



Relationship between Vitamin D Level on Pain, Functional Status and Quality of Life in Individuals with Osteoarthritis

Osteoartritli Bireylerde Vitamin D Düzeyi ile Ağrı, Fonksiyonel Durum ve Yaşam Kalitesi Arasındaki İlişki

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Abstract

Objective: This study was conducted to determine the correlation between vitamin D level and pain, functional status, and quality of life in individuals with osteoarthritis.

Material and Method: This cross-sectional and descriptive study was completed with 138 individuals. The study was carried out between April 15 and August 30, 2019. The research data were collected using the Identification Form, Visual analogue scale, The Western Ontario and McMaster University Osteoarthritis Index and Short Form-36- Quality of Life scale were used.

Results: 64.5% of the individuals had a vitamin D level of 20 ng/ml and less. It was determined that there was no significant correlation between individuals' vitamin D levels and age, VAS, WOMAC, and SF-36 subscales ($p>0.05$).

Conclusion: Vitamin D deficiency is very common in individuals with osteoarthritis. No relationship was found between vitamin D levels and pain, functional status and quality life of patients.

Keywords: Osteoarthritis, vitamin D, functional status, quality of life.

Öz

Amaç: Bu çalışma, Osteoartritli bireylerde vitamin D düzeyi ile ağrı, fonksiyonel durum ve yaşam kalitesi arasındaki ilişkiyi belirlemek amacıyla yapıldı.

Gereç ve Yöntem: Kesitsel ve tanımlayıcı tipte olan bu çalışma 138 kişi ile 15 Nisan - 30 Ağustos 2019 tarihleri arasında yapıldı. Veriler, tanımlayıcı bilgi formu, Görsel Kıyaslama Ölçeği, WOMAC Osteoartrit İndeksi ve Kısa Form- 36 yaşam kalitesi ölçeği kullanılarak toplandı.

Bulgular: Bireylerin % 64.5'nin D vitamini düzeyi 20 ng/ml ve daha düşüktü. Bireylerin D vitamini düzeyleri ile yaş, Görsel Kıyaslama Ölçeği, WOMAC ve SF-36 alt ölçekleri arasında anlamlı bir ilişki olmadığı belirlendi ($p> 0.05$).

Sonuç: D vitamini eksikliği osteoartritli bireylerde çok yaygındır. Hastaların D vitamini düzeyleri ile ağrı, fonksiyonel durum ve yaşam kalitesi arasında ilişki bulunmadı.

Anahtar Sözcükler: Osteoartrit, vitamin D, fonksiyonel durum, yaşam kalitesi.



INTRODUCTION

Osteoarthritis (OA) is a dynamic process that causes symptoms such as pain, decreased ROM and stiffness due to the breakdown of joint cartilage, progresses with mechanical and biochemical factors. Osteoarthritis is ranked as the 13th highest contributor of 310 diseases to global disability in 2015.^[1] Although it is thought that genetic, metabolic, environmental, and biomechanical factors affect the pathogenesis, the pathogenesis of OA is not fully known. While cartilage fibrillation is superficial at the beginning of the disease, later the degeneration progresses to deep layers.^[2,3] Osteoarthritis affects all elements of a joint such as the cartilage forming the synovial joint, capsule, subchondral bone, synovial tissue, and muscles; however, primary changes include loss of joint cartilage, reshaping of subchondral bone, and formation of osteophytes.^[2] Pain, decreased physical function, stiffness, depression and sleep disturbances experienced by patients with decrease the quality of life.^[4] The aim of OA treatment is to protect and improve joint functions by eliminating pain and stiffness, to prevent or recover disability, to preserve and improve muscle strength, to increase quality of life and to prevent treatment complications. Currently, there is no effective treatment for reversing or preventing structural changes developed in OA.^[5]

