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Original Research

The effect of vitamin d levels on the mood disorders of the operating room and intensive care unit staff

Vitamin D and anxiety and depression

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Abstract

Aim: Operating rooms and intensive care units are stressful working environments, therefore mood disorders suchas anxiety and depression ratio are frequent in workers. Additionally increased frequency of vitamin D insufficiency in health workers is demonstrated in other studies. We examined if there is a relationship between vitamin D levels and levels of anxiety -depression in our volunteers working in our operating rooms and intensive care units. Material and Method: The study is carried out over 96 volunteers working in our hospital's operating room and intensive care units. Attendants were asked to answer the Hospital Anxiety and Depression Scale (HADS) questionnaire which was validated in Turkey for assessment of anxiety and depression status of participants and containing demographic data. Although vitamin D levels were studied. Results: The average vitamin D levels of attendants was 19.43 ± 7.95. Mean vitamin D levels of intensive care unit workers (16.98 ± 1.04) were significantly lower than of operating room workers (20.90 ± 1.10). The average of HADS-A of workers was 7.43 ± 3.31 and HADS-D average was 5.58 ± 3.32. Improvement in HADS-D scores with aging (senescence) and significantly positive relationship in between HADS-A and HADS-D was found in our study. Also, as vitamin D levels decreasing, increasing in HADS-A and HADS -D scores were deserved and negative relationship between 2,5 % - 5.4 % is identified. Discussion: Our study shows that vitamin D deficiency negatively affects anxiety and depression levels in the personnel working at a closed environment like operating rooms and intensive care units.

Keywords

Vitamin D; Hospital Anxiety and Depression Scale; Operation Room; Intensive Care Unit

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Introduction

The operating rooms (OR) and the intensive care units (ICU) are stressful workplaces which staff frequently present with anxiety and mood disorders such as depression [1-3]. Several factors constitute the stressors including sleep irregularities, indoor workplaces, shift work, taking care of ICU patients with poor general conditions, and the risk of acquiring infectious diseases.

Vitamin D insufficiency is frequent currently with many underlying factors in its etiology. The studies in the literature have demonstrated that the risk of having vitamin D insufficiency is frequent in hospital staff especially in those working indoors [4,5]. While vitamin D is known to have a central role in the musculoskeletal system, it may also be associated with several psychiatric disorders such as schizophrenia, depression, anxiety, and somatoform disorders as well [6-8].

By conducting this study, we aimed to investigate the impact of vitamin D levels on the anxiety and depression severity of the OR and ICU staff. It is assumed that the results may contribute to the investigation, detection, and minimalization of the stressors for the staff working at these units, allowing the creation of a healthier workplace.

Material and Method

Study participants

After obtaining the approval of the local ethics committee (2017/105), our study was conducted at the Ministry of Health-University Training and Research Hospital in November 2017 on the volunteering healthcare personnel working in OR and ICU (pregnant women were excluded from the study).

Data management

After collecting the consent forms of the individuals participating in the study, they were asked to fill in the following study forms including the data collection form and the Hospital Anxiety and Depression Scale (HADS) [9,10]. The data collection form contained study participant information including age, gender, marital status, profession, the place of work, and duration of the working hours at the OR/ICU. HADS is a validated and reliable scoring tool to be used in Turkish.

Hospital Anxiety and Depression Scale (HADS)

HADS was developed by Zigmond and Snaith in 1983. The Turkish validity and reliability studies have been performed by Aydemir et al. in 1987 in Turkey. The scale is used to evaluate the risk, score, and the changes in the severity of anxiety and depression in a given patient [10]. The scale consists of a total of 14 questions. While the 7 odd-numbered items measure the level of anxiety, the remaining seven even-numbered items measure the level of depression. The scale provides a four-point Likert-type scoring. The items 1, 3, 5, 6, 8, 10, 11 and 13 indicate the levels of severity in the decreasing order and they are scored as 3, 2, 1, 0. On the other hand, the items 2, 4, 7, 9, 12, and 14 are scored as 0, 1, 2, 3. The total scores of the subscales are obtained by summing up of these items. While the scores attributed to the items 1, 3, 5, 7, 9, 11, and 13 are summed up, yielding the total anxiety subscale score; the scores of the items 2, 4, 6, 8, 10, 12, and 14 are summed up to obtain the total depression subscale score. The study evaluating the Turkish validity and reliability of the HADS has determined the cut-off points of the scale as 10/11 and 7/8 for the anxiety and depression subscales, respectively. The individuals with scores above these cut-off points are evaluated to be at risk.

