International Journal of Community Medicine and Public Health
Oraibi O et al. Int J Community Med Public Health. 2024 Jan;11(1):11-19
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20233825

Original Research Article

Investigating the link between vitamin d deficiency and depression and anxiety in medical students at Jazan university: a cross-sectional study

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Received: 16 November 2023
Accepted: 01 December 2023

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ABSTRACT

Background: Numerous studies have assessed the prevalence of vitamin D insufficiency among Saudi individuals and correlated depression and anxiety with vitamin D deficiency. However, studies have not looked at these factors in Saudi Arabia's Jazan medical students. The current study aimed to clarify the relationship between low vitamin D levels, depression, anxiety, and academic performance.
Methods: A cross-sectional study was conducted among medical students at Jazan university. The dependent variables were depression and anxiety, and their association with covariates, including sex, marital status, GPA, BMI, vitamin D level, and physical exercise, was evaluated. The 21-item depression, anxiety, and stress scale, which has been validated, was utilized.
Results: Of 252 students, the prevalence of vitamin D deficiency was 54.4%; anxiety, 62.3%; and depression 68.7%. Comparatively, more female students than male students were vitamin D deficient. Stress was found to be substantially related to vitamin D deficiency ($p<0.001$). Anxiety was also significantly related to vitamin D deficiency ($p<0.001$), wherein the students with anxiety had a considerably higher prevalence of vitamin D deficiency than those without anxiety (84% vs. 32.5%). Similarly, depression was significantly associated with vitamin D deficiency ($p<0.001$), wherein students with depression were much more likely to get vitamin D deficiency than students without depression (86.7% vs. 27.5%)-no significant association otherwise with other variables.
Conclusions: Stress, depression, and anxiety are associated with vitamin D deficiency. This finding highlights the importance of mental health promotion among medical students owing to its link to quality of life and academic performance.

Keywords: Depression, Anxiety, Medical students, Academic performance, Vitamin D deficiency

INTRODUCTION

Vitamin D is a necessary fat-soluble nutrient crucial for sustaining healthy bones. Vitamin D is mostly obtained through sunlight. Foods like liver, salmon, and tuna only contain trace amounts of vitamin D. Heart failure, myocardial infarction, and even mortality have all been related low levels of vitamin D.[1] In line with Schneider et al, low serum levels of 25(OH)D3 are related to psychiatric diseases, particularly depression.[2]

Bosomworth et al, Faiz et al and Goldstein reported that low vitamin D levels, including vitamin D insufficiency (10.1 to 30 ng/ml) and deficiency (10 ng/mL), have emerged as an epidemic. This epidemic endangers and impacts the health of the worldwide population, including

children and adults. It is also connected to mental health issues such as mood disorders, depression, and anxiety.[3-5]

According to Ahmed, vitamin D inadequacy and insufficiency are blatant issues in Saudi Arabia.[6] Elsammak et al, Hussain et al, and Sadat-Ali et al showed that 28% and more than 65% of Saudis of all ages had low vitamin D levels.[7-9]

Numerous studies have assessed the prevalence of vitamin D insufficiency among Saudi individuals.[1-10] One study on vitamin D deficiency conducted among 50 Saudi married couples in Saudi Arabia revealed that 70% of Saudi women had vitamin D deficiency compared with 40% of Saudi men.[11] Additionally, Hasanato et al evaluated 178 healthy medical students in Riyadh and found that vitamin D insufficiency was common among female medical students and may have been caused by dietary, social, and environmental factors.[12] Depression is characterized by a depressing attitude or a loss of interest or enjoyment in nearly all activities for the majority of each day for at least two weeks. Identifying the pathophysiology of major depressive disorder has proven challenging due to the variety of its clinical features and etiologies.[13]

Depression is a complicated condition with numerous subtypes and causes, including the potential involvement of vitamin D. The brain contains vitamin D receptors all over it. These receptors are found in the parts of the brain where depression first appears. Vitamin D and depression have, therefore, been linked.[1]

