ORIGINAL ARTICLE

Vitamin D Deficiency and its Impact on Depression among Al-Maarefa University Students, Riyadh, Saudi Arabia

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Abstract

Aim: Health science university students are exposed to a lot of issues that may lead to depression. A poor or unhealthy diet and lack of outdoor places for exercising due to hot weather are major reasons attributed for Vitamin D deficiency in Riyadh. The current study was designed to estimate the prevalence of Vitamin D deficiency and depression and explore if there is a relationship between them among university students. **Materials and Methods:** A cross-sectional comparative study survey was distributed to male and female students who study at Al-Maarefa Colleges of Science and Technology during March–May 2017 in Riyadh. The level of depression was measured by DASS 21 scale. Analysis of data was done using SPSS-IBM and $P < 0.05$ was considered significant. **Results and Discussion:** As participants of the current study were university students, most of them were in an age group of 20–22 years. Furthermore, the majority of the students volunteered to give their feedback in this questionnaire study were females (74%) when compared to male (26%). High percentage of surveyors in the female section was found with Vitamin D deficiency when compared to their male counterparts. Three scales of DASS 21 revealed a significant association between Vitamin D deficiency and depression. A significant relationship between low Vitamin D level and prevalence of depression is demonstrated in this study. **Conclusion:** Therefore, efforts are necessary to bring about awareness among university students to take effective steps to combat Vitamin D deficiency, and hence possible induction of depression could be avoided that might increase their academic performance.

Key words: Depression, Riyadh, Saudi Arabia, university students, Vitamin D deficiency

INTRODUCTION

Vitamin D is a fat-soluble vitamin that is essential mainly for bone health.[1] Exposure to the sun is a major source of Vitamin D. There is a small amount of the Vitamin D in foods such as tuna, salmon, and liver.[2] Vitamin D deficiency has been associated with an increased risk of death, heart failure, and myocardial infarction.[3]

Several studies have reported that lower levels of serum Vitamin D are significantly associated with depression.[4] It has been found that Vitamin D can improve the neurocognitive functioning of the nerves and central nervous system through different ways.[5,6] Vitamin D deficiency is prevalent worldwide; it has been estimated that around 1 billion people worldwide suffering from Vitamin D deficiency or insufficiency.[7] However, the prevalence is extensively variable among countries. Moreover, it's most significant surprisingly in the Middle East and Asia, despite its plentiful sunshine.[8,9]

The high prevalence of Vitamin D deficiency in Saudi participants has been evaluated in several studies. One of the studies on Vitamin D deficiency in Saudi Arabia was conducted by Elshafie *et al*. in 50 Saudi married couples showed that the prevalence of Vitamin D deficiency was 70% in women, compared with 40% in men.[10] In addition,

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another study showed 71% of female medical students with Vitamin D deficiency.[11] On the contrary, a report from Qassim Region, Saudi Arabia demonstrated only 28% population with Vitamin D deficiency.[12]

Depression is a condition categorized by depressed mood or loss of interest or pleasure in nearly all activities most of every day for a period lasting at least 2 weeks.[13] Due to the clinical and etiological heterogeneity of major depressive disorder, it has been hard to explain its pathophysiology.[14] It is a complex disorder that has multiple subtypes and multiple reasons, including maybe a role for Vitamin D.[15] Vitamin D receptors have been found in many parts of the brain. These receptors are established in the areas of the brain that is related to the development of depression. For this reason, Vitamin D has been linked with depression.[16]

Despite biological, psychological, and environmental theories have been raised[17] the underlying cause of depression remains unknown, and it is likely that several different mechanisms are involved.[18-20] Some studies have revealed a strong relationship between Vitamin D and depression[21,22] while others have revealed no relationship.[23,24]

Retrospective chart review study demonstrated by Przybelski and Binkley showed the impact of Vitamin D deficiency on cognitive impairment and memory quality.[25] Although many studies have claimed the relationship between Vitamin D deficiency and cognitive impairment, the evidence of the effect of Vitamin D deficiency on academic performance is still insufficient.[26] On the other hand, a study published recently negates this relationship between low Vitamin D level and academic performance.[27]

As mentioned above, there are several studies that correlate depression and Vitamin D deficiency, but there is no study available in the literature to date examining the relationship between these two variables among university students of Riyadh, Saudi Arabia. Thus, the current study was designed to elucidate the association between Vitamin D deficiency and depression among University Students of Al-Maarefa Colleges using standard validated DASS scoring system.

