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Evaluation of vitamin D levels in patients with chronic low back-leg pain

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ABSTRACT

Objective: We aimed to examine the relationship between the levels of vitamin D and patients with chronic low back-leg pain (CLBLP) and to investigate its effects on pain and functional capacity.

Methods: 145 patients (female/male:103/42) with CLBLP, aged between 35 and 65 years (mean age: $53,06 \pm 8,14$), participated in the study. Visual Analog Pain Scale (VAS) was used to measure the state of pain. Pain-related functional capacity was evaluated through Oswestry Disability Index (ODI). Patients were classified into three groups based on their serum vitamin D levels: normal (≥ 30 ng/ml), vitamin D insufficiency ($21-29$ ng/ml), and vitamin D deficiency (≤ 20 ng/ml).

Results: We found that 22,8% of patients (n:33) had vitamin D deficiency, 42,8% (n:62) had vitamin D insufficiency, and 34,5% (n:50) had normal levels of vitamin D. VAS scores were $4,75 \pm 0,93$; $4,66 \pm 0,97$ and $4,52 \pm 0,90$ for patients with vitamin D deficiency, vitamin D insufficiency, and normal levels of vitamin D, respectively. We found that there was no significant relationship between vitamin D level and VAS score ($p > 0,05$). ODI scores were $18,78 \pm 7,89$; $15,46 \pm 5,57$ and $14,52 \pm 7,19$ for patients with vitamin D deficiency, vitamin D insufficiency, and normal levels of vitamin D, respectively. CLBLP-related functional capacity was found to be significantly lower in patients with vitamin D deficiency when compared to other two groups ($p < 0,05$).

Conclusion: Vitamin D deficiency may lead to lower functional capacity, and clinically, Vit D levels should be checked in musculoskeletal pain patients at risk of Vit D deficiency.

Level of Evidence: Level IV, Diagnostic study.

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Introduction

Low back pain is one of the most prevalent complaints in musculoskeletal pain, and is a serious condition that may result in loss of functionality as well as labor.¹ It is categorized into three types according to the duration of pain: acute (lasting less than six weeks), subacute (lasting between 6 and 12 weeks), and chronic (lasting longer than 12 weeks).² 30% of acute low back pain becomes chronic.³

Acute low back pain results in muscle spasm in locomotor system structures, whereas in chronic cases, by producing a number of pathological changes, it may lead to difficulty in the performance of routine tasks.⁴ In their studies, Russel et al observed muscle

atrophy in patients with vitamin D deficiency, and the biopsies they conducted on atrophic muscles provided evidence that atrophy rates were significantly higher in type II-a muscle fibers.⁵ Recent studies have emphasized that vitamin D deficiency leads to resistant chronic musculoskeletal system pain and neuromuscular dysfunction.⁶ Therefore, it is believed that vitamin D deficiency may have potentially detrimental effects on musculoskeletal system.⁷ The initial manifestations of vitamin D deficiency may involve weakness of proximal muscles and widespread pain. Patients may complain particularly of lower extremity pain. Weakness of proximal muscles may cause difficulty while walking and an antalgic walking pattern.⁸ Hence, chronic low back pain (CLBP), one of the symptoms resulting from vitamin D deficiency, may decrease quality of life in that it leads to functional insufficiency, thereby negatively affecting social and work life.⁹

A review of the relevant literature reveals that research into the relationship between chronic musculoskeletal pain and vitamin D

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are few in number, with contradictory findings. In this study, it was aimed to investigate the relationship between vitamin D levels and CLBLP, and to examine its effects on pain and functional capacity.

