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Research Article

Relationship between musculoskeletal pain and Vitamin D levels in elderly women

Yaşlı kadınlarda kas-iskelet sistemi ağrısıyla D vitamini düzeyleri arasındaki ilişki

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ABSTRACT

Introduction: Pain is a common symptom of aging. Vitamin D is an effective pre-prohormone with ubiquitous receptors in many tissues, including the musculoskeletal system. Vitamin D deficiency is known to cause pain, proximal muscle weakness in lower extremities, skeletal mineralization defects, balance disorders, increased risk of fall and fracture, and reduced functional capacity. This study aimed to evaluate the relationship between vitamin D levels and the musculoskeletal pain in female patients aged 65 years or over.

Methods: This descriptive cross-sectional study included 120 female patients aged 65 years and over who were admitted to physical therapy and rehabilitation outpatient clinic. The participants were administered a questionnaire consisting of demographic data (age, education, occupation, sun exposure, physical activity levels, intake of calcium-rich foods), musculoskeletal pain, and location of the pain. The levels of 25(OH) vitamin D (vitamin D), calcium, phosphorus, alkaline phosphatase, and parathormon in the serum were recorded from the hospital database.

Results: Of the participants, 101 (84%) had vitamin D deficiency or insufficiency, 83 (69%) had musculoskeletal pain, and 37 (31%) had no pain at all. Serum vitamin D levels were significantly lower in those who had pain (p=0.008). Sixty-two (75%) of the patients with musculoskeletal pain (n=83) had vitamin D deficiency or insufficiency. Among those with musculoskeletal system pain and vitamin D deficiency or insufficiency (n=62), the pain was most frequently localized to the lower back (41%) and upper back (32%).

Conclusion: It is important to evaluate serum 25(OH) vitamin D levels particularly in elderly female patients admitted with musculoskeletal pain. Vitamin D deficiency should be kept in mind for female patients suffering from the lower and upper back pain. Considering the role of vitamin D on the musculoskeletal system, assessment of vitamin D levels and, in case of deficiency, supplementation therapy is recommended for elderly women.

Keywords: Vitamin D, female, musculoskeletal pain

ÖZ

Giriş: Ağrı yaşın ilerlemesiyle sık karşılaşılan bir semptomdur. D vitamini, yaygın reseptörleri ile kas iskelet sistemi dahil olmak üzere pek çok dokuda etkili pre-prohormondur. D vitamini eksikliğinin, ağrı, alt ekstremite de proksimal kas güçsüzlüğü, iskelet mineralizasyon defekti, denge bozukluğu, kırık ve düşme riskinde artış ve fonksiyonel kapasitede azalmaya yol açtığı bilinmektedir. Amacımız 65 yaş ve üzeri kadın hastalarda D vitamini düzeylerini ve kas iskelet sistemi ağrısıyla D vitamini ilişkisini değerlendirmektir.

Yöntem: Kesitsel tanımlayıcı çalışmaya fizik tedavi ve rehabilitasyon polikliniğine başvuran, gönüllü olur formunu imzalayan 65 yaş ve üstü,120 kadın hasta dahil edildi. Hastaların demografik verileri (yaş, eğitim, meslek, güneşle temas, fiziksel aktivite düzeyleri, kalsiyumlu gıda alımları), kas iskelet sistemine ait ağrı olup olmadığı ve ağrısı olanlarda bölgesi sorgulandı. Serum 25(OH) vitamin D(vitamin D), kalsiyum, fosfor, alkalen fosfataz, parathormon düzeyleri kaydedildi.

Bulgular: Altmış beş yaş ve üzeri, 120 kadın hastanın D vitamin düzeyleri değerlendirildiğinde 101(%84)'inde eksiklik ve yetersizlik bulundu. Hastaların 83 (%69)'ünde kas iskelet sistemi ağrısı varken, 37(%31)'sinde ağrı yoktu. Kas iskelet sistemi ağrısı olanlar(n=83)ve olmayanlar(n=37) karşılaştırıldığında, ağrısı olanların serum D vitamini düzeyleri anlamlı düşük bulundu (p=0,008). Kas iskelet sistemi ağrısı olan (n=83) hastaların 62(%75)'sinde D vitamini eksikliği veya yetersizliği vardı. D vitamini düzeyinde eksiklik ve yetersizlik olanlarda (n=62), kas iskelet sistemi ağrısı değerlendirildiğinde en sıklıkla bel(%41), ikinci sıklıkta sırt ağrısı(%32) semptomu vardı.