Anxiety is a frequent mental disease characterized by tense sensations, over-worrying about many issues, and physical changes, including elevated blood pressure.[14] According to Alanazi, Saudis of all ages frequently experience anxiety.[15] Al-gelban reported that the prevalence of anxiety was 48.9% in Saudi school boy adolescents.[16] El-Sayed D et al also revealed that anxiety affected 54.9% of female students in secondary schools, while Nair et al indicated that 14.3% of girls from Saudi secondary schools in the city of Abha reported having anxiety.[17,18]

In the study by Khoshhal et al a higher frequency of anxiety was discovered among medical students at Taibah University, Medina, Saudi Arabia, with 65% of students reporting examination anxiety for various reasons.[19] Penckofer et al found that weekly vitamin D supplementation at 50,000 IU among women with type 2 diabetes, substantial depressive symptoms, and low 25(OH)D levels improved their depression, anxiety, and other mental health outcomes.[20]

One of the primary objectives of education is the improvement of academic performance. According to Burrows et al extensive research has been conducted to determine the variables affecting university students' academic success. However, more investigation is required to determine how vitamin D affects university students' academic performance.[21] Whether vitamin D helps improve cognitive function remains controversial. According to Llewellyn et al, higher vitamin D levels are linked to improved cognitive performance.[22] However, in their prospective study, Slinin et al discovered no connection between vitamin D levels and cognitive function in older men.[23] Owing to the significant prevalence of vitamin D deficiency in Saudi Arabia, particularly among female university students, it is crucial to ascertain if students' vitamin D levels impact their academic performance.[24]

As was already established, several studies link a vitamin D deficit to anxiety and depression. As far as we know, no study has examined the connection between these factors among medical university students in Jazan, Saudi Arabia. Therefore, the objective of the current study was to clarify the relationship between vitamin D insufficiency, anxiety, depression, and academic performance among university students in Jazan, Saudi Arabia.

METHODS

Study design, setting, and population

An observational cross-sectional study at Jazan University medical students uses a self-administered anonymous computerized questionnaire to assess the prevalence of vitamin D deficiency and its links to stress, depression, and academic performance. Jazan is one of the main provinces of Saudi Arabia, which is in the southwest of Saudi Arabia, and roughly 2 million people are living in the Jazan Province. Our study focused on medical students at Jazan University in their second through sixth years, both genders. Students from different universities and colleges, first-year students, and interns were also not included.

Sample size and technique

The Raosoft sample size calculator was used to calculate the sample size; out of 897 male and female medical students, a sample size of 217 was determined to be sufficient to achieve a 95% confidence interval with a 5% margin of error. Convenience sampling was used to choose the study's sample.[25]

Study instrument and data collection

The self-administered anonymous computerized survey was adapted from a prior study carried out in Saudi Arabia.[1] Between December 2022 and January 2023, the surveys were disseminated via social media platforms like Twitter, Telegram, and WhatsApp. Three sections made up the questionnaire:

The first part comprised questions to determine the demographic data of the participants: age, sex, marital

status, nationality, monthly income, academic year, and GPA.

The second part aimed to assess the general characteristics of the students, including health status and physical activity. This covered recent changes in body weight, how one regarded their body, and how much they exercised.

The third part consisted of questions to reflect the vitamin D status of the students, including the amount of time spent in the sun, identification of signs of vitamin D deficiency, the status of supplementing with vitamin D, use of sunblock, use of artificial vitamin D sources like tanning beds, and status of vitamin D intake, and risk factors for depression and the status of antidepressant use.

The fourth part included the validated 21-item depression, anxiety, and stress scale (DASS-21)(26). Both English and Arabic languages were used in the questionnaire. The DASS-21 is a 21-item self-report questionnaire with seven items per subscale that is intended to both identify and gauge the severity of the states of depression, anxiety, and stress. It is a suitable tool for screening healthy adolescents and adults. Respondents must state whether or not they have a symptom over the previous week. Each item is given a score between 0 (did not apply to me at all over the last week) and 3, which means it did apply to me a lot or most of the time, and the length of it. The response to the questions is evaluated utilizing a Likert scale from 0 to 3 (0=never; 1=sometimes; 2=often; and 3=almost always).

Pilot study

After obtaining ethical approval, a pilot study was carried out to assess the questionnaire's validity, precision, and understandability using 10% of the total sample size. Considering the findings of the pilot research, certain questions were revised and reorganized. The final data analysis did not include the findings of the pilot study.

