



Knowledge and practice of vitamin D toxicity among people of Saudi Arabia-A cross-sectional study

Shouq Adel Alanazi¹, Amal Mohammed Almalki¹, Bashayer Atiah Alatwi¹, Uzma Faridi^{1*}

¹Shouq Adel Alanazi, Postgraduate student, Department of Biochemistry, College of Science, University of Tabuk, Saudi Arabia

¹Amal Mohammed Almalki, Postgraduate student, Department of Biochemistry, College of Science, University of Tabuk, Saudi Arabia

¹Bashayer Atiah Alatwi, Postgraduate student, Department of Biochemistry, College of Science, University of Tabuk, Saudi Arabia

¹Uzma Faridi, Associate Professor, Department of Biochemistry, College of Science, University of Tabuk, Saudi Arabia

Key words: Vitamin D, Toxicity, Saudi Arabia, Deficiency, Questionnaire, Cross section survey.

<http://dx.doi.org/10.12692/ijb/20.6.176-184>

Article published on June 25, 2022

Abstract

Vitamin D deficiency is very common among the people of Saudi Arabia. Majority of the population here is aware of it and most of the people try to have medication without checking their vitamin D level or even consulting the doctors, due to Vitamin D related toxicity is very common among the general public. The aim to conduct this cross section survey was to study the awareness of Vitamin D deficiency and toxicity among the population of Saudi Arabia. The cross-sectional study was conducted by developing questionnaire related to the deficiency and the toxicity of vitamin D, The questionnaire was generated in Tabuk city, Saudi Arabia in March, 2022. 400 people participated in the survey out of which were mostly female participants. The education level of the participants was highest among the age of 31-45 and educational qualification was at university level. Results indicated that the general population is well aware of vitamin D deficiency but they had very little knowledge about vitamin D intoxication.

*Corresponding Author: Uzma Faridi ✉ ufaridi@ut.edu.sa

Introduction

Vitamin D is one of the fat soluble vitamins. It is required to absorb many ions in the body such as calcium, magnesium, phosphate, and zinc by intestine. Vitamin D is not only involved in the absorption of different ions but also crucial for many other important functions including antioxidation and calcium homeostasis as well as bone mineralization. A lot of attention has been paid to vitamin D in the last few years, especially given that a large proportion of people are suffering from this (Bokhari FF, 2019) and it has become one of the tests most frequently ordered in the clinics over the past decade. The widespread deficiency of vitamin D, as a result of increased awareness scientific studies show the benefit of vitamin D in improving the outcomes, many diseases, such as cancer and diabetes (Grant WB, 2005; Hanlon P, 2017), People started consuming it without consulting the clinicians which led to several vitamin D (Shea RL, 2017). The recommended dose of vitamin D is 600 IU each day for individual of age from age 1 to 70 years, and for the adults over the age of 71 consumption limit is 800 IU per day. These recommendations result in serum levels of 25-hydroxyvitamin D of 20 ng/ml, alternatively, the Food and Nutrition Board has set a maximum intake of vitamin D at 2000 IU/day (50 g/day) (Hathcock JN, 2007). For high doses of more than 50,000 IU/day, the serum concentrations are raised above 150 ng/mL that can result in hypercalcemia (Coburn JW, 1984). In both industrialized and developing countries, vitamin D supplements are now widely available, with many of these supplements being available in unregulated formulations that are sold to the general public without much direction regarding how to use them safely (Galior K, 2018). It would appear that this has led to a dramatic increase in the number of cases of vitamin D toxicity being reported all over the world as a consequence (Lim K, 2020). In fact, despite all the benefits provided by vitamin D therapy, such therapies are not without their own risks due to vitamin D toxicity, as it has been shown to cause serious health effects (Marcinowska-Suchowierska E, 2018). Overdosing on vitamin D is relatively

uncommon, due to its wide therapeutic index, but it does happen with extremely high doses (Amrein K, 2020; Kaur P, 2015). Due to the lack of awareness of the required dose of vitamin d and related toxicity is very common among the public. We conducted a cross section survey to study the awareness of Vitamin D deficiency and toxicity among the population of Saudi Arabia.

The aim of the present study was to find out the Knowledge and practice of vitamin D toxicity among people live in, Saudi Arabia.

