



# The Relationship Between Vitamin D Deficiency and Burnout Syndrome in Operating Room Workers: Correlational Research

## Ameliyathane Çalışanlarında D Vitamini Eksikliği ile Tükenmişlik Sendromu Arasındaki İlişki: Korelasyonel Araştırma

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### ABSTRACT

**Objective:** The aim of this study was to determine the relationship between burnout syndrome and vitamin D levels of the operating room staff who had to work indoors.

**Methods:** Vitamin D, phosphor, complete blood count, iron, alanine aminotransferase and aspartate amino transferase, thyroid stimulating hormone, vitamin B12 and creatinine levels were examined in the healthy staff working in the operating room (minimum 1 year) between the ages of 18-50. The General Health scale, Maslach Burnout inventory and the Beck Depression inventory (BDI) were applied to the operating room staff.

**Results:** There were a low degree of correlation between age and vitamin D levels, positive and modest correlation between income and emotional exhaustion, and low degree of negative correlation between personal accomplishment (PA) and sleep duration. There were low positive correlation between BDI and emotional exhaustion, low positive correlation between BDI and depersonalization, moderate positive correlation between emotional exhaustion (EE) and personal accomplishment, moderate positive correlation between EE and depersonalization, and low positive correlation between PA and depersonalization. There was no significant correlation between other variables.

### ÖZ

**Amaç:** Bu çalışmanın amacı, kapalı alanda çalışmak zorunda olan ameliyathane personelinin tükenmişlik sendromu ile D vitamini düzeyleri arasındaki ilişkinin belirlenmesidir.

**Yöntemler:** Ameliyathanede çalışan (en az 1 yıl) 18-50 yaş arası sağlıklı gönüllülerin kanlarında D vitamini, hemogram, demir, alanin amino transferaz, aspartat amino transferaz, tiroid stimulan hormon, B12 vitamini ve kreatinin ölçümleri yapılmıştır. Ameliyathane personeline Genel Sağlık ölçeği, Beck Depresyon ölçeği (BDÖ) ile Maslach Tükenmişlik ölçeği uygulandı.

**Bulgular:** Katılımcıların D vitamini düzeyi ile yaşı arasında düşük derecede pozitif korelasyon, duygusal tükenmişlik ile gelir arasında orta derecede pozitif korelasyon, kişisel başarıda (KB) azalma ile uyku süresi arasında düşük derecede negatif korelasyon tespit edilmiştir. Ölçek puanları ve D vitamini düzeyinin aralarındaki korelasyona baktığımızda; BDÖ ile duygusal tükenmişlik arasında düşük derecede pozitif korelasyon, BDÖ ile duyarsızlaşma arasında düşük derecede pozitif korelasyon, duygusal tükenmişlik ile KB'de azalma arasında orta derecede pozitif korelasyon, duygusal tükenmişlik (DT) ile duyarsızlaşma arasında orta derecede pozitif korelasyon, KB'de azalma ile duyarsızlaşma arasında düşük derecede

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**ABSTRACT**

**Conclusion:** As a conclusion, a significant relationship could not be determined between the scores of the BDI and the emotional exhaustion, depersonalization and PA subscales of the Maslach Burnout scale and the level of vitamin D.

**Keywords:** Vitamin D, burnout, depression, questionnaires

**ÖZ**

pozitif korelasyon bulunurken diğer değişkenler arasında anlamlı bir korelasyon bulunmamıştır.

**Sonuç:** Sonuç olarak çalışmamızda, D vitamini düzeyi ile, Beck Depresyon ölçeği ve Maslach Tükenmişlik ölçeğinin alt boyutlarından DDT, KB'de azalma ve duyarsızlaşma puanları arasında anlamlı bir ilişki saptanamamıştır.

**Anahtar Sözcükler:** D vitamini, tükenmişlik, depresyon, ölçek

**Introduction**

Burnout Syndrome is a state of exhaustion in the internal resources of the individual as a result of failure, weariness, decrease in energy and power or unsatisfied desires, and it affects working life negatively. Vitamin D has an effect on calcium homeostasis, bone health and has a relationship with the immune system. Burnout is affecting physicians and its overall prevalence is unknown (1-3).