Statistical analysis

The data were examined using the SPSS, version 23. Frequencies and percentages were used to display the category variables. The chi-square test was used to establish that the. The existence of a relationship between the category variables was examined using the chi-square test. The significance threshold was established at p=0.0.

RESULTS

A total of 252 participants were included in this study. Table 1 shows the sociodemographic and academic profiles of the participants. The mean age of participants was 22.19±1.78 years. Regarding sex, 124 (49.2%) participants were men, while 128 (50.8%) were women. Regarding nationality, all 252 (100%) participants were Saudis. Regarding marital status, 183 (72.6%) were single; 65 (25.8%), married; and 4 (1.6%), divorced. Regarding monthly income, 23 (9.1%) had an income of <5000 SR; 103 (40.9%), 5000-9999 SR; 61 (24.2%), 10000-15000 SR; and 65 (25.8%), >15000 SR. Regarding academic year, 43 (17.1%) were in their second year, 45 (17.9%) in their third year, 52 (20.6%) in their fourth year, 57 (22.6%) in their fifth year, and 55 (21.8%) in their sixth year. Regarding GPA, 33 (13.1%) had a letter grade of A+; 90 (35.7%), A; 73 (29%), B+; 32 (12.7%), B; 18 (7.1%), C+; 4 (1.6%), C; and 2 (0.8%), D+.

Table 1: Sociodemographic and academic profiles of the participants, (n=252).

Characteristic	N	Percentages (%)
Age (in years)		
Mean	22.19	
Standard deviation	1.78	
Sex		
Male	124	49.20
Female	128	50.80
Nationality		
Saudi	252	100.00
Marital status		
Single	183	72.60
Married	65	25.80
Divorced	4	1.60
Monthly income (SR)		
<5000	23	9.10
5000-9999	103	40.90
10000-15000	61	24.20
>15000	65	25.80
Academic year		
Second year	43	17.10
Third year	45	17.90
Fourth year	52	20.60
Fifth year	57	22.60
Sixth year	55	21.80
GPA (letter grade)		
A+	33	13.10
A	90	35.70
B+	73	29.00
B	32	12.70
C+	18	7.10
C	4	1.60
D+	2	0.80

Table 2 displays the participants' profiles on weight, exercise, and antidepressant use. Regarding BMI, 36 (14.3%) participants were underweight; 132 (52.4%) had a normal BMI; 72 (28.6%) were overweight; and 12 (4.8%) were obese. Regarding changes in body weight in the past 3 months, 32 (12.7%) reported losing weight; 74 (29.4%), gaining weight; and 146 (57.9%), having no change in their weight. Regarding physical exercise, only 80 (31.7%) reported exercising. Regarding the frequency of exercise, 20 (25%) reported exercising 1–2 days/week; 46 (57.5%), 3-4 days/week; and 14 (17.5%), >4 days/week. Regarding the duration of exercise per week,

20 (25%) reported practicing mild exercise, such as walking for 30 minutes or less; 47 (58.8%), moderate exercise for at least 30 minutes; and 13 (16.3%), intense exercise for at least 20 minutes. Among the participants, 25 (9.9%) reported using antidepressants.

Table 2: Participants' profile on weight, exercise, and antidepressant use, (n=252).

Characteristic	N	Percentages (%)
BMI (kg/m^2)		
Underweight (<18.5)	36	14.30
Normal weight (18.5-24.9)	132	52.40
Overweight (25-29.9)	72	28.60
Obese (≥30)	12	4.80
Did you gain or lose body weight during the past 3 months?		
Weight loss	32	12.70
No change	146	57.90
Weight gain	74	29.40
Do you practice physical exercise?		
Yes	80	31.70
No	172	68.30
How many times do you exercise per week? (n=80)		
1-2 days	20	25.00
3-4 days	46	57.50
>4 days	14	17.50
What is your exercise duration per week? (n=80)		
Mild exercise such as walking for 30 min/less	20	25.00
Moderate exercise for at least 30 minutes	47	58.80
Intense exercise for at least 20 minutes	13	16.30
Do you currently take antidepressants?		
Yes	25	9.90
No	227	90.10