MATERIALS AND METHODS

Subjects and methods

The present study was based on a cross-sectional survey among students of Al-Maarefa Colleges, Riyadh. The study was conducted at the colleges, from March to May 2017. The study employed a predesigned validated structured questionnaire to collect the data. Participation in this study survey was completely voluntary, and full confidentiality and anonymity were maintained at all times, with no identifying information being recorded in the survey results. A consent form was added at the beginning of the questionnaire explaining the purpose of the study and requesting their participation. Required permission was obtained from the Committee of Research Seminar, College of Pharmacy, Al-Maarefa Colleges, Riyadh.

Study design

The current research was carried out by cross-sectional comparative study design. It was a time-bound study to be completed in a short span of time; hence, we selected cross-sectional design. The questionnaire was developed by a thorough literature review in addition to the discussion with the experts in the field. The questionnaire after its validation was subjected for a pilot study involving a few study samples. Final refinement and fine-tuning of the questionnaire were done based on the pre-test report.

Study setting/location

The study is single centered study and was carried out at Al-Maarefa Colleges by personal interview of the respondents during March-May 2017.

Study population

Male and female students studying at Al-Maarefa College for Science and Technology from different colleges (Medicine, Pharmacy, and Applied Sciences).

Eligibility criteria

Inclusion criteria

The following criteria were included in the study:
1. Student of Al-Maarefa College.
2. Male and female students.
3. Residents of Saudi Arabia.
4. From different colleges (Medicine, Pharmacy, and Applied Sciences).

Exclusion criteria

The following criteria were excluded from the study:
1. Any student from departments other than Medicine, Pharmacy, and Applied Sciences.
2. Not Studying at Al-Maarefa Colleges.
3. Staff members.

Data collection

The questionnaire consisted of three parts. The first part documented the demographic data of the participants: Age, gender, colleges/departments, study level, GPA, and nationality.

Questions in the second part pertained to assess general characteristics of students. This included recent body weight

fluctuation, perceived body shape, physical exercise practice and its duration, duration of exposure to sun, determination of some features indicating Vitamin D deficiency, status of Vitamin D deficiency, status of Vitamin D supplements, use of sun-protective creams, and use of artificial Vitamin D supplier such as tanning bed, dietary status for Vitamin D intake, exploring risk factors for depression, status of intake of antidepressants, and use of drugs or chemical that is known to induce depression.

To understand the prevalence of depression among respondents of study, internationally validated and approved depression, anxiety, and stress scale were used. The DASS 21 is a 21 item self-report questionnaire designed to measure the severity of a range of symptoms common to both depression and anxiety. In completing the DASS, the individual is required to indicate the presence of a symptom over the previous week. Each item is scored from 0 (did not apply to me at all over the past week) to 3 (applied to me very much or most of the time over the past week). The response to the questions is taken based on Likert response scale from 0 to 3 (0 = Never; 1 = Sometimes; 2 = Often; and 3 = Almost always). This section has 21 items after shortening the traditional scale with 42 items. Out of 21 items, 7 items are dedicated to elucidating depression among respondents. The statements are I couldn't seem to experience any positive feeling at all, I found it difficult to work up the initiative to do things, I felt that I had nothing to look forward to, I felt down-hearted and blue/depressed, I was unable to become enthusiastic about anything, I felt I wasn't worth much as a person, and I felt that life was meaningless.

Statistical analysis

The collected data were entered and analyzed using Statistical Package for the Social Science, version 23 (IBM SPSS Inc., Chicago, IL, USA). Data were presented using frequencies and percentage as appropriate. The students' responses on Vitamin D status were compared with academic performance. Further, Vitamin D profile was compared with the DASS score to analyze the implication of Vitamin D deficiency on the induction of depression. The comparison of two variables was done with student t-test, and further comparison of more than two variables was carried out using analysis of variance (ANOVA) and post ANOVA test LSD for multiple comparisons. For all purposes, the criteria of significance were considered at $P = 0.05$.