Material and methods

A cross-sectional web-based survey was made utilizing a produced questionnaire from the Google survey tool (Google Forms), and the resulting link was inserted in an invitation given to all citizens living in Tabuk, Saudi Arabia, between February and March 2022. The Google form was configured to enable just one submission per participant in order to assess their understanding and practice of vitamin D toxicity. The survey has been uploaded to the Google questionnaire.

The survey questions were changed to be suitable to the Saudi Arabian population following an intensive and detailed assessment of the previously available research. There were total of 25 questions in the questionnaire, which was designed in both English and Arabic to appeal to a wider audience, including members of the local community. The questionnaire also included the following items:

Socio-Demographic Factors: Age, gender, education level, and nationality were among the socio-demographic data gathered (Table1). Knowledge of Vitamin D, its relevance, and treatment sources, as well as knowledge of Vitamin D overdose and its negative effects; To test knowledge, we created a questionnaire with 10 questions regarding Vitamin D, its importance, and treatment information sources, and 11 questions about Vitamin D overdose and its adverse effects. O'connor *et al.*, (2018) were used to construct the knowledge score. One point was

awarded for each person who said yes, two points for those who said no, and three points for those who said they didn't know. The scores were then converted to percentages by dividing them by the greatest possible score (Bernerd *et al.*, 2014) and multiplying the result by 100.

Data analysis

The statistics was analyzed using Statistical Package for the Social Sciences (SPSS) version 24 software (SPSS Inc., Chicago, IL, SA).

Results

The general characteristics of participants with age ranging from 15 to 60 are shown in table 1. Total 400 participants took part in survey. The majority of participants were females (64.5%), 143 were males, and about 389 (97.25%) of participants was Saudi only 12 were non Saudi. More than half (55.25%) of participants aged 31 to 45. About 326 (81.5%) of participants had university degree, rest had high school or primary school degree (Table 1) (Figure 1, 2 3&4).

Table 1. Distribution of general characteristics of participants.

Item	N (%)
Gender	
Male	143 (35.75)
Female	258 (64.5)
Age (in years)	
15-30	127(31.75)
31-45	221(55.25)
46-60	52 (13)
Nationality	
Saudi	389 (97.25)
Non Saudi Arabs	12(2.25)
Education level	
University	326(81.5)
High school	62(15.5)
Primary school/Intermediate school	12 (2.25)

Knowledge about Vitamin D, its importance and sources information about treatment

Almost every participant was aware of vitamin D deficiency (95%). Most of the participants (81.75%)

were well aware of vitamin D deficiency but only approximately 48.75% were tested for deficiency as shown in Table 2.

Table 2. Knowledge about Vitamin D, its importance and sources information about treatment.

SNo.	Question	Answer		
		Yes	No	Not sure
1.	Have you ever read or heard about Vitamin D deficiency?	380(95)	15(3.75)	5(1.25)
2.	Do you know how dangerous vitamin D deficiency is?	327 (81.75)	57(14.24)	16(4)
3.	Do you understand the importance and functions of Vitamin D?	311(77.75)	66(16.5)	23(5.75)
4.	Do you know the normal range of vitamin D?	255(63.74)	114(28.49)	31(7.75)
5.	Do you think there is a relationship between vitamin D and calcium?	264(66)	66(16.5)	70(17.5)
6.	Have you checked your vitamin D levels?	282(70.5)	116(28.99)	2(0.5)
7.	Did you know that increasing vitamin D levels increases calcium levels in the blood?	150(37.5)	144(36)	98(24.5)
8.	Do you have a vitamin D deficiency?	230(57.49)	76(19)	94(23.5)
9.	If you have a vitamin D deficiency, have you treated this deficiency?	195(48.75)	4(1)	1(0.25)
10.	Have you used a dose of vitamin D treatment without consulting a doctor?	82(20.5)	316(79)	2(0.5)

Knowledge about Vitamin D overdose and its side effects

Although majority of the participants were aware of vitamin D deficiency, no more than 24.5% knew about vitamin D toxicity. Interestingly, only 6.5% of

participants reported that they or their family members or relative encountered vitamin D toxicity. Only few of them knew about the symptoms related with vitamin D intoxication. Results are presented in Table 3.

