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Assessment of Vitamin D Status in a Sample of Egyptian Population

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Abstract

This fat-soluble vitamin has a critical function to perform in human health. Vitamin D deficiency continues to be a public health issue across the globe. Beyond the well-known skeletal issues, this deficit has a wide range of implications that are currently under investigation. According to their findings, a representative sample of Egypt's healthy population has their 25-hydroxyvitamin D levels checked. Methods and Subjects: This cross-sectional study recruited a total of 90 people who appeared to be in good health. Laboratory tests included serum levels of calcium (calcium), phosphorus (phosphorus), alkaline phosphatase (ALP) and parathormone hormone (PTH) levels as well as 25 hydroxyvitamin D (Vit D) (Vit.D). As a result, there were 57 women in the sample (63.3 percent). The average age of the participants was 34.25 years plus or minus 3.5 standard deviations. This group had a mean BMI of 28.86 SD kg/cm2. The total calcium concentration was 8.86 SD (between 7.4 and 9.5 mg/dl), while the ionised calcium concentration was 1.19 SD (between 0.97 and 1.25 mmol/l). The mean level of vitamin D was 16.87 SD (between 6.7 and 37 ng/mL). Three of the three measurements were within the normal range: P was 4.04 mg/dl, PTH 46.49 micrograms per millilitre, and ALP 215.64 micrograms per millilitre. Vit. D deficiency can be predicted by looking at factors like age, physical activity, sun exposure, and dietary intake of calcium and vitamin D (P0.05). However, there was no correlation between serum Vit. D levels and body mass index (BMI). Conclusion: The healthy Egyptian adults in the study sample had a significant deficiency in vitamin D. Vit. D deficiency was linked to decreased physical activity, decreased sun exposure, and a decreased intake of vitamin D.

Keywords: Vitamin D, Deficiency, Egyptian population, Sun exposure.

1. Introduction

Vitamin D, an important component for intestinal calcium absorption and bone mineralization, has been shown to boost immunity and cardiovascular disease outcomes in addition to preserving muscular strength and function [1].

Rickets, osteomalacia, osteoporosis, fracture risk, and cancer have all been linked to vitamin D deficiency.

Colorectal, lung, prostate, breast, and ovarian cancers have also been linked to it [2].

Exposure to ultraviolet-B (UVB) may either create vitamin D or be received via the food.

To convert vitamin D3 into its physiologically active form, vitamin D3 must first be hydroxylated in the liver into 25-hydroxycholecalciferol, which is then transformed in the kidney by the 1-alphahydroxylase to 1,25 dihydroxy cholecalciferol, often known as vitamin D3 or vitamin D3.

Vitamin D2 (ergocalciferol), on the other hand, is a dietary supplement.

Vitamin D (i.e., vitamin D2 and D3) is converted in the liver to 25-hydroxyvitamin D, which is widely used as a biomarker to detect vitamin D status [3].

Despite the fact that enough vitamin D production may be achieved by exposing arms and legs to the sun for 5 to 30 minutes twice a week, poor vitamin D status is still a global public health issue [4].

25-hydroxyvitamin D levels below 20 ng/mL are considered deficient, whereas levels between 21 and 29 ng/mL are considered insufficient [1].

Nearly half of the world's population is deficient in vitamin D.

Vitamin D insufficiency affects an estimated 1 billion individuals globally, regardless of ethnicity or age (VDD).

The rise in the number of people with hypovitaminosis D may be traced in large part to a decline in the amount of time spent outside in the sunshine, which is necessary for the body to produce vitamin D in response to ultraviolet B (UVB) radiation [5].

According to their findings, a representative sample of Egypt's healthy population had their 25-hydroxyvitamin D levels checked.

2. Subjects and methods

2.1. Subjects

The Rheumatology, Rehabilitation and Physical Medicine Department of the Faculty of Medicine at Benha University Hospitals recruited 90 healthy volunteers between the ages of 18 and 30 and 45 and 60 for this cross-sectional research, which took place from June 2020 to May 2021.

