

Role of vitamin D in the academic performance of health sciences students in Saudi Arabia

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Abstract

Purpose – Many researchers have reported that vitamin D can affect brain development as well as brain function. The prevalence of vitamin D deficiency in the Saudi population is 81% and it is more among women than among men. Though many studies have been done to find out the factors influencing the academic performance of Health sciences students, there is not adequate evidence regarding the influence of vitamin D level on academic performance. Therefore, this study aims to find out the association if any, between the vitamin D level and academic performance of health sciences students.

Design/methodology/approach – After obtaining the ethical committee approval, the data was collected from 86 female medical students, 70 female applied medical sciences students and 57 nursing students of Northern Border University. The detailed questionnaire contained the aim of the study, demographic characteristics and academic performance predictors such as self-efficacy, academic motivation, academic engagement and social engagement. The vitamin D levels were measured by an enzyme-linked immunosorbent assay (ELISA) machine (BioTek) which is available in the local hospital. The multiple linear regression analysis was used to find out the association between vitamin D levels and academic performance.

Findings – This study showed that vitamin D level had a significant association with the overall performance of the students as well as their self-efficacy.

Research limitations/implications – Since there is a lot of stress among health sciences students due to subject overload and inadequacy of time, the health aspects are often overlooked. This study emphasizes the importance of early screening of vitamin D levels and early intervention in those with low vitamin D levels for better academic performance.

Social implications – There is very little awareness of the impact of vitamin D deficiency on academic motivation, academic engagement, social engagement and self-efficacy among medical and health sciences students. This study can increase awareness.

Originality/value – There are very few studies done to find out the association between Vitamin D level and academic performance. This study is unique as it has highlighted the association between vitamin D level and grade point average (GPA) and also the association between vitamin D level and academic predictors such as self-efficacy, academic motivation, academic engagement and social engagement.

Keywords Vitamin D, Academic performance, Health sciences students

Paper type Research paper



Introduction

Improvement in academic performance is considered to be one of the main goals of education (Al Shawwa *et al.*, 2015). There are several studies done to find out the factors influencing the academic performance of university students. But there is a paucity of literature regarding the influence of vitamin D on the academic performance of university students (Burrows, Whatnall, Patterson, & Hutchesson, 2017). The role of vitamin D in improving cognitive function has been a subject of debate. Some studies have pointed out that higher vitamin D level is associated with increased cognitive function (Llewellyn, Langa, & Lang, 2009; Llewellyn *et al.*, 2010; Buell *et al.*, 2009, 2010; Annweiler *et al.*, 2010; Lee *et al.*, 2009). On the other hand, another group of researchers in their prospective study found no association between vitamin D levels and cognitive function in elderly men (Slinin *et al.*, 2010). Due to the high prevalence of vitamin D deficiency especially among female university students in Saudi Arabia (Sulaiman, Abukanna, Alenezy, & Balla, 2017; Hasanato *et al.*, 2015), it is important to find out whether vitamin D level has any influence on the academic performance of the female students. This study was, therefore, undertaken among female health sciences students to evaluate the influence of vitamin D level on academic performance.

Materials and methods

After obtaining the approval of the ethical committee, the study was done at Northern Border University. The data was collected from January 2022 to March 2022. The subjects of our study were the female students of colleges of medicine, applied medical sciences and nursing. The students with comorbidities like diabetes, hypertension and renal diseases were excluded from the study. In total, 213 students volunteered to participate in our study of which 86 students were from medicine, 70 students from applied medical sciences and 57 students were from nursing. A detailed questionnaire which had the aim of the study mentioned was used to collect the data. The first part of the questionnaire included the details such as the college in which they were studying and year of study and grade point average (GPA). The vitamin D level was measured using an enzyme-linked immunosorbent assay (ELISA) machine (BioTek) and vitamin D 25-OH ELISA Assay Kit from Calbiotech Incorporation which is available in the local hospital. The vitamin D levels were studied in three groups students with <12, 12–20 and >20 ng/ml, as earlier studies have shown that most of the female students have low levels of vitamin D in Saudi Arabia (Al-Elq, 2012).

Other than the GPA, the academic performance part of the questionnaire had four main components which are non-cognitive predictors of academic performance, namely, Self-Efficacy (SE), Academic Motivation (AM), Academic Engagement (AE) and Social Engagement (S. Eng.) (Feldman & Kubota, 2015; Olivier, Archambault, De Clercq, & Galand, 2019; Huang, 2011). Each of these components had items (questions) that they could answer in the form of a 1 to 5 Likert scale. The average response to all the questions formed a score for each component. The average of the scores of all four components was taken as the overall performance score. So, each participant had four components scores and one overall score that summarized her performance. IBM SPSS v26 software was used for statistical analysis. The demographic variables were analyzed using frequency distribution. The main variables, namely, the academic performance predictors, were summarized as mean and standard deviation (SD). Multiple linear regression analysis was used to find out the association between vitamin D level and academic performance. A *p*-value < 0.05 was considered statistically significant.