Vitamin D is a steroid precursor that is important for bone, which undergoes 2 hydroxylations, the first converting vitamin D to 25-hydroxyvitamin D (25 (OH) D), which is an indicator of vitamin D status, and the second to the main active form, 1,25-dihydroxy vitamin D. Vitamin D deficiency (VDD) affects calcium metabolism, articular cartilage structure, and bone density negatively.^[6,7] Vitamin D can prevent OA development and progression by reducing degeneration in cartilage and bone.^[8] Moreover, in VDD, proinflammatory cytokines are formed; therefore the severity of pain in the joints and bones may increase and the pain process may change. In addition, many researchers have shown the association between VDD with pain, muscle weakness and deterioration of cognitive function.^[7,9] Risk of progression of OA doubled in participants with low levels of vitamin D.^[10] Yu et al.^[11] was found that there was low association of VDD with knee cartilage loss as evidenced by JSN (joint space narrowing). However, it showed no direct correlation with radiographic knee OA as assessed by osteophytes on plain radiograph. Thus, the association between the concentration of vitamin D and OA is controversial.^[12-14] In addition, there is insufficient study showing the correlation between Vitamin D level and pain, functional status, and quality of life in OA.^[6,13,14] In our study, vitamin D levels of patients were evaluated together with their quality of life, functional status and pain. In this respect, it is thought that this study will contribute to the literature.

Research questions

What are the levels of vitamin D, pain, functional status and quality of life in OA patients?

Is there a relationship between vitamin D levels and pain, functional status and quality of life in patients with osteoarthritis?

MATERIAL AND METHOD

This study was conducted as a descriptive and cross-sectional. The study was carried out between April 15 and August 30, 2019, at the Orthopedics Clinic of a Research and Practice Hospital. The population of the research consisted of all patients with osteoarthritis who applied to the hospital between the specified dates. The research was completed with 138 individuals who met the inclusion criteria. At the end of the study power analysis (G*Power (v3.1.7) was performed using in order to determine the sample size. Considering VAS activity value with vitamin D obtained, the power of the study was found to be 82% at alpha=0.05. Inclusion criteria were (a) being diagnosed with osteoarthritis for at least 6 months (b) being aged 18 years and older (c) being diagnosed with gonarthrosis (d) not having any problem that restricted daily life activities (e) being examined for vitamin D level (g) volunteering to participate in the research. Exclusion criteria were (a) being used drugs acting on the central nervous system (b) having a cancer diagnosis (c) being used vitamin D, calcium, parathyroid hormone, and antiresorptive drugs in the last year.

Data Collection

The research data were collected using the Identification Form, VAS, WOMAC and SF-36- Quality of Life scale were used. The data was collected through face to face interviews with the participants. Each interview lasted about 20-30 minutes.

The Identification form was prepared by the researchers by investigating the literature and consists of 16 questions regarding patients' socio-demographic variables, information about the disease.^[6,15,16]

The Visual Analogue Scale (VAS) scale is used to determine pain severity. The most severe pain is score "10" points and the absence of pain is scored "0". The most intense pain the individual feels is marked on the scale.^[17] In this study, the severity of pain was questioned separately at activity and resting periods.

Turkish validity and reliability study of the WOMAC Osteoarthritis Index (WOMAC) was performed by Tüzün, Eker, and Ayar (2005) in 72 patients (Cronbach's alpha between 0.75-0.96).^[18] The index consists of 24 questions and three subscales. In the Likert-type index, the pain subscale is rated between 0-20; stiffness is rated between 0-8 for; the subscale of difficulties experienced during daily activities is rated 0-68. The highest score indicates an increase in pain and stiffness, a deterioration in physical function, and the highest level of physical limitation.^[17,19] Cronbach's a values for the WOMAC pain, stiffness, and physical function subdimensions in our study were 0.95, 0.94, and 0.97

SF-36 is used scales for measuring the quality of life. It was developed (1992) by Ware et al.^[20] and the Turkish validity and reliability study was conducted by Kocyigit et al. (Cronbach's alpha between 0.73-0.76).^[21] The scale consists of 36 items and these items enable the measurement of 8 dimensions. The subscales evaluate health between 0 (poor health) and 100 (good health).^[21] In our study Cronbach's alpha were found to range between 0.62 and 0.93.

Vitamin D levels of the patients were examined under appropriate conditions and in the same laboratory. VDD was defined as <20 ng/mL.^[22-25] No additional vitamin D examination was conducted for the study. The patient, who was deemed appropriate for vitamin D by the physician, was reported after the examination. A questionnaire was applied to that patient. When the vitamin D result came out, the result was saved from the system.

