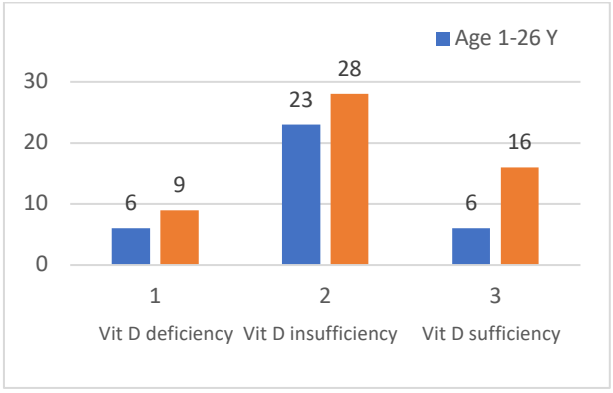

Figure (4). Distribution of female subjects according to age groups and vitamin D levels.

As shown in table 6 the correlation between vitamin D deficiencies and (gender, age) for 135, reveal that there are no relationship which the p-value was =0.99, and 0.97 for gender and age respectively. The mean ages of the Vitamin D deficient, were mean (1.570), SD

(0.496), while mean gender of Vitamin D deficient, were mean (1.651), SD (0.478).

Table (6). Correlation between vitamin D, gender and age.

Pearson correlation	Mean	SD	P-value
Correlation of vitamin D			
Correlation of age	1.570	0.496	0.971
Correlation of gender	1.651	0.478	0.998

1 Discussion

Qaminis is sunny twon and located in northeast of Libya. It is roughly 50 kilometers south of Benghazi. In the Qaminis region, the incidence of vitamin D insufficiency was 74.81%. According to our research, females and males suffer from vitamin D deficiency, especially the adult age group. Faid *et al* (2018); Omar *et al* (2018); and Agila (2020) earlier published results, indicating that women in Benghazi, Misurata, and Tobruk cities were the most afflicted by vitamin D insufficiency. AlQuaiz *et al*. (2018) found that male participants had a higher prevalence rate of vitamin D deficiency than female participants.

With a detailed overall incidence of 30 - 80% subjects in children and adults, vitamin D deficiency is a major general medical problem in both industrialized and developing countries (Andıran *et al*., 2012).

The sunniest regions in the world, which include the Middle East and Asian nations like Qatar, Saudi Arabia, the United Arab Emirates, Iran, Turkey, and India, have been linked to increased prevalence of hypovitaminosis, according to reports (Naee *et al*., 2011);(Alsuwaida *et al*.,2013).

The Food and Agriculture Organization stated in 2016 that 81% of Saudi girls and 62% of teenagers in Qatar were vitamin D deficient.Up to 85% of Saudi women were found to have the highest level of vitamin D insufficiency (FAO, 2017)

Vitamin D insufficiency was found to be widespread throughout Africa, with northern African nations having the highest prevalence, according to a systematic review and meta-analysis study conducted in 2020 that included 129 papers and 21474 subjects from 23 African countries, including Libya (Mogire *et al*., 2020).

In a cross-sectional study conducted in Benghazi, Libya, 8.7% of participants had enough vitamin D, compared to 76.1% with insufficiency and 15.2% with deficiency. Women were more likely than men to be deficient in vitamin D. 26.1% of men were deficient and 21% were insufficient in vitamin D, whereas 58.4% of women were deficient and 25% were insufficient (Omar *et al*., 2018).

According to Mofieda *et al* (2017), a different study conducted in Tripoli, Libya, revealed that 69% of nursing moms had vitamin D insufficiency (≤20 ng/ml) and 30% had vitamin sufficiency (≥30 ng/ml). Moreover, a study done in Misurata City, women were more likely than males to have low vitamin D levels, with 61.6% of them having levels over 25 nmol/L and 20.2% having levels between 25 and 50 nmol/L (Faid *et al*., 2018). Approximately 80% of participants had low vitamin D levels. According to a survey, the majority of Libyan women live indoors and wear traditional clothing. They also avoid the sun because of cultural traditions. Because of this, the majority of their vitamin D intake comes from their diet, which could not be enough to meet their needs (Omar *et al*., 2018).