Sonuç: Özellikle polikliniklere kas iskelet sistemi ağrısı ile başvuran altmış beş ve üzeri yaş hastalarda serum 25(OH) vitamin D değerlendirilmesi önemlidir. Bel ve sırt ağrısı şikâyetiyle gelen kadın hastalarda D vitamini eksikliği de akılda tutulmalıdır. Kas iskelet sistemi üzerinde D vitamininin etkileri göz önüne alındığında, ileri yaş kadın hastalarda D vitamini düzeylerinin değerlendirilerek eksikliğinin tespiti halinde tedavisinin planlanması önerilmektedir.

Anahtar Kelimeler: D vitamini, kadın, kas-iskelet sistemi ağrısı

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Introduction

Pain is a common problem associated with advanced age. Pain emerges as a consequence of a sensory warning and neurological damage and varies according to one's memory, expectations and emotional state [1]. Pain is a common symptom in the elderly; musculoskeletal pain leads to decreased physical performance and disability and therefore is an important problem affecting the quality of life [2].

Vitamin D is a fat-soluble vitamin, which is also defined as a group of sterols that are hormones or hormone precursors as they can be synthesized endogenously inappropriate biological conditions. Vitamin D is mostly synthesized under the sunlight but can be also taken with food to some extent [3]. The changes in the skin due to aging, spending more time indoors due to decreased physical activity, and decreased sun exposure due to spending less time outdoors are known to contribute to the rise of vitamin D deficiency [2]. Through widespread vitamin D receptors in the body, vitamin D has been shown to have biological activity in several tissues including the musculoskeletal system. Vitamin D deficiency has been shown to be associated with several chronic diseases including common cancers, cardiovascular diseases, metabolic syndrome, and infectious and autoimmune diseases [4].

Studies have shown that vitamin D deficiency was related to pain, weakness in proximal muscles of the lower extremities, skeletal mineralization defect, impaired balance, increased risk of fall and fracture, and decreased functional capacity [5-7]. Previous studies have evaluated the relationship between vitamin D levels and musculoskeletal pain [8,9]. The aim of this study was to evaluate the relationship between vitamin D levels and musculoskeletal pain in women aged 65 and over.

Method

The descriptive cross-sectional study included female patients admitted to the Physical Medicine and Rehabilitation Outpatient Clinic at the University of Health Sciences, Izmir Tepecik Training and Research Hospital in December – May 2013.The study was approved by the local ethics committee at Izmir Tepecik Training and Research Hospital (approval #: 2013-49-5, approval date:22.05.2013).

The study included women aged 65 years or over who could communicate in Turkish, signed the volunteer form, and had no mental illness, malignancy, infection, and endocrinological or connective tissue disease. The study excluded those diagnosed with and treated for osteomalacia, advanced osteoporosis, or compression fracture and those who take vitamin D supplementation.

Participants were interviewed to gather data about socio-demographics (age, gender, occupation, and education), sun exposure, intake of calcium-rich foods, exercise routines, presence of musculoskeletal pain, and location of musculoskeletal pain (neck, upper back, lower back, knee, and other). Positive sun exposure was defined as exposure to sunlight for at least 15 minutes per day between 10 AM and 2 PM until the skin turns pink while arms and face were uncovered. The recommended daily calcium intake for the elderly is 1200 mg. Four servings of dairy products (one serving = 200 mL milk/yogurt or 30-40 g cheese) are enough to meet the daily requirement. Below this amount was considered insufficient daily calcium intake [10]. The participants were grouped as sedentary or those exercise regularly. Those who walk for at least 45 minutes or perform aerobic exercises daily for three or more days per week were grouped in the latter; others were considered as sedentary.