RESULTS

Demographic characteristics

As evident from Table 1, most of the surveyors (58.9%) of the study were in an age group of 20–22 years, whereas, only 31.9% and 9.2% were from the age group 23–24 years and 25–26 years, respectively. Majority of the students volunteered to give their feedback in this questionnaire study were females (75%) when compared to male (25%). Furthermore, half of the surveyors were from the pharmacy department about (52.6%), and the rest were from the medical department (33.4%) and 14% from the applied science department. A few of surveys were taken from the younger levels 1st to 4th (15.1%), from 5th to 7th levels (38.5%), and from 8th levels or more (46.7%). Most of them have moderate GPA from 1.51 to 3 (60.1%), 0 to 1.5 (6.0%), and 3.1 to 4 (33.9%). Furthermore, most of the surveyors were from Saudi (71.3%), whereas, only 28.7% were non-Saudis.

Table 1: Demographic characteristics

Characteristics	Frequency (%)
Age (years)	
20–22	159 (58.9)
23–24	86 (31.9)
25–26	25 (9.2)
Gender	
Male	72 (25.0)
Female	216 (75.0)
College	
College of medicine	96 (33.4)
College of pharmacy	151 (52.6)
College of applied science	40 (14.0)
Study level	
1–4	41 (15.1)
5–7	104 (38.2)
More than or equal 8	127 (46.7)
GPA	
0–1.5	13 (6.0)
1.51–3	131 (60.1)
3.1–4	74 (33.9)
Nationality	
Saudi	189 (71.3)
Non-Saudi	76 (28.7)

General characteristics of the participants

A very high percentage (68.2%) of participants admit significant variation in their body weight in the previous 3 months with the percentage of (31.8%) perceived to carry a normal body shape. The proportions of students who perceived themselves as lean, normal, and obese were (15.2%), (62.4%), and (22.4%), respectively. Regarding physical exercise, a very similar percentage obtained between participants who are practicing physical exercise (50.9%) and who do not (49.1%). Among the 50.9% who are practicing physical exercise, 42.1%, 44.4%, and 13.5% of them were practicing 1–2 days per week, 3–4 days per week, and >4 days per week, respectively.

And also, they describe the pattern of their physical activity as intense at least 20 min (29.8%), moderate at least 20 min (38.6%), or walking at least 30 min (31.6%). Most of the participant spend about 1–2 h per day or less outside in the daylight time (68.2%), 2–4 h per day (14.9%), and 6 or more hours per day (16.9%) in the sunlight as a Vitamin D source. About 29.4% of participants admit having Vitamin D deficiency, while 70.6% were either do not have or do not know if they have any deficiency in Vitamin D. A very low percentage of participants were taking Vitamin D supplements or multivitamins that include Vitamin D 29.8% compared to 70.2% who denies taking any Vitamin D supplements. Most of the students participated in the study decline the use of sun protective cream in the past 12 months (62%) or use of tanning bed as a source of Vitamin D (82.7%). About 96.2% of the participants deny taking any antidepressant medication, while only 3.8% were taking antidepressants.

Table 1 shows statistical data about the demographic characteristics of participants of the study. The data are expressed in frequency distribution and percentage.

Table 2 summarizes the details about general aspects that may have an impact on altering Vitamin D status.

Association between Vitamin D status and academic performance

As evident from Table 3, there was no significant correlation existed between Vitamin D deficiency and the students' academic performance. Students who are known to have Vitamin D deficiency or who take Vitamin D supplements do not show significant change in the GPA when compare to those who do not have any known deficiency of Vitamin D. Most of the students participated in the study deny the use of sun protective cream or use of tanning bed as a source of Vitamin D.

As shown in Table 4, a higher percentage of participants from female side admit having Vitamin D deficiency when compared to male participants. Although the number of female surveyors applies sun protective creams are not significant when compared to the number of their comrade who does not apply on the female side, they still are at a higher level when compared to their male counterparts. The overall impact of Vitamin D deficiency on the academic performance is not significant both in the female and male sections. Our assumption in the male section is not with the similar emphasis as we have in the female section, due to their lower number of participation.

Symptomatic determination of Vitamin D deficiency

Table 5 demonstrates the possible symptoms that might be elicited in Vitamin D deficient individuals. The above features may be seen due to multiple factors in addition to Vitamin D deficiency, however, in certain cases, development of these features may result in the accidental discovery of Vitamin D deficiency.