Patients and methods

In this study, laboratory data and files belonging to patients who applied to our polyclinic for CLBLP over the period of November 2014–December 2015 were retrospectively analyzed. Patients aged 35–65 who had lower back pain for at least 3 months were included in the study. The patients were put into three groups according to their ages: 35–45, 46–55, and 56–65 years. During the physical examination, patients who had positive results in Straight Leg Raising Test (signals sciatic nerve irritation) and Schober's Test (indicates lumbar flexion mobility) were instructed to have a Magnetic Resonance Imaging (MRI) scan. According to MRI scan, patients who had lumbar disc herniation or lumbar spondylosis with no surgical indication were accepted into the study sample. Patients with a history of severe trauma such as fall from height or traffic accident, stroke, spinal surgery, diabetes, malignancy, chronic inflammatory lower back pain, or prolonged use of analgesics or antidepressants were not included in the study sample. In addition, patients with clinical findings indicating a serious pathology (red flags), or with abnormal levels of hemogram, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), calcium (Ca), phosphorus (P), alkaline phosphatase (ALP), urea, creatinine, aspartate aminotransferase (AST), alanine aminotransferase (ALT), serum T3, T4, thyroid stimulating hormone (TSH), or parathormone (PTH) were excluded from the sample. Thus, out of the 2572 patients with CLBLP, 2427 were excluded from the study group for the following reasons: 586 – age; 213 – physical examination findings; 128 – lack of MRI scan, 173 – patient history unconformity, 425 – red flag findings, 225 – inappropriate laboratory findings; and 677 – no vitamin D level. The remaining 145 patients (mean age: $53,06 \pm 8,14$ years, female/male: 103/42) constituted the study group.

Vitamin D levels were measured for each patient. Patients were classified into three groups based on their serum vitamin D levels: normal (≥ 30 ng/ml), vitamin D insufficiency (21–29 ng/ml), and vitamin D deficiency (≤ 20 ng/ml).

Visual Analog Pain Scale (VAS) (0–10 cm; 0 = no pain, 10 = worst pain) was used to evaluate the state of pain.¹⁰ Pain-related functional capacity was assessed by Oswestry Disability Index (ODI), through which the severity of pain, personal care, load bearing, walking, sitting down, standing, social life, sleep, travel status, and cognitive status of pain were evaluated. Each item was given a score between 0 and 5, and maximum total score was 50. In ODI, it is known that as total score increases, so does the level of functional incapacity and disability.¹¹

Findings were expressed in mean and standard deviation (mean \pm sd). Kolmogorov–Smirnov Test was used to evaluate the concordance of data to normal distribution. For the comparison of the groups, Mann–Whitney U-test was used for pairwise comparison, and Kruskal–Wallis test was used when more than two groups were compared. Spearman's rank order correlation was used for binary correlation analysis, and Chi-square test was used to analyze categorical data. All data compiled was analyzed on SPSS 22.0 (SPSS Inc., Chicago IL, USA) software. Statistical significance value was set at $p < 0,05$.

Results

Of the 145 patients (mean age $53,06 \pm 8,14$), 103 (71%) were women, and 42 (29%) were men. The categorization of patients according to vitamin D levels showed that 22,8% (n:33) had vitamin

D deficiency, 42,8% (n:62) had vitamin D insufficiency, and 34,5% (n:50) had normal levels of vitamin D. There was no significant difference between genders as regards vitamin D levels ($p > 0,05$) (Fig. 1) (Table 1).

VAS scores were found to be $4,75 \pm 0,93$; $4,66 \pm 0,97$ and $4,52 \pm 0,90$ for patients with vitamin D deficiency, vitamin D insufficiency, and normal levels of vitamin D, respectively. We found that there was no significant relationship between vitamin D level and VAS score ($p > 0,05$) (Fig. 2).

ODI scores were found to be $18,78 \pm 7,89$; $15,46 \pm 5,57$ and $14,52 \pm 7,19$ for patients with vitamin D deficiency, vitamin D insufficiency, and normal levels of vitamin D, respectively. CLBLP-related functional incapacity was found to be significantly higher in patients with vitamin D deficiency when compared to other two groups ($p < 0,05$) (Fig. 3). ODI scores for age groups were found to be $14,70 \pm 7,69$; $15,25 \pm 5,36$ and $18,71 \pm 7,66$ in 35–45 year olds, 46–55 year olds, and 56–65 year olds, respectively. CLBLP-related functional incapacity was found lower in 35–45-year-old patients than other groups significantly ($p < 0,05$).