Measurement of Vitamin D (Vit D) levels

After a period of overnight fasting, venous blood samples were collected from the study participants. The Vit D levels in these samples were investigated by the investigators at an external site with the electrochemiluminescence method using a Roche Diagnostic e601 device. The lower limit of the measurement was 3 ng/ml within the range of 3 – 70 ng/ml.

Statistical Analysis

First, the Levene's test was used to test whether the data (age, HADS-A, HADS-D, and the levels of Vit D) conform to the assumption of the homogeneity of variance. Then, the Shapiro-Wilk test was used to test if the data meet the normality assumption ($p > 0.05$)).The differences between the measured values of the demographic data of the study participants were determined by Student t-test (gender, marital status, and the healthcare unit they work at) or one-way analysis of variance and Tukey multiple comparison tests (education status, duration of work, and profession). The correlations between the age, Vitamin D levels, HADS-A, and HADS-D scores were determined by the Pearson correlation coefficient. The data were expressed as n, mean, and SD. $P < 0.05$ was considered to be significant. All statistical analyses were performed with the SPSS v22.0 statistical software.

Results

A total of 96 healthcare staff working at the ORs and ICUs of our hospital participated in the study. Of the study participants, 76 (79.2%) were females and 20 (20.8%) were males. The mean age of study participants was 38.12 ± 8.52. Of all participants, the mean age of females was 38.38 ± 9.19 and the mean age of males was 37.15 ± 5.26. Table 1 presents the sociodemographic data of healthcare personnel participating in the study. The comparison of the Vitamin D levels of the study participants according to the gender, marital status, profession, educational status, the healthcare unit they work at and the duration of the working hours at the OR/ICU are shown in Table 2. The mean level of Vitamin D of the study participants was 19.43 ± 7.95. The mean levels of Vitamin D of the healthcare personnel working at the ICUs (16.98 ± 1.04) were significantly lower than those of the study participants working at the ORs (20.90 ± 1.10) ($p = 0.019$).

The comparison of the data of the healthcare personnel according to the levels of Vitamin D, whether the levels are within normal limits or lower, is presented in Table 3. The frequency of lower levels of Vitamin D was significantly higher in females (63.2%) compared to the males (30.0%) (p:0,008). As regards to the comparison of data according to the education levels, the lower levels of Vitamin D were significantly less frequent in the primary school graduates ($p=0.033$).

The mean values of the HADS-A and HADSD scores of the study participants are presented in Table 4. The mean HADS-A

Table 1. The sociodemographic data of healthcare personnel participating in the study.

		n (number)	% (percent)
Gender	Female	76	% 79,2
	Male	20	% 20,8
Marital status	Single	17	% 17,7
	Married	79	% 82,3
Educational status	Primary education	3	% 3,1
	High school	17	% 17,7
	University	76	% 79,2
Profession	Medical officials	13	% 13,5
	Anesthesia technician	19	% 19,8
	Nurse	56	% 58,3
	Doctor	8	% 8,3
The place of work	Operating room	60	% 62,5
	Intensive care unit	36	% 37,5
Duration of the working hours at the OR/ICU	1-5 year	24	% 25,0
	6-10 year	31	% 32,3
	11-15 year	19	% 19,8
	Over 15 years	22	% 22,9

OR: Operating room
ICU: Intensive care unit

Table 2. The comparison of the Vitamin D levels of the study participants according to demographic characteristics

		n (number)	Mean Vit D values (± SD)	P values*
Gender	Female	76	18,91± 8,57	P= 0,212
	Male	20	21,42 ±4,58	
Marital status	Single	17	22,56 ± 9,08	P=0,074
	Married	79	18,76 ± 7,58	
Educational status	Primary education	3	21,76 ± 1,38	P=0,191
	High school	17	16,31 ± 4,51	
	University	76	20,04 ± 8,54	
Profession	Medical officials	13	18,07 ± 4,51	P=0,138
	Anesthesia technician	19	21,91 ± 7,10	
	Nurse	56	18,31 ± 8,02	
	Doctor	8	23,57 ± 11,77	
The place of work	Operating room	60	20,90 ± 8,53	P= 0,019*
	Intensive care unit	36	16,98 ± 6,25	
Duration of the working hours at the OR/ICU	1-5 year	24	16,67 ± 5,73	P= 0,256
	6-10 year	31	20,83 ± 7,53	
	11-15 year	19	19,88 ± 12,16	
	Over 15 years	22	20,08 ± 5,49	

*p<0,05: statistically significant
OR: Operating room, ICU: Intensive care unit

and HADS-D scores of the study participants were 7.43 ± 3.31 and 5.58 ± 3.32, respectively. The mean HADS-A scores (7.81 ± 0.37) were higher in females than males (6.00 ± 0.69) (p= 0.028). The mean scores of HADS-A were significantly lower in the primary school graduates, compared to those who were the graduates of high school and College (p=0.034 and p=0.008). When the HADS-A scores were compared according to the profession, the frequency of high scores was more common in the nurses (p=0.011, Table 5).