Muscle weakness and frequent tiredness were seen in large percentage of participants (table 4) of this study with Vitamin D deficiency, unless and until other etiological factors are explored, we hypothesized that the Vitamin D deficiency is one of the contributory factors for above mentioned features.

Dietary status of participants

Table 6 shows about the diets rich in Vitamin D taken by the participants of the study. Diet rich in dairy products, cheese were found as dominant selection which was followed by fatty fish and egg yolk. People with regular intake of Vitamin D rich food may not develop Vitamin D deficiency and its complications.

It could be one of the possible reasons for having less percentage of Vitamin D deficient individuals in the given population.

Determination of etiological factors for depression

Table 7 depicts the possible risk factors, triggering factors, precipitating factors, or etiological agents for induction of depression. It is known to see a high prevalence of depression in individuals with positive family history. Around 18% ruled out the depression in their family.

Regardless of their medical problems (e.g., Vitamin D deficiency) students who are being academically stressed are more likely to develop depression by recording 21%. This factor might be the most common cause of depression in some students due to the excessive academic demand and the negative impact of this factor on the participant's socioeconomic status.

Some health problems such as chronic injuries and drugs abuse were considered as minor causes for depression by recording the lowest percentages (3% and 4.8%, respectively). This might be because that the subsequences of some health problems such as chronic injuries or drugs abuse could not be considered as deadly conditions by some people, and thus, they are less likely to cause depression.

As expected, there might be a clear relationship between thyroid gland disorder and depression. 14% of students who were suffering from depression had a problem with their thyroid gland.

Despite the slight difference, the percentages of the depressed participants who were suffering from heart diseases, the recent

Table 2: General characteristics of the subjects

Characteristics	Frequency (%)
Did you gain or lose body weight recently during the past 3 months	
Weight loss	121 (41.9)
Maintaining	92 (31.8)
Weight gain	76 (26.3)
Your perceived body shape	
Lean	44 (15.2)
Normal	181 (62.4)
Obese	65 (22.4)
Do you practice physical exercise	
Yes	142 (49.1)
No	147 (50.9)
How many times you do physical exercise per week	
1–2 days per week	72 (42.1)
3–4 days per week	76 (44.4)
More than 4 days per week	23 (13.5)
What is your duration of physical exercise per week	
Intense physical activity at least 20 min	51 (29.8)
Moderate physical activity at least 30 min	66 (38.6)
Walking at least 30 min	54 (31.6)
Including exercise, how many hours and minutes of time do you spend outside during daylight hours	
<1 h/day	95 (39.3)
1–2 h/day	70 (28.9)
2–4 h/day	36 (14.9)
4–6 h/day	19 (7.9)
More than 6 h	22 (9)
Do you have Vitamin D deficiency	
Yes	85 (29.4)
No	97 (33.6)
I don't know	107 (37)
Do you take Vitamin D supplement or multivitamin that includes Vitamin D	
Yes	86 (29.8)
No	203 (70.2)
Have you use sunscreen/sun protective cream in the past 12 months	
Yes	109 (38.0)
No	178 (62.0)
Did you ever tried with tanning bed/tanning booth	
Yes	49 (17.3)
No	235 (82.7)
Do you currently take an antidepressant medication	
Yes	11 (3.8)
No	227 (96.2)

death of close relatives or social isolation were significantly close to each other (11%, 11%, and 9.2%, respectively) the reason of why these factors have similar results is unclear.

Compared to excessive academic demands, losing or starting a job (5.8%), the dispute in the family (5.1%), and cancer (5.8%) might be considered as minor factors for depression.

Table 3: Association between Vitamin D status and academic performance based on the students' current GPA (grade point average)

Questions	Vitamin D status	GPA			*P* value
		Low (%)	Moderate (%)	High (%)	
Do you have Vitamin D deficiency	Yes	3.6	73.2	23.2	0.114
	No	6	61.4	32.5	
	I don't know	7.7	50	42.3	
Do you take Vitamin D supplement or multivitamin that includes Vitamin D	Yes	4.8	51.6	43.5	0.117
	No	6.5	63.2	30.3	
Have you use sunscreen/sun protective cream in the past 12 months	Yes	6.25	52.5	41.25	0.232
	No	5.9	65.2	28.9	
Did you ever tried with tanning bed/tanning booth	Yes	8.8	58.8	32.4	0.769
	No	5.6	60.3	34.1	