Acute or chronic sickness, intestinal malabsorption, familial history of hypocalcemia, vitamin D deficiency diseases, history of drugs altering bone metabolism (like calcium or vitamin D supplements, anticonvulsants, or corticosteroids) or pregnant females were excluded from the study.

All of the participants provided their written, informed permission in advance of the study.

The medical ethics committee of Benha University Hospitals gave its approval to this investigation.

Ms.16.5.2018 has been approved. **٢.٢Methods:**

Clinical assessment:

The Rheumatology, Rehabilitation and Physical Medicine Department of the Faculty of Medicine at Benha University Hospitals recruited 90 healthy volunteers between the ages of 18 and 30 and 45 and 60 for this cross-sectional research, which took place from June 2020 to May 2021.

Acute or chronic sickness, intestinal malabsorption, familial history of hypocalcemia, vitamin D deficiency diseases, history of drugs altering bone metabolism (like calcium or vitamin D supplements, anticonvulsants, or corticosteroids) or pregnant females were excluded from the study.

All of the participants provided their written, informed permission in advance of the study.

The medical ethics committee of Benha University Hospitals gave its approval to this investigation.

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Laboratory assessment:

All participants had blood drawn from their veins.

Testing included full blood counts, kidney and liver function tests (25-OH Vitamin D), serum total calcium and total phosphorus (P), as well as alkaline phosphatases (ALP) and parathyroid hormones (PTH).

A disposable plastic syringe was used to collect blood samples from each participant for (25-OH) vitamin D testing. The blood samples were placed in a simple sterile tube (without anticoagulant) for serum separation.

After 30 minutes at ambient temperature, the tube was centrifuged at 3000 rpm for 30 minutes to coagulate.

The final serum was kept at 20°C until it could be analysed.

The manufacturer's instructions were followed at all times.

Perfect Ease Biotec, (Beijing) Co., Ltd.'s "Enzyme Immunoassay for the Quantitative Determination of total 25-OH Vitamin D in Human Serum and Plasma" Cat. No. 10501 was used to assess serum vitamin D levels.

As determined by the concentration in one's serum of 25-hydroxyvitamin D, a person is either vitamin D deficient (less than 20 ng/mL) or insufficient (between 21 and 29 ng/mL) [16].

Special assessments:

International Physical Activity Questionnaire (IPAQ)

Assessment of physical activity in the last 7 days in adults and adolescents was done using the International Physical Activity Questionnaire (IPAQ) short form it is a 9 items self-report **[17]** which measured the physical activity as low, moderate, and vigorous intensity level and it included both the frequency and the time spent doing that activity.

٢.٣Statistical analysis:

The collected data were tabulated and an analysed with the use of SPSS version 16 software (SPSS Inc, Chicago, ILL Company).

Chi square test (X2) and Fisher's exact test (FET) were used to examine categorical data reported in numbers and percentages.

The OR and 95% confidence interval (CI) were computed.

The Shapiro-Wilks test was used to determine if the quantitative data were normal, with normality being assumed when P>0.05 was reached.

T-test was employed to determine the significance of the difference between two population means when there were independent samples, with normal distribution, involved in the research

Pearson's correlation coefficient was used to measure the strength of the relationships (r).

A case's chances are calculated by dividing its case probability by its non-case probability.

Using regression analysis, we were able to determine the link between two or more variables and one dependent variable.

A threshold of significance of 0.05 was adopted in this study (P less than 0.05).

3. Results

In this Cross-sectional study, a total of 90 apparently healthy volunteers were recruited in the Rheumatology, Rehabilitation and Physical Medicine Department, Faculty of Medicine, Benha University Hospitals. They were 57 females (63.3 %) and 33 males (36.7 %). Their mean age was 34.25**±5** years. (Table 1)

By history, clinical examination, and completion of the designated questionnaires, it was found that near 70% of the subjects had mild clinical manifestations that affected the quality of their life without interfering with their activity of daily living, **figure (1).**

Table (2) shows the mean levels Vit. D, the mean level of total Ca and ionized Ca, the mean level phosphorus (P), the mean level of parathyroid hormone (PTH) and the mean level of alkaline phosphatase (ALP).