In the married study participants, the mean levels of Vit D were lower and the scores of HADS were higher compared to the single study participants. Although this difference was not statistically significant, it was considered to be significant clinically (p=0.074 and p=0.054).

In our study, it was observed that as the HADS-D scores increased with age(p=0.042). The correlation between the HADS-A and HADS-D scores were positive significantly (p < 0.001). In addition, as the levels of Vitamin D decreased, HADS-A and HADS-D scores increased with a negative correlation in a range between 2.5% - 5.4% (r=-0.025, Table 6).

Discussion

Vitamin D deficiency and insufficiency is common in our country as well as in the world [11,12]. Several factors such as age, gender, body mass index, comorbid diseases, medications, diet, the duration of exposure to sunlight, occupation, dressing style, and working indoors affect this condition [13]. Although exogenous intake of Vit D is possible with food, the main source of Vit D in the body is cholecalciferol which is produced by the exposure of 7-dehydrocholesterol in the skin to the sunlight. Vit D insufficiency is known to cause mostly musculoskeletal system diseases, however, it has been found out that it is associated with several diseases such as Type 1 diabetes mellitus, atherosclerosis, autoimmune diseases, allergies, depression, some cancers, and schizophrenia as well [6, 7, 13, 14]. 25(OH)D3 levels are usually measured to assess the Vitamin D condition of the body. Although the limits of 25(OH)D3 levels have not been clarified yet in assessing Vitamin D deficiency and insufficiency, the guidelines published by the American Institute of Medicine (IOM) and The European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO) suggest that the levels of 25(OH)D3 below 20 ng/ml are evaluated in favor of Vitamin D deficiency [14,15]. Studies in the literature have demonstrated that the risk of developing Vit D insufficiency is higher in the hospital staff, especially in the staff working at ORs and ICUs, due to several causal factors such as shift work, heavy workload, and working indoors [5,16]. In the light of this information, we investigated whether any correlations exist between the vitamin D levels and the levels of anxiety and depression of the staff working at ORs and ICUs.

A study on 392 healthcare professionals in Lebanon reported that the mean levels of 25(OH)D3 were 15.61 ± 7.91 ng/ml and there were no significant differences by gender [16]. Another study in Iran, conducted on 114 female nurses, demonstrated that the mean levels of 25(OH)D3 were 11.7± 9.3 ng/ml. Secondly, the study reported that only 6.1% of the study participants had normal levels of Vitamin D [4]. Similar to the findings of these studies, the mean 25(OH)D3 level of 96 healthcare professionals in our study was 19.43 ± 7.95 ng/ml with mean levels of 18.91 ± 8.57 in females and 21.42 ± 4.58 in males. Our study demonstrated that the results were borderline for Vitamin D insufficiency. The frequency of lower levels of Vit D was significantly higher in females (63.2%) compared to the males (30.0%) (p=0.008). It is suggested that the adverse effects of increased workload, less duration of exposure to the sunlight, shift work, resting during the daytime after the night shifts, and irregular eating habits lead to Vitamin D insufficiency.

As the proverb “The healthy is hopeful and the hopeful is fulfilled” indicates, being healthy is at the forefront of many pri-

Tablo 3. The comparison of the data of the healthcare personnel according to the levels of Vitamin D, whether the levels are within the normal limits or lower

