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Could ferritin, vitamin B_{12}, and vitamin D play a role in the etiopathogenesis of fibromyalgia syndrome?

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Introduction. Fibromyalgia syndrome (FS) comprises general body pain, sleep disturbances, and fatigue. Vitamin B_{12} (VB), vitamin D (VD), and iron deficiencies lead to similar complaints. First, this study aimed to evaluate the VB, VD, and ferritin levels of patients with FS. Second, it aimed to investigate whether there was a relationship between these parameters and FS severity.

Material and methods. The study included 58 female patients with FS and 58 healthy females as a control group. The patients completed the Fibromyalgia Impact Questionnaire (FIQ), Visual Analog Scale (VAS), fatigue questionnaire, Pittsburgh sleep quality scale, and the Short Form-36 (SF-36). This study examined the VD, VB, and ferritin levels of the patient and control groups.

Results. The VB (240.0 [110.0–394.0] vs 291.0 [210.0–609.0] pg/ml, p<0.001), VD (12.5 [3.0–45.0] vs 20.0 [5.0–54.0] ng/ml, p=0.013), and ferritin levels (21.2 [4.0–86.0] vs 32.0 [7.1–120.0], ng/ml, p=0.009) of the FS patients were determined to be significantly lower than those of the control group. A negative correlation was determined between the number of tender points and VB, VD, and ferritin levels. In the regression analysis, we found low ferritin levels (odds ratio [OR] 1.036, 95% confidence interval [CI] 1.015–1.058, p<0.001) and VB (OR 1.010, CI 1.002–1.018, p=0.010) to be an independent risk factor for FS.

Conclusions. There may be a relationship between VB, VD, and ferritin levels and the number of tender points in patients with FS. Levels of iron and VB may play a vital role in FS etiopathogenesis. However, VD levels may not be a risk factor for FS etiopathogenesis.

Key words: fibromyalgia, vitamin B_{12}, vitamin D, iron, anemia.

INTRODUCTION

Fibromyalgia syndrome (FS) is a clinical picture of an unknown etiology accompanied by general body pain and somatic symptoms with aching tender points in physical examination [1]. FS is a disease that is often accompanied by psychological concerns, including sleep disturbances, fatigue, and cognitive functional impairments [2]. Patients with FS have a low pain threshold [2]. The etiopathogenesis of FS has not yet been well known. Genetic, environmental, neuroendocrine, immunelogical, and psychological factors may play a role in its etiopathogenesis [3,4]. Patients with FS have general musculoskeletal pain. However, their physical examination, laboratory results, and radiological examinations are within normal limits [5].

Vitamin B_{12} (VB) is a necessary vitamin for routine cell activity and metabolism [6]. A deficiency in VB causes symptoms that are also frequently observed in FS, such as weakness, fatigue, general muscle pain, and sleep disturbances [7,8]. Interestingly, subnormal VB levels may cause these symptoms [9,10]. Previous studies have reported that FS patients have similar VB levels to healthy individuals [11,12]. VD deficiency was associated with fatigue and generalized pain [13,14]. VD deficiency is seen much more often in females than males, and FS is usually seen in females [5,13]. There are controversial results in the literature regarding the VD level of patients with FS. Some studies have reported the VD levels of these patients as low, and other studies claimed their VD levels higher than healthy people [15,16]. Iron deficiency

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can cause general pain and fatigue [17]. Iron may be responsible for the etiopathogenesis of both FS and restless legs syndrome [12,18]. A low ferritin value is the first finding showing a reduced iron reserve.

First, this study aimed to evaluate the VB, VD, and ferritin levels of patients with FS. Second, it aimed to investigate whether there was a relationship between these parameters and FS severity.

MATERIAL AND METHODS

Subjects

Fifty-eight female patients who applied to our Physical Therapy and Rehabilitation and Rheumatology outpatient clinics between January and February 2016 with complaints of at least one year were enrolled in the study. Patients corresponding to the American College of Rheumatology (ACR) 2010 diagnostic criteria were accepted as FS. Fifty-eight healthy female individuals who did not have any rheumatological or painful disease and were compatible with FS patients in terms of age were included in the study between January and February 2016, simultaneously with the patient group. We received the study approval from the local Ethics Committee and obtained the signed informed consent form from all participants.