Sedentary lifestyles and little sun exposure were associated with poor vitamin D status because of traditional costumes and restrictions on the use of short sleeves and revealing apparel (Portela *et al*., 2010). It's probable that the female participants' low vitamin D levels (deficiency) were brought on by insufficient sun exposure. According to Mahony *et al*. (2001), exposure to sunlight can increase vitamin D concentrations.

Research on women conducted in Turkey and Jordan Alagol *et al* (2000); Mishal (2001) revealed a significant correlation with clothing. Vitamin D levels increased among women wearing western attire, and decreased in traditional women, who wearing headscarves and fully veiled women wearing niqab.

Vitamin D insufficiency is relatively widespread worldwide, but among adults, it is more common in the Middle East. According to our research, vitamin D deficiency is more common among young adults. Schoor & Lips (2011) previously published similar results showing young individuals' susceptibility to vitamin D deficiency and proposed that sunscreen use, skin pigmentation, inadequate sun exposure, and clothing that covers up the skin are risk factors for vitamin D deficiency.

Furthermore, the study conducted in Saudi Arabia on elderly individuals revealed the lowest levels of vitamin D (Sedrani *et al*., 1983). Munns *et al* (2006), who suggested that, the dermal synthesis of older individuals is reduced, and those who live in assisted living facilities or retirement homes and have limited outdoor exposure are particularly vulnerable to low vitamin D levels. Due to factors such as more pigmented skin, a practice of avoiding the sun, wearing clothing that covers up, and a diet deficient in dairy and seafood , non-Western immigrants moving to higher latitudes with less UV-B irradiation are more vulnerable. (Flicker *et al*., 2003); (Portela *et al*., 2010).

This result was the result of multiple factors. One of these causes is dietary patterns; vitamin D is found in a limited number of foods, such as fatty fish and fish liver oil, which are not commonly consumed by Libyans, particularly in Qaminis town. Furthermore, Libyans tend to have lighter skin tones, hence sunscreen and parasols are frequently used outside. Because of these defenses, less ultraviolet B (UVB) light can reach the skin, which reduces the production of vitamin D

Vitamin D levels are significantly influenced by clothing choices as well. In Libya, where veils are worn to hide one's skin and long robes are typical, everyone is Muslim. According to earlier research, 80%–90% of vitamin D is produced by solar synthesis, which has been identified as the primary source of the vitamin (Sahota, 2014; Antonucci *et al*., 2018). In addition, study by Matsui *et al* (2019), who demonstrated that, UVB irradiation of the skin is a crucial step in the process of making vitamin D because it facilitates the process that produces previtamin D3 from 7 dehydrocholesterol. Furthermore, race influences skin tone, which in turn influences vitamin D status (Richard *et al*., 2017). Generally speaking, residents of Qaminis have darker skin, which can prevent UVB rays from penetrating.

The relationship between vitamin D concentrations and economic development is additionally evident. The majority of Libyan nations, particularly the research town of Qaminis, are developing nations without access to reliable vitamin D dietary supplements. The low levels of vitamin D in populations may be caused by the combined effects of the aforementioned variables.

This study demonstrated a no relationship between low vitamin D and demographic traits, with p-values for gender, and age = 0.99, and 0.97 respectively. These disagreement with earlier research by Ashraf & Azab (2018); Eljamay *et al* (2022).

1 Conclusions

It can be concluded that the population of Qaminis in eastern Libya, suffers from vitamin D deficiency. Our research showed that both women and men suffer from vitamin D deficiency, especially in the age groups between 26-80 years. Further research is required to understand the causes and mechanisms of vitamin D insufficiency in the future.

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