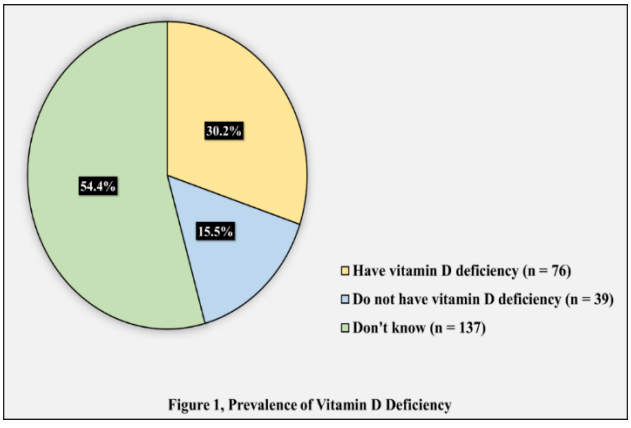

Figure 1: Prevalence of vitamin D deficiency.

Figure 1 presents the prevalence of vitamin D deficiency. Of the participants, 76 (30.2%) reported having vitamin D deficiency; 39 (15.5%), not having vitamin D deficiency; and 137 (54.4%), not knowing whether they have vitamin D deficiency.

Table 3: Vitamin D profile of the participants with vitamin d deficiency, (n=76).

Characteristic	N	Percentages (%)
Do you take vitamin D supplements?		
Yes	61	80.30
No	15	19.70
Have you used sunscreen in the past year?		
Yes	54	71.10
No	22	28.90
Have you ever tried tanning (e.g., salon or tanning spray)?		
Yes	11	14.50
No	65	85.50

Table 3 demonstrates the vitamin D profile of the participants with vitamin D deficiency. Among these participants, 61 (80.3%) reported taking vitamin D supplements; 54 (71.1%), using sunscreen in the past year; and 11 (14.5%), trying tanning (e.g., salon or tanning spray) before.

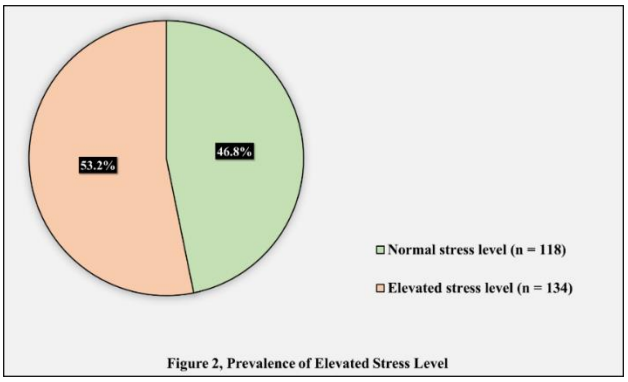

Figure 2: Prevalence of elevated stress level.

Figure 2 illustrates the prevalence of stress level elevation. Among the participants, 134 (53.2%) had elevated stress levels, while 118 (46.8%) had normal stress levels.

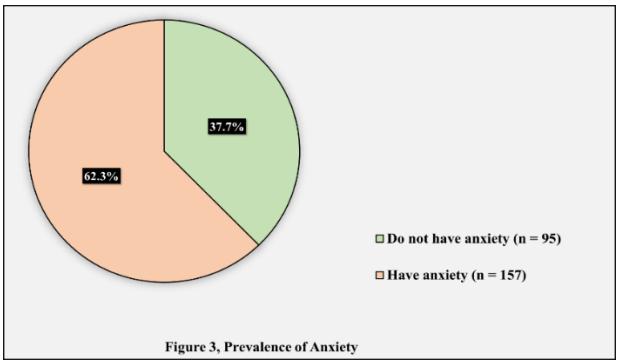

Figure 3: Prevalence of anxiety.

Figure 3 shows the prevalence of anxiety. Of the participants, 157 (62.3%) had anxiety, while 95 (37.7%) did not.

