

## Prevalence of Vitamin D Deficiency among Patients Presented in Endocrinology Clinic at King Abdul-Aziz Hospital and Oncology Center – Jeddah

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### Abstract

**Background:** Vitamin D deficiency is the most common nutritional deficiency in the world. It is found more frequently in the Middle East. Proper identification and treatment must be done to prevent complications.

**Aim:** The aim was to observe the current prevalence of Vitamin D deficiency, and to determine whether it is more common in the female population. We will attempt to identify the possible causes of such deficiency.

**Method:** Cross-sectional study among 300 Saudi patients was conducted out of which 233 were included in the interview. The study was held at the city of Jeddah, endocrinology department at King Abdul Aziz Hospital and Oncology Center.

**Conclusion:** The overall prevalence of Vitamin D deficiency in the population interviewed was 41%, which is lower than other studies conducted in the Kingdom, yet higher than many other countries. There is definitely a higher prevalence among the females (51.58%) compared with males (28.35%).

**Keywords:** Vitamin D Deficiency; Women Saudi Arabia; Osteomalacia; Sunlight Exposure

### Introduction

Among nutritional deficiencies, Vitamin D deficiency is the most common deficiency in developing and developed countries, and distributed among all age groups [1]. The prevalence of the deficiency in Saudi Arabia ranges from 38.6% - 72.8% [2,3], which is very much higher compared to other geographical regions such as Europe countries, or the United States where, among the general population deficiency prevalence is 4.6% - 10.3% [13].

Vitamin D is important for skeletal health and for calcium homeostasis. The important function of vitamin D is to increase the absorption of calcium from the small intestine. Heaney and colleagues showed that maximum calcium absorption occurs at levels of 25-hy-

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droxyvitamin D (25[OH]D) greater than 32 ng/mL [4]. Vitamin D further helps in the absorption of phosphorus from small bowel. Calcium and phosphorus absorption is important for proper mineralization of the bone. Vitamin D is involved in the maturation of osteoclasts, which reabsorb calcium from the bones [4].

Vitamin D can mean either vitamin D2 or vitamin D3. Vitamin D3 (cholecalciferol) is made in the skin or obtained from the diet such as fatty fish. Vitamin D2 (ergocalciferol) can be obtained from irradiated fungi e.g. yeast. Vitamin D2 and vitamin D3 supplement food products, or are available in multivitamins [5]. Vitamin D3 production in the skin involves a series of reactions starting with 7-dehydrocholesterol. When exposed to ultraviolet B (UVB) radiation between the wavelengths of 290-315 nm, or in other words, to natural sunlight, 7-dehydrocholesterol is converted to previtamin D3. Previtamin D3 is then converted to vitamin D3 by a thermally induced isomerization reaction in the skin. After the skin, the newly synthesized vitamin D3 enters the circulation by binding to vitamin D binding protein (DBP). It is then activated by 2 sequential hydroxylations to form 1,25-dihydroxyvitamin D (1,25[OH]<sub>2</sub> D) in the liver and kidney respectively [6]. After entering the cell, the 1,25(OH)<sub>2</sub> D hormone binds to the vitamin D receptor (VDR). The binding forms a heterodimer with the retinoic acid X receptor (RXR). This heterodimer travels to the nucleus to bind to DNA to increase transcription of the vitamin D-related genes [7].

Inadequate circulating active vitamin D causes lesser absorption of calcium, and subsequently causes the parathyroid hormone (PTH) to rise; this condition is called secondary hyperparathyroidism. The rise in PTH may result in increased mobilization of calcium from the bone, which leads to decreased mineralization of the bone [8].

Causes that result in deficiency of vitamin D in adults are categorized as: Inadequate exposure to sunlight - This causes a deficiency in cutaneously synthesized vitamin D [9], Vitamin D malabsorption problems such as celiac sprue, short bowel syndrome, cystic fibrosis [10,11], medications that induce hepatic p450 enzymes to accelerate the catabolism of vitamin D e.g Dilantin, phenobarbital, and rifampin [11], chronic liver or kidney diseases [12].

In Saudi Arabia, several studies showed that the deficiency of vitamin D is significantly higher in females compared to males, which probably is a reflection of cultural and religious practices. A study done by Ebtehal Al-Mogbel demonstrated the prevalence of hypovitaminosis among young Saudi female to be 79.1% [14]. As shown by AkramKharroubi., *et al.* the prevalence of low bone mineral density was 9%. Serum osteocalcin was found significantly higher in candidates with low bone mineral density, 20.67 ng/ml versus 10.7 ng/ml, and it was negatively correlated with T-scores [15].

Al-Agha AE., *et al.* in Awareness of Vitamin D and its Deficiency in Jeddah Population, Saudi Arabia, showed that 65.5% confirm that difficulty going outside due to work or weather issues are one of the main causes. 83.9% of population chose 7 am to 9 am as the best time for sun exposure, with 62.1% thought that hands, arms, face and legs should be exposed to the natural sunlight to be beneficial [16].