Table (3) shows vit. D status in the studied subjects.

There was no statistically significant difference of serum vitamin D level according to different age subgroups (P= 0.44) while 51.1% of subjects of vitamin D insufficiency and deficiency group were females (P = 0.009).

Concerning sun exposure, it was found that 35 subjects of vitamin D insufficiency and deficiency group were categorized as fair or poor sun exposure (P= 0.016). It was found that 47.8% of subjects with low vitamin D were fair or poor **Ca and Vitamin D dietary intake** (P = 0.281).

There was no statistically significant difference between both groups according to BMI (P = 0.270) , figure 3

Regarding the calcium profile, there were statistically significant difference between both groups according to total **Ca (P =** 0.003), **Ionized Ca (P =** 0.013)**, P (P=** 0.009) **and ALP (P** <.0001) . There was no statistically significant difference between both groups according to **PTH (P =** 0.46), table 4

According to the relation between Vit. D and other parameters, There was a positive correlation between vitamin D levels and total Ca, ionized Ca, On the other hand, there was a negative correlation between vitamin D levels and ALP, But there was no significant correlation between vitamin D levels and PTH and P. table 5

According to predictors of Vit. D deficiency, there was a statistically significant positive correlation between serum Vit. D concentration and (age, physical activity, Sun exposure, and Ca and Vit. D intake) (P<0.05) while no significant correlation between serum Vit. D concentration and BMI. table 6

Table (1) General characteristic of the study group.

Age (years)	Mean		34.25
	Males	n (%)	33 (36.7%)
Gender	Females	n (%)	57 (63.3%)
BMI	28.86		
Total			90

*BMI = Body mass index

Table (2) Mean values of Lab. investigations in the selected samples.

	Vit D	Total Ca	Ionized Ca	PTH	P	ALP
Mean	16.87	8.86	1.19	46.49	4.04	215.64
Max	37	9.5	1.25	111.2	5.1	301
Min	6.7	7.4	0.97	30.8	3.2	112

Ca: Calcium, PTH: Parathyroid Hormone, P: Phosphorus, ALP: Alkaline Phosphatase

Table (3) Description of Vitamin D levels in each category among the studied group.

Variable		No. (N=90)	% (100%)	Meam ng/ml	Rang ng/ml
Vitamin D status	**Sufficiency**	28	31.1	35.29	30.1-37
	Insufficiency	23	25.6	23.64	20.5-28
	Deficiency	39	43.3	10.26	6.7-19.9

N: Number

Table (4) Comparison between the studied groups regarding the calcium profile.

		Mean	± SD	t	P
Total Ca	**Sufficient**	9.07	0.35	2.80	0.003
	Insufficient and Deficient	8.75	0.43		
Ionized Ca	**Sufficient**	1.21	0.02	2.26	0.013
	Insufficient and Deficient	1.17	0.06		
PTH	**Sufficient**	46.16	14.36	0.09	0.46
	Insufficient and Deficient	46.63	19.33		
P	**Sufficient**	4.21	0.46	2.43	0.009
	Insufficient and Deficient	3.96	0.31		
ALP	**Sufficient**	260.37	35.03	-4.71	< .0001
	Insufficient and Deficient	194.91	54.43		

Ca: Calcium, PTH: Parathyroid Hormone, P: Phosphorus, ALP: Alkaline Phosphatase

Table (5) Relation between Vit. D and other parameters.

Pearson Correlation Coefficient with Vit D	r^2 **value**
Total Ca	0.1875
Ionized Ca	0.0835
PTH	0.0034*
P	0.114
ALP	0.4303

Ca: Calcium, PTH: Parathyroid Hormone, P: Phosphorus, ALP: Alkaline Phosphatase
P >0.05 is non significant (ns)
P≤ 0.05 is significant (s)

Table (6) Regression analysis of predictors of Vit. D deficiency.

