



# Is there a relationship between serum vitamin D levels and onychomycosis?

*Serum D vitamini düzeyleri ile onikomikoz arasında ilişki var mıdır?*

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## Abstract

**Background and Design:** Vitamins are necessary for various biochemical functions and are either insufficiently synthesized or not synthesized by the organism; therefore, they are taken from the diet. Many dermatoses such as psoriasis, atopic dermatitis, rosacea, acne vulgaris, vitiligo, and pityriasis versicolor, which are associated with vitamin D deficiency, have been reported. This cross-sectional study aimed to compare vitamin D levels between patients with onychomycosis and healthy controls and determine the relationship between vitamin D and onychomycosis.

**Materials and Methods:** Serum 25-hydroxyvitamin D [25(OH)D] levels were measured in the blood sample for any reason in the last 1 month of patients diagnosed with onychomycosis and healthy controls.

**Results:** The study included 40 participants (21 men). The mean level of serum 25(OH)D of all participants was 12.66 ng/mL. No significant correlation was found between the age of the participants and 25(OH)D levels. 25(OH)D levels were lower in the patient group (10.79±8.12 ng/mL) than in the control group (13.91±6.76 ng/mL) (p=0.02).

**Conclusion:** The results of this study revealed that vitamin D levels are low in the Turkish population, but mean values are lower in patients with onychomycosis.

**Keywords:** Onychomycosis, vitamin D, skin barrier

## Öz

**Amaç:** Vitaminler çeşitli biyokimyasal işlevler için gereklidir ve organizma tarafından sentezlenmedikleri veya yetersiz sentezlendikleri için diyetle alınırlar. Yapılan çalışmalarda D vitamini eksikliği ile psoriasis, atopik dermatit, rozasea, akne vulgaris, vitiligo, pitriyazis versikolor gibi birçok dermatoz arasında ilişki ortaya konmuştur. Bu kesitsel çalışmada, onikomikoz hastaları ile sağlıklı kontroller arasındaki D vitamini düzeylerinin karşılaştırılması ve D vitamini ile onikomikoz arasındaki ilişkinin ortaya konması amaçlanmıştır.

**Gereç ve Yöntem:** Dermatoloji polikliniğine başvuran ve onikomikoz tanısı konulan hastalar ile sağlıklı kontrollerin son 1 ayda herhangi bir nedenle serum 25-hidroksivitamin D [25(OH)D] düzeyleri ölçülenleri çalışmaya dahil edildi.

**Bulgular:** Çalışmaya 40 katılımcı (21 erkek) dahil edildi. Tüm katılımcıların ortalama serum 25(OH)D vitamini düzeyi 12,66 ng/mL idi. Katılımcıların yaşı ile D vitamini düzeyleri arasında anlamlı bir ilişki yoktu. 25(OH)D düzeyleri hasta grubunda (10,79±8,12 ng/mL) kontrol grubuna (13,91±6,76 ng/mL) göre daha düşük bulundu (p=0,02).

**Sonuç:** Çalışmamız, Türk toplumunda D vitamini düzeylerinin düşük olduğunu, ancak onikomikozlu olgularda ortalama değerlerin daha düşük olduğunu ortaya koydu.

**Anahtar Kelimeler:** Onikomikoz, vitamin D, deri bariyeri

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## Introduction

The pathogenic role of vitamin D levels in inflammatory skin diseases has not yet been proven. In a study from Germany, serum 25-hydroxyvitamin D3 [25(OH)D] levels of 1,532 patients with various dermatoses such as psoriasis, atopic dermatitis, non-atopic eczema, vitiligo, rosacea, chronic urticaria, and pyodermitis were measured. Patients with severe acute or chronic infectious skin diseases (such as herpes zoster, acute abscess, and pyoderma) had a lower mean vitamin D level, and the mean vitamin D levels of the patients were significantly lower than those of the healthy controls<sup>1</sup>. The modulating role of vitamin D on immunity has been previously reported. In addition, vitamin D deficiency can affect host immunity, leading to an increase in the prevalence and severity of various infectious diseases<sup>2</sup>. Based on these data, this study aimed to determine the level of vitamin D levels of patients with onychomycosis and compare it with those of the general population.