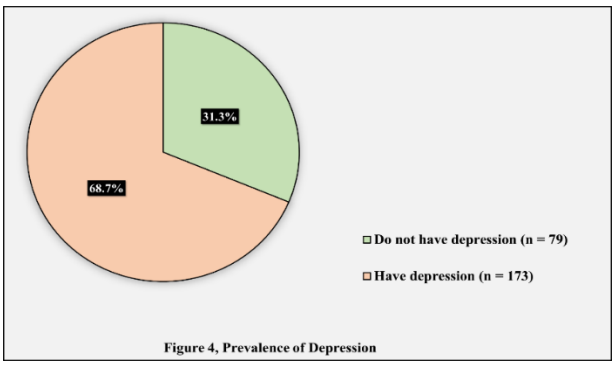

Figure 4: Prevalence of depression.

Figure 4 displays the prevalence of depression, of the participants, 173 (68.7%) had depression, while 79 (31.3%) did not.

Table 4: Stress, anxiety, and depression scores and levels, (n=252).

Questions	N	Percentages (%)
Stress score		
Mean	16.88	
Standard deviation	11.62	
Stress level		
Normal	118	46.8
Mild	28	11.1
Moderate	37	14.7
Severe	46	18.3
Extremely severe	23	9.1
Anxiety score		
Mean	12.41	
Standard deviation	10.64	
Anxiety level		
Normal	95	37.7
Mild	19	7.5
Moderate	50	19.8
Severe	26	10.3
Extremely severe	62	24.6
Depression score		
Mean	17.07	
Standard deviation	12.50	
Depression level		
Normal	79	31.3
Mild	25	9.9
Moderate	52	20.6
Severe	31	12.3
Extremely severe	65	25.8

Table 4 presents the stress, anxiety, and depression scores and levels. The mean stress score was 16.88±11.62. Among the participants, 118 (46.8%) had normal stress levels; 28 (11.1%), mild stress levels; 37 (14.7%), moderate stress levels; 46 (18.3%), severe stress levels; and 23 (9.1%), extremely severe stress levels. The mean anxiety score was 12.41±10.64. Among the participants, 95 (37.7%) had no anxiety; 19 (7.5%), mild anxiety levels; 50 (19.8%), moderate anxiety levels; 26 (10.3%), severe anxiety levels; and 62 (24.6%), extremely severe anxiety levels. The mean depression score was 17.07±12.5. Among the participants, 79 (31.3%) had no depression; 25 (9.9%), mild depression; 52 (20.6%), moderate depression; 31 (12.3%), severe depression; and 65 (25.8%), extremely severe depression.

Table 5 demonstrates the factors associated with vitamin D deficiency. Sex was found to be substantially linked with vitamin D insufficiency among them (p=0.002), with the prevalence of vitamin D deficiency being significantly greater in female participants (75.6%) than in male participants (45.9%). Elevated stress levels were also significantly related to vitamin D deficiency (p<0.001), wherein the participants with elevated stress levels had a significantly higher prevalence of vitamin D deficiency than those with normal stress levels (89.4% vs. 34.7%). Vitamin D insufficiency and anxiety were both substantially correlated (p=0.001), with those with anxiety having a much greater prevalence of vitamin D deficiency than participants without anxiety (84% vs. 32.5%). Similar to this, vitamin D insufficiency and depression were substantially correlated (p=0.001), compared to those without depression, those with depression exhibited a significantly higher frequency of vitamin D insufficiency (86.7% vs. 27.5%). A significant association was also found between vitamin D deficiency and stress (p<0.001), anxiety (p<0.001), and depression scores (p<0.001). The participants with vitamin D deficiency had significantly higher scores of stresses, anxiety, and depression than those without. On the other hand, there was no connection between vitamin D insufficiency and marital status, GPA, BMI, or exercise.

Table 6 shows the factors associated with elevated stress, anxiety, and depression. Gender was significantly associated with stress (p<0.001) and anxiety (p=0.016) but not with depression. It was observed that females had a significantly higher rate of anxiety and elevated stress than males. Marital status was significantly associated with stress level (p<0.001), anxiety (p=0.002), and depression (p<0.001), respectively. Where it was observed that single participants had notably lower rates of elevated stress, anxiety, and depression, respectively, compared to married and divorced participants. BMI was significantly associated with stress level (p=0.005), anxiety (p=0.002), and depression (p=0.008), respectively. For elevated stress, the BMI group with the lowest rate of elevated stress as those with normal weight. For anxiety, the BMI group with the lowest rate of anxiety was obese patients. For depression, the BMI group with the lowest rate of depression was obese patients. Practicing physical exercise was not significantly associated with stress, anxiety, or depression.