Regression analysis for predictors of Vit D deficiency	**R**	**P**
Age	0.3014	0.0039*
BMI	0.0265	0.8041
physical activity	0.3562	0.0006*
Sun exposure	0.2881	0.0058*
Ca &Vit D intake	0.2516	0.0168*

BMI = Body mass Index, Ca: Calcium
P >0.05 is non significant (ns)
P≤ 0.05 is significant (s)

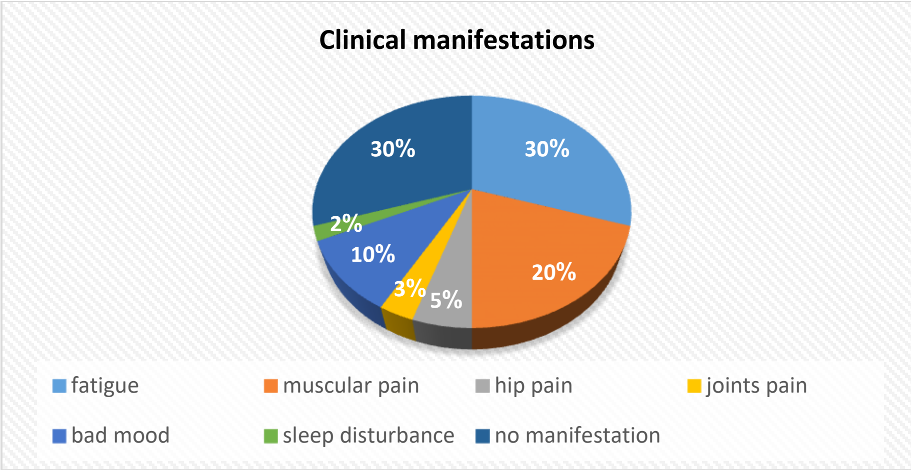

Fig.(1) Clinical manifestations in the studied groups.