Table 3. Knowledge about Vitamin D overdose and its side effects.

SNo.	Question	Answer (N& %)		
		Yes	No	Not sure
1	Have you heard/read about vitamin D toxicity?	98(24.5)	267(66.75)	35(8.75)
2	Have you encountered people who were suffering from vitamin D toxicity?	26(6.5)	276(69)	98(24.5)
Side-effects during treatment				
1	Were they suffering from some symptoms?	43(10.75)	118(29.5)	239(59.75)
2	Did they suffer from high blood pressure?	8(18.60)	34(79)	1(2.34)
3	Did they have vomiting or nausea?	6(13.95)	35(81.39)	2(4.65)
4	Did they suffer from frequent urination?	15(34.88)	26(60.46)	2(4.65)
5	Did they suffer from constant thirst?	14(32.55)	1(2.34)	28(65.11)
6	Do you suffer from depression?	13(30.23)	26(60.46)	3(6.97)
7	Did they Suffer from dehydration?	19(44.18)	21(48.83)	3(6.97)
8	Did they have difficulty concentrating?	23(53.48)	19(44.18)	1(2.34)
9	Did they suffer from pain?	17(39.53)	23(53.48)	3(6.97)

Discussion

Vitamin D is essential for calcium homeostasis and bone mineralization. Vitamin D has several non-skeletal impacts, most notably in cancer, cardiovascular illness, and autoimmune disorders (Galior and Singh, 2018). Vitamin D deficiency [25-hydroxyvitamin D – 25(OH)D level 20 ng/ml] and insufficiency [25(OH)D level 21-29 mg/ml] is a widespread concern (Bouillon, 2015). Because of greater public awareness of vitamin D insufficiency in recent years, the population's usage of vitamin D supplements has grown, as has the use of high dosages of vitamin D prescribed by physicians to treat vitamin D deficiency.

This rising usage of vitamin D supplements by the general population, as well as the growing number of therapeutic dose prescriptions without any monitoring, may raise the risk of hypervitaminosis D, commonly known as vitamin D toxicity (VDT)

(Dudenkov and Yawn, 2015). Vitamin D toxicity, on the other hand, is exceedingly rare; but, it does occur at overly high dosages (Galior and Singh, 2018).

This research evaluated participants' knowledge of vitamin D insufficiency and toxicity. The findings revealed that virtually all of the participants were aware of vitamin D insufficiency, but relatively few were aware of the toxicity.

In the current study, we discovered that females knew more about vitamin D than males, in contrast to another study conducted in a Saudi school where males were found to be more familiar with vitamin D (Al-Saleh *et al.*, 2015); they discovered no difference between female and males in their knowledge about the importance of vitamin D. Another study in China Hong Kong found a discrepancy between people's awareness and habits for obtaining vitamin D (Kung, 2006; Alwadei *et al.*, 2018).