Results

The participants of this study were students from 3 colleges, namely, medicine (86), applied medical sciences (70) and nursing (57) who were in their 2nd to 5th year of study at the

university. Overall, 291 % of these students has their vitamin D level between 12 and 20 ng/ml, 23.9% had <12 ng/ml and 46.94% had >20 ng/ml. The descriptive statistics of the participants are shown in Table 1. Their median GPA was from 4 to 4.4. Their average SE score was 3.36. Average score of the response of each item under SE was similar except for the first item, namely, “can you manage your time well,” which had a lower average score (3.04). The average of AM score was 3.48. For two items, namely, “perform better” and “taking up challenges to reach goals” the average score was high (4.11 and 3.93, respectively). The average AE score was 3.04. But the item, “reading up topics before attending class” had a lower score (2.77). The average of S. Eng. score was 3.32. But the item, “how is your relationship with fellow students” had a high score (3.77) and “It’s normal thing to ask others for help” had a low average score of 3.06 (Table 2).

When the data was analyzed using multiple linear regression (Table 3), there was a significant association between vitamin D level and overall academic performance (p -value = 0.017) and also between vitamin D level and self-efficacy (p -value = 0.003). If the sample size was larger, small deviations from significance as in the case of AM and AE could have been cured. The medical students had a high overall academic performance when compared to the applied medical sciences students. When the GPA was analysed separately to find out its association with vitamin D level, in the 2nd-year and 3rd-year students, vitamin D levels had a significant association with GPA (p -values were 0.001 and 0.043, respectively) – Table 4.

Discussion

Several important roles including brain health, maintenance of bone health and prevention of fatigue and stress have been attributed to vitamin D by researchers (Holick, 2009; Anjum, Jaffery, Fayyaz, Samoo, & Anjum, 2018; Nowak *et al.*, 2016; Quraishi & CamargoCA, 2012; Kusmiyati, Suryani, Heravati, & Firdausi, 2020). Studies done in the USA and UK have revealed that unhealthy dietary habits add to the health risk of university students (El Ansari *et al.*, 2011; Lowry *et al.*, 2000). Studies done on school children to find out the effect of dietary habits on school performance showed that there is a strong association between eating a healthy breakfast (containing milk and fruits), regularity of meals and school performance. The researchers were of the opinion that the beneficial effect they found may be partially due

Table 1.
Sample characteristics
and demographics

Variable	Categories	Frequency	% (N = 213)
College	Applied medical science	70	32.9
	Medicine	86	40.4
	Nursing	57	26.8
College year	2	61	28.6
	3	34	16.0
	4	57	26.8
	5	61	28.6
GPA	<2.5	3	1.4
	2.5 +	3	1.4
	3 +	17	8.0
	3.5 +	28	13.1
	4 +	74	34.7
	4.5 +	88	41.3
Vitamin D (ng/ml) <i>(Mean = 20.3, SD = 10.8)</i>	<12	51	23.9
	12-20	62	29.1
	>20	100	46.94

				Vitamin D and academic performance
Components	Item	Mean	SD	
Self-efficacy (SE)	Can you manage your time well	3.04	1.28	43
	Can you participate well in group discussions	3.32	1.31	
	Do you have a good understanding of subjects	3.46	1.23	
	Are you confident in talking to the faculty members	3.50	1.32	
	Do you perform well in exams	3.48	1.31	
	<i>SE Score</i>	3.36	1.10	
Academic motivation (AM)	Do you have clear academic goals	3.55	1.33	
	Do you want to perform better	4.11	1.30	
	Are you willing to take up challenges to reach your goals	3.93	1.31	
	I am far from failing	2.72	1.45	
	I know when to be serious and when to have fun	3.08	1.33	
	<i>AM Score</i>	3.48	0.66	
Academic engagement (AE)	I like to do academic presentations	3.00	1.39	
	I like to do academic research projects with others	3.06	1.32	
	I like to discuss lectures with faculty members	3.14	1.34	
	I read up topics before I attend the class	2.77	1.42	
	I like to get a feedback from my faculty members	3.23	1.44	
	<i>AE Score</i>	3.04	1.17	
Social Engagement (S. Eng.)	How is your relationship with fellow students	3.77	1.37	
	Do you enjoy studying with others	3.26	1.42	
	It is a normal thing to ask others for help	3.06	1.32	
	Are you cool against criticism	3.17	1.39	
	Are you active in community services	3.22	1.35	
	Do you like to participate in any academic-related activity	3.24	1.40	
<i>Overall Performance Score</i>	Do you have a good relationship with the faculty	3.50	1.40	Table 2. Academic performance Likert scale response
	<i>S. Eng. Score</i>	3.32	0.74	
		3.30	0.74	

to the skipping of fast food or any unhealthy food which they would otherwise consume during the day (Kim *et al.*, 2016; Mahoney, Taylor, Kanarek, & Samuel, 2005; Widenhorn-Muller, Hille, Klenk, & Weiland, 2008). A systematic review to examine the beneficial effect of breakfast on the academic performance of children and adolescents concluded that most of the studies were targeted at the memory and attention of students rather than cognitive tasks like problem-solving skills (Hoyland, Dye, & Lawton, 2009). Although these studies examine the role of a healthy diet in the performance of school students and university students, there are relatively few studies specifically examining the role of vitamin D level on academic performance.