To diagnose FS, some laboratory tests such as complete blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), thyroid stimulating hormone, and antinuclear antibody should be within the normal limits. Also, physical examination should not have signs of inflammatory syndromes. All individuals participating in the study were examined by an internist and a rheumatologist. The individuals' previous health records (diagnosis, laboratory tests, and electrocardiogram, etc.) and new examination and laboratory findings were reviewed. After carefully the investigation, individuals with any of the following conditions were excluded from the study: Active infection, deficit presence, any inflammatory rheumatoid diseases, thyroid disorders, the liver, kidney, cardiovascular and cerebrovascular diseases, intellectual capacity defect, those using vitamin or iron supplements, smokers, and alcohol drinkers.

Methods

The age, body mass index (BMI), disease duration, the number of tender points, and the morning stiffness time of patients were recorded. Two investigators assessed the number of tender points by digital palpation during a physical examination, according to the 1990 ACR definition. First, FS diagnostic criteria are changed intermittently due to the confusion experienced. The 2010 FS diagnostic criteria were criticized for disabling physician evaluation. However, many physicians accustomed to the 1990 diagnostic criteria continue to examine both the tender points and the symptoms with symptom severity scale. Second, the ACR 2010 criteria had considerably higher specificity than the ACR 1990 criteria. However, the sensitivity of the 2010 criteria was moderate relative to the old criteria. That's why we determined the tender points according to the 1990 criteria [19]. The tender points evaluated bilaterally are listed below: anterior aspects of the C5, C7 intertransverse spaces, upper border of the trapezius, mid-portion, second rib space (about 3 cm lateral to the sternal border), muscle attachments to the lateral epicondyle, medial fat pad of knee proximal to the joint line, insertion of nuchal muscles into occiput, muscle attachments to the upper medial border of the scapula, upper outer quadrant of gluteal muscles, muscle attachments just posterior to the greater trochanter [20]. The patients were examined between 9:00 and 11:00 AM. We evaluated morning stiffness and pain with the Visual Analog Scale (VAS) and fatigue with a Visual Analog Fatigue Scale. Life quality was measured using the Short form-36 (SF-36), sleep quality with the Pittsburgh Sleep Quality Index (PSQI), and functional state with the Fibromyalgia Impact Questionnaire (FIQ).

Visual Analogue Scale (VAS)

A 10 cm ruler is used to measure the intensity of pain. Patients were informed about the meaning of numbers on the 10-cm ruler between 0-10 that 0 is no-pain, 10 is the most severe pain, and 5 is moderate pain. Patients then defined their pain severity on the ruler, and a score between 0 (no pain) and 10 (most severe pain) was applied [21].

Fibromyalgia Impact Questionnaire (FIQ)

Burckhardt *et al*. developed this scale to test the functional status of FS [22]. Physical sufficiency is tested by 11 items related to daily activities. These 11 items are mood, daily workforce loss, difficulty working, pain, tiredness, freshness after waking up, anxiety, and depression. High values show functional limitations.

Pittsburgh Sleep Quality Scale (PSQS)

Buysse *et al*. developed this scale to evaluate sleep quality, sleep times, and sleep disturbances [23]. The scale consists of 19 questions scored between 0 and 3. The PSQS has seven sub-domains of subjective sleep quality, late sleep, sleep duration, adequacy of continuous sleep, sleep pills use, and functional disorder during the day. High points show lower sleep quality.

Short Form-36 (SF-36)

SF-36 has been developed for testing quality of life and use in clinical practice and research [24]. The SF-36 comprises 36 questions and eight subscales of physical function (10 items), role-physical (4 items), body pain (2 items), general health (5 items), vitality (4 items), social function (2 items), emotional role (3 items) and mental health (5 items). Physical component summary scores (PCS) and mental component summary scores (MCS) are calculated based on these separate domains.