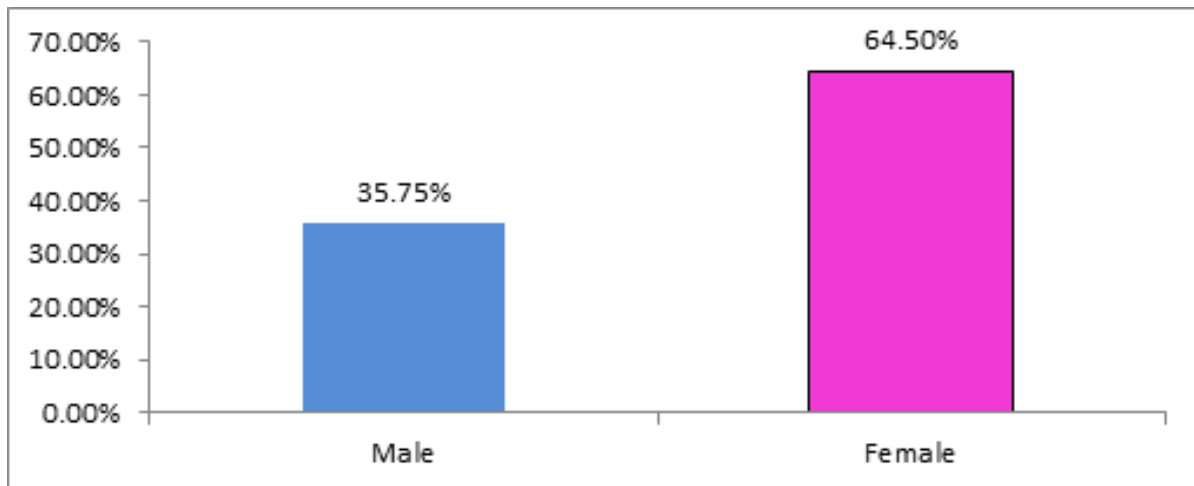


Fig. 1. Percentage of participants on the basis of their gender.

According to earlier research, educational facilities (universities) were the most generally reported and preferred source of knowledge about vitamin D among participants, demonstrating the value of education in becoming aware of any disease or medical condition that may impact anybody (Mohamed *et al.*, 2021). The current study, on the other hand, demonstrated that the elderly is aware of the importance of vitamin D. According to the authors of an Australian research, being female, older, and having a higher educational degree were

indications of having a better level of knowledge (Sim *et al.*, 2009; Alamoudi *et al.*, 2019). In Agha's study a lack of knowledge was not related with a lack of education (Eid Al Agha and Alorabi, 2016).

According to our findings, the vast majority of participants (95 %) were aware of vitamin D insufficiency and its harmful consequences (81 %). Vitamin D insufficiency has been linked to a variety of ailments, including bone abnormalities, chronic diseases, and cancer (Alwadei *et al.*, 2018).

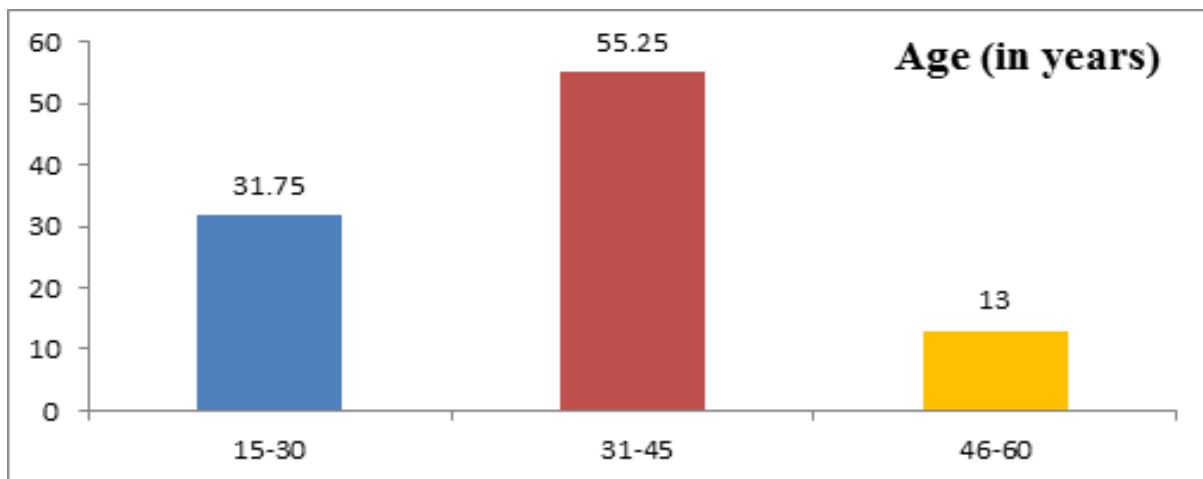


Fig. 2. Percentage of participants on the basis of their age.

The present study found that participants had a decent degree of understanding of vitamin D's advantages, with more than two-thirds (77.8 %) knowing that vitamin D helps with bone health, dental health, immunological health, and muscular health (Alamoudi *et al.*, 2019). These findings were

greater than those of Australian research (43.0 percent) (Sim *et al.*, 2009). Moreover, according to the findings of a French research (78.1 %) (Gupta *et al.*, 2014). Despite the fact that the majority of the participants were aware of this information, only 70% of them examined their vitamin D level. In previous

research, around 31% of individuals began their medication without first determining their vitamin D level. Our study contradicted the findings of Maini *et al.*, (2018) who discovered that approximately 90% of people were unaware of the level of vitamin D in their blood, which was required to perform many biological functions in our bodies. This gave the impression that citizens in Saudi Arabia were aware of vitamin D by the time of our study.