Operating room workers mostly work in environments that are not exposed to sunlight, under stress and anxiety.

The aim of this study was to determine the relationship between vitamin D levels, Maslach Burnout scale (MBS) and Beck depression inventory (BDI) scores in operating room workers who had to work in a sunless environment.

**Methods****Study Design**

Personnels who were working in the operating room for at least 1 year, between the ages of 18-50, without any bone, thyroid, pituitary, neurological, kidney or liver disease were included in the study. Vitamin D, phosphor, hemogram, iron, alanine amino transferase, aspartate amino transferase, thyroid stimulating hormone, vitamin B12 and creatinine levels were measured in the blood. The General Health Scale, BDI and MBS were used as questionnaires.

**Statistical Analysis**

The MedCalc statistical package program was used for statistical analyses. Paired-unique student's t-test and chi-square test were used and a p value of <0.05 was considered significant.

**Results**

Demographic data and findings are given in Table 1. Participants' blood values are given in Table 2. Maslach's Three-Dimensional Burnout Model considers burnout as a three-component group of psychological symptoms. Emotional exhaustion, depersonalization, and personal accomplishment (PA) (4). There are 9 items on emotional exhaustion (EE), 5 items on depersonalization (D), and 8 items on accomplishment PA on the scale. After the question items that make up the MBS are scored in the range of 0-4 points, each subscale is summed

up and three separate points are obtained. By summing these scores, scores ranging from 0-36 for EE, 0-20 for D and 0-32 for PA are obtained. The EE includes feelings of being exhausted and overloaded by one's occupation; D describes the feelings of the person to be devoid of emotion and careless towards the people they serve; the PA describes the individual's feelings of overcoming problems with success (Figure 1).

When we evaluated the relationships between sociodemographic data, vitamin D level, BDI score, and EE, D and PA subscales scores of MBS; there was no statistically significant relationship between gender, marital status, having a child, profession, career choice, and leave after work shift, and vitamin D level, BDI score, and PA subscale score ( $p>0.05$ ) (Table 3).

When EE subscale score was compared in terms of marital status and having a child, there was a statistically significant relationship ( $p<0.05$ ), but no statistically significant relationship was found in terms of gender, profession, career choice and taking leave after work shift ( $p>0.05$ ). When D subscale score was compared in terms of gender, marital status, profession, career choice, and taking leave after work shift, there was no statistically significant relationship ( $p>0.05$ ), while there was a statistically significant relationship in terms of having children ( $p<0.05$ ).

When we evaluated the participants' habits and disease status and vitamin D level, BDI score, and EE, D and PA subscales scores; no statistically significant difference was found between hobby, smoking, alcohol use, presence of chronic disease, problems experienced and coping methods, vitamin D level, PA and D subscales scores ( $p>0.05$ ) (Table 4).

While there was a statistically significant relationship between having a problem and BDI score ( $p<0.05$ ), there was not statistically significant relationship between hobby, smoking, alcohol use, the presence of chronic disease, and methods of coping with the problem and BDI score ( $p>0.05$ ). While there was a statistically significant relationship between the presence of a chronic disease and EE subscale score ( $p<0.05$ ), there was no statistically significant relationship between the hobby, smoking, alcohol use, having problems and the methods of coping with problems ( $p>0.05$ ).