Fatigue scale

The physical, cognitive, and social effects of fatigue in the previous month are measured with the Fatigue scale with 40 questions (0 = No problem, 4 = extreme). The total score ranges from 0 to 160, with high scores indicating lower fatigue levels [25].

Laboratory measurements

Venous blood samples of all participants were collected into dry tubes. The samples were centrifuged at 1,000 g for 15 minutes. Afterward, the serum and plasma samples were rapidly placed in separate Eppendorfs and stored at -80 ^{0}C until analysis time. Biochemical parameters were measured using the Electrochemiluminescence immunoassay (ECLIA) method (Roche-Cobas e 601 Manheim, Germany). Hematological parameters were measured using the flow cytometry method (Mindray BC-6800 Auto Hematology Analyzer, Shenzhen, China).

Statistical analysis

All statistical analyses were applied using SPSS version 18 software (Chicago, IL, USA). The results were stated as mean ± SD and median (range). Kolmogorov-Smirnov test was used to determine whether the data showed a homogeneous or non-homogeneous distribution. Non-homogeneous data (ferritin, VB, and VD) were compared using the Mann-Whitney U test. Homogeneous data (age and BMI) were compared using Student's t-test. Categorical data, such as the number of tender points, were compared with the Chi-square test.

18–65 age range in women includes premenopausal, perimenopausal, menopausal, and postmenopausal periods. As a woman goes through these stages, her serum estradiol level drops, and levels of some biochemical parameters, including vitamin levels and ferritin, may change. Therefore, the patients and the control group were divided into two subgroups, taking the cut-off value of 40 years (≤40 years old patients with FS, >40 years old patients with FS, ≤40 years old healthy control, and >40 years old healthy individuals, respectively). Ferritin, VB, and VD values of four groups were evaluated by the One-Way ANOVA test and followed by Bonferroni analysis.

Spearman rank test was used for correlation analysis. Logistic regression analysis was used to determine independent risk factors such as ferritin, VB, VD, age, and BMI that may play a role in FS etiopathogenesis. A p-value of <0.05 was considered statistically significant.

RESULTS

The VB (240.0 [110.0-394.0] vs 291.0 [210.0–609.0] pg/ml, p<0.001), VD (12.5 [3.0–45.0] vs 20.0 [5.0–54.0] ng/ml, p=0.013), and ferritin levels (21.2 [4.0–86.0] vs 32.0 [7.1–120.0], ng/ml, p=0.009) of the FS patients were determined to be significantly lower than those of the control group. ESR and CRP values of both groups were similar. The VAS, FIQ, PSQS scores of the FS group were higher than those of the control group, and the SF-36 value was lower. The demographic characteristics and the laboratory results of the patient and control groups are shown in Table 1. Ferritin, VB, and VD levels are given in Figures 1, 2, and 3, respectively.

In the subgroup analysis, the VB level (312.4±66.5 pg/ml) of healthy controls ≤40 years of age was significantly higher than the VB levels of both ≤40 years (250.4±66.9 pg/ml, p<0.05) and >40 years old (262.2±67.5 pg/ml, p<0.05) patients with FS. Ferritin and VD values of the four groups were similar. The subgroup analysis results are shown in Table 2.

In the correlation analysis for patients, a negative correlation was determined between

ferritin and the number of tender points (r=-0.202, p=0.029), fatigue scale (r=-0.378, p=0.003), FIQ score (r=-0.517, p<0.001), and PSQS score (r=0.263, p=0.046). A negative correlation was determined between VB and fatigue VAS level (r=-0.308, p=0.018), tender points (r=-0.312, p<0.001), and FIQ score (r=-0.309, p=0.018). A negative correlation was determined between VD and the number of tender points (r=-0.234, p=0.012) and FIQ score (r=-0.346, p=0.008).

In the correlation analysis for healthy control, a negative correlation was determined between ferritin and pain duration (r=-0.299, p=0.023), VAS pain (r=-0.326, p=0.013) and FIQ score (r=-0.432, p<0.001). A negative correlation was determined between VD and pain duration (r=-0.259, p=0.049), tender points (r=-0.471, p<0.001), and VAS pain (r=-0.274, p=0.038). All correlation analysis results are shown in Table 3.