Table 5: Factors associated with vitamin D deficiency.

Factors	With vitamin D deficiency, n (%)	Without vitamin D deficiency, n (%)	P value
Sex (n, %)			
Male	17 (45.9)	20 (54.1)	0.002*
Female	59 (75.6)	19 (24.4)	
Marital status			
Single	46 (59.7)	31 (40.3)	0.110
Married	28 (80)	7 (20)	
Divorced	2 (66.7)	1 (33.3)	
GPA (letter grade)			
A+	12 (75)	4 (25)	0.485
A	31 (63.3)	18 (36.7)	
B+	19 (59.4)	13 (40.6)	
B	10 (83.3)	2 (16.7)	
C+	2 (50)	2 (50)	
C	2 (100)	0 (0)	
BMI (kg/m^2)			
Underweight (<18.5)	11 (73.3)	4 (26.7)	0.065
Normal weight (18.5-24.9)	32 (55.2)	26 (44.8)	
Overweight (25–29.9)	30 (81.1)	7 (18.9)	
Obese (≥30)	3 (60)	2 (40)	
Do you practice physical exercise?			
Yes	26 (68.4)	12 (31.6)	0.710
No	50 (64.9)	27 (35.1)	
Prevalence of stress level elevation			
Normal stress level	17 (34.7)	32 (65.3)	<0.001*
Elevated stress level	59 (89.4)	7 (10.6)	
Prevalence of anxiety			
With anxiety	13 (32.5)	27 (67.5)	<0.001*
Without anxiety	63 (84)	12 (16)	
Prevalence of depression			
With depression	11 (27.5)	29 (72.5%)	<0.001*
Without depression	65 (86.7)	10 (13.3%)	
Stress score (mean ± standard deviation)	23.89±10.54	7.9±10.42	<0.001*
Anxiety score (mean ± standard deviation)	18.87±11.09	5.18±7.89	<0.001*
Depression score (mean ± standard deviation)	23.66±12.1	6.72±8.80	<0.001*

*Significant at p<0.05.

Table 6: Factors associated with stress, anxiety, and depression.

Factors	Stress level, n (%)		P value
	Normal	Elevated	
Marital status			
Single	100 (54.6)	83 (45.4)	<0.001*
Married	17 (26.2)	48 (73.8)	
Divorced	1 (25)	3 (75)	
GPA (letter grade)			
A+	16 (48.5)	17 (51.5)	0.063
A	48 (53.3)	42 (46.7)	
B+	35 (47.9)	38 (52.1)	
B	9 (28.1)	23 (71.9)	
C+	10 (55.6)	8 (44.4)	
C	0 (0)	4 (100)	
D+	0 (0)	2 (100)	
Anxiety	With	Without	
Marital status			
Single	81 (44.3)	102 (55.7)	0.002*
Married	13 (20)	52 (80)	
Divorced	1 (25)	3 (75)	
GPA (letter grade)			
A+	9 (27.3)	24 (72.7)	0.591
A	33 (36.7)	57 (63.3)	
B+	33 (45.2)	40 (54.8)	
B	10 (31.3)	22 (68.8)	
C+	8 (44.4)	10 (55.6)	
C	1 (25)	3 (75)	
D+	1 (50)	1 (50)	
Depression	**With**	**Without**	
Marital status			
Single	72 (39.3)	111 (60.7)	<0.001*
Married	7 (10.8)	58 (89.2)	
Divorced	0 (0)	4 (100)	
GPA (letter grade)			
A+	14 (42.4)	19 (57.6)	0.209
A	28 (31.1)	62 (68.9)	
B+	23 (31.5)	50 (68.5)	
B	6 (18.8)	26 (81.3)	
C+	8 (44.4)	10 (55.6)	
C	0 (0)	4 (100)	
D+	0 (0)	2 (100)	

*Significant at p<0.05.

