

Knowledge and Practice of Vitamin D Deficiency and Risk of Depression Among Population in Makkah City, Saudi Arabia

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ABSTRACT

Background: Depression can be correlated with severe disability, mortality, and significant healthcare costs. It is the third leading cause of disability in worldwide affecting around 840 million people¹. Vitamin D, which is a distinctive hormone with target receptors found in many areas in the body and in human brain, plays an important role in the development of depression through many physiological processes. In Saudi Arabia we found that the prevalence of depression is high, however, the exact cause is unknown. Moreover, there are many risk factors that can trigger the onset of depression such as chronic infection diseases, low socio-economic statue, stressful life events, family history, traumatic experience, all these associated with risk of depression.

Objective: The aim of the study was to identify and to assess the knowledge and practice of vitamin D deficiency and risk of depression among the adult population in Makkah city.

Methods: This is a cross-sectional descriptive study that was done in Makkah holey city, in the western region of Saudi Arabia.

Results and conclusions: The majority of this study's participants were familiar with vitamin D, with the media serving as the most prevalent source of this information. Our participants also had substantial experience with vitamin deficiency. Similarly to a study conducted in Riyadh, our findings showed that medical experts were the most often cited information source. Overall, we found that the group we examined had a strong grasp of the relationship between vitamin D insufficiency and the recognition of depressive symptoms and put that understanding into practise. Additional research into the correlation between vitamin D and depression is warranted.

Keywords: Vitamin D, Depression, Knowledge, Practice, Makkah.

INTRODUCTION

Depression can be correlated with severe disability, mortality and significant healthcare costs¹. It is the third leading cause of disability in worldwide affecting around 840 million people². Vitamin D, which is a distinctive hormone with target receptors found in many areas in the body and in human brain, plays an important role in the development of depression through many physiological processes³. Neurons and glial cells, both of which are located within the brain, contain vitamin D receptors that have been linked to depression's pathogenesis³.

It is biologically plausible that depression is linked to vitamin D and that vitamin D supplementation can be an important part of depression treatment because vitamin D is involved in many brain processes like neurotrophic factor control, neuroimmunomodulation, neuroplasticity, brain growth and neuroprotection^{4,5,6}. Some brain regions like the, thalamus, cerebellum, substantia nigra, cingulate cortex, hippocampus and amygdala, express vitamin D receptors, suggesting that vitamin D may play a role in mental illnesses.

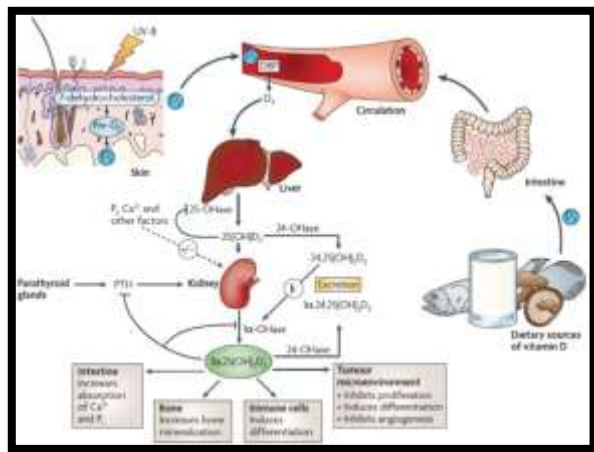
Experimental and animal studies showed that in the hippocampus region, vitamin D receptors interact with glucocorticoid, and 1,25-dihydroxycholecalciferol promotes monoamine neurotransmitter synthesis.^{7,8,9} The cortex, a particularly vulnerable region of the brain, undergoes significant alterations when under stress. Furthermore, stress can cause morphological changes, including hippocampal connections, reduced neurogenesis and disruption of neurotransmitters.^{10,11}

The expression of 1 alpha-hydroxylase enzymes, which may convert 25(OH)D to 1,25(OH)2D3, in several of these brain regions suggests that vitamin D may have autocrine or paracrine effects.^{12,13,14}

Table 1: selected food sources of Vitamin D

Food	IUs per serving*	Percent DV**
fortified with 20% of the DV for vitamin D, Yogurt, 6 ounces (Yogurts that have been fortified more heavily supply greater DV)	80	20
2 sardines, drained, canned in oil, sardines	46	12
1 large Egg (Egg yolk is a good source of vitamin D)	41	10
1 ounce, Swiss, Cheese	6	2
3 ounces, cooked, beef, Liver	42	11
One cup of vitamin D-enhanced orange juice (as amount of added vitamin D differs, check product labels)	137	34
1 tablespoon, fortified, margarine,	60	15
vitamin D added at 10% of the daily value, Ready to eat cereal, 0.75 1 cup (Increasingly enriched breakfast cereals may be a source of additional DV)	40	10
1 tablespoon, Cod liver oil,	1,360	340
1 cup milk, reduced fat, nonfat, vitamin D-fortified,	115-124	29-31
3 ounces swordfish, cooked	566	142
cooked, 3 ounces, Salmon (sockeye),	447	112
drained, 3 ounces, canned in water, Tuna fish,	154	39