Participants' serum vitamin D, calcium, phosphorus, alkaline phosphatase, and parathormon levels were recorded during their first visits to the outpatient clinic. Vitamin D level was assessed by measuring serum 25(OH)vitamin D (vitamin D), which has a half-life of 2-3 weeks [10]. Due to short half-life (4 hours) and low serum concentration, 1,25-dihydroxy vitamin D does not provide very reliable information about the vitamin D status. Hence, the serum concentration of 25(OH)vitamin D is generally used for the diagnosis of vitamin D deficiency. Measurement of 25(OH)vitamin D levels is recommended for only those at risk of vitamin D deficiency, which includes the participants of this study [10]. Serum 25(OH)vitamin D levels were evaluated by the chemiluminescence immunoassay in Advia Centaur analyzer (Siemens, New York, USA). Serum 25(OH)vitamin D levels were analyzed in three categories: deficient (<20 ng/mL), insufficient (21-29 ng/mL), and adequate (>30 ng/mL) [10]. Participants were divided into two groups as those with and without musculoskeletal pain; their vitamin D levels were compared. For those with vitamin D deficiency or insufficiency, the location of pain and frequency of pain localized in various regions were evaluated.

Statistical analysis

The data were analyzed with SPSS version 17.0 (SPSS Inc., Chicago, USA). Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to analyze the data. Coefficient of variation, histograms, and one-sample Kolmogorov-Smirnov test were used to test the normal distribution of the quantitative data. Categorical data were analyzed with chi-square and Fisher's exact test; numerical data were analyzed with one-way analysis of variance and Student's *t*-tests. Results were evaluated at a 95% confidence interval.

Results

The study included a total of 120 participants. Participants' age, gender, education, and habits of sun exposure, exercise, smoking, and consumption of dairy products was summarized in Table 1. The mean age of the participants was 69.8 ± 4.6 (65-79) years. Hundred-and-ten (92%) of the participants were housewives; ten (8%) were retired. Hundred-and-fifteen participants (96%) had a sedentary lifestyle, not exercising or leaving the residence unless necessary; five (4%) walked or exercised regularly for at least three days a week. Eight participants (7%) smoked one pack per day. Seventy-four participants (62%) consumed calcium-rich foods daily (two cups of milk or equivalent)

Table 1. Demographic characteristics of the participants (N=120).

Characteristic	n	%
Age		
65-69 years	65	54
70-74 years	36	30
75-79 years	19	16
Education		
Illiterate	55	46
Elementary	59	49
Middle School	4	3
University	2	2
Gender		
Female	120	100
Male	0	0
Sun exposure		
Yes	6	5
No	114	95
Consumption of dairy products		
None	7	6
Irregular	74	32
Regular	39	62
Exercise		
Sedentary	114	95
Regular exercise	6	5
Smoking		
Yes	8	7
No	112	93

Of the participants, 80(67%) had vitamin D deficiency, 21(18%) had vitamin D insufficiency, and 19(16%) had adequate vitamin D levels (Table 2).

Table 2. Serum 25(OH) vitamin D levels (N=120).

Vitamin D levels	n (%)
Deficient (<20 ng/mL)	80 (67%)
Insufficient (21-29 ng/mL)	21 (18%)
Adequate (>30 ng/mL)	19 (16%)

Of the participants, 37 (31%) had no musculoskeletal pain; 83 (69%) had pain. Average vitamin D level was16.03 ±11.63 ng/mL in those who had musculoskeletal pain, which was significantly lower compared with those who had no pain (23.22 ±17.05 ng/mL, p=0.008) (Table 3). Vitamin D levels were significantly lower in the 70-74 age group (p=0.020).

Table3. Relationship between musculoskeletal pain and vitamin D levels.

	Has pain (n=83)	**No pain** (n=37)	***p****
Average vitamin D level (ng/mL)	16.03±11.63	23.22 ±17.05	0.008

*Independent samples *t*-test.

Of the patients with musculoskeletal pain (n=83), 62 (75%) had vitamin D deficiency, and 21 (25%) had vitamin D levels in the normal range. Among those with pain and vitamin D deficiency (n=62), the pain was most common in the lower back (n=25, 41%) and upper back (n=20, 32%) (Table 4).

Table4. Distribution of musculoskeletal pain by body region in participants with vitamin D deficiency.

Location of pain	n	%
Neck	3	5
Upper back	20	32
Lower back	25	41
Knee	5	8
Other	9	14

Discussion

Musculoskeletal pain is an important and common problem in advanced age. In this study, 69% of the patients had pain. Previous studies reported prevalence of pain in elderly ranging from 88% to 99%; the frequency of chronic pain has been reported to be 31-64% [11,12]. Lower rate of pain in

our study may be due to the fact that elderly people do not frequently express their pain as it is common in and perceived as a natural consequence of advanced age [12].