DISCUSSION

In this study, 30.2% of the students had vitamin D deficiency, consistent with other reports in Saudi Arabia.[7,8,11,12] Decreased sunlight exposure, sedentary lifestyle, and poor diet have been previously reported as factors attributed to vitamin D deficiency.[7,8,11,27] Other factors also include fast-food consumption and the lack of open spaces in colleges, where students spend most of their day.[12,24]

Our study found that 80% of the students taking supplements were deficient in vitamin D. This finding

was also noted in other studies, indicating that taking supplements may not be enough owing to the suboptimal amount of vitamin D found in food as some studies have suggested.[8,12,28,29] A previous study has shown that students using multivitamin supplements instead of vitamin D supplements had low vitamin D levels.[12] Herein, 71% of the participants were using sunscreen the majority of the research participants opt not to tan, only 14.5% trying tanning; this finding could indicate that sunscreen use affects vitamin D levels, as observed in other studies.[30-33] Further, comparatively, more female than male students were vitamin D deficient. Similar results were found in studies conducted inside and outside Saudi Arabia.[8,11,12,24,27,34,35] In terms of the contributing factors of vitamin D deficiency, skin pigmentation, pregnancy, and covering of the skin have been suggested.[8,27] Other studies have found no association between skin color, covering of the skin, and vitamin D deficiency. One study has suggested that differences between the sexes are attributed to genetic and dietary factors.[11]

A study on dental students reported that 89% had vitamin D insufficiency and found a positive correlation between anxiety and vitamin D insufficiency; 62% of dental students had moderate and severe anxiety (36). Similarly, vitamin D insufficiency and anxiety have been found to be associated, ranging between moderate and extremely severe. The increased anxiety levels could be attributed to the teaching–learning process, course load, family expectations, and career choices.[19,36,37] The present study also noted an association between vitamin D deficiency and stress, anxiety, and depression, wherein 53% of the students had stress, 62% had anxiety, and 68.7% had depression which could be attributed mainly to gender, marital status, and BMI, (Table 4). However, practicing physical exercise was not significantly associated with stress, anxiety, or depression. Similarly, previous studies have found high mental distress levels in third-year and advanced students.[19,24,36,37] Our study also revealed an association between vitamin D deficiency and depression, wherein 68.7% of the students had moderate and extreme depression, in contrast to a previous report that 66% of students did not have depression.[36] A study conducted in the Czech Republic found a similar association between vitamin D deficiency, anxiety, and depression.[38]

It has been suggested that psychiatric illness affects vitamin D levels owing to decreased outdoor activity, poor diet, and use of antidepressants.[34,39,40] Meanwhile, vitamin D supplementation has been revealed to positively affect psychiatric illness.[35,39,40] Similar to our results, previous reports show a minimal relationship between vitamin D levels and academic performance.[24,36] A study on older adults found minimal evidence between vitamin D levels and cognitive impairment.[23] In contrast, a similar study noted that vitamin D levels were high in cognitively healthy patients.[22] The present study showed a significant relationship between low vitamin D levels and anxiety, depression, and stress, thereby deserving attention.

This cross-sectional study design and a number of methodological issues should be considered when applying the results obtained in this study. The fact that just one university (Jazan university) contributed the data, the findings might not be applicable to other universities. The collected data about vitamin D levels was based on a self-report tool. Hence, serum 25-hydroxyvitamin D should be collected so that the association between depression and anxiety with vitamin D levels can be tested precisely. Also, this study recruited medical students from different years and, despite sharing the longitudinal curriculum where the topics are delivered across the years with the same style. The student's GPA score and vitamin D deficiency can be assessed holistically by considering that many other factors can affect their GPA, like the nature of subjects studied each year, the learning process, course load, etc. Finally, evaluating cognitive functions is crucial, which could reflect the negative effects of vitamin D deficiency more accurately than academic performance. Hence, cognitive function should be included to accurately measure the connection between vitamin D status and academic performance.

CONCLUSION

Stress, depression, and anxiety are associated with vitamin D deficiency. This finding highlights the importance of mental health promotion among medical students owing to its link to quality of life and academic performance.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee of Jazan University with reference no. REC-44/05/415.

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Cite this article as: Oraibi O, Somaili M, Jaawna E, Alfaraj S, Majhali J, Zuqayl A, et al. Investigating the link between vitamin d deficiency and depression and anxiety in medical students at Jazan university: a cross-sectional study. Int J Community Med Public Health 2024;11:11-9.