Only a small amount of vitamin D comes from dietary sources, e.g fish, or fortified milk, juice, cereals. Most of it is made in the skin by exposure to sunlight [17]. With regards to sunlight exposure duration, a whole body exposure in bathing suit to one Minimum Erythema Dose (MED) (sunlight enough to turn skin slightly pink) of ultraviolet radiation is equal to 10,000 IU of vitamin D [18]. The MED is specific to each individual and varies with the source of ultra violet radiation, the tanning capacity, skin color, and any adaptation from previous exposures [19]. For a person with moderately fair skin, exposure of face, hands and arms for 6 – 7 minutes at 10:00 or 14:00 in summer (or 9 – 12 minutes in winter) in northern Australia (latitude 17° south), should produce around 1,000 IU of vitamin D, an amount sufficient to maintain vitamin D concentrations in the normal range [20]. Although a low prevalence should be expected, studies carried out in the last two decades show a high prevalence of vitamin D deficiency in many tropical countries, like Saudi Arabia [21].

## Methodology

**Study Setting:** The study was conducted in the city of Jeddah, endocrinology department at King Abdul Aziz Hospital and Oncology Center

**Study Design:** It is a cross-sectional study among 300 Saudi patients. They underwent routine Vitamin D level analysis during their lab tests for other endocrinological complaints.

**Variables:** The dependent variables in this study were:

- patients' gender, age,
- lab results positive of vitamin D Deficiency , which is 25[OH]D less than 12 ng/mL (yes/ no)  
history of other chronic diseases (kidney/ liver/ gastro-intestinal mal-absorption/ psychiatric medication intake)
- Sun exposure between 10 am to 3 pm (daily/ 3-4 times a week/ 1-2 times a week/ rarely)
- intake of multivitamin (yes/ no)
- diet history (fortified milk, fortified juice/ egg/ sardines fish/ tuna)

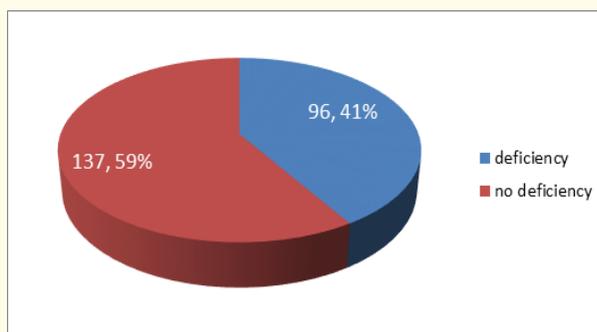
**Data Collection:** Data collection was done from April 2016 till June 2016 from those attending the Department of Endocrinology. Approval for study was obtained from all participants, and they were given brief description. Out of 300 patients interviewed, 67 patients were excluded from the study as they had chronic conditions, namely chronic kidney disease and chronic liver disease, which would affect vitamin D level. The resultant patients who were included to make the data were a total of 233 patients. The age group was between 21 to 50 years old.

**Data Analysis:** Statistical analyses were performed to detect association between different independent variables.

## Results

In the study among 300 Saudi patients, routine Vitamin D level analysis during their lab tests for other endocrinological complaints was done. Patients with chronic kidney disease, chronic liver disease, gastro-intestinal mal absorption disease, and patients on psychiatric medications were excluded. The resultant patients who were included to make the data were a total of 233 patients.

Figure 1 shows from the 233 people interviewed, 137 (59%) were tested positive for Vitamin D deficiency, or 25[OH]D less than 12 ng/mL. 96 (41%) of them had their values above the cut-off value.



**Figure 1:** Lab results positive of vitamin D deficiency, which is 25[OH]D less than 12 ng/mL.

Table 1 Shows the analysis based on gender. Out of 101 male participants, 28 (38.35%) were tested positive, while 73.28% were tested negative. From the 132 female participants, 68 (51.58%) were tested positive, while 64 (48.48%) were negative. The ratio of female to male would be 1.7.

Males (101)		Females (132)	
deficiency	No deficiency	deficiency	No deficiency
28 (38.35%)	73 (72.28%)	68 (51.58%)	64 (48.48%)

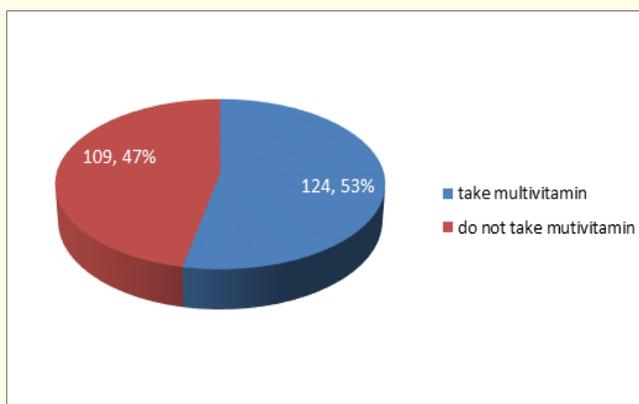
**Table 1:** Distribution based on sex.