Vitamin D levels were found to be $34,40 \pm 3,53$ ng/ml; $27,15 \pm 2,77$ ng/ml and $18,17 \pm 1,23$ ng/ml in 35–45 year olds, 46–55 year olds, and 56–65 year olds, respectively. Vitamin D levels of patients with CLBLP who were over 55 years old were significantly lower than other age groups ($p < 0,001$) (Fig. 4). A negative correlation between vitamin D levels and age ($r: -0,695$; $p < 0,001$) as well as between vitamin D levels and ODI scores ($r: -0,204$; $p < 0,05$) was found, indicating that aging results in a decrease in vitamin D levels, deficiency in vitamin D levels result in lower functional capacity. The VAS scores of patients aged 35–45, 46–55, and 56–65 were found to be $4,16 \pm 1,08$, $4,48 \pm 1$, and $4,76 \pm 0,93$, respectively. Patients aged 56 and over had the highest VAS score of statistical significance ($p < 0,05$). A significant positive correlation existed between age group and VAS score ($r: 0,207$; $p < 0,05$) (Table 2).

The duration of discomfort due to CLBLP was $14,23 \pm 6,57$ months. Patients with vitamin D deficiency suffered from CLBLP for $19,57 \pm 5,69$ /months, whereas patients with vitamin D insufficiency had CLBLP for $13,58 \pm 5,39$ /months. This duration was $10,83 \pm 6,32$ /months for patients with normal levels of vitamin D. The duration of discomfort was highest in patients with vitamin D

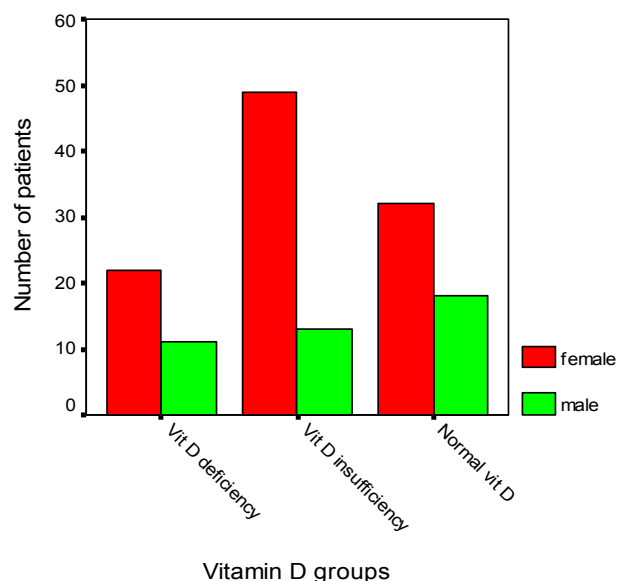


Fig. 1. Vitamin D groups in number of patients according to the gender.

Table 1
Demographic values for vitamin D groups.

(n:145)	Vitamin D deficiency (n:33) (%22,8)	Vitamin D insufficiency (n:62) (%42,8)	Normal D vitamin (n:50) (%34,5)	r	p
Age (years)	62,18 ± 3,00	53,79 ± 5,03	46,16 ± 7,23	-0,695	<0,05
Female/male	22/11	47/15	34/16		>0,05
VAS scores	4,75 ± 0,93	4,66 ± 0,97	4,52 ± 0,90	-0,730	>0,05
ODI scores	18,78 ± 7,89	15,46 ± 5,57	14,52 ± 7,19	-0,204	<0,05
Disease duration (months)	19,57 ± 5,69	13,58 ± 5,39	10,83 ± 6,32	-0,485	<0,05
Vitamin D (ng/ml)	10,72 ± 4,90	25,97 ± 2,68	38,21 ± 7,70		<0,001

Bold indicates $p < 0,05$: statistically significant.

ODI: Oswestry Disability Index; VAS: Vizuel Analogue score.