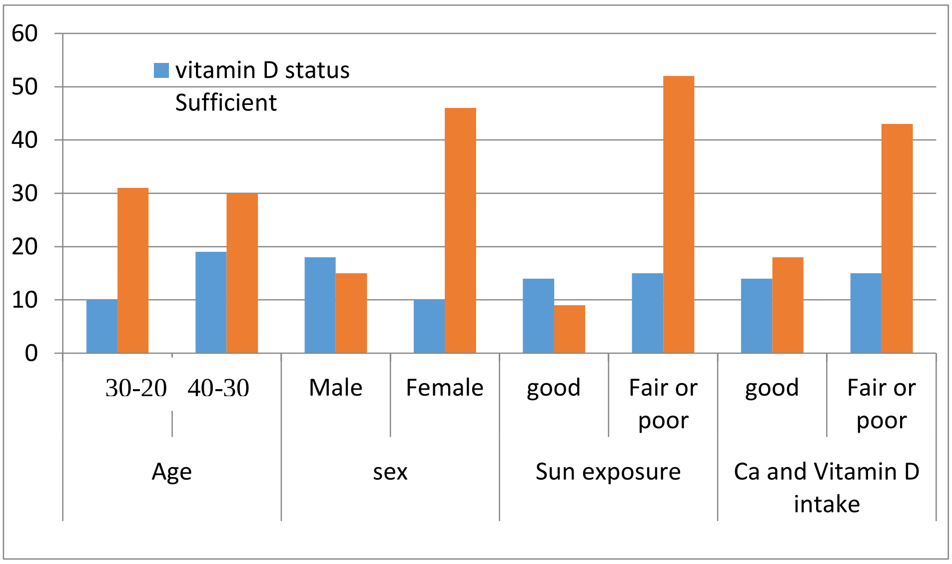

Fig. (2) Studying the risk factors of vitamin D insufficiency and deficiency

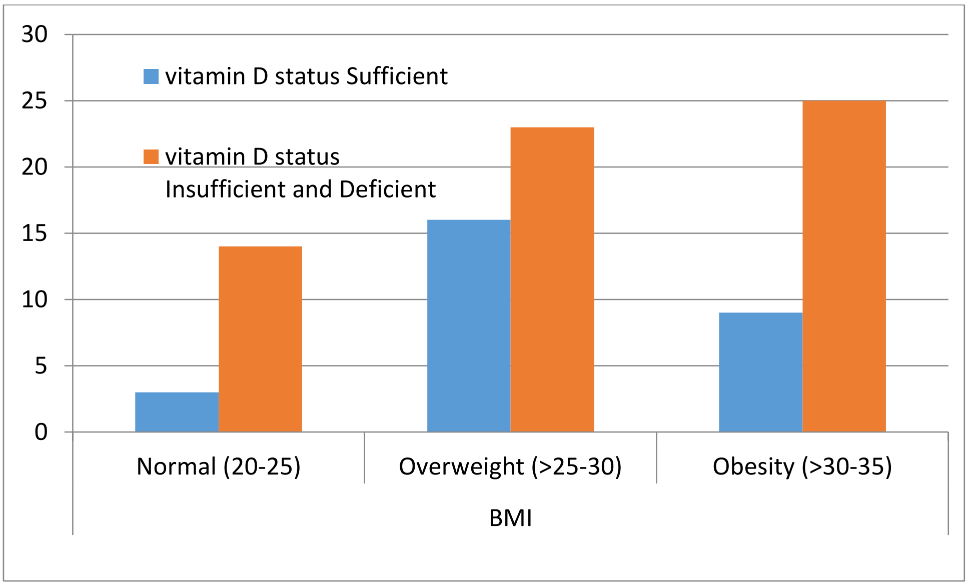

Fig. (3) Relation between the vitamin D status and body mass index.

4. Discussion

Vitamin D deficiency was found in 68.9% of participants in this investigation (25.6 percent were insufficient, 43.3 percent were deficient).

Vitamin D deficiency was found in 64% of the individuals in the research by Al-dabhani et al. [6], a Qatari population, according to our findings.

Another quarter of the population had vitamin D deficiency.

The incidence of hypovitaminosis D varied from 58% to 62% in children, 44% to 60% in adults, and 41% to 62% in the elderly in a research by Hoteit et al. [7], who evaluated the prevalence of the condition in Lebanon.

In most sub-groups, the prevalence was over 78% at a cut-off of 30 ng/ml.

In contrast, Golbahar et al. [8] found that the prevalence of vitamin D deficiency was 49.4% and the mean vitamin D level was 27.9 19.3 in their research of predictors of vitamin D deficiency and insufficiency in adult Bahrainis.

The median serum 25(OH)D level in Kuwaiti adults was 13.8 ng/ml, according to Zhang et al. [9].

A whopping 56% of Kuwaiti adults had inadequate levels of vitamin D (25(OH)D = 12–19.9 ng/ml) and 27% had inadequate levels of vitamin D (25(OH)D 12 ng/ml).

The discrepancies between our findings and those of other ethnic groups may be due to cultural variations, lifestyle variables, and variances in the dietary consumption of fortified foods..

Low vitamin D levels were found in 62 (68.9 percent) of the individuals in the current investigation.

Twenty-three (25.6 percent) and thirty-nine (43.3 percent) of the participants had inadequate vitamin D levels, respectively.

Females comprised 51.1 percent of the population, while men accounted for 16. (16.6 percent).

Females showed considerably lower median 25OHD levels than men (P 0.001), according to Sayed-Hassan et al. [10].

According to Batieha et al. [11], a study of vitamin D status in Jordan, 37.3 percent of women and 5.1 percent of men had low 25(OH)D levels.

In all age categories, the mean values were considerably higher in men (P = 0.000) than women.

Males had a mean of 73.3 ng/ml, while females had a mean of 39.8 ng/ml.

The mean blood 25-hydroxyvitamin D level in central Anatolia, Turkey, was 14.58.8 ng/mL for women and 18.18.4 ng/mL for males, according to a study by Solak et al [12].

Women had significantly lower levels of serum 25-hydroxyvitamin D than males (P0.001).

Serum 25-hydroxyvitamin D concentrations vary across sexes for unknown causes [12].

Another possible reason for the lack of vitamin D in Egyptian women is the fact that women spend more time inside than males, as well as their style of clothing and sun protection and sun avoidance mentality.