In the logistic regression analysis, we found low ferritin levels (odds ratio [OR] 1.036, 95% confidence interval [CI] 1.015-1.058, p<0.001) and VB (OR 1.010, CI 1.002-1.018, p=0.010) to be an independent risk factor for FS. VD was not determined to be independent risk factors for FS (p>0.05). The regression analysis results are shown in Table 4.

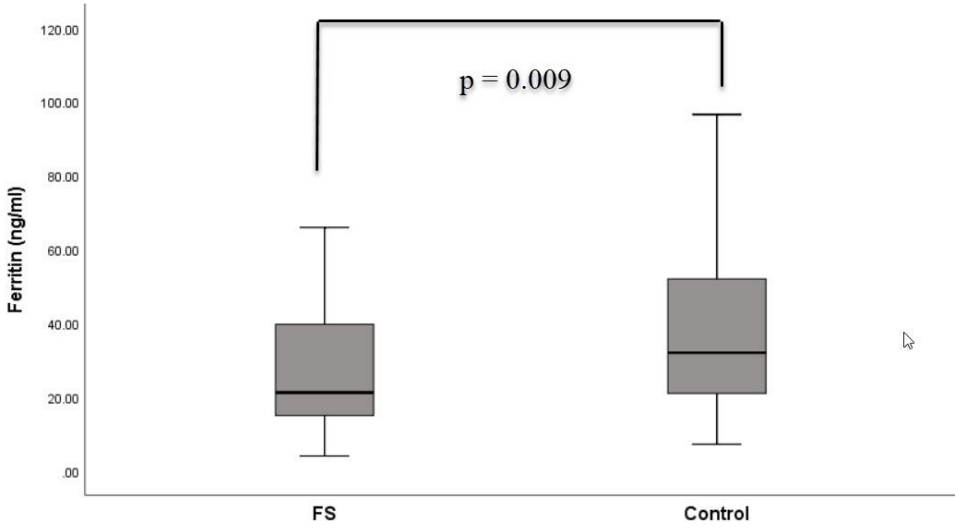

Figure 1. Ferritin levels of patient and control group.

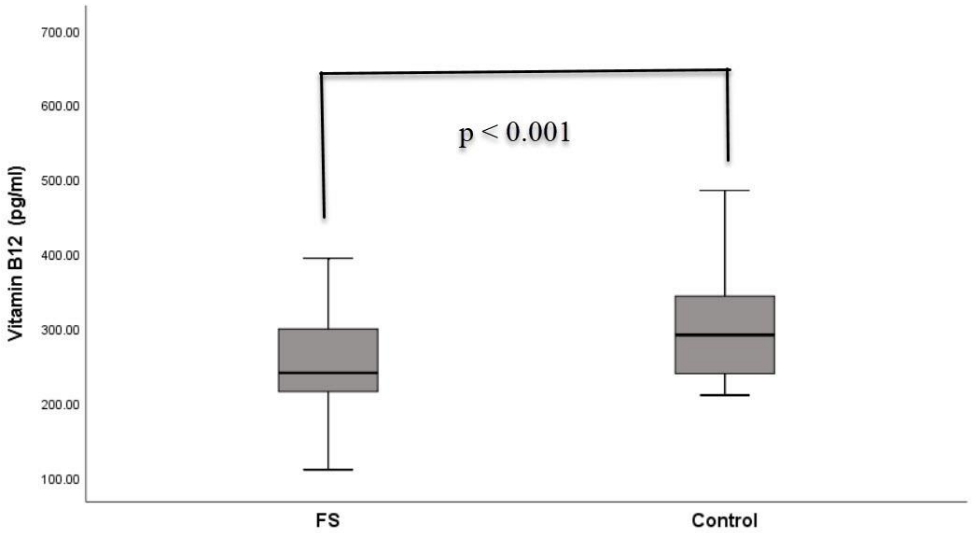

Figure 2. Vitamin B_{12} levels of patient and control group.