When we looked at the correlation between scale scores and vitamin D levels; low positive correlation between BDI score and EE subscale score ( $\rho = 0.281$ ,  $p<0.05$ ), low positive correlation

**Table 1.** Sociodemographic characteristics and the habits and disease status of the participants

		Number	
Gender	Male	30	
	Female	54	
Age (mean $\pm$ SD) years		30.36 $\pm$ 6.90	
Marital status	Married	49	
	Single	34	
	Divorced	1	
Status of having children	No	50	
	Yes	34	
Profession	Janitor	14	
	Nurse	15	
	Technician	27	
	Secretary	4	
	Resident Dr	13	
	Specialist Dr	11	
Career choice	Willingly	58	
	Influence of relative	11	
	Random	15	
Average monthly income (mean) *(TL)		4489.69	
Time in the profession (mean) *(years)		8.29	
Weekly working hours (mean) *(hours)		56.13	
Taking leave after work shift, yes/no (%)		43/28 (60.6/39.4)	
		Number	%
Do you have any hobby?	Yes	57	67.9
	No	27	32.1
Smoking status	Yes	24	28.6
	No	60	71.4
Alcohol	Yes	5	6.0
	No	79	94.0
Having a chronic disease	Yes	10	11.9
	No	74	88.1
Daily sleep time hour (mean)**		6.27	0.88
Having problems?	No	30	35.7
	Problem in work environment	35	41.7
	Health	5	6.0
	Sexuality	5	6.0
	Economy	5	6.0
	Education	4	4.8
Trouble time (mean $\pm$ SD)** hours		3	2
Methods of coping with problems	Share with someone	24	28.6
	Walk	5	6.0
	Friend	48	57.1
	Shopping	5	6.0
	Housework	2	2.4

\*Mean values are given for continuous variables.

\*\*Mean and standard deviation (SD) are given for continuous variables.

**Table 2.** Participants' blood values

	Mean	Standard deviation	Minimum	Maximum
Vitamin D ng/mL	8.53	5.15	2.50	29.00
Glucose mg/dL	90.90	13.52	70.00	141.00
Urea mg/dL	25.61	7.44	11.00	49.00
BUN mg/dL	11.67	3.43	5.00	22.00
Creatinine mg/dL	0.69	0.12	0.50	1.00
EGFR mL/min/1.73 m <sup>2</sup>	116.24	9.98	86.00	141.00
AST U/L	17.64	5.97	8.00	36.00
ALT U/L	18.39	10.13	6.00	53.00
Ca mg/dL	9.67	0.37	8.70	10.60
Phosphor mg/dL	3.67	0.56	2.50	5.50
Iron ug/dL	78.02	36.53	15.00	185.00
Iron binding capacity ug/dL	379.22	51.89	251.00	606.00
UIBC ug/dL	303.40	72.51	146.00	541.00
Leukocyte 10 <sup>3</sup> /uL	7.11	1.80	3.20	12.40
Hemoglobin g/dL	13.54	1.60	10.20	17.00
Hematocrit %	41.03	4.41	32.00	50.00
PLT 10 <sup>3</sup> /uL	245.29	50.40	146.00	403.00
TSH uIU/mL	1.54	0.87	0.30	4.90
PTH pg/mL	65.42	59.61	17.00	541.00
Ferritin ng/mL	40.68	42.88	5.90	234.00
Vitamin B12 pg/mL	314.52	97.13	130.00	642.00

BUN: Blood urea nitrogen, EGFR: Estimated glomerular filtration rate, AST: Aspartate transaminase, ALT: Alanine transaminase, PLT: Platelet, TSH: Thyroid-stimulating hormone, PTH: Parathyroid hormone

**Table 3.** Evaluation between the sociodemographic data of the participants and their vitamin D level, Beck depression inventory, and the sub-dimensions of Maslach Burnout scale: emotional exhaustion, personal accomplishment, and depersonalization scores