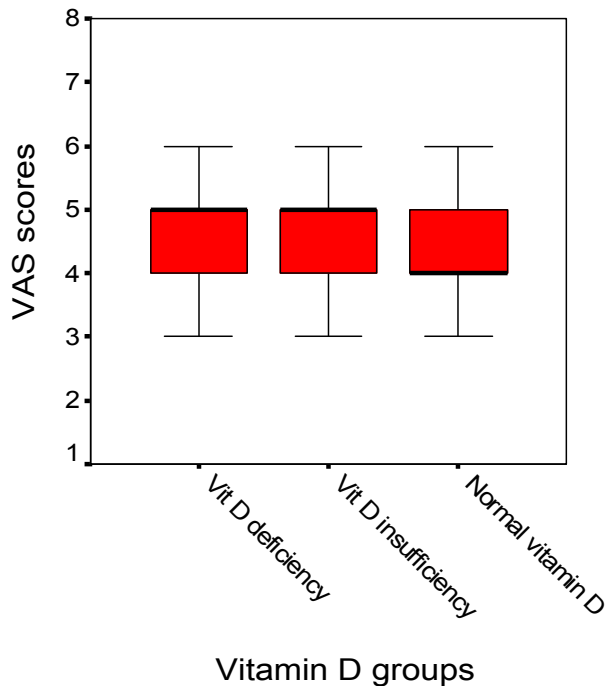


Fig. 2. VAS scores in vitamin D groups.

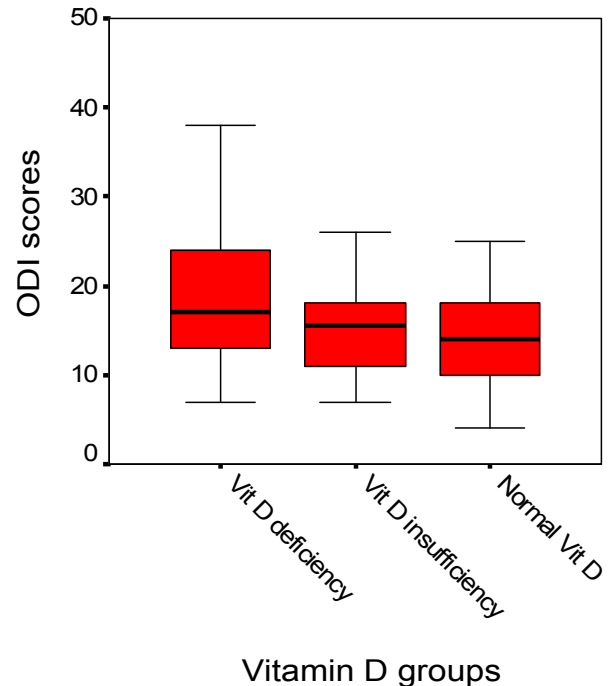


Fig. 3. The relationship between ODI scores and vitamin D levels.

deficiency. A statistically significant negative correlation was found between vitamin D levels and duration of discomfort ($r: -0,405$; $p < 0,001$) (Fig. 5).

Discussion

Vitamin D deficiency is a widespread complaint, and is regarded as a global health concern. The findings of the previous studies on the relationship between vitamin D levels and CLBP are contradictory. Alfaraj et al found that 83% of patients with CLBP had vitamin D deficiency,¹² whereas this percentage was 81,7% in the study conducted by Lotfi et al,¹³ 74,3% in the study by Hwan-Kim et al,¹⁴ and 22,5% in eSilva et al's study.¹⁵ In our study, we found that 22,8% of patients had vitamin D deficiency, whereas 42,8% had vitamin D insufficiency. It has been shown that the relationship between CLBP and vitamin D insufficiency is more evident in old women than men.¹⁶ However, in another study conducted on 350 patients with CLBP, no significant correlation was found between vitamin D levels and gender,¹⁴ which is in accord with our findings.

There are several hypotheses explaining the fact that vitamin D insufficiency causes low back pain. Foremost among these is the fact that free nerve endings are able to regenerate and function properly thanks to an adequate level of vitamin D. Previous studies have also revealed that, in the presence of vitamin D deficiency,

neuromuscular dysfunction may develop as a result of hypersensitivity and sensorial hyperinnervations in muscles.¹⁷ Neuromuscular dysfunction may cause pain to become chronic. It has been shown that vitamin D deficiency could be a risk factor for CLBP. Hicks et al indicated that older women suffering from vitamin D deficiency experience low back pain more severely.¹⁶ Another study found that patients with vitamin D deficiency diagnosed with lumbar disc herniation have more severe discogenic pain.¹⁸ It was also found that severity of pain is higher in lumbar spinal stenosis patients with vitamin D deficiency.¹⁴ In another study, it was shown that there is no relationship whatsoever between vitamin D deficiency and severity of LBP,¹⁹ which is in accord with our findings.