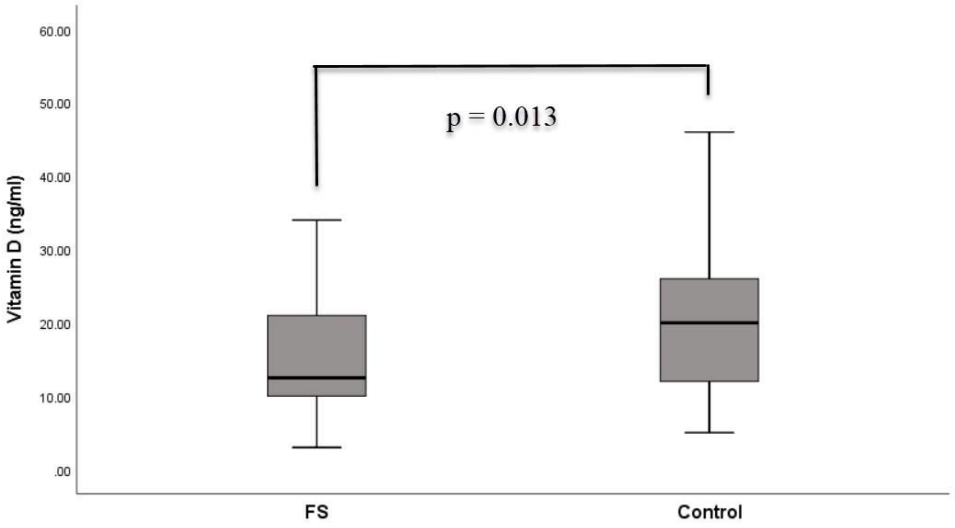

Figure 3. Vitamin D levels of patient and control group.

Table 1
Demographic, clinical and laboratory data of the patient and control groups

	Fibromyalgia (n=58)	**Control (n=58)**	**P value**
Age (years)*	41.0±6.9	39.8±10.6	0.470
BMI (kg/m^2)*	26.9±3.7	27.5±5.8	0.537
Pain duration (years)**	2.0 (0.5-20.0)	0.25 (0-9.0)	0.001
VAS pain**	8.0 (5.0-10.0)	6.0 (0.0-9.0)	0.001
Fatigue VAS level**	9.0 (2.0-10.0)	5.0 (0.0-9.0)	0.001
Fatigue Scale**	91.5 (52.0-133.0)	36.5 (0.0-124.0)	0.001
FIQ Score**	70.7 (46.9-99.3)	35.4 (0.0-92.1)	0.001
PSQS**	8.0 (1.0-15.5)	4.0 (0.0-17.0)	0.001
Tender point (n)**	14.0 (4.0-18.0)	0.0 (0.0-0.5)	0.001
PCS**	30.6 (15.8-52.0)	40.6 (24.8-54.5)	0.001
MCS**	35.6 (21.3-61.3)	42.3 (25.8-622.4)	0.001
Vitamin B$_{12}$ (pg/ml)**	240.0 (110.0-394.0)	291.0 (210.0-609.0)	0.001
Vitamin D (ng/ml)**	12.5 (3.0-45.0)	20.0 (5.0-54.0)	0.013
Ferritin (ng/ml)**	21.2 (4.0-86.0)	32.0 (7.1-120.0)	0.009
Hb (g/dl)*	12.9±1.2	13.2±1.1	0.151
ESR (mm/h)*	15.4 ±8.0	14,7±8.4	0.645
CRP (mg/dl)**	0.3 (0.0-14.0)	0.3 (0-4.2)	0.406

Abbreviations: *Mean±SD; **Median (range); **BMI,** body mass index; **VAS,** Visual Analogue Scale; **FIQ,** Fibromyalgia Impact Questionnaire; **PSQS,** Pittsburgh Sleep Quality Scale; **PCS**, Physical Component Summary score; **MCS,** Mental Component Summary score; **Hb,** Hemoglobin; **ESR,** erythrocyte sedimentation rate; **CRP,** C-reactive protein.