		Vitamin D		BDI		Emotional exhaustion		Personal accomplishment		Depersonalization	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender	Male	9.15	4.72	13.59	7.07	13.47	5.79	11.03	4.84	5.30	2.96
	Female	8.19	5.39	11.09	6.35	15.07	6.29	12.04	4.12	5.11	2.91
	P	0.156*		0.105 <sup>†</sup>		0.252 <sup>†</sup>		0.344*		0.642*	
Marital status	Married	9.35	6.09	12.29	6.69	13.14	5.87	11.16	4.33	4.80	2.79
	Single, widow	7.39	3.19	11.51	6.72	16.40	6.05	12.40	4.43	5.71	3.03
	P	0.268*		0.603 <sup>†</sup>		0.015 <sup>†</sup>		0.327*		0.279*	
Status of having children	No	7.90	4.46	11.48	6.68	15.82	6.21	12.24	3.91	6.00	3.03
	Yes	9.45	5.98	12.70	6.69	12.56	5.53	10.85	4.95	3.97	2.28
	P	0.407*		0.419 <sup>†</sup>		0.016 <sup>†</sup>		0.208*		0.005*	
Profession	Auxiliary staff	9.82	6.81	10.53	6.54	12.11	4.64	12.72	5.39	4.39	2.57
	Health personnel	8.18	4.60	12.33	6.71	15.15	6.35	11.39	4.07	5.39	2.98
	P	0.407*		0.323 <sup>†</sup>		0.062 <sup>†</sup>		0.145*		0.348*	
Career choice	Willing	8.48	5.49	11.79	6.32	14.47	6.34	11.09	4.30	5.14	2.79
	Influence of relative	9.25	5.69	11.73	8.88	15.64	7.17	11.91	4.74	5.27	4.03
	Random	8.19	3.30	12.80	6.60	13.80	4.52	13.80	4.04	5.27	2.63
	P	0.516**		0.869 <sup>††</sup>		0.754 <sup>††</sup>		0.091**		0.913**	
Taking leave after work shift	Yes	7.88	3.50	11.71	6.43	14.42	5.86	11.65	4.05	5.42	2.92
	No	8.92	5.72	14.04	6.22	15.54	6.17	12.29	4.61	5.46	2.71
	P	0.746*		0.139 <sup>†</sup>		0.445 <sup>†</sup>		0.489*		0.910*	

\*Mann-Whitney U, \*\*Kruskal-Wallis test, <sup>†</sup>T-test in independent groups, <sup>††</sup>ANOVA, BDI: Beck depression inventory

**Table 4.** Evaluation between the participants' habits and disease status and their vitamin D level, Beck depression inventory, and emotional exhaustion, personal accomplishment and depersonalization scores, which are the sub-dimensions of the Maslach Burnout scale

		Vitamin D		BDI		Emotional exhaustion		Personal accomplishment		Depersonalization	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Do you have any hobby?	Yes	8.08	3.87	11.91	7.14	14.42	6.68	11.19	4.84	5.26	3.23
	No	9.48	7.14	12.08	5.63	14.67	4.87	12.70	3.06	5.00	2.15
	p	0.719*		0.918 <sup>†</sup>		0.865 <sup>†</sup>		0.197*		0.877*	
Smoking status	Yes	8.96	4.26	13.83	7.41	15.00	6.30	12.12	5.57	6.17	3.33
	No	8.36	5.49	11.20	6.26	14.30	6.10	11.50	3.85	4.78	2.66
	p	0.203*		0.104 <sup>†</sup>		0.639 <sup>†</sup>		0.235*		0.063*	
Alcohol	Yes	10.16	4.80	15.20	8.14	16.40	5.37	12.40	5.98	6.20	3.90
	No	8.46	5.21	11.73	6.61	14.32	6.20	11.56	4.30	5.08	2.86
	p	0.221*		0.265 <sup>†</sup>		0.466 <sup>†</sup>		0.392*		0.520*	
Having a chronic disease	Yes	9.45	7.43	15.10	7.98	18.10	6.59	13.40	5.54	4.90	3.48
	No	8.41	4.82	11.53	6.42	14.01	5.94	11.45	4.20	5.22	2.85
	p	0.804*		0.114 <sup>†</sup>		0.047 <sup>†</sup>		0.170*		0.500*	
Having problems?	No	8.24	4.83	9.03	6.16	12.80	6.30	10.30	4.59	4.63	2.83
	Working environment	8.49	4.95	12.91	6.62	15.29	5.99	11.83	3.54	5.40	3.00
	Healthy, sexuality	10.00	8.28	15.10	6.61	17.50	6.17	14.10	6.15	6.40	3.50
	Economy, education	8.03	2.51	14.22	5.95	13.78	4.97	13.00	3.28	4.78	1.86
	p	0.952**		0.020 <sup>††</sup>		0.143 <sup>††</sup>		0.152**		0.398**	
Methods of coping with problems	With someone, friend	8.89	5.43	11.88	6.56	14.04	5.99	11.68	4.43	4.90	2.83
	Walk	5.98	2.98	18.25	9.32	20.40	6.88	10.80	4.76	8.40	2.51
	Shopping	6.42	1.43	9.20	5.63	14.60	6.11	11.80	5.07	5.60	3.51
	Housework	7.20	0.28	9.50	0.71	16.00	5.66	13.50	0.71	6.00	0.00
	p	0.495**		0.196 <sup>††</sup>		0.160 <sup>††</sup>		0.935**		0.062**	