Table 1. Distribution of patients with osteoarthritis according to their descriptive characteristics

| Characteristics | n | % |
|--|---------------------------|------|
| Gender | | |
| Female | 106 | 76.8 |
| Male | 32 | 23.2 |
| Marital status | | |
| Married | 123 | 89.1 |
| Single | 15 | 10.9 |
| Place of residence | | |
| Province | 56 | 40.6 |
| District | 41 | 29.7 |
| Village | 41 | 29.7 |
| Educational status | | |
| Illiterate | 40 | 29.0 |
| Primary school | 69 | 50.0 |
| Secondary school | 18 | 13.0 |
| High school and over | 11 | 8.0 |
| Income status | | |
| Income less than expenses | 40 | 29.0 |
| Income equal to expenses | 92 | 66.7 |
| Income more than expenses | 6 | 4.3 |
| Family type | | |
| Nuclear | 112 | 81.2 |
| Extended | 26 | 18.8 |
| Presence of other chronic diseases* | | |
| Yes | 45 | 32.6 |
| No | 93 | 67.4 |
| Joint deformity | | |
| Yes | 36 | 26.1 |
| No | 102 | 73.9 |
| Use of osteoarthritis-related drugs | | |
| Yes | 119 | 86.2 |
| No | 19 | 13.8 |
| Status of receiving training on osteoarthritis and its care | | |
| Yes | 25 | 18.1 |
| No | 113 | 81.9 |
| Vitamin D (ng/ml) | | |
| Vitamin D <20 | 89 | 64.5 |
| Vitamin D ≥ 20 | 49 | 35.5 |
| Mean age (year) | 59.00 \pm 11.66 (45-89) | |
| Mean disease duration (year) | 5.38 \pm 4.15 (1-15) | |
| Mean treatment duration (year) | 3.90 \pm 3.37(1-15) | |
| Mean vitamin D level (ng/ml) | 16.37 \pm 8.33(3-39) | |

* Hypertension, Myocardial Infarction, Stroke etc.

Statistical Analysis

The research data were evaluated in SPSS 21.0 package program in a computer environment. The Kolmogorov-Smirnov test and Shapiro-Wilk test were used to assess normally distributed data. Research findings were obtained by arithmetic mean, standard deviation and student's t-test.^[26] The statistical significance of the results was evaluated at $p<0.05$.

RESULTS

It was found that 76.8% (n:106) of the individuals with osteoarthritis were female; 89.1% (n:123) were married. It was determined that 67.4% (n:93) of the individuals had no other chronic disease; 73.9% (n:102) had no joint deformity; 86.2% (n:119) used drugs for osteoarthritis. 64.5% (n:89) of the individuals had a vitamin D level of 20 ng/ml and less. This finding demonstrates that most of the patients had VDD. The mean age of the individuals was 59.00 \pm 11.66 years; the mean disease duration was 5.38 \pm 4.15 years; the mean vitamin D level was 16.37 \pm 8.83 g/ml (**Table 1**).

The mean resting and activity VAS scores were 3.78 \pm 2.42 and 5.94 \pm 2.26, respectively. The mean WOMAC pain, stiffness and physical function were 10.57 \pm 5.54; 3.83 \pm 2.29 and 33.33 \pm 14.55 respectively. When the SF-36 mean subscale scores were examined, it was determined that the mean subscale score was 18.60 \pm 4.91 for physical functioning, 5.29 \pm 1.45 for role-physical, 6.43 \pm 1.91 for bodily pain, 13.48 \pm 4.17 for general health, 12.52 \pm 4.24 for Vitality (Energy), 5.54 \pm 1.72 for social functioning, 4.12 \pm 1.07 for role-emotional, and 20.91 \pm 4.59 mental health (**Table 2**).

It was determined that there was no significant correlation between individuals' vitamin D levels and age, VAS (Resting-Activity), WOMAC, and SF-36 subscales ($p>0.05$) (**Table 3**).

Table 2. Distribution of the VAS, WOMAC, and SF-36 Quality of life scale subscale scores of the individuals with osteoarthritis

| Scales | Mean \pm SD (Min-Max) |
|------------------------|--------------------------|
| VAS | |
| Resting | 3.78 \pm 2.42 (0-10) |
| Activity | 5.94 \pm 2.26 (1-10) |
| WOMAC | |
| Pain | 10.57 \pm 5.54 (0-20) |
| Stiffness | 3.83 \pm 2.29 (0-8) |
| Physical Function | 33.33 \pm 14.55 (0-58) |
| SF-36 Subscales | |
| Physical Functioning | 18.60 \pm 4.91 |
| Role-Physical | 5.29 \pm 1.45 |
| Bodily Pain | 6.43 \pm 1.91 |
| General Health | 13.48 \pm 4.17 |
| Vitality (Energy) | 12.52 \pm 4.24 |
| Social Functioning | 5.54 \pm 1.72 |
| Role-Emotional | 4.12 \pm 1.07 |
| Mental Health | 20.91 \pm 4.59 |

