



## AWARENESS AND PRACTICES RELATED TO VITAMIN D IN THE GENERAL COMMUNITY, NAJRAN, SAUDI ARABIA

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### Abstract

**Introduction:** While the biological factors contributing to vitamin D deficiency are well understood, the sociocultural and behavioral aspects remain less clear. This research seeks to assess the awareness of vitamin D deficiency among the Saudi population.

**Methods:** Employing a cross-sectional observational study design, we conducted research among individuals attending primary health care (PHC) in Najran city. Participants were randomly selected from the PHC waiting list using a two-stage stratified systematic sampling technique. A self-administered questionnaire was utilized to gather data across four domains: sociodemographic factors, awareness, attitudes, and practices related to vitamin D. Respondents achieving less than 60% correct answers were considered to have a low level of awareness, while those scoring  $\geq 60\%$  were deemed to have high awareness.

**Results:** Among 384 respondents at Primary Health Care (PHC) centers, 59.5% were male. All participants affirmed their familiarity with vitamin D, citing health staff and friends or relatives as the primary sources of information. In terms of the origin of vitamin D, 6% and 48% attributed it to diet or sun exposure, respectively, while 45.7% recognized both as accurate. Gender, education level, nationality, and income did not exhibit significant associations with awareness of vitamin D deficiency ( $p>0.05$ ). However, there was a noteworthy correlation between the source of information and awareness ( $p=0.009$ ).

**Conclusions:** The study revealed a low level of awareness about vitamin D among attendees at PHC, coupled with a heightened concern about the current state of vitamin D. Participants reported limited exposure to sunlight and a low usage of sun protection.

**Keywords:** Vitamin D, Awareness, Practices, Osteoporosis, Saudi

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## Introduction

Vitamin D, a crucial fat-soluble vitamin, is primarily synthesized in the skin through exposure to ultraviolet light (UV) or obtained orally from natural or fortified food sources [1]. Playing a vital role in calcium balance and bone health, vitamin D deficiency is linked to bone diseases such as rickets in children and osteomalacia in adults [2]. Numerous studies have also connected vitamin D deficiency to conditions like cardiovascular diseases [3], diabetes mellitus [4], certain cancers [5], depression [6], brain dysfunction [7], immune system function, and hyperparathyroidism [8]. Vitamin D, a crucial component for maintaining calcium balance and promoting bone health, plays a vital role in various physiological functions. However, the global prevalence of vitamin D deficiency has raised concerns, with potential associations identified not only with bone-related diseases but also with cardiovascular conditions, diabetes, certain cancers, mental health issues, immune system functioning, and more.

In Saudi Arabia, where vitamin D deficiency has been recognized as a significant public health concern for decades, varying prevalence rates across demographic groups underscore the complexity of the issue. Despite the biological causes being well-established, the sociocultural and behavioral determinants of vitamin D deficiency in the Saudi population remain less explored. The global prevalence of vitamin D deficiency spans various age groups, with reports of low vitamin D levels particularly prevalent in Middle East countries, especially among females, despite assumed sufficient UV radiation for preventing deficiency [9]. Studies in Gulf states have shown undiagnosed low vitamin D levels ( $\leq 25$  nmol/L) in 10-60% of mothers and 40-80% of their infants [10, 11]. Against this backdrop, this cross-sectional observational study aims to delve into the awareness levels regarding vitamin D deficiency among individuals attending primary health care (PHC) centers in Najran city, Saudi Arabia. The research spans the period from December 2018 to May 2019, focusing on adults aged 18 years and older with sound mental health. By employing a two-stage stratified systematic sampling technique, the study seeks to assess the knowledge and practices related to vitamin D among participants, using a comprehensive questionnaire covering sociodemographic factors, attitudes, and practices associated with vitamin D. This investigation is not only pertinent for addressing the local context of vitamin D awareness but also contributes valuable insights that can inform public health interventions and policies targeting vitamin D deficiency in similar

regions. Pregnant women face a heightened risk of vitamin D deficiency, associated with an increased likelihood of gestational diabetes, postpartum depression, low birth weight, and a higher rate of cesarean section [12]. In Saudi Arabia, vitamin D deficiency has been a significant public health concern since 1983 [13]. The prevalence of low vitamin D status in the Saudi population varies across demographic groups, with the highest reported prevalence at 100% among young adult women, 28% in adult men, and 80% among children [14, 15, 16]. A national survey in 2013 indicated a prevalence of 40% in males and 60% in females in the general population [17]. This study seeks to assess awareness among the Saudi population regarding vitamin D deficiency.