\*Mann-Whitney U, \*\*Kruskal-Wallis test, <sup>†</sup>t-test in independent groups, <sup>††</sup>ANOVA, BDI: Beck depression inventory, SD: Standard deviation

between BDI score and D subscale score ( $\rho = 0.238$ ,  $p < 0.05$ ), moderate positive correlation between EE and PA subscales scores ( $\rho = 0.342$ ,  $p < 0.05$ ), moderate positive correlation between EE and D subscales scores ( $\rho = 0.582$ ,  $p < 0.05$ ), and low positive correlation between PA and D subscales scores ( $\rho = 0.285$ ,  $p < 0.05$ ) were found. No significant correlation was found between other variables.

When we took the cut-off score of the BDI as 17 and compared it with MBS's subscales scores and vitamin D level; there were statistically significant relationships between EE subscale score and BDI subscale score, and between PA and D subscales scores ( $p < 0.05$ ). No statistically significant relationship was found between other scale scores and vitamin D level ( $p > 0.05$ ) (Tables 5, 6).

## Discussion

Burnout syndrome (BS) is a condition that can be seen in jobs where working hours are long and accompanied by stress, negatively affecting both the work and private life of hospital

staff. The presence of vitamin D receptors in depression-related regions such as the prefrontal cortex, hippocampus, cingulate gyrus, thalamus, and hypothalamus suggests that vitamin D may be involved in the etiology of depression (5).

In a comprehensive study including 7,970 participants in the USA, it was stated that vitamin D deficiency increased the susceptibility to depression (6). A similar study in the Netherlands in which 1,282 older adults (65-95 years old) participated supported those results (7). Studies investigating the relationship between depression and burnout suggested that there was a relationship between depression and burnout (8). Considering these results, it can be mentioned that there is a relationship between BS and vitamin D deficiency. However, there are no studies directly investigating vitamin D deficiency and BS.

Considering the studies examining the burnout status of those working in the field of anesthesia, it was observed that the participants consisted of anesthesiologists or assistants. In some studies, the participants consisted only of nurses or anesthetic