Note: Visual analogue scale (VAS); WOMAC osteoarthritis index (WOMAC); SF-36: Short Form 36; SD: Standard Deviation

Table 3. Comparison of scale scores of individuals with osteoarthritis according to their Vitamin D levels

| Characteristics | Vitamin D<20 (n:89) | Vitamin D≥20 (n:49) | p* |
|-------------------------|---------------------|---------------------|-------|
| VAS Resting | 3.73±2.56 | 3.87±2.15 | 0.734 |
| VAS Activity | 6.01±2.30 | 5.83±2.21 | 0.667 |
| WOMAC Pain | 10.30±5.14 | 11.24±4.86 | 0.296 |
| WOMAC Stiffness | 3.609±2.30 | 4.24±2.24 | 0.118 |
| WOMAC Physical Function | 32.55±14.93 | 34.75±13.87 | 0.396 |
| SF-36 Subscales | | | |
| Physical Functioning | 18.76±4.79 | 18.32±5.14 | 0.618 |
| Role-Physical | 5.28±1.45 | 5.32±1.46 | 0.861 |
| Bodily Pain | 6.40±1.93 | 6.50±1.89 | 0.782 |
| General Health | 13.48±4.36 | 13.48±3.84 | 0.993 |
| Vitality (Energy) | 12.43±4.41 | 12.69±3.95 | 0.736 |
| Social Functioning | 5.57±1.75 | 5.48±1.68 | 0.787 |
| Role-Emotional | 4.19±1.18 | 4.06±1.04 | 0.523 |
| Mental Health | 20.96±4.58 | 20.8±14.65 | 0.855 |

Note: *Student t test used.

DISCUSSION

Vitamin D has recently found focus due to its widespread effects on the musculoskeletal system. Also, the prevalence of VDD has consistently been on the rise.^[27] In our research, most of the patients were found to have VDD. Likewise, Hekimsoy et al. was found that 74.9% had vitamin D deficiency.^[27] Our study finding is similar to the literature.

In our research, it was determined that there was no significant correlation between vitamin D levels of the patients and VAS and WOMAC subscales. However, the studies was found that vitamin D had a protective effect against cartilage defect progression and Vitamin D deficiency seems to be a factor contributing to pain, muscle weakness, and disability.^[28,29] Similar to our study, in the studies conducted no correlation were found between vitamin D levels and osteoarthritis.^[7,8,30] In a systematic review published in 2017, the effect of the use of vitamin D on the treatment of knee osteoarthritis was mainly focused on the pain parameter and it was reported that it did not affect pain.^[31] The association between the concentration of vitamin D and OA is controversial. These findings determined in our study indicate that randomized controlled studies with larger sample size should be performed.

Vitamin D deficiency have been linked to poor quality of life.^[9,32] In particular, pain and functional impairments are the primary burden of patients with OA, and taken together, they often cause a significant decrease in quality of life. According to evidence-based knee osteoarthritis treatment recommendations of the Turkish League Against Rheumatism, the first goal of the OA treatment is to control the pain, maintain and improve joint functions, provide functional independence, and improve the quality of life.^[33] It was determined that there was no significant correlation between vitamin D levels and SF-36 subscales. In the study conducted by Dhesi et al., it was found that there was no significant improvement in any of the subscales of quality of life in the

vitamin D loaded group.^[34] In the study conducted by Alkan et al. (2012), no significant correlation was found between initial vitamin D levels and quality of life.^[15] It is suggested that quality of life should be evaluated frequently by health professionals and that the quality of life should be improved by prioritizing the symptom control.

The limitations of the study include the lack of repetitive vitamin D measurements, the lack of monitoring patients after they received vitamin D supplements, the evaluation of instant status, the ignorance of the current changes in normal life of patients while only considering the severity of the disease during the examination of osteoarthritis, which has a complex structure. This is considered among the uncontrollable factors of the research.

CONCLUSION

VDD is very common in OA. Vitamin D was no correlation between pain, functional status and quality of life of patients. Health professionals may apply practices regarding the prevention of VDD in patients with osteoarthritis to prevent symptoms of the disease. We recommend that these patients be regularly evaluated for VDD. Long-term studies are needed to evaluate the effects of vitamin D.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Bozok University Faculty of Medicine Non-Invasive Trial Ethics Committee (Decision Number:2017-KAEK-189_2019.04.24_14).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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