## Methods

This is a cross-sectional observational study design conducted in people attending primary health care. This study employed a cross-sectional observational design, conducted at primary health care (PHC) facilities in Najran city from December 2018 to May 2019. The study focused on adults (age  $\geq 18$  years) with a sound mental status. The required sample size for estimating the level of awareness was determined based on an expected "good level" of awareness at 30%, as reported in prior studies [18, 19]. With a confidence level of 95% and an estimation error of 0.05, the minimum sample size was calculated to be 323 participants. A two-stage stratified systematic sampling technique was utilized. Initially, 13 PHC centers were randomly selected from the list of PHCs in Najran city, with odd-ordered centers chosen as sampling sites for participant selection. In the second stage, participants were randomly chosen from the waiting list of patients at the PHC centers using their systematic random sampling. Data collection relied on a self-administered questionnaire that addressed study variables. Despite the absence of a validated questionnaire in the literature, locally piloted questionnaires were used to assess awareness levels on vitamin D-related matters. The questionnaire constructed by Aljefree et al. was employed due to its comprehensiveness, covering four domains: sociodemographic factors, awareness, attitudes, and practices related to vitamin D [20]. Questions with less than 60% correct answers were indicative of a low level of awareness, while those with  $\geq 60\%$  correct answers were considered reflective of high awareness. Data entry and analysis were carried out using the Statistical Package for Social Science (SPSS), version 23. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated. The

association between predictor variables and categories of awareness about vitamin D deficiency was assessed using the chi-squared test. A P-value < 0.05 was considered indicative of a statistically significant association or difference.

## Results

A total of 384 participants in Primary Health Care (PHC) centers responded to the survey, with 59.5% being male. The majority of respondents were Saudi nationals (95.9%), and half reported a middle-income range (5000-15000 Saudi Riyal). Approximately 68% had a high level of education, having completed university or postgraduate studies, and 83% were married. Only 40.2% engaged in regular physical exercise at least once a week (Table 1). In terms of awareness of vitamin D deficiency, all respondents claimed to have heard about vitamin D, with health staff and friends or relatives being the most common sources of information. Regarding the origin of vitamin D, 6% and 48% attributed it to diet or sun exposure, respectively, while 45.7% identified both as correct. Respondents expressed a notable concern about their vitamin D levels, with a mean attitude score of  $3.2 \pm 1.3$  on a scale of 1 to 5, indicating moderate to high concern. Additionally, 20% reported rarely or never liking sun exposure (Table 2). The prevalence of practices related to vitamin D deficiency is outlined in Table 3. A substantial percentage spent less than one hour outdoors on weekdays (82%), and only 41.1% spent  $\geq 1$  hour outdoors on weekends. Eating habits revealed that a significant proportion did not consume fatty fish (61.9%), liver (45.4%), dairy products (44%), or eggs (2.9%). Conversely, a minority reported daily consumption of eggs (6.9%), dairy products (4.3%), liver (2.3%), and fatty fish (1.5%). A quarter of respondents used a parasol for sun protection, while 65.3% never wore sunscreen outdoors. Approximately 18% reported regular use of vitamin D supplements. Table 4 indicates that gender, educational level, nationality, and income were not significantly associated with awareness of vitamin D deficiency ( $p > 0.05$ ). However, the source of information demonstrated a significant relationship with awareness ( $p = 0.009$ ), with higher awareness observed among those obtaining information from reading materials or health staff. Awareness of vitamin D deficiency significantly influenced respondents' attitudes and practices, as shown in Table 5. It was associated significantly with a high level of concern about current vitamin D levels ( $p < 0.001$ ). Additionally, high awareness correlated significantly with increased consumption of dairy products and fish, while no significant association was observed with egg

consumption. The association between awareness of vitamin D and the frequency of sun exposure was not statistically significant ( $p = 0.996$ ).