**Table 5.** Comparison of scale scores and vitamin D levels with sociodemographic data

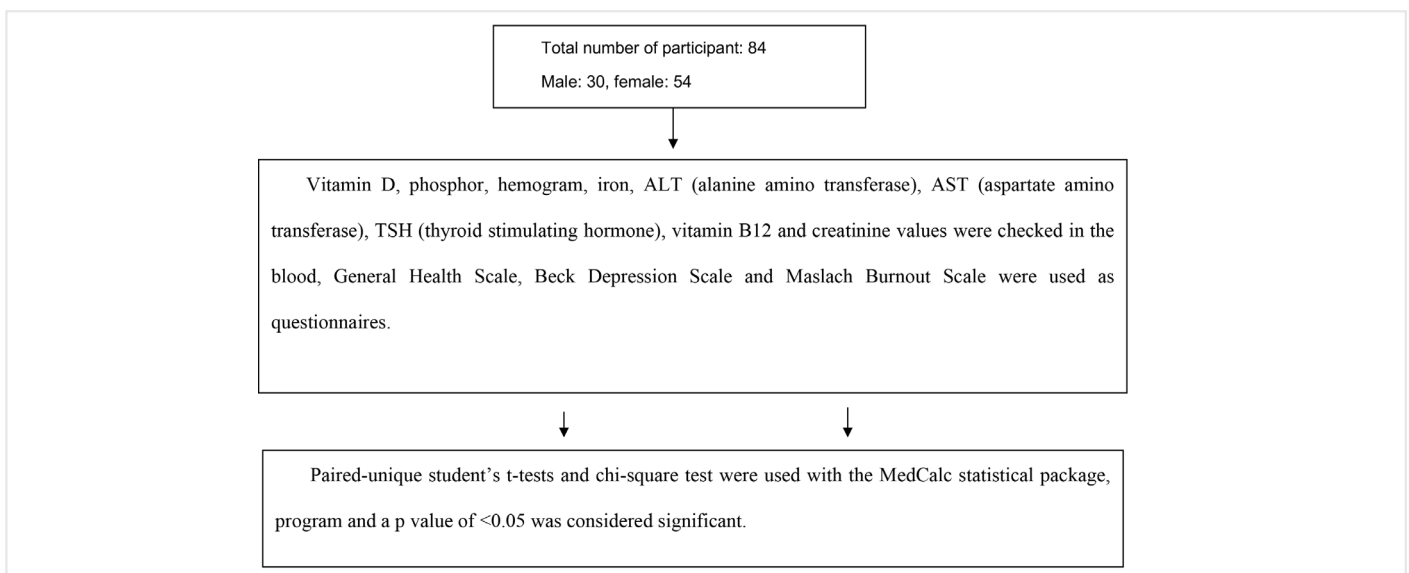
		Age	BMI	Year	Working hour	Sleep	Income
Vitamin D	rho	0.249*	0.133	0.174	-0.07	-0.026	0.031
	p	<b>0.023</b>	0.226	0.113	0.528	0.814	0.781
BDI	rho	0.038	0.095	-0.04	0.169	-0.157	0.169
	p	0.735	0.395	0.718	0.126	0.157	0.127
Emotional exhaustion	rho	-0.054	0.152	-0.122	0.099	-0.108	0.309**
	p	0.625	0.167	0.269	0.369	0.328	<b>0.004</b>
Personal accomplishment	rho	0.089	0.096	-0.068	0.144	-0.216*	-0.102
	p	0.421	0.386	0.539	0.191	<b>0.048</b>	0.358
Depersonalization	rho	-0.079	0.102	-0.136	-0.004	-0.16	0.159
	p	0.477	0.354	0.216	0.97	0.145	0.147

BDI: Body mass index, BDI: Beck depression inventory

**Table 6.** Correlation comparison between scale scores and vitamin D levels

		Vitamin D	BDI	Emotional exhaustion	Personal accomplishment	Depersonalization
Vitamin D	rho		-0.061	-0.109	0.102	-0.081
	p		0.583	0.323	0.358	0.466
BDI	rho	-0.061		0.281	0.101	0.238
	p	0.583		<b>0.01</b>	0.364	0.03
Emotional exhaustion	rho	-0.109	0.281		0.342	0.582
	p	0.323	<b>0.01</b>		<b>0.001</b>	<b>0.001</b>
Personal accomplishment	Rho	0.102	0.101	0.342		0.285
	p	0.358	0.364	<b>0.001</b>		<b>0.009</b>
Depersonalization	rho	-0.081	0.238	0.582	0.285	
	p	0.466	<b>0.03</b>	<b>0.001</b>	<b>0.009</b>	

BDI: Beck depression inventory



**Figure 1.** Flow chart for this correlational research

technicians working in the field of anesthesia, while in some studies both anesthesiologists and anesthesia nurses were included. In our study, unlike the other studies in the literature, personnel, technicians, and secretaries working in the operating room were also included, apart from the anesthesiologists and nurses (9-12). With this feature of our study, we think that it is an inclusive study for all employees working in the operating room. Studies suggest that anesthesiologists have a high risk for burnout (13).