Table 2
Subgroup analysis by age

Parameters	FS ≤40 years old (n=28)	FS > 40 years old (n=30)	Control ≤40 years old (n=35)	Control >40 years old (n=23)
Ferritin (ng/ml)	28.8±18.2	27.8±20.4	36.3±23.2	44.5±29.3
VB (pg/ml)	250.4±66.9	262.2±67.5	312.4±66.5*Ŧ	295.5±95.9
VD (ng/ml)	15.5±9.7	16.2±8.6	22.3±12.1	19.0±9.8

Abbreviations: FS, Fibromyalgia syndrome; VB, vitamin B_{12}; VD, vitamin D.
*p<0.05 vs FS ≤40 years old
Ŧp<0.05 vs FS > 40 years old

Table 3
Correlations of vitamin B_{12}, vitamin D, ferritin and other parameters in patients

	Patients with Fibromyalgia syndrome					
	Vitamin B_{12}		**Vitamin D**		**Ferritin**	
Variable	**r value**	**p *value***	**r value**	**p *value***	**r value**	**p *value***
Pain duration	0.110	0.410	0.184	0.167	0.105	0.454
VAS pain	0.181	0.174	0.183	0.170	0.242	0.067
Fatigue VAS level	0.308	0.018	0.100	0.454	0.253	0.055
Fatigue Scale	0.022	0.870	0.217	0.102	0.378	0.003
Tender point	0.312	0.001	0.234	0.012	0.202	0.029
FIQ	0.309	0.018	0.346	0.008	0.517	0.001
PSQS	0.010	0.941	0.014	0.916	0.263	0.046
PCS	0.023	0.863	0.095	0.477	0.213	0.108
MCS	0.003	0.981	0.075	0.577	0.174	0.191
	Control Group					
	Vitamin B_{12}		**Vitamin D**		**Ferritin**	
Variables	**r value**	**p *value***	**r value**	**p *value***	**r value**	**p *value***
Pain duration	0.036	0.787	0.259	0.049	0.299	0.023
VAS pain	0.092	0.490	0.274	0.038	0.326	0.013
Fatigue VAS level	0.116	0.385	0.134	0.314	0.043	0.716
Fatigue Scale	0.078	0.560	0.150	0.260	0.087	0.516
Tender point	0.233	0.078	0.471	0.001	0.168	0.207
FIQ	0.154	0.248	0.011	0.935	0.432	0.001
PSQS	0.024	0.856	0.073	0.588	0.067	0.616

Table 3 (*continued*)

PCS	0.062	0.645	0.060	0.653	0.138	0.303
MCS	0.059	0.663	0.107	0.427	0.156	0.246

Abbreviations: VAS, Visual Analogue Scale; **FIQ,** Fibromyalgia Impact Questionnaire; **PSQS,** Pittsburgh Sleep Quality Scale; **PCS**, Physical Component Summary score; **MCS,** Mental Component Summary score.

Table 4
Logistic Regression Analysis to determine risk factors of FS

Independent Variables	OR	95%Cl	P value
Ferritin	1.036	1.015–1.058	0.001
VB	1.010	1.002–1.018	0.010
VD	1.043	0.998–1.089	0.059
Age	1.005	0.945–1.069	0.876
BMI	1.031	0.929–1.145	0.560

Abbreviations: FS, Fibromyalgia syndrome; **OR,** odds ratio; **Cl,** confidence interval; **VB,** vitamin B_{12}; **VD,** vitamin D; **BMI,** body mass index.

DISCUSSION

These tests were rigorously evaluated to diagnose FS. Our results showed that ferritin, VB and VD levels were significantly lower in patients with FS compared to healthy individuals. There was a relationship between the tender point number of patients and their VB, VD, and ferritin levels. Also, low VB, VD, and ferritin levels significantly affected the patients' FIQ score. In logistic regression analysis, we found ferritin and VB levels as independent risk factors for FS etiopathogenesis. These findings suggest that the iron and VB level may play a vital role in the etiopathogenesis of FS. There was a negative correlation between the number of tender points and only VD levels in healthy women. Also, there was a negative correlation between the FIQ score and only ferritin levels in healthy individuals. Besides, the ferritin level affected the PSQS score of healthy controls. Iron and VD can affect the VAS pain score of healthy individuals.