## Materials and Methods

Positive results of 10% KOH native examination from patients aged 18-65 years who applied to our hospital's dermatology outpatient clinic with complaints of color and toenail deformities were included in the study. Age- and sex-matched healthy controls who did not have onychomycosis were also enrolled. Individuals who received topical/systemic antifungal treatment for the last 6 months and pregnant individuals were excluded from the study. In both groups, the serum levels of vitamin D that had been measured by the enzyme-linked immunosorbent assay were noted. The microbiological culture was studied in seven patients, and the results were also noted. The Zonguldak Bülent Ecevit University Non-Interventional Clinical Research Ethics Committee approval (approval number: 2021/15, date: 11.08.2021) and patient informed consent were obtained for the study.

### Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows version 23.0 (IBM Corp., Armonk, NY, USA). Since vitamin D values were not normally distributed, the Mann-Whitney U test was used to determine the relationship between categorical variables and vitamin D levels. Pearson correlation analysis was used to determine the relationship between numerical data. The mean and frequency values of the variables were revealed. The power analysis calculation was made in the G-power program by taking the effect size = 0.3, alpha = 0.01, and power = 0.90 values, and the appropriate sample size was reached.

## Results

Epidemiologic data presented as counts and percentages, mean values of age, and sex distribution in the study groups are summarized

in Table 1. A total of 16 patients who met the inclusion criteria and 24 healthy controls were evaluated in the study. In this study, 21 participants were male, with a mean age of  $49.43 \pm 17.96$  years, and 19 participants were female, with a mean age of  $38.68 \pm 13.42$  years. The mean levels of serum 25(OH)D of all participants were 12.66 ng/mL; however, 25(OH)D levels over 30 ng/mL were detected in one individual from the patient group (37.00 ng/mL) and two individuals from the control group (30.50 and 30.90 ng/mL). The serum levels in male patients ( $15.41 \pm 8.70$  ng/mL) were significantly higher than those in female patients ( $9.62 \pm 3.97$  ng/mL) ( $p=0.01$ ). No significant correlation was found between age and 25(OH)D levels. The mean levels in the patient group were lower ( $10.79 \pm 8.12$  ng/mL) than those in the control group ( $13.91 \pm 6.76$  ng/mL) ( $p=0.02$ ) (Table 2). *Candida albicans* was detected in seven patients who underwent microbiological culture.

## Discussion

Vitamin D is a fat-soluble vitamin, and dermal synthesis secondary to ultraviolet B radiation accounts for 90% of vitamin D supplementation<sup>3</sup>. In the body, its most important function is to facilitate calcium homeostasis by promoting enterocyte differentiation and intestinal calcium absorption<sup>4</sup>. Since vitamin D receptors are found not only in the small intestine but also in the colon, activated T- and B-lymphocytes, mononuclear cells, beta islet cells, skin, brain, heart, gonads, prostate, and breasts, the accompanying extraskeletal effects of vitamin D deficiency can occur<sup>5</sup>. Observational studies have suggested a relationship between vitamin D deficiency and hypertension, cardiovascular event risk, cancer, musculoskeletal pain, migraine, schizophrenia, dementia, or depression<sup>6</sup>. In the human body, the best indicator of vitamin D status is the serum 25(OH)D concentration, and the optimum 25(OH)D level varies for different populations<sup>7</sup>. In adults, the essential level of vitamin D is at least 30 ng/mL for disease prevention according to the International Osteoporosis Foundation, Endocrine Society, National Osteoporosis Foundation, and American Geriatrics Society<sup>6,8-10</sup>. Despite fewer studies on vitamin D deficiency in Türkiye, according to available data, vitamin D deficiency is common in this country<sup>11</sup>. In a study conducted on 391 adults aged >20 years in Türkiye, vitamin D deficiency was found at a rate of 74.9%. Vitamin D deficiency was significantly higher in women than in men (78.7% vs 66.4%)<sup>12</sup>. In our study, serum vitamin D levels >30 ng/mL were detected in one