The tendency of university students is to consume fast food during break hours as they do not have adequate time to enjoy regular meals and most of them are found to have vitamin D deficiency. In a study done in UAE, the researcher highlighted the fact that 44% of female college students from different Arab countries had vitamin D deficiency (Nimri, 2018). Some researchers who studied the vitamin D levels of young women between 25 and 30 years of age in Saudi Arabia, reported that vitamin D level of <20 ng/ml was found in 30% of women (Al-Turki, Sadat-Ali, Al-Elq, Al-Mulhim, & Al-Ali, 2008). Another study done among college students in Saudi Arabia found that 67.8% of female college students had vitamin D level <20 ng/ml (Alzaheb & Al-Amer, 2017). In our study, we found that 23.9% of female health sciences students had <12 ng/ml, whereas 53% of them had <20 ng/ml.

To find out the association between vitamin D level and academic performance, we used academic performance predictors such as self-efficacy, academic motivation, academic engagement and social engagement along with GPA (Brown, Lent, & Larkin, 1989; Dogan,

Academic component	Effect <i>p</i> -value	Parameter	Parameter <i>p</i> -value
Self-efficacy	0.003	MED	0.037
		AMS + NUR	0.799
		Year 2	0.652
		Year 3	0.191
		Year 4	0.185
Academic motivation	0.091	Year 5	0.692
		MED	0.142
		AMS + NUR	0.873
		Year 2	0.056
		Year 3	0.028
Academic engagement	0.086	Year 4	0.563
		Year 5	0.389
		MED	0.011
		AMS + NUR	0.967
		Year 2	0.923
Social engagement	0.397	Year 3	0.475
		Year 4	0.520
		Year 5	0.743
		MED	0.012
		AMS + NUR	0.478
Overall performance	0.017	Year 2	0.406
		Year 3	0.640
		Year 4	0.388
		Year 5	0.396
		MED	0.007
		AMS + NUR	0.790
		Year 2	0.685
		Year 3	0.297
		Year 4	0.531
		Year 5	0.975

Table 3.
Vitamin D versus
academic components

Note(s): (MED-Medicine, AMS-Applied Medical Sciences, NUR- Nursing)

Effect	Effect <i>p</i> -value	Parameters	Parameter <i>p</i> -value (robust)
College	0.393	AMS &NUR: 0.140	0.217
		MED: 0.087	0.333
College year	0.000	Year 2: 0.582	0.001
		Year 3: 0.376	0.043
		Year 4: 0.292	0.118
		Year 5: 0.207	0.289
		0.005	0.134
Vitamin D level	0.145		

Table 4.
Vitamin D versus GPA

2015; Mai, Yusuf, & Saleh, 2015). Self-efficacy is defined as a personal belief in one's own ability to manage things in life (Walker & Greene, 2009). Self-efficacy helps in facing challenges, forming strategies to overcome challenges and also solving problems (Bandura, 1994). Researchers have found a positive correlation between self-efficacy and academic performance (Yazici, Seyis, & Altun, 2011). In our study, we found a significant association between vitamin D level and self-efficacy. Researchers have put forward the theory that self-efficacy is a direct predictor of academic achievement (Schunk & Mullen, 2012). The significant association between vitamin D level and self-efficacy observed in our study

stresses the importance of maintaining adequate levels of vitamin D for academic achievement.

Academic motivation and Academic engagement had some relationship with vitamin D level but there was no statistically significant association (p -value > 0.05). There are no studies found in the available literature to compare our results. However, a study done to find out the impact of vitamin D deficiency on depression among university students revealed that there is a significant relationship between low vitamin D level and prevalence of depression among university students (Tashtoush *et al.*, 2018). Social engagement had no association with vitamin D level. The overall score of the predictors had a significant association with vitamin D level. This further strengthens the evidence that vitamin D level can influence academic performance.

The GPA had a significant association with vitamin D level only in 2nd- and 3rd-year students. As the students experience maximum stress during the initial years of study in medicine as well as allied health sciences, low vitamin D level can aggravate the stress affecting their academic performance adversely.

Conclusion

Our study highlights the importance of early screening of vitamin D level and early intervention for those with low vitamin D level along with adequate diet advice, to improve the academic performance of medical and health science students. Further studies with a larger number of students are needed to establish the role of vitamin D in academic performance.

Limitations of the study

The sample size was small as the students had to get the vitamin D test done and many students were reluctant to do it due to the fear of contracting COVID-19 infection when they visit the hospital laboratory.

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