The FS is a disease with symptoms like general body pain, sleep disturbance, fatigue, depression, forgetfulness, and decreased concentration. The etiology of the disease has not been fully elucidated yet. However, genetic predisposition and psychological causes are thought to be responsible [26]. Pamuk *et al*. reported that the prevalence of FS in iron deficiency anemia is 17.6% and iron deficiency anemia in FS is 24.5% [27]. Dopamine, norepinephrine, and serotonin are neurotransmitters that work in many signal pathways in the brain. Decreased levels of these transmitters may play a role in FS etiopathogenesis [28]. Iron is a cofactor for the production of serotonin and dopamine. Iron deficiency can decrease the levels of these neurotransmitters in the central nervous system [12]. Iron deficiency can cause sleep disturbance and restless legs syndrome by reducing dopamine synthesis [29]. Iron deficiency leads to general body pain, weakness, and fatigue; therefore, it can easily be confused with FS. Iron treatment in FS patients with iron deficiency may reduce these symptoms [30]. Serotonin and norepinephrine are vital for emotional behavior. Iron deficiency leads to a decrease in the levels of these neurotransmitters. Iron deficiency can lower the levels of these transmitters and cause symptoms similar to FS [31]. Ortancil *et al*. found significantly lower ferritin values in the FS group than in the control group. They showed that a low ferritin value was an independent risk factor for FS in the multivariate analysis [12]. Mader *et al*. [32] reported that unlike Ortancil *et al*.' study, ferritin levels of patients with

FS and the control group were similar. They could not find a relationship between the FIQ score and serum ferritin and iron levels [32]. Similar to our results of that Ortancil *et al*.' study, in the current study, the ferritin value of the FS group was significantly lower than that of the control group, and in the regression analysis, a low ferritin value was determined to be an independent risk factor for the development of FS. Ferritin is an acute-phase reactant, and its value increases in the presence of inflammation. Hemoglobin and ferritin values of both FS and control groups were within normal limits (hemoglobin, 12.0 to 15.5 g/dl for women; ferritin, 10 to 150 ng/ml for women) [33]. Normal ferritin levels helped us to exclude inflammatory diseases. In our study, we found that the symptoms of FS patients were closely related to the ferritin value, although ferritin was within the normal range. Also, we found that ferritin was associated with PSQS score, not VB and VD in patients with FS. However, Okan *et al*. could not find any relationship between sleep disturbance and iron deficiency in the patients [34]. There are still contradictory results about whether there is a relationship between FS etiopathogenesis and iron level. Detailed and multi-participant studies are needed on this subject.

Symptoms such as fatigue, exhaustion, headache, neck and back pains, forgetfulness, and depression occur in VB deficiency like FS's symptoms. Similar findings of both diseases may lead to an incorrect diagnosis of FS.VB deficiency could disrupt methionine synthesis enzyme activity and cause nerve demyelination [35,36]. Demyelination of the nerves causes a decrease in the pain threshold and general body pain in patients. There is a strong relationship between VB levels and general body pain, and most patients' pain symptoms may decrease with VB supplementation [37]. De Carvalho JF *et al*. reported that they did not encounter VB deficiency in 29 patients with FS [11]. In another study, Ortancil *et al*. found that the VB level in FS patients was similar to healthy controls [12]. Unlike these studies, we found that the VB level of patients with FS was significantly lower than healthy controls. There was a relationship between VB and the number of tender points and FIQ score. In regression analysis, we determined that VB may play a role in FS etiopathogenesis. According to our study, VB can play an important role in FS etiopathogenesis.