It is noteworthy that insufficient amounts of serum vitamin D may lead to the development of metabolic bone defects, myopathy, pervasive weakness in proximal muscles, and functional incapacity as well as an increased risk of bone fractures. Recent studies have hinted at a possible link between vitamin D deficiency and lower functional capacity. A decrease in functional capacity is a prevalent condition which is increasingly placing a burden on patients in terms of socioeconomic situation.²⁰ Bischoff et al reported that muscle strength and functional capacity in 60-year-old or older patients with vitamin D deficiency is lower than patients with normal levels of vitamin D,²¹ whereas another study conducted on patients with CLBP found no relationship between vitamin D deficiency and functional capacity.¹⁴ Still another study indicated

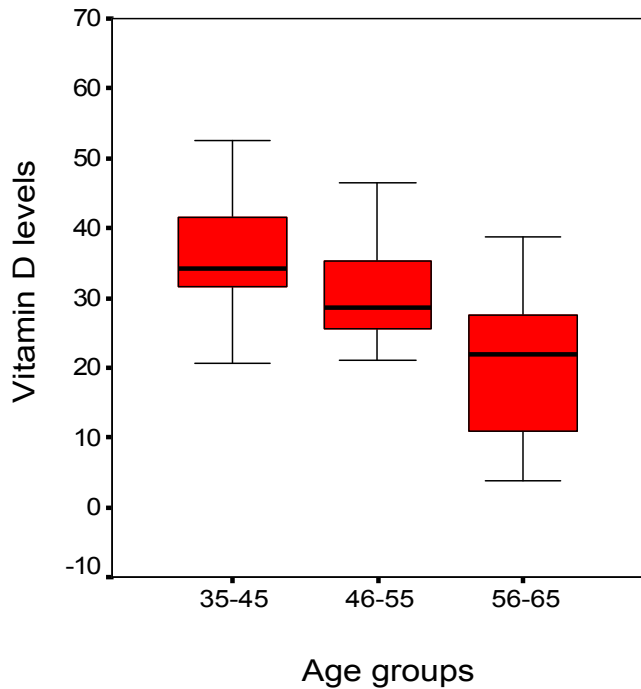


Fig. 4. The relationship between age groups and vitamin D levels.

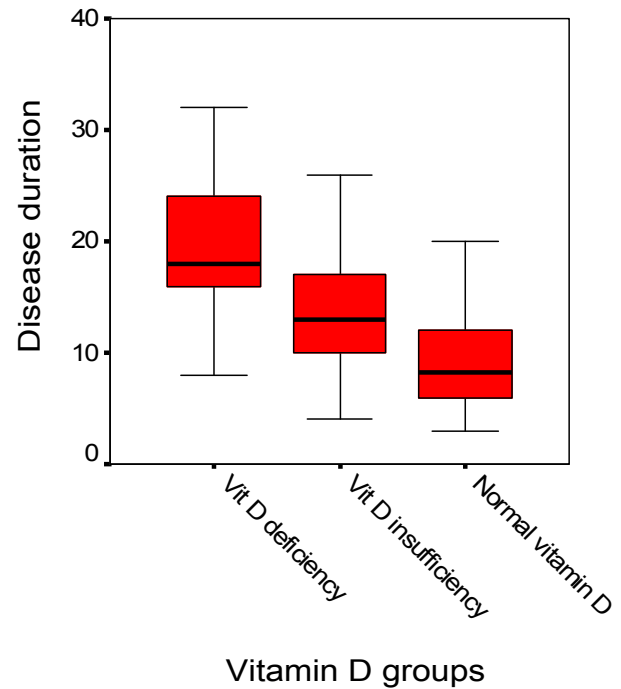


Fig. 5. Disease duration in vitamin D groups.

Table 2
Relationship between VAS scores and age groups.