**Table 1. Demographic data for the study groups**

Study groups	Age	Sex	
		Male	Female
Control (n=16)	$42.88 \pm 17.08$	9 (56.3)	7 (43.8)
Patients (n=24)	$45.29 \pm 16.70$	12 (50)	12 (50)
Total (n=40)	$44.33 \pm 16.68$	21 (52.5)	19 (47.5)
Data are presented as mean $\pm$ standard deviation or frequency (%)			

**Table 2. Serum 25-hydroxyvitamin D levels in the participants**

Table 2: Serum 25-hydroxy vitamin D levels in the participants				
Vitamin D levels	Study groups		Sex	
	Patients (n=16)	Control (n=24)	Male (n=21)	Male (n=21)
	10.79±8.12	13.91±6.76	15.41±8.70	9.62±3.97
p-value	0.02		0.01	
Data are presented as mean ± standard deviation				

individual from the patient group (37.00 ng/mL) and two individuals from the control group (30.50 and 30.90 ng/mL). Vitamin D deficiency was found in all the remaining participants.

Vitamin D has various effects on the skin, such as keratinocyte proliferation and apoptosis; immunomodulation on monocytes, T- and B-lymphocytes, and Langerhans cells; and photoprotection by the generation of antioxidants in keratinocytes. Moreover, many dermatoses such as psoriasis, vitiligo, atopic dermatitis, ichthyosis, skin cancer, skin fibrosis, skin tuberculosis, seborrheic keratosis, rosacea, acne vulgaris, and leg ulcers have been associated with vitamin D<sup>13</sup>.

In the study by Khosravi et al.<sup>14</sup> from Iran, they retrospectively evaluated tinea capitis cases, and the underlying immunosuppression was attributed to vitamin D deficiency in one of the 20 cases. Another study compared plasma vitamin D levels in patients with pityriasis versicolor (PV) and healthy individuals. The mean plasma level of vitamin D in patients with PV was significantly lower than that in the healthy control individuals<sup>15</sup>. In another study evaluating serum vitamin D levels of 85 patients with PV and 85 healthy control individuals, no significant difference in vitamin D3 levels was found between the two groups<sup>16</sup>. In a study conducted in India, serum vitamin D levels were normal in 20% of the patients with common tinea corporis infection in whom serum 25(OH)D levels were quantitatively measured, whereas a deficiency was found in 80%<sup>17</sup>. Bouzid et al.<sup>18</sup> showed that vitamin D3 can have fungicidal activity against *Candida albicans*, and they attributed this effect to the large liposolubility of vitamin D3, changing the integrity of the cell membrane.

### Study Limitations

Because of the limited testing facilities in our hospital, *Candida albicans* was found in a small number of patients as a result of nail culture in our study.

### Conclusion

The results of this study revealed that vitamin D levels are low in the Turkish population, and mean values are lower in cases with onychomycosis. A small number of participants were included in our study, which can be considered a limitation. Vitamin D has various effects on the body, and these have not yet been fully elucidated. Its effects on immunity undoubtedly change the antifungal defense of our skin. Similar studies are needed in the future.

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### Ethics

**Ethics Committee Approval:** The Zonguldak Bülent Ecevit University Non-Interventional Clinical Research Ethics Committee approval (approval number: 2021/15, date: 11.08.2021).

**Informed Consent:** Patient informed consent were obtained for the study.

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

### Authorship Contributions

Surgical and Medical Practices: Z.M., K.D., Concept: Z.M., K.D., Design: Z.M., K.D., Data Collection or Processing: Z.M., K.D., Analysis or Interpretation: Z.M., K.D., Literature Search: Z.M., K.D., Writing: Z.M., K.D.

**Conflict of Interest:** The authors declared that they have no conflict of interest.

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