The VD deficiency is a common condition worldwide and is defined as a blood 25-OH-VD level below 20 ng/ml [38]. VD affects pain sensitivity by lowering the level of PGE2 and regulating the levels of proinflammatory cytokines and nitric oxide [39]. In VD deficiency, the levels of neurotransmitters change, and the pain threshold decreases. Low VD levels can lead to general body and musculoskeletal pain, weakness, and emotional behavior disorder. The musculoskeletal pain improves with VD treatment [40,41]. VD levels may be low in patients with FS, and low VD levels can negatively relate to the FIQ score [42]. Doğru *et al*. reported that in 60% of FS patients, the VD level was <30 ng/ml, and the FIQ scores of the patients decreased with VD treatment [16]. Maafi *et al*. and Olama *et al*. reported that the VD level was <20 ng/ml in both the FS and the control group. Maafi *et al*.'s study, the VD level of FS patients was higher than the VD level of the control group [15]. However, Olama *et al*.'s study, the VD levels of patients with FS were lower than the VD level of the control group [43]. Mateos *et al*. reported similar VD values in the FS and control groups [44]. We found that the VD level of the FS group was significantly lower than the control group. We found a relationship between VD level and the number of tender points in patients with FS. However, we could not find an independent relation between VD and FS etiopathogenesis in regression analysis. There are conflicting results in the literature regarding the VD value of patients with FS [15,43–46]. However, no study in the literature has claimed that VD deficiency is an independent risk factor in FS etiopathogenesis.

Limitation of study

The study has a small sample size. Our results may have been affected by the number of individuals. Studies with a large population are needed. There may be differences between genders, especially in ferritin values. However, we included only the female gender in the study. Depending on the decreasing estradiol levels with aging, patients' biochemical parameters or pain sensitivity may change. However, we did not evaluate estrogen values. We could not find a significant difference in subgroup analysis according to age 40 years old. In our study, the VAS value of the control group was lower than the FS patients, but this value was slightly above the normal range. Erroneous VAS pain measurements of up to 20 mm have been reported in the literature [47]. Also, low VD levels can affect the VAS score [48]. VD levels may have affected the VAS pain score of our healthy controls. Besides, we may have made a mistake in measuring the VAS score.

CONCLUSION

Our results showed that the VB, VD, and ferritin levels of FS patients are significantly lower than those of healthy women. Ferritin and VB levels may affect the FIQ score and tender points. Low ferritin and VD levels may play a role in FS etiopathogenesis. In patients with FS, the VD level was low and associated with tender points. However, VD level was not an independent risk factor for FS etiopathogenesis.

Introducere. *Fibromialgia (FS) este reprezentată de dureri generalizate, oboseală și modificări ale somnului. Vitamina B_{12} (VB), vitamina D (VD) și deficitul de fier sunt caracterizate de aceleași acuze. Studiul și-a propus să evalueze nivelurile VB, VD și ale feritinei la pacienții cu FS și să studieze corelțiile cu severitatea FS.*

Materiale și metode. *58 de paciente cu FS și 58 de femei sănătoase au fost incluse în studiu. Pacientele au completat chestionarul FIQ, VAS și chestionarul de oboseală, scala de calitatea a somnului Pittsburgh și SF-36. Totodată au fost evaluate nivelurile VB, VD și ale feritinei.*

Rezultate. *VB (240,0 [110,0–394,0] vs 291,0 [210,0–609,0] pg/ml, p<0,001), VD (12,5 [3,0–45,0] vs 20,0 [5,0–54,0] ng/ml, p=0,013) și feritina (21,2 [4,0–86,0] vs 32,0 [7,1–120,0], ng/ml, p=0,009) au fost semnificativ statistic mai mici la pacienții FS. S-a observat o corelație negativă între numărul punctelor dureroase și VB, VD, feritină. În analiza de regresie feritina scăzută (odds ratio [OR] 1,036, 95% interval de încredere [CI] 1,015–1,058, p<0,001) și VB (OR 1,010, CI 1,002–1,018, p=0,010) sunt factori independenți pentru FS.*

Concluzii. *S-a observat o corelație negativă între VB, VD și feritină și numărul de puncte dureroase la pacienții cu FS. Nivelurile feritinei și ale VB ar putea juca un rol în patogeneza FS. Totuși nivelurile VD nu par să fie un factor de risc pentru FS.*

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