Vitamin D has effects on pain, as it has effects on several systems. Vitamin D influences the perception of pain by reducing proinflammatory cytokines (prostaglandin E2) and T cell activity and by regulating the sensory-motor excitability [9,13-15]. In this study, we aimed to evaluate musculoskeletal pain and vitamin D levels in women aged 65 years and over. We found the rate of vitamin D deficiency or insufficiency to be as high as 85%. Vitamin D deficiency was especially more pronounced in the 70-79 age group. With age, changes in the structure of skin decrease vitamin D synthesis by one-fourth compared to that in the thirties [16]. In addition, decreased oral intake of vitamin D, decreased intestinal absorption, and decreased activity of 1-alpha-hydroxylase enzyme activity in the kidneys lead to vitamin D deficiency in advanced age [17,18]. Extremely low level of sun exposure (5%) and common sedentary lifestyle (95%) indicate that the participants do not often leave the house and exercise outdoors, which may be a reason for the high rate of vitamin D deficiency or insufficiency. In their study of 360 women, Al Faraj et al. reported the rate of vitamin D deficiency to be as high as 90% among those who wear concealing clothing and have limited sun exposure. They also reported that vitamin D supplementation in the group of participants with vitamin D deficiency led to a significant reduction in pain symptoms [5].

Several studies have previously addressed the relationship between vitamin D levels and pain; there are studies indicating a relationship as well as those indicating otherwise [19-21]. In our study, we found that the rate of vitamin D deficiency was significantly higher among those who reported pain. Observational and interventional studies emphasized that vitamin D has an influence on the severity and management of pain [21]. It has been suggested that musculoskeletal pain in vitamin D deficiency stems from the deficiency of calcium phosphate, which is necessary to mineralize the collagen matrix, leading to the widening of the matrix under the periosteum and diffuse pain [22]. Effects of vitamin D on muscles also suggested that vitamin D deficiency might lead to a decrease in muscle strength and can cause pain [23].

In our study, the pain was most commonly localized to lower and upper back in the group with vitamin D deficiency. Hicks et al. investigated the relationship between vitamin D and musculoskeletal pain in 958 male and female patients aged 65 years and over. They examined back and lower extremity pain and found that low levels of vitamin D were associated with significant lower back pain in women but not in men [17]. Kim et al. found vitamin D deficiency in 74% of the 350 patients diagnosed with the lumbar narrow can aland demonstrated that the upper and lower back pain was associated with vitamin D deficiency and biomarkers of osteoporosis and bone resorption [24].

It has been reported that vitamin D deficiency was associated with obesity, and obesity might lead to increased pain due to mechanical loading [25]. The lack of body mass index data for the participants is a limitation of our study. There are studies showing, in contrast to our study, that vitamin D was not related to lower back pain and vitamin D replacement therapy was not effective on lower back pain [26]. In a systematic review evaluating the relationship between vitamin D and lower back pain, Jishua A et al. found that vitamin D deficiency was significantly more common among women over 60 years of age compared to men but was not related to the severity of pain [27]. It has been suggested that movement was restricted in the elderly patients with lower back pain, leading to a decrease in outdoor activities and exposure to direct sunlight, which in turn might reduce vitamin D synthesis and result in decreased vitamin D levels. It has been reported that, in addition to lower back pain, vitamin D deficiency was also associated with knee and hip pain and, in case of deficiency, replacement therapy led to a significant decrease in pain scores [28]. Vitamin D deficiency was associated with several health problems including chronic pain [28-30].

Limitations of the study

The lack of a healthy control group, measurement of pain severity, and measurement of the body mass index were the main limitations of this study.

Conclusion

Considering the fact that the elderly population increases rapidly and they present to clinics more often, it is important to evaluate vitamin D levels of elderly patients with musculoskeletal pain. Vitamin D deficiency should be kept in mind for female patients with lower and upper back pain. Given the effects of vitamin D on the musculoskeletal system, assessment of vitamin D levels and, in case of deficiency, supplementation therapy is recommended for elderly women. Future randomized controlled studies involving a larger sample size will contribute to understanding the relationship between vitamin D and pain.

Conflict of interest: The authors declare that they have no conflict of interest regarding this study.

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