Table 4: Gender-based comparison: Relationship between Vitamin D deficiency and academic performance

Gender	Vitamin D status	GPA			*P* value
		Low (%)	Moderate (%)	High (%)	
Male	Do you have Vitamin D deficiency				
	Yes	0	100	0	0.231
	No	9.4	71.9	18.7	
	I don't Know	5.9	47	47	
	Do you take Vitamin D supplement or multivitamin that includes Vitamin D				
	Yes	0	33.3	66.7	0.284
	No	8.3	66.7	25	
	Have you use sunscreen/sun protective cream in the past 12 months				
	Yes	0	33.3	66.7	0.248
	No	8.5	68	23.4	
	Did you ever tried with tanning bed/tanning booth				
	Yes	25	37.5	37.5	0.082
	No	4.6	69.8	25.6	
Female	Do you have Vitamin D deficiency				
	Yes	3.7	72.2	24	0.157
	No	4.1	55.1	40.8	
	I don't know	8.2	50.8	41	
	Do you take Vitamin D supplement or multivitamin that includes Vitamin D				
	Yes	5.1	52.5	42.4	0.440
	No	5.7	62	32.3	
	Have you use sunscreen/sun protective cream in the past 12 months				
	Yes	6.5	53.2	40.3	0.380
	No	4.7	64	31.4	
	Did you ever tried with tanning bed/tanning booth				
	Yes	14.3	42.85	42.85	0.736
	No	4.6	69.8	25.6	

Table 5: Experience profile of Vitamin D deficiency in the past 12 months

Experience	Frequency (%)	
	Yes	No
Experience bone fracture	8 (2.7)	275 (94.2)
Experience muscle weakness	82 (28.1)	205 (70.2)
Experience bone deformity	12 (4.1)	275 (94.2)
Experience frequent tiredness	74 (25.3)	213 (72.9)
Experience recall events difficulty	30 (10.3)	257 (88.0)
Experience breathlessness	46 (15.8)	241 (82.5)
Experience chest pain	32 (11.0)	255 (87.3)
Experience inflammatory bowel diseases	23 (7.9)	264 (90.4)

Table 6: Diet status

Experience	Frequency (%)	
	Yes	No
Fatty fish	103 (35.3)	187 (64.0)
Dairy products	113 (38.7)	177 (60.6)
Soy milk	36 (12.3)	254 (87.0)
Cereals	33 (11.3)	257 (88.0)
Beef liver	28 (9.6)	262 (89.7)
Cheese	113 (38.7)	177 (60.6)
Egg yolks	98 (33.6)	192 (65.8)

Although the deadly subsequences of cancer disease on people health, these factors have very close results.

Drug use profile for causing Vitamin D deficiency

Table 8 explains the profile of respondents who were exposed to drugs or agents that may induce Vitamin D deficiency. Significantly low percentage of respondents agrees that they take any of the listed agents regularly.

The highest percentage was seen for isotretinoin; it might be indicated for acne treatment as most of the participants are in an age group that normally is seen with a higher prevalence of acne. The second highest percentage of drug that might lead to Vitamin D deficiency, used among participants of this study was statins, a drug that lowers cholesterol, prescribed commonly in Saudi Arabia due to high intake of fat. The lowest percentage was seen for barbiturates this drug use for both psychologically and

Table 7: Determination of possible etiological factors for depression

Condition	Frequency (%)	
	Yes	No
Family member with depression	53 (18.2)	236 (80.8)
Recent death of close relative	32 (11.0)	258 (88.4)
Drug abuse	14 (4.8)	276 (94.5)
Cancer	17 (5.8)	272 (93.2)
Heart disease	32 (11.0)	258 (88.4)
Thyroid disease	42 (14.4)	248 (84.9)
Chronic injury	9 (3.1)	281 (96.2)
Dispute in the family	15 (5.1)	275 (94.2)
Social isolation	27 (9.2)	263 (90.1)
Losing job or taking new job	17 (5.8)	273 (93.5)
Excessive academic demand	60 (20.5)	230 (78.8)