Fatty fish like salmon, tuna, and mackerel are excellent dietary sources of vitamin D, along with cheese, beef liver, and egg yolks, which can also give lower amounts (Table 1). Vitamin D can be increased by a novel and intriguing method: exposing plants to

Figure 1: Vitamin D metabolism^{2,13}

ultraviolet radiation.^{2,16,17} The best way to assess vitamin D status is with a blood test measuring 25-hydroxyvitamin D (25-OH D) when a healthy vitamin D intake regimen has been followed for at least three months.^{2,16}

Risk factors for vitamin D insufficiency include ageing, obesity, kidney or gastrointestinal disease, usage of specific medications, and elements that influence how the skin develops (such as insufficient exposure to sunshine, the use of sunscreen or protective gear, or dark skin pigmentation). (Table 2).²

Table 2: Risk factors associated with vitamin D deficiency

Breastfeeding
Obesity (BMI >30 kg/m ²)
The utilisation of drugs that affect vitamin D metabolism (eg, glucocorticoids, anticonvulsants.)
Deficient sunlight
Hepatobiliary disease
Renal disease
>65 age
Malabsorption
Malabsorption

A vitamin D level below 30 nmol/L is considered vitamin D insufficiency, whereas a level below 20 nmol/L is considered vitamin D deficiency.. Over 100 nmol/L of 25(OH)D is considered excessive, and may possibly be hazardous, leading to hypervitaminosis D (Table 3).²

Table 3: Serum 25-Hydroxy vitamin D [25(OH)D] Concentrations and Health

nmol/L**	ng/mL*	Health status
≥50	≥20	Accepted as sufficient for healthy bone and general health in persons.
>125	>50	New evidence suggests that concentrations above 150 nmol/L (60 ng/mL) may be harmful.
<30	<12	causes rickets in children and osteomalacia in adults due to a lack of vitamin D.
30 to < 50	12 to <20	As a rule, healthy people are not given enough to meet their skeletal and general nutritional needs.

* 25(OH)D serum levels are given in both nmol/L and ng/mL.
 ** 1 nmol/L = 0.4 ng/mL

Vitamin D (ascorbic acid) intake between 200 and 600 IU/day is considered adequate for both sexes from infancy through midlife. The RDA rises to 600 IU/day for those aged 51–70, and to 800 IU/day for those aged 70 and up. The American Academy of Pediatrics recently recommended increasing the recommended daily intake of vitamin D for infants, children, and adolescents to 400 international units per day. Dietary reference intake values established by the Institute of Medicine’s Food and Nutrition Board are shown in (Table 4). It is questionable whether or not high-dose vitamin D3 treatment is necessary to alleviate depression symptoms.^{3,17,18,19}

Table 4: Daily Recommended Vitamin D Intakes

Age	Male	Female	Pregnancy	Lactation
>70 yrs	800 Iu (20 mcg)	800 Iu (20 mcg)		
51-70 yrs	600 Iu (15 mcg)	600 Iu (15 mcg)		
19-50 yrs	600 Iu (15 mcg)	600 Iu (15 mcg)	600 Iu (15 mcg)	600 Iu (15 mcg)
14-18 yrs	600 Iu (15 mcg)	600 Iu (15 mcg)	600 Iu (15 mcg)	600 Iu (15 mcg)
1-13 yrs	600 Iu (15 mcg)	600 Iu (15 mcg)		
0-12 months*	400 Iu (20 cg)	400 Iu (20 mcg)		

Depression is considered a treatable condition; however, most people with depression usually do not accept treatments. Moreover, not treating depression will lead to multiple consequences such as low energy level, decreased cognitive functions and bad mood^{5,20}. Therefore, depression may affect quality of life, decrease daily activity and physical health. Leading to disturbed relationship with family, friends, and work.

In Saudi Arabia we found that the prevalence of depression is high, however, the exact cause is unknown⁵. Moreover, there are many risk factors that can trigger the onset of depression such as chronic infection diseases, low socio-economic status, stressful life events, family history, traumatic experience, all these associated with risk of depression.^{5,21,22}

METHODS

Sample: Makkah holey city is located in the western area of Saudi Arabia, and this study is a descriptive cross-sectional analysis of the local population. The investigation was conducted between September 2020 and January 2021, and it followed the STROBE23 guidelines for documenting observational studies in epidemiology. Sample of 557 cases is calculated. The additional 20% was included to account for any gaps in the data. In total, 745 participants were included in the sample. There was an online poll conducted on vitamin D.