In a study conducted with physicians who received assistant training in the field of anesthesia, it was stated that female physicians had a higher risk of BS and depression compared to males (14). In another study investigating BS of anesthesiologists, it was stated that gender was not important for BS (15). In our study, there was no relationship between vitamin D level, BDI score, MBS's subscales scores and gender of the physicians.

It has been reported in studies that the marital status of anesthesiologists are not correlated with MBS's subscales scores (10,15,16). In our study, similar results were found with the studies in the literature, except for EE subscale score. In our study, EE subscale score was found to be higher in single and divorced anesthesia workers. Some authors have emphasized that the level of burnout is related to the number of children rather than having children. In the same study, it was stated that anesthesiologists had lower burnout scores if they had two or more children compared to individuals without children (10). In a study evaluating the burnout status of 1,508 anesthesiologists, it was stated that anesthetists who were parents showed lower depression and BS characteristics (14). In our study, however, no difference was found between having a child and the status of vitamin D, BDI score, and PA subscale score. In addition, our study shows similar results with the studies in the literature in terms of D and EE subscales scores.

As age increases, the concentration of 7-dehydrocholesterol, a precursor of vitamin D, decreases in the skin. This reduces the skin's capacity to synthesize vitamin D. In our study, contrary to this literature finding, a slight positive correlation was found between the ages of the participants and their vitamin D levels. One of the two main sources of vitamin D is exposure to sunlight, while the other is food (17,18). It is thought that those who have to work for a long time in closed areas away from sunlight will have deficient vitamin D levels in their bodies. Operating room workers stay in closed environments for a long time. In order to determine vitamin D excess or deficiency, 25-hydroxyvitamin D levels are checked.

25-hydroxyvitamin D level;

- Vitamin D deficiency, if it is less than 20 ng/mL,
- Vitamin D insufficiency between 21 and 29 ng/mL,
- Normal vitamin D level, if it is higher than 30 ng/mL,
- Vitamin D intoxication, if it is higher than 150 ng/mL (19). In our study, the mean vitamin D level was  $8.53 \pm 5.15$ .

There are no systematic studies investigating vitamin D level and BS in the literature. The results of our research can contribute to the literature. In our study, no relationship was found between vitamin D levels and PA and D subscales scores. A relationship was found between vitamin D level and EE subscale score.

The MBS, which evaluates EE, D and PA, is an important scale that evaluates the general burnout status of the person. As in our study, it is expected that the subscales evaluating different dimensions of burnout are in a positive correlation with each other.

Some studies show that vitamin D deficiency is a facilitating factor for depression (20). In our study, when the cut-off point was taken as 17, no correlation was found between vitamin D level and having depression. There was no correlation between vitamin D level and MBS's subscales scores.

It has been reported in studies that the marital status of anesthesiologists is not correlated with MBS's subscales scores. In our study, similar results were found with the studies in the literature, except for EE subscale score. In our study, EE subscale score was found to be higher in single and divorced anesthesia workers. In our study, divorced and single participants were considered together. Considering this information in the literature, not examining divorced and single people separately could be considered as a limitation of our study. Our study created a different information from the literature in the general population of those working in the operating room environment.

## Conclusion

In conclusion, in our study, there was no significant relationship between vitamin D level and BDI score and PA and D subscales scores, while a relationship was found between vitamin D level and EE subscale score.

## Ethics

**Ethics Committee Approval:** The study was conducted after the approval of the Bezmialem Vakıf University Clinical Research Ethics Committee, with decision number 24/17 and dated 30.12.2015.

**Peer-review:** Externally peer reviewed.

## Authorship Contributions

Concept: G.B., M.Ç., M.Çal., K.K., Design: G.B., F.D., K.K., Data Collection or Processing: Z.S.A., Analysis or Interpretation: Z.S.A., G.B., M.Çal., Literature Search: Z.S.A., M.Çal., Writing: G.B.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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