Table 8: Drug use profile for causing Vitamin D deficiency

Drugs	Frequency (%)	
	Yes	No
Isotretinoin	26 (8.9)	264 (90.4)
Alcohol	6 (2.1)	284 (97.3)
Anticonvulsant	1 (0.3)	289 (99)
Barbiturates	0 (0)	290 (99.3)
Benzodiazepine	9 (3.1)	281 (96.2)
Beta blockers	9 (3.1)	281 (96.3)
Calcium channel blocker	5 (1.7)	284 (97.3)
Interferon Alfa	1 (0.3)	288 (98.6)
Nuvaring	5 (1.7)	285 (97.6)
Opioids	9 (3.1)	281 (96.2)
Statin	11 (3.8)	279 (95.5)
Varenicline	6 (2.1)	284 (97.3)
Acyclovir	1 (0.3)	289 (99)

physically addictive really need this drug in this age. Few percentage was used alcohol because it's not available in Saudi Arabia, varenicline helps you stop smoking, both varenicline and alcohols were taken 2.1% acyclovir was used to treat infections caused by certain types of viruses, Interferon Alfa. This medication was used to treat various cancers (e.g., leukemia, melanoma, and AIDS-related Kaposi's sarcoma). It is also used to treat virus infections (e.g., chronic hepatitis B, chronic hepatitis C, and condylomata acuminate) and anticonvulsant. These drugs

are used to control seizures, epilepsy, and anxiety and work specifically on the central nervous system, only 0.3% of the participants have reported its use. The other drugs that were listed in our questionnaire were beta blockers, used in hypertension and heart failure, and benzodiazepine, anxiolytics, only 3.1% of the participants reported the use of each of this drug, while the use of calcium channel blockers were reported by only 1.7% of the surveyors.

Analysis of depression using DASS-21

Table 9 discusses the profile of depression in participants with Vitamin D deficiency. The DASS-21 was used as a scoring system for elucidating the presence of depression.

0 Did not apply to me at all - NEVER, 1 Applied to me to some degree, or some of the time - SOMETIMES, 2 Applied to me to a considerable degree, or a good part of time - OFTEN,3 Applied to me very much, or most of the time - ALMOST ALWAYS

The DASS 21 is a 21 item self-report questionnaire designed to measure the severity of a range of symptoms common to both depression and anxiety. In completing the DASS, the individual is required to indicate the presence of a symptom over the previous week. Each item is scored from 0 (did not apply to me at all over the past week) to 3 (applied to me very much or most of the time over the past week).

The essential function of the DASS is to assess the severity of the core symptoms of depression, anxiety, and stress. Accordingly, the DASS allows not only a way to measure the severity of a patient's symptoms but also a means by which a patient's response to treatment can also be measured.

The scale 2 of Table 9 shows a significant impact of Vitamin D deficiency on 'difficult to work up the initiative to do things' with an average score >1. This implies that they sometimes experience difficulty in designing some work. Vitamin D deficiency might be contributory for this symptom of depression.

Another significant impact of Vitamin D deficiency appears at the scale 4 of the DASS that state how the person feels unhappy and having no hope or downhearted and depressed with an average score >1. Vitamin D deficiency may aid this feeling.

This table also shows at the scale 6 how the Vitamin D deficiency implication is on the feeling of worthless or valueless as a person with an average score >1. Vitamin D deficiency might participate to increase this feeling.

Table 9: Analysis of depression using DASS-21

Questions	Vitamin D status	DASS score					*P* value
		0	1	2	3	Average	
I couldn't seem to experience any positive feeling at all	Yes	38	27	11	9	0.894	0.431
	No	50	21	17	9	0.845	
	I don't know	55	35	10	9	0.752	
I found it difficult to work up the initiative to do things	Yes	18	28	32	7	1.329	0.022
	No	34	38	17	8	0.989	
	I don't know	38	42	19	10	1.009	
I felt that I had nothing to look forward to	Yes	45	19	17	4	0.764	0.695
	No	55	24	12	6	0.680	
	I don't know	65	27	12	5	0.605	
I felt down-hearted and blue/depressed	Yes	14	20	34	16	1.6	0.007
	No	27	39	18	11	1.113	
	I don't know	26	39	25	11	1.119	
I was unable to become enthusiastic about anything	Yes	32	25	20	8	1.047	0.324
	No	38	35	13	11	0.969	
	I don't know	53	33	15	8	0.798	
I felt I wasn't worth much as a person	Yes	52	18	11	4	0.611	0.038
	No	55	22	14	6	0.701	
	I don't know	83	9	9	8	0.467	
I felt that life was meaningless	Yes	59	9	9	8	0.6	0.219
	No	55	21	15	6	0.711	
	I don't know	69	19	9	12	0.669	

Since all the previous 3 scales with $P<0.05$, the hypothesis of the relationship is more accepted than the null hypothesis which denies the relationship.