## Discussion

In many regions of Saudi Arabia, despite the ample sunlight, numerous studies consistently report low vitamin D status, attributable to cultural and lifestyle factors such as the widespread use of Hijab among females, limited outdoor activities during daylight hours, and dietary habits low in vegetables [21]. The present study acknowledges that while all respondents claimed awareness of vitamin D, a more robust measure of awareness lies in understanding where individuals believe the body obtains vitamin D. Only 45.7% correctly identified both diet and sun exposure as sources, reflecting a low level of awareness among Primary Health Care (PHC) attendees. This echoes findings from a study among adult Chinese women, highlighting high awareness of vitamin D but a deficient understanding of its sources and role [22]. Conversely, a large-scale study in France revealed a higher proportion (61-72%) correctly identifying vitamin D sources [23]. Despite varying UV indices, low awareness is reported globally, even in countries like Canada, where only 29% of students correctly answered vitamin D-related awareness questions [24]. The study emphasizes the importance of health practitioners in disseminating information, given that 55.7% of participants sourced their information from health staff. Notably, a prior study in Najran city found inadequate vitamin D awareness among general practitioners, with only 30% exhibiting high awareness [18]. Recognizing the significance of general practitioners in health education campaigns becomes crucial for effective interventions. Qualitative research on Saudi women identified reasons for low sun exposure, including avoidance due to hot weather, traditional clothing covering the entire body, and limited sunlight accessibility indoors [26], aligning with a high reported vitamin D deficiency (60%) among Saudi women [17]. A study assessing awareness among Saudi women found low correct response rates regarding vitamin D importance, sources, and complications [19]. Patients with coronary heart diseases in Saudi Arabia also displayed lower vitamin D awareness, linked to deficiency [20]. In the current study, 71.9% of respondents expressed moderate to high concern about their vitamin D levels, with those more concerned demonstrating higher awareness about vitamin sources. This contrasts with an Australian study where only 9% of office workers were concerned about their vitamin D levels [27]. The present study highlights the importance of

addressing awareness gaps through educational campaigns, especially given the low rate of vitamin D supplementation (18%) compared to reported deficiency levels. Improved supplementation rates and targeted education on vitamin D sources are vital for successful public health interventions.

### Conclusions

In summary, our study in Najran, Saudi Arabia, reveals a concerning lack of awareness about vitamin D among attendees at Primary Health Care (PHC) centers, despite the region's abundant sunlight. Contributing factors include cultural practices such as Hijab use and limited outdoor activities, highlighting the need for targeted educational campaigns. Interestingly, there is a high level of concern among respondents about their vitamin D status, suggesting a gap between knowledge and perceived risk. The reported low exposure to sunlight and minimal use of sun protection further compound the challenges of vitamin D deficiency. Importantly, our findings indicate that awareness significantly influences attitudes and practices, emphasizing the potential impact of well-designed awareness initiatives on health-related behaviors. The study underscores the importance of culturally sensitive public health interventions to improve vitamin D awareness, promote healthier practices, and address this prevalent deficiency in the population.

### Conflict of interests

The authors declared no conflict of interests.

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**Table (1): Demographic characteristics of the respondents**

<i>Variables</i>	<i>Frequency</i>	<i>Percent (%)</i>
<b>Gender (n=338)</b>		
<i>Male</i>	201	59.5
<i>Female</i>	137	40.5
<b>Marital status (n = 348)</b>		
<i>Married</i>	289	83.0
<i>Single</i>	57	16.4
<i>Divorced</i>	2	0.6
<b>Education (n = 348)</b>		
<i>Illiterate</i>	2	0.6
<i>Primary School</i>	8	2.3
<i>Secondary School</i>	100	28.7
<i>University level</i>	201	57.8
<i>Postgraduate level</i>	37	10.6
<b>Nationality (n=343)</b>		
<i>Saudi</i>	329	95.9
<i>Non-Saudi</i>	14	4.1
<b>Income (n=332)</b>		
<i>&lt; 5000</i>	63	19.0
<i>5000-15000</i>	167	50.3
<i>&gt; 15000</i>	102	30.7
<b>Physical exercise (n = 348)</b>		
<i>Rarely</i>	178	51.1
<i>1-2 Times/Week</i>	91	26.1
<i>&gt; 4 Times/Week</i>	39	11.2
<i>3-4 Times/Wek</i>	10	2.9
<i>None</i>	30	8.6