Vit. D has a high relationship with ALP, and a reasonable relationship with total Ca as well as P, as well as a weak relationship with ionised Ca and PTH, according to the correlations we established with other parameters.

The correlation between serum total 25(OH)D and age (r = 0•131, P 0.003), serum Ca (r = 0•174, P = 0•001) and male sex (r = 0•388, P 0.001) and plasma PTH (r = 0•19, P 0.003) was confirmed by our findings.

Serum 25(OH) D was positively associated with age and negatively associated with weight, BMI, waist circumference, and fat mass, whereas no association was evident with lean body mass in a study by Sadiya et al. (13), who studied vitamin D status and its relationship with metabolic markers in obese and diabetic patients in the United Arab Emirates.

PTH and ALP were shown to be negatively linked to serum 25(OH)D, however calcium was found to be favourably connected with it (P0.05).

Vitamin D insufficiency may be predicted by factors such as age, exercise, sun exposure, and calcium and vitamin D consumption (P0.05). However, there was no statistically significant correlation between blood Vit. D concentration and BMI.

Women's sex, winter season, participants over 35, and fewer than three times a week of athletic practise were all significant predictors of moderate-to-severe vitamin D insufficiency in univariate analysis by Sayed-Hassan et al. [10].

Female sex [adjusted odds ratio (95 percent CI) 3.7 (2.4–6.0)] was found in the multivariate model.

[95 percent confidence interval (95 CI) adjusted odds ratio (2.8 (1.8–4.4)]

In the absence of sex and season, physical activity and age group were no longer significant predictors of mild to severe vitamin D insufficiency.

There was no correlation between a BMI of less than 30 kg/m2 and a moderate-to-severe vitamin D insufficiency, regardless of how it was measured.

According to Alloubani et al. [14], this research attempted to determine the prevalence of Vitamin D insufficiency in Saudi Arabia, disclosing the country's lifestyle and dietary habits, and evaluating the link between Vitamin D deficiency, Diabetes Mellitus, and obesity.

The results showed that women (P 0.05) were more likely than men to have Vitamin D Deficiency, as were those who were younger, had higher incomes (P 0.05), were smokers (P 0.05), and were not exposed to the sun (P 0.05). Other risk factors included being a smoker and not being exposed to the sun.

Vitamin D Deficiency is also linked to exercise (P 0.05).

Less Vitamin D consumption (P 0.05) and less calcium intake were also shown to increase the log odds of vitamin D deficiency (P 0.05) in the participants.

Vitamin D deficiency is more likely to occur in those with a higher BMI (P 0.05).

Last but not least, we found a high frequency of hypovitaminosis D in a sample of healthy adult males and females in our sunny nation, even though the Egyptian population receives abundant sunlight, which should assist vitamin D production.

According to our findings, women who wear the Neqab (a full-body covering that includes the face and hands) or the Hijab (which covers the whole body but spares the face and hands).

Because most women work from home, they don't get enough exercise or exposure to the sun between the hours of 10 a.m. and 3 p.m.

Vitamin D is difficult to get in diet, and even fortified foods don't meet the body's needs.

High amounts of pollution in the atmosphere may dramatically diminish UVB levels on the ground.

Vitamin D insufficiency may be caused by living in a polluted area.

Vitamin D deficiency was shown to be associated with the following variables (decreased physical activity, decreased sun exposure, and decrease Vit. D intake).

As a result, nutritionists, nurses, and doctors must educate the public on ways to improve dietary vitamin D intake or prescribe supplementation.

Efforts at the public level should focus on the assessment of Vitamin D levels, supplementation, and fortification.

Our study was limited by the small number of participants we could gather because they were all drawn from a single geographic region.

5. Conclusion

Vitamin D insufficiency was shown to be prevalent among healthy Egyptian adults, particularly females.

Vitamin D deficiency has been linked to a reduction in physical activity, sun exposure, and vitamin D consumption.

In order to carry out the essential public health actions, more study is needed to identify vulnerable populations and determine their risk factors for low vitamin D levels.

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Author contribution

Authors contributed equally in the study**.**

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