The rest 4 scales 1, 3, 5, and 7 that explore or measure the tendency of a person to feel positive, looking forward to, become enthusiastic or interested in anything and that if the person sees, the life was meaningless.

DISCUSSION

The current study was carried out to elucidate the prevalence of Vitamin D deficiency among students of Al-Maarefa colleges and compare its implication on academic performance and induction of depression in them. The depressive profile was determined using DASS scale, and Vitamin D status was explored by the verbal admission of participants in addition to features of Vitamin D deficiency and use of Vitamin D supplementation. The study outcome shows a high prevalence of Vitamin D deficiency among students of Al-Maarefa Colleges regardless of their affiliation to which department; however, no significant relationship was found between Vitamin D deficiency and academic performance. Further, significant evidence was obtained for depression in students who possess Vitamin D deficiency.

Most of the surveyors of the study were in an age group of 20–22 years, and from the female side due to the lower number of participants from the male side. An equal distribution of response from different colleges was hard to maintain, thus about half of the respondents were pharmacy students. GPA categories were divided into low, moderate, and high GPA. The highest percentage of students has a moderate.

The prevalence of Vitamin D deficiency in the present study (29.4%) is lower than that mentioned in the literature, where 70.7% of the sample reported to have their Vitamin D level below 20 ng\ml,[11] even though their sample was health-care students as in our study. Moreover, most of the participants in our study deny any Vitamin D supplement intake. This difference in the level of Vitamin D might be attributed to the good lifestyle habits of the participants, where most of the respondents had a normal body shape, practice physical exercise about 3–4 days per week.

There was no significant correlation existed between Vitamin D deficiency and their academic performance in both male and female sections. These findings is similar to a study reported in the literature which negates the relationship between low Vitamin D level and academic performance,[27] another study stated that more than 90% of students who do not consume enough amount of Vitamin D are more likely to have a slightly less academic performance than those who consume a large amount of Vitamin D and other dietary sources.[26]

Bone fracture was the least symptom that could be noticed in the participants. This significant difference in the results between these symptoms could be due to the participant's ages was between 20 and 26, bone fractures could not be easily noticed in young people compared to the elderly. Feskanich *et al.* claim that bone fractures could be more commonly seen in elderly women (postmenopausal women) who have vitamin or calcium deficiency than in young women due to the hormonal changes that might affect bone density.[28]

Dairy products and cheese were the most diets that were consumed by the participants followed by fatty fish and egg yolk. These diets are very rich in Vitamin D, people who consume them regularly might not develop Vitamin D deficiency, and it might be one of the possible reasons for having less percentage of Vitamin D deficient individuals as shown earlier by a systemic review study was conducted by Bolland.[29]

Students who are being academically stressed are more likely to develop depression. This factor might be the most common cause of depression.[30]

Some health problems such as chronic injuries and drugs abuse were considered as minor causes for depression. This might be because that the consequences of some health problems such as chronic injuries or drugs abuse could not be considered as deadly conditions by some people. National Institute of Drugs Abuse (2008) states that around 60% of people in the US abuse their drugs including alcohol, stimulants, or other drugs.[31]

As expected, there might be a clear relationship between thyroid gland disorder and depression. 14% of students who were suffering from depression had a problem in their thyroid gland. Hage and Azar (2012) claimed that there might be a clear correlation between hormones disorder such as thyroid hormone and depression.[32]

In our study, three parameters out of seven revealed there is a relationship between Vitamin D and depression whereas other four are compatible with null which states there is no relation. According to that, the present study revealed there is a significant relationship between Vitamin D and the depression based on certain depression parameters of the DASS scale.

CONCLUSION

The prevalence of Vitamin D deficiency was low. There was no significant correlation existed between Vitamin D deficiency and the student's academic performance. However, there was a significant relationship between Vitamin D deficiency and depression among Al-Maarefa students.

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