**Table (2): Distribution of the factors related to the Awareness and attitudes towards vitamin D deficiency**

<i>Factors</i>	<i>Frequency</i>	<i>Percent (%)</i>
<b>Awareness about vitamin D</b>		
<i>Have you ever heard/learnt about vitamin D? (n=341)</i>		
<i>Yes</i>	341	100%
<i>Source of information about vitamin D?</i>		
<i>Reading Materials (Books or Internet)</i>	10	2.9
<i>Friends or Relatives</i>	141	40.5
<i>Health staff</i>	194	55.7
<i>Educational Lectures</i>	3	0.9
<i>Where do you think the body gets vitamin D from?</i>		
<i>Diet</i>	22	6.3
<i>Sun exposure</i>	167	48.0
<i>Diet and sun exposure</i>	159	45.7
<b>Attitudes towards vitamin D deficiency</b>		
<i>How much do you agree or disagree with the following statement: "I'm concerned that my current vitamin D level might be too low"?</i>		
<i>Low Concern</i>	98	28.2
<i>Moderate</i>	121	34.8
<i>High Concern</i>	129	37.1
<i>How do you feel about sun exposure?</i>		
<i>Always like sun exposure</i>	47	13.5
<i>Sometimes like sun exposure</i>	231	66.4
<i>Rarely like sun exposure</i>	37	10.6
<i>Never like sun exposure</i>	33	9.5

**Table (3): Respondents' practices which could affect vitamin D deficiency**

Practices	Frequency	Percent (%)
<b>How much time do you often spend outdoors per day on weekdays?</b>		
< 1 hour per day	286	82.2
≥ 1 hour per day	62	17.8
<b>How much time do you often spend outdoors per days on weekends?</b>		
< 1 hour	205	58.9
≥ 1 hour per day	143	41.1
<b>How often do you eat dairy product?</b>		
Never	153	44.0
1-2 times/week	125	35.9
3-6 times/week	55	15.8
≥ once per day	15	4.3
<b>How often do you eat eggs?</b>		
Never	10	2.9
1-2 times/week	193	55.5
3-6 times/week	121	34.8
≥ once per day	24	6.9
<b>How often do you eat fish? (n=341)</b>		
1-2 times/week	211	61.9
Never	125	36.7
3-6 times/week	5	1.5
<b>How often do you eat liver?</b>		
Never	158	45.4
1-2 times/week	182	52.3
>= one per day	8	2.3
<b>Do you often use a parasol to shade from the sun?</b>		
Yes	89	25.6
No	259	74.4

**Table (4): Association between respondents' characteristics and Awareness about the vitamin D deficiency**

Respondents' characteristics	Awareness about the vitamin D deficiency		Chi-square	P value
	High Awareness	Low Awareness		
<b>Educational level</b>				
High school or lower level	45	65	1.48	0.224
	40.9%	59.1%		
University or higher level	114	124		
	47.9%	52.1%		
<b>Gender</b>				
Male	90	111	0.05	0.911
	44.8%	55.2%		
Female	63	74		
	46.0%	54.0%		
<b>Source of information</b>				
Reading Materials (Books or Internet)	6	4	10.66	0.009
	60.0%	40.0%		
Friends or Relatives	50	91		
	35.5%	64.5%		
Health Staff	102	92		
	52.6%	47.4%		
Educational Lectures	1	2		
	33.3%	66.7%		
<b>Nationality</b>				
Saudi	153	176	0.07	0.789

	46.5%	53.5%		
Non-Saudi	6	8		
	42.9%	57.1%		
<b>Income</b>				
< 5000	25	38	2.55	0.280
	39.7%	60.3%		
5000-15000	75	92		
	44.9%	55.1%		
> 15000	53	49		
	52.0%	48.0%		

**Table (5): The effect of respondents' Awareness on certain attitudes and practices related to vitamin D deficiency**

Respondents' Awareness	Concern about low vitamin D level		Chi-square	P value
	Low concern	High concern		
High Awareness	62	97	16.98	< 0.001
	39.0%	61.0%		
Low Awareness	36	153		
	19.0%	81.0%		
<b>Eating of dairy products</b>				
	Yes	No		
High Awareness	120	39	44.90	< 0.001
	75.5%	24.5%		
Low Awareness	75	114		
	39.7%	60.3%		
<b>Eating of eggs</b>				
	Yes	No		
High Awareness	151	8	4.88	0.051
	95.0%	5.0%		
Low Awareness	187	2		
	98.9%	1.1%		
<b>Eating of fatty fish</b>				
	Yes	No		
High Awareness	134	25	56.22	<0.001
	84.3%	15.7%		
Low Awareness	82	100		
	45.1%	54.9%		
<b>How often like sun exposure?</b>				
	Always or sometimes like exposure to sun	Rarely or never like exposure to the sun		
High Awareness	127	32	0.001	0.996
	79.9%	20.1%		
Low Awareness	151	38		
	79.9%	20.1%		