Vitamin D insufficiency has been associated to bone health owing to its function in calcium and phosphate metabolism control (Maini *et al.*, 2018) The current study reflects on Saudi Arabian citizens' knowledge

and attitudes concerning the relationship between vitamin D and calcium, which show a reasonable level of awareness (66%), which is consistent with previous results (Ayub *et al.*, 2016). In terms of vitamin D testing, about (70%) of participants had their vitamin D levels in their blood examined. This finding was consistent with Babelghaith *et al.*, (2017), who conducted a study in Riyadh, Saudi Arabia and discovered that the majority of participants (89.3%) were willing to do a vitamin D test. This study was also consistent with Selim *et al.*, (2020), who found that approximately 68 percent agreed to perform the test, reflecting Saudi Arabian awareness of vitamin D complications.

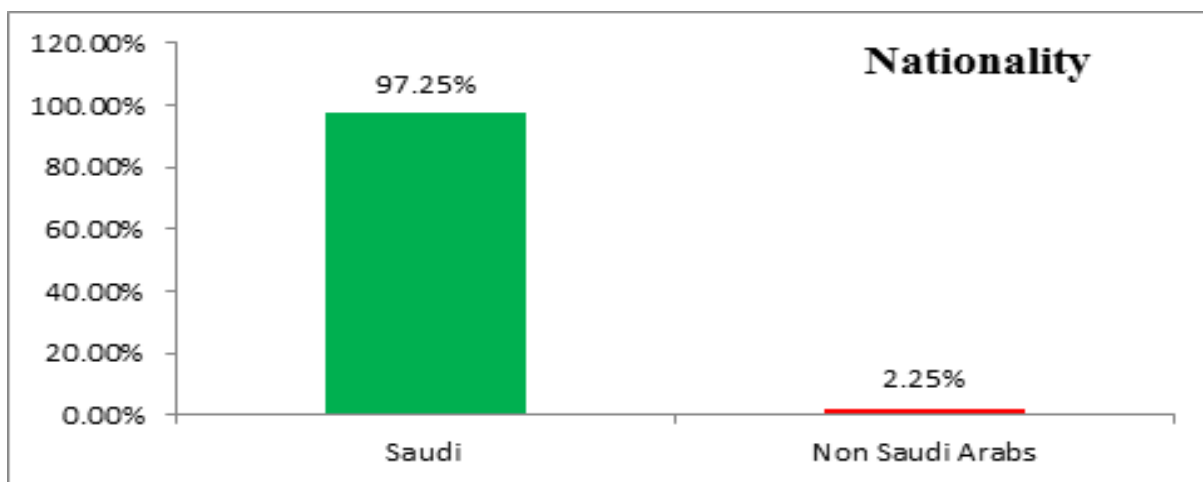


Fig. 3. Percentage of participants on the basis of their nationality.

Despite the fact that the Gulf nations have abundant of sun, vitamin D insufficiency remains a public health problem (Al Saleh and Beshyah, 2020). According to a meta-analysis of data from 2008 to 2016, a substantial portion of Saudi Arabian populations had low levels of vitamin D, with 63.5% of the investigated persons suffering from Vitamin D insufficiency (Al-Alyani *et al.*, 2018). Furthermore, reported studies show that a portion of Saudi young adults have vitamin D deficiency and are prone to developing osteoporosis due to poor diet and low sun exposure, necessitating preventive interventions such as public health measures, which is consistent with our study, which found that approximately 50% of participants had vitamin D deficiency. More over half of the participants receive therapy for vitamin D insufficiency, indicating that individuals are more

aware of the risks of this shortage than in earlier research (Agens *et al.*, 2012; Geddawy *et al.*, 2020).

Vitamin D-mediated hypercalcemia is caused by a variety of processes, including an excess of vitamin D and its metabolites (Tebben and Singh, 2016b) As a result, we should not take any medication without first consulting with a doctor. Our study found that about one-third of participants take vitamin D supplements to treat vitamin D deficiency, and several studies show that 56% of females take vitamin D supplements without a doctor's prescription (Selim *et al.*, 2020). On the other hand, around 37% are aware that when vitamin D levels rise, calcium levels rise as well, resulting in hypercalcemia and a variety of problems, particularly in the kidney (Tebben and Singh, 2016b).