		n (number)	Lower Vit D levels		Normal Vit D levels		P value*
			n (number)	% (percent)	n (number)	% (percent)	
Gender	Female	76	48	% 63,2	28	% 36,8	P=0,008*
	Male	20	6	% 30,0	14	% 70,0	
Marital status	Single	17	9	% 52,9	8	% 47,1	P=0,762
	Married	79	45	% 57,0	34	% 43,0	
Educational status	Primary education	3	0	% 0,0	3	%100,0	P=0,033*
	High school	17	13	% 76,5	4	% 23,5	
	University	76	41	% 53,9	35	% 46,1	
Profession	Medical officials	13	7	% 53,8	6	% 46,2	P=0,242
	Anesthesia technician	19	8	% 42,1	11	% 57,9	
	Nurse	56	36	% 64,3	20	% 35,7	
	Doctor	8	3	% 37,5	5	% 62,5	
The place of work	Operating room	60	31	% 51,7	29	% 48,3	P=0,243
	Intensive care unit	36	23	% 63,9	13	% 36,1	
Duration of the working hours at the OR/ICU	1-5 year	24	18	% 75,0	6	%25,0	P=0,184
	6-10 year	31	16	% 51,6	15	% 48,4	
	11-15 year	19	10	% 52,6	9	% 47,4	
	Over 15 years	22	10	% 45,5	12	% 54,5	

*p<0,05: statistically significant
OR: Operating room, ICU: Intensive care unit

Table 4. The mean values of the HADS-A and HADS-D scores of the study participants

		n (number)	Mean HADS-A levels (±SD)	P value*	Mean HADS-D levels (±SD)	P value*
Gender	Female	76	7,81± 3,28	0,028*	5,67 ± 3,33	0,617
	Male	20	6,00 ± 3,09		5,25 ± 3,36	
Marital status	Single	17	6,52 ± 3,31	0,214	4,17 ± 2,62	0,054
	Married	79	7,63 ± 3,29		5,88 ± 3,39	
Educational status	Primary education	3	2,00 ± 2,64		5,33 ± 4,16	
	High school	17	7,05 ± 3,56	0,010*	6,00 ± 3,51	0,850
	University	76	7,73 ± 3,11		5,50 ± 3,29	
Profession	Medical officials	13	4,69 ± 2,59		4,53 ± 2,84	
	Anesthesia technician	19	6,57 ± 3,35		4,36 ± 2,47	
	Nurse	56	8,37 ± 3,16	0,001*	6,21 ± 3,53	0,118
	Doctor	8	7,37 ± 2,55		5,75 ± 3,65	
The place of work	Operating room	60	7,25 ± 3,33		5,41 ± 3,23	
	Intensive care unit	36	7,75 ± 3,29	0,477	5,86 ± 3,49	0,447
Duration of the working hours at the OR/ICU	1-5 year	24	7,12 ± 2,23		5,16 ± 3,10	
	6-10 year	31	7,93 ± 3,70		6,03 ± 3,69	
	11-15 year	19	7,00 ± 3,39	0,748	5,31 ± 3,16	0,790
	Over 15 years	22	7,45 ± 3,73		5,63 ± 0,70	

*p<0,05: statistically significant
HADS-A: Hospital Anxiety and Depression Scale- Anxiety, HADS-D: Hospital Anxiety and Depression Scale- Depression, OR: Operating room, ICU: Intensive care unit

orities in life. For this reason, health professionals are the members of one of the highly valued professional groups, however, they encounter many challenges as well. In particular, many adverse situations in OR and ICU, such as working indoors continuously, shift work, irregular sleep, treating patients with the poor general condition, and the death of patients may lead to psychological problems in the staff. The studies on healthcare professionals have demonstrated that the frequencies of psychological disorders such as anxiety, depression, and burnout syndrome have been increased [1-3, 17]. A study by Martin et al, evaluating 1200 healthcare professionals, reported that the frequencies of depression and burnout syndrome were 17.1% and 15.7% in the females respectively and 19.4% and 22% in the males respectively. In addition, it was noted that depression and burnout syndrome coexisted in 6.5% of the females and in 9.4% of the males [18]. Schmidt et al. conducted a study with 211 operating room nurses as the study participants. They observed the mean anxiety score as 6.3 and the mean depression score as 5.2 using HADS [1]. We observed the mean anxiety scores as 7.43 ± 3.31 and the mean depression scores as 5.58 ± 3.32 in the volunteering study participants of our study. In our study, the mean score of anxiety in females was (7.81 ± 3.28) significantly higher compared to those scores of males (6.00 ± 3.09). There was a direct correlation between the levels of education and anxiety. In addition, our study demonstrated that nurses constitute the profession group with the highest levels of anxiety. As most of the nurses are females and maintain longer durations of communication with the patients compared to the other hospital staff, we suggest that these two factors may have an impact on these results.