Study design and Questionnaire: We categorised participants' knowledge as poor when they answered only two questions, as fair when they answered four questions, and as good when they answered seven questions from the questionnaire about the relationship between vitamin D and the risk of depression. The same idea was applied to the practise score, with a 2 representing really bad practise, a 4 representing average practise, and a 6 representing excellent practise. The first page of the questionnaire explains the research topic and the number of minutes it takes to fill it. On the second page, questions were placed to find out the gender, age, social and education status of the respondents, skin colour, and whether they smoke. On the third and last page, 21 questions were placed. It was drafted in Arabic and piloted on 20 members of the general public who were not involved in the study in order to gauge response rates, ensure internal consistency, and verify the veracity of the questions and faces.

Statistical analysis: SPSS version 22 was used for data coding, validation, and analysis. We used frequency and proportion in the results to portray the data. As a 5% significance test, chi-squared was utilised.

RESULTS

Participants' demographics and other background info are listed in Table 1. There was a response rate of 99.6 percent, with 745 individuals filling out the survey. The majority of participants (57%) fell into the 18-25 age bracket. Around 52.80 % were females and lowest age range was 56≤ years (11.20%). the response from the marital status of single people was 454 (61.40%). While the percentage among university students was 577 (78.10%). The white skin was the most responsive average 392 (53.30%).

Table 1: characteristics of the study subjects at the outset

Characteristics	Number (745)	Percentage
Sex		
Male	349	47.20%
Female	390	52.80%
Age (years)		
18-25	421	57%
26-35	74	10%
36-45	76	10.30%
46-55	85	11.50%
56≤	83	11.20%
Marital status		
Single	454	61.40%
Married	285	38.60%
Educational status		
Secondary school	103	13.90%
University	577	78.10%
Other	59	8.00%
Smokers		
Yes	152	21%
No	587	79.40%
Skin color		
Dark brown	29	3.90%

Light brown	123	16.70%
White	192	26.10%
Whitish	392	53.30%

In Table 2, we saw how the study subjects were distributed in terms of their vitamin D consumption and use. Upon the close of the survey, 745 individuals had responded, with a response rate of 99.6%. 570 (80.90%) participants answered yes that they know what vitamin D is, around 49.60% knew it from other sources .312 (44.30%) participants was diagnosed with vitamin D deficiency, around 54.60% were not had any mood symptoms. 372 (52.50%) participants suffer from muscle pain and general body fatigue symptoms, around 58.40% were not take any treatment for these symptoms. 607 (85.60%) participants answered yes that they know that vitamin D is important for bone health. 401 (56.60%) Participants chosen yes that vitamin D affects sleep, 268 (40.50%) participants thought that vitamin D affects they weight. 463 (65.70%) thought that vitamin D it's important to protect against many diseases including depression. 261(37%) chosen NO thought that vitamin D has no side effects. 636(90%) of participant ready to take medication. 161 (23%) of Participants got their vitamin D by eating fatty fish like tuna, 91(13%) by eating milk and dairy product, 16(2.30%) by eating breakfast cereal and 432 (61.70%) of Participants got their vitamin D by consuming all of the above. 242 (34.20%) of Participants their food contained natural sources of vitamin D, 49 (6.90%) their food did not contain it and 417(58.90%) of the Participants their maybe. 193(27.20%) of the Participants practice the sport while 193(27.20%) of the Participants were not exercising. 166(35.90%) of participants practiced 150 minutes of cardio exercise a week ,187(40.40%) of participants practiced resisting 30 minutes a week ,109(23.50%) of participant practiced balance exercise once a week .256(36.30%) participants answered yes, that they been exposed to sunlight while 86(12.20%) participants they are not exposed to sunlight, 363(51.50%) participants may have been exposed to sunlight. 302(52.10%) of participants were exposed to sunlight for 10 minutes ,101(17.40%) of participants exposed for 15 minutes and 175(30.20%) were exposed to sunlight for more time. 42(6%) of participants used sunblock with SPF 15% ,56(8%) used SPF 30% and 98(13.90%) used sunblock with SPF 50% while 507(72.10%) of participants were not using sun block.