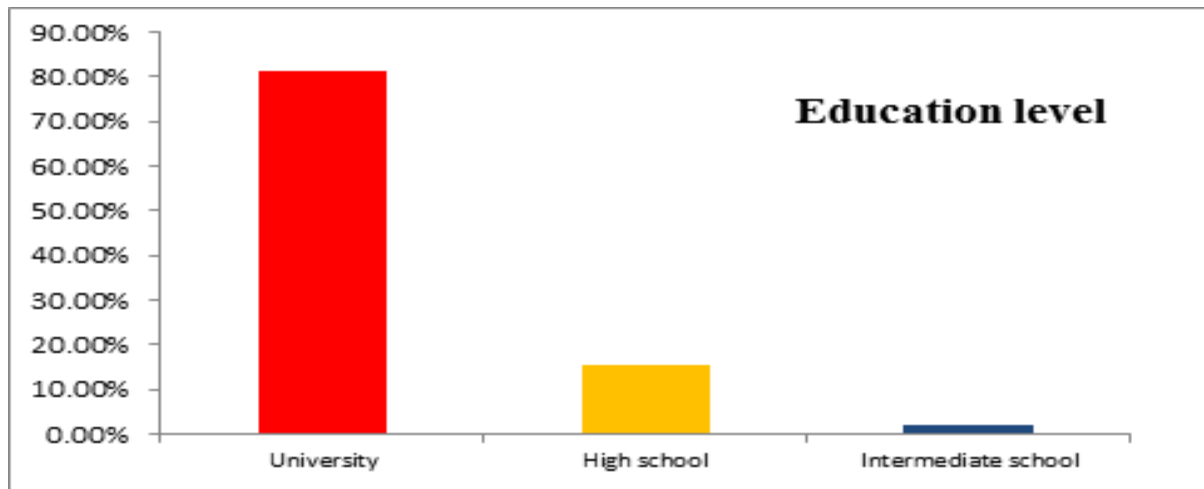


Fig. 4. Percentage of participants on the basis of their educational level.

The next set of questionnaires focused on vitamin D toxicity, its awareness, and any adverse effects experienced by subjects during therapy. Although more than 95% of participants were aware of vitamin D insufficiency, less than 25% were aware of the toxicity. Vitamin D poisoning can cause a variety of health problems, including nausea, vomiting, stomach discomfort, frequent urination and thirst, and dehydration (Marcinowska-Suchowierska *et al.*, 2018).

We asked our subjects these questions to verify the vitamin D-related toxicity while they were receiving vitamin D deficient therapy. Only 10% of them were fully aware that they had vitamin D toxicity, and the majority were unsure, which is consistent with Alamoudi *et al.*, (2019), who discovered that 74% were unaware of vitamin D toxicity.

People are taking megadoses of vitamin D orally or intramuscularly as a supplement without adequate medical supervision and indication.

This results in vitamin D poisoning, which causes hypercalcemia, acute renal damage, and sensory changes (Bhat *et al.*, 2022). Clinically, vitamin D overdose manifests as hypercalcemia, nausea, vomiting, polyuria, dehydration, altered sensorium, acute renal damage, and pancreatitis (Turner, 2017) This is consistent with our findings, which revealed that 38% of them had difficulties concentrating.

Dehydration affected 32% of the participants. On the other hand, our study found that approximately 90% of respondents were unaware of the symptoms of vitamin D toxicity, such as nausea and vomiting, indicating that there is an urgent need to educate and inform them about the consequences and symptoms of vitamin D toxicity through the development of education programmes in multiple languages and in a simple manner to accommodate people of all levels.

Conclusion

Results showed that the general population is well aware of vitamin D deficiency but there is a very less awareness about vitamin D intoxication and its side-effects. The results highlighted the importance to educate the public about vitamin D toxicity and the risk of the treatment of vitamin D deficiency without medical consultation and testing.

Acknowledgements

Present study was carried for the project course of students of Master of Science toxicology and Forensic. Authors are grateful to dean and the head of the department for their support.

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