The studies on rats have demonstrated the presence of 1,25-dihydroxy vitamin D3 receptor (VDR receptor) in the brain, having a role in the development of the central nervous system. They have further demonstrated that hypovitaminosis D disrupts brain development [19,20]. Conducting a large cohort study with 2981 individuals, Milaneschive et al. demonstrated that both the presence and the severity of depression were associated with lower levels of 25(OH)D3 and they suggested that hypovitaminosis D may represent an underlying biological defect leading to the development of depression [21]. Another study including 5607 in England found that there was a significant association between the lower levels of 25(OH)D3 and higher depression scores. This finding, also suggests that the deficiency of Vitamin D especially in women is a risk factor for the development of depression especially at later ages [22]. Similarly, in our study, as the Vitamin D levels decreased, it was observed that the levels of anxiety and depression increased. In addition, a positive correlation was found between the age and the depression scores as well.

In conclusion, our study demonstrated that the lower Vitamin D levels in the OR and ICU staff in hospitals had a negative impact on the levels of anxiety and depression. We are of the opinion that larger cross-sectional studies on this issue may provide remarkable contributions to identify the conditions,

Table 5. The comparison of the data of the healthcare personnel according to the levels of HADS-A and HADS-D, whether the levels are within the higher limits or lower

		n (number)	Lower HADS-A levels	Higher HADS-A levels	P value*	Lower HADS- D levels	Higher HADS-D levels	P value*
Gender	Female	76	52 (%68,4)	24 (%31,6)	P=0,053	63 (%82,9)	13 (%17,1)	P=0,763
	Male	20	18 (%90,0)	2 (%10,0)		16 (%80,0)	4 (%20,0)	
Marital status	Single	17	13 (% 76,5)	4 (% 23,5)	P=0,716	16 (% 94,1)	1 (% 5,9)	P= 0,159
	Married	79	57 (% 72,2)	22 (% 27,8)		63 (% 79,7)	16 (% 20,3)	
Educational status	Primary education	3	3 (%100,0)	0 (%0,0)	P=0,321	2 (% 66,7)	1 (% 33,3)	P= 0,580
	High school	17	14 (%82,4)	3 (%17,6)		13 (% 76,5)	4 (% 23,5)	
	University	76	53 (% 69,7)	23 (% 30,3)		64 (% 84,2)	12 (% 15,8)	
Profession	Medical officials	13	13 (%100,0)	0 (%0,0)	P=0,011*	11 (%84,6)	2 (% 15,4)	P= 0,409
	Anesthesia technician	19	16 (% 84,2)	3 (% 15,8)		18 (% 94,7)	1 (%5,3)	
	Nurse	56	34 (% 60,7)	22 (% 39,3)		44 (% 78,6)	12 (% 21,4)	
	Doctor	8	7 (%87,5)	1 (% 12,5)		6 (% 75,0)	2 (% 25,0)	
The place of work	Operating room	60	45 (% 75,0)	15 (%25,0)	P=0,553	51 (% 85,0)	9 (%15,0)	P= 0,369
	Intensive care unit	36	25 (% 69,4)	11 (% 30,6)		28 (%77,8)	8 (% 22,2)	
Duration of the working hours at the OR/ICU	1-5 year	24	21 (% 87,5)	3 (% 12,5)	P=0,151	21 (% 87,5)	3 (% 12,5)	P= 0,800
	6-10 year	31	19 (% 61,3)	12 (% 38,7)		24 (% 77,4)	7 (% 22,6)	
	11-15 year	19	15 (% 78,9)	4 (% 21,1)		16 (% 84,2)	3 (% 15,8)	
	Over 15 years	22	15 (% 68,2)	7 (% 31,8)		18 (%81,8)	4 (% 18,2)	

*p<0,05: statistically significant
HADS-A: Hospital Anxiety and Depression Scale- Anxiety, HADS-D: Hospital Anxiety and Depression Scale- Depression, OR: Operating room, ICU: Intensive care unit

Table 6. Assessment of the relationship between vit D values of health workers and HADS-A and HADS-D levels

		VİT D	HADS-A	HADS-D
age	r value	-0,055	0,120	0,208
	P value	0,595	0,245	0,042*
VİT D	r value	1	-0,025	-0,054
	P value		0,808	0,604
HADS-A	r value	-0,025	1	0,475
	P value	0,808		0,000**

*p<0,05 statistically significant , **p<0,001 statistically significant
HADS-A: Hospital Anxiety and Depression Scale- Anxiety, HADS-D: Hospital Anxiety and Depression Scale- Depression

which might affect the health conditions of the hospital staff adversely. Furthermore, these studies may contribute to implementing precautions to prevent untoward consequences.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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