Table 2 correlates the frequency of weekly exposure of hands and face to adequate sun for a minimum of 15 minutes between 10:00 to 15:00. Men with daily exposure to sunlight had a prevalence of 21.4%, while with 3-4 times/ week exposure resulted in 45.5% positive results. Those with 1 - 2 times/ week exposure had 80% low vitamin D, and those with rare exposure to sun showed 100% positive test. 69.3% men in Jeddah get daily adequate exposure to sunlight. Inversely the percentage of women who received an adequate amount of sunlight was 15.1%. These women had 25% positive test for hypovitaminosis. Females with 3-4 times/ week had a 42.1% positive test, while those with 1-2 times per week showed 81.7% low vitamin D, and those with rare sun exposure had 77.3% positive tests.

Frequency	daily		3 - 4times/ week		1 - 2 times/ week		Rare or never	
	-	+	-	+	-	+	-	+
Vid D deficiency	-	+	-	+	-	+	-	+
Males	55	15 (21.4%)	12	10 (45.5%)	1	4 (80%)	0	4 (100%)
	70 (69.3%)		22(21.7%)		5 (4.9%)		4 (3.9%)	
Females	15	5 (25%)	11	8 (42.1)	13	58 (81.7%)	5	17 (77.3%)
	20(15.1%)		19 (14.4%)		71 (53.8%)		22 (16.7%)	

**Table 2:** Vitamin D deficiency based upon the frequency of sun exposure from 10 am to 3 pm, for minimum of 15 minutes.

Figure 2 shows that 124 (53%) of participants are taking multivitamins, while 109 (47%) are not taking them.



**Figure 2:** How many take multi-vitamin.

Figure 3 shows the dietary intake of vitamin D rich food at least three times in a week. The most commonly used brand of milk contains vitamin D3 400 IU/Liter, as mentioned in the ingredient tag. The total number of participants taking milk was 121 (51.9%). Number of people taking regular fortified juice was 103 (48.1%). Those who took egg were 99 (42.5%). Participants consuming sardines fish were 25 (10.7%) and those taking tuna regularly were 74 (31.8%).

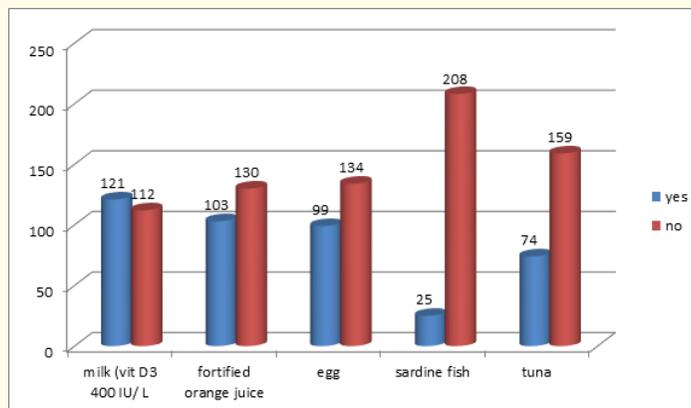


Figure 3: Number of patients taking Vitamin D rich diet at least 3 serving per week.

## Discussion

In this study, we realized the prevalence of vitamin D deficiency is high in Jeddah, Saudi Arabia (41%) compared to many other countries of the world. Also, not surprisingly, it is very much higher among the female population (51.58%). The life style of Saudi Arabia may be the cause behind these findings, as many people prefer to stay at home due to hot weather during the day times, and women, additionally for cultural reasons don't go out very much, especially during the day. Another factor may be associated with the religious purposes where many women prefer to cover their arms and faces.

Additional factors that make the effect of ultra violet less is use to sunscreen [22]. Darker color of skin tone also makes on prone to less effective sun bathing. Vitamin D production by the skin also declines as a person ages [23].

The study has methodological limitations, and must be kept in mind while interpreting results. The results found in this study showed lower prevalence than many other studies conducted in the past years. However, it should be noted that many patients were already started on multivitamin in the process of treatment of other illnesses.

Vitamin D deficiency in adult population results in osteomalacia, which presents with poorly mineralized skeletal matrix. These adults can experience chronic muscle aches and pains. On physical examination, periosteal bone pain, would be best detected with firm pressure on the sternum or tibia [4].

Lower vitamin D levels have been reported to increase risk for fractures, falls, and functional limitations, some types of cancer, diabetes, cardiovascular disease, depression, and death. However, current evidence is inadequate to determine whether screening for and treatment of asymptomatic low 25-(OH)D levels improve clinical outcomes in community-dwelling adults [24].

## **Conclusion**

The overall prevalence of Vitamin D deficiency in the population interviewed was 41%, which is lower than other studies done in the Kingdom, yet higher than many other countries. There is definitely a higher prevalence among the females (51.58%) against males (28.35%). The people must be educated about ways to prevent deficiency, by maximizing sun exposure, diet intake, and multivitamin intake if the first two options are not convenient. There are no current recommendations for routine screening.

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