Age groups (n:145)	VAS scores	r	p
35–45 (n:30) (20,6%)	4,16 ± 1,08	0,207	<0,05
46–55 (n:47) (32,4%)	4,48 ± 1,01		
56–65 (n:68) (47%)	4,76 ± 0,93		

Bold indicates $p < 0,05$: statistically significant.

that no significant relationship exists between vitamin D deficiency and myopathy including its related functional symptoms.¹⁹ Glerup et al, on the contrary, showed that symptoms related with myopathy were most commonly found in patients with vitamin D deficiency.²² It has been stated that vitamin D deficiency affects muscles in postmenopausal women, thus causing reduced functional capacity.²³ In our study, we found functional capacity to be lower in patients with vitamin D deficiency.

A study conducted in a country where duration of exposure to sunlight in a year was high reported that people with a more covered way of dressing were more likely to suffer from vitamin D deficiency.¹² Another study found that vitamin D deficiency was more prevalent among people living in Northern Europe, where exposure to sunlight is limited.²⁴ Bolu, the city where this study was conducted, is located at 40°44'05"N and 31°36'27"E, and can be considered to have a cold climate, with an average yearly temperature of 10–15 °C. Due to the fact that duration of exposure to sunlight does not differ much between seasons, we do not believe that vitamin D levels of patients is affected by seasonal factors in our region. However, we think that some factors, such as the fact that the people in Bolu have a more covered way of dressing compared to their European counterparts, and that there are differences as regards eating habits, levels of physical activity, and cultural factors, contribute greatly to deficient levels of vitamin D.

Vitamin D deficiency is particularly common in seniors. Lodh et al reported vitamin D deficiency to be more prevalent in CLBP patients aged 60 years old older.²⁵ In contrast, the findings of another study suggest that there is no significant correlation between age and vitamin D levels.¹⁹ We detected a significant negative correlation between vitamin D levels and age, as vitamin D levels in patients aged 56–65 had significantly lower levels of vitamin D. Therefore, it can be considered that there could be other factors that may contribute to the severity of pain in older patients with chronic LBP.

The fact that CLBLP is, in clinical terms, a multi-factor process resulting from the interaction of somatic, psychosocial, and environmental factors leads to the consideration of a possible relationship between duration of discomfort and vitamin D levels. In a study conducted on CLBP patients with an average duration of discomfort of 23 months, no significant correlation was found between CLBP and duration of discomfort, and it was shown that there did not exist a relationship between duration of discomfort and vitamin D levels,¹³ which is in line with the report of Johansen et al, who found no significant relationship between vitamin D levels and duration of discomfort.¹⁹ In contrast with the aforementioned findings, we found a statistically significant negative correlation between duration of discomfort and vitamin D levels in patients with an average period of discomfort of 14 months.

As vitamin D has taken on clinical importance, so have replacement treatments. A study reported 90% recovery in clinical findings in nonspecific muscle pain patients with vitamin D deficiency as a result of vitamin D replacement.²⁶ Another study found vitamin D deficiency in 83% of patients who had low back pain for at least 6 months, and clinical improvement was achieved with a replacement treatment of 5000–10,000U/day administered over a follow up period of three months.¹² In contrast with these findings, no significant improvement in clinical findings of patients with nonspecific low back pain was found following vitamin D replacement over 8 weeks as reported in another study.²⁷ We have provided vitamin D supplementation to CLBLP patients with vitamin D deficiency and observed a decrease in their complaints.

However, this paper is limited in that we have been unable to provide supporting data due to a number of difficulties in patient follow-ups, and that vitamin D levels could not be compared to patients with no chronic LBP as there was no control group. Even though our study has a smaller patient group size than some other studies on chronic LBP and vitamin D deficiency,^{12–14} it is indicative of the effects of vitamin D deficiency on the functional capacity of patients with chronic LBP, and it is hoped that this study could prove beneficial for future research to be conducted on the subject with a larger group of subjects.

In conclusion, we found that CLBLP patients with vitamin D deficiency had lower functional capacity, that vitamin D levels decreased according to age and duration of discomfort, and that no significant correlation existed between vitamin D levels and severity of pain or gender. We have not been able to find a Turkey-based study into the relationship between vitamin D levels and functional capacity in patients with CLBLP in the relevant literature; therefore, our study is the first ever to indicate such a relationship. It should be kept in mind that vitamin D deficiency leads to lower functional capacity, and clinically, in cases of chronic pain, an assessment of vitamin D levels should be requested.

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