Table 2: Research participants' routines as measured by frequency

Item	Number	Percentage
Do you know what is vitamin D?		
Yes	570	80.90%
No	39	5.50%
Maybe	96	13.60%
Where did you get your information about vitamin D?		
social media	158	22.60%
TV	13	1.90%
search browsers	181	25.90%
others	346	49.60%
Have you been diagnosed with a vitamin D deficiency?		
Yes	312	44.30%
No	306	43.50%
Maybe	86	12.20%
Have you had any mood symptoms after you were diagnosed with a vitamin D deficiency?		
Yes	189	27.40%
No	377	54.60%
Maybe	125	18.10%
Do you suffer from muscle pain and general body fatigue?		
Yes	372	52.50%
No	208	29.40%
Maybe	128	18.10%
Did you take any treatment for these symptoms?		
Yes	265	37.90%
No	409	58.40%

Maybe	26	3.70%
Did you know that vitamin D is important for bone health?		
Yes	607	85.60%
No	75	10.60%
Maybe	27	3.80%
Do you think vitamin D affects your weight?		
Yes	286	40.50%
No	236	33.40%
Maybe	184	26.10%
Do you think Vitamin D affects sleep?		
Yes	401	56.60%
No	139	19.60%
Maybe	168	23.70%
Did you know that vitamin D is important to protect against many diseases, including depression?		
Yes	463	65.70%
No	154	21.80%
Maybe	88	12.50%

Figure 1 demonstrates the frequency of vitamin D deficiency in male and female participants of the study around 97% of the female and 89% of males were all aware of this deficiency and what can happen to the body related to it.

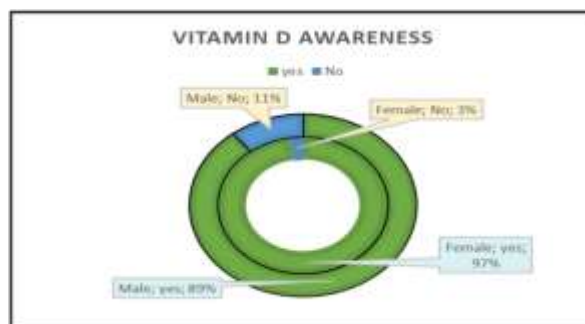


Figure1: Frequency of vitamin D deficiency in male and female.

DISCUSSION

Around 570 (80.90%) participants answered yes that they know what vitamin D is, around 49.60% knew it from other sources. Almost 312 (44.30%) participants were diagnosed with vitamin D deficiency, around 54.60% were not had any mood symptoms. About 372 (52.50%) participants suffer from muscle pain and general body fatigue symptoms, around 58.40% were not take any treatment for these symptoms. 607 (85.60%) participants answered yes that they know that vitamin D is important for bone health. Almost 401 (56.60%) Participants chosen yes that vitamin D affects sleep, 268 (40.50%) participants thought that vitamin D affects they weight. There were 463 (65.70%) thought that vitamin D it's important to protect against many diseases including depression. Also, around 261(37%) chosen NO thought that vitamin D has no side effects. 636(90%) of participant ready to take medication. In addition, 161 (23%) of Participants got their vitamin D by eating fatty fish like tuna, 91(13%) by eating milk and dairy product, 16(2.30%) by eating breakfast cereal and 432 (61.70%) of Participants got their vitamin D by consuming all of the above. 242 (34.20%) of Participants their food contained natural sources of vitamin D, 49 (6.90%) their food did not contain it and 417(58.90%) of the Participants their maybe. Around 193(27.20%) of the Participants practice the sport while 193(27.20%) of the Participants were not exercising. 166(35.90%) of participants practiced 150 minutes of cardio exercise a week ,187(40.40%) of participants practiced resisting 30 minutes a week ,109(23.50%) of participant practiced balance exercise once a week . Also 256(36.30%) participants answered yes that they been exposed to sunlight while 86(12.20%) participants they are not exposed to sunlight, 363(51.50%) participants may have been exposed to

sunlight. 302(52.10%) of participants were exposed to sunlight for 10 minutes ,101(17.40%) of participants exposed for 15 minutes and 175(30.20%) were exposed to sunlight for more time. 42(6%) of participants used sunblock with SPF 15% ,56(8%) used SPF 30% and 98(13.90%) used sunblock with SPF 50% while 507(72.10%) of participants did not use any sun block.

During the years researchers explored Vitamin D deficiency among population and their knowledge and awareness in relation to multiple disorders.^{31,32,33,34} As vitamin D is essential for the human body and plays a vital role in many processes as metabolism, bone, immunity, and balance.^{35,36} Any deficiency of vitamin D especially if severe will lead to multiple disorders in neurologic, endocrine, bone and other systems.^{37,38}

Therefore, continuous examining of public awareness about vitamin D deficiency and what it can lead of causing symptoms and disorders is very essential to reduce any risk of having low vitamin D deficiency that can lead to depressive symptoms that will affect the quality of life and the good health of any person.

CONCLUSION

We found that the population we studied had an excellent understanding of vitamin D insufficiency and depression symptom awareness, both in theory and in practise.. Future studies to investigate how Vitamin D and depression is related is needed to continue this study.

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