Cerrahpaşa Med J 2022; 46(2): 129-133 ORIGINAL ARTICLE

# Factors Affecting Serum 25-(OH)D Levels and Its Relation with Quality of Life: A Single-Center Study in a Sample of Turkish Postmenopausal Women

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***Abstract***

**Objective:** We aimed to investigate the relationship of vitamin D levels, which gain more importance in postmenopausal women due to osteoporosis, with knowledge, physical and environmental factors, and quality of life.

**Methods:** One hundred two postmenopausal women who applied to Istanbul University-Cerrahpasa, Cerrahpasa Medical Faculty, Family Medicine and Internal Medicine clinics between December 2017 and July 2018 were recruited for this study. Nottingham Health Profile and a questionnaire of 13 items about demographics and knowledge about vitamin D were applied face to face. The participants were separated into 3 groups: group 1. (25(OH) vitamin D level <20 ng/mL), vitamin D deficiency; group 2: (25(OH) vitamin D level 20.01-29.99 ng/mL), vitamin D insufficiency; and group 3: (25(OH) vitamin D level ≥30 ng/mL), normal vitamin D. Data were evaluated using Kolmogorov–Smirnov test, chi-square test, Fisher's exact test, 1-way analysis of variance, and Kruskal–Wallis test.

**Results:** There were 37 women (36.30%) in group 1, 27 women (26.50%) in group 2, and 38 women (37.30%) in group 3. Their median age was 55 (42-98) years and mean body mass index was 27.97 ± 4.96 kg/m². Quality of life was not significantly different between the 3 groups ($P > .05$). Alcohol use, skin type, clothing style, and physical activity were significantly different between the 3 groups ($P = .04$, $P = .013$, $P = .001$, and $P = .020$). Better knowledge about 25(OH)D was related significantly to higher vitamin D levels ($P < .05$).

**Conclusion:** Increasing physical activity and sunbathing with enough skin exposure should be recommended for postmenopausal women in order to augment plasma vitamin D levels.

**Keywords:** Postmenopause, 25(OH)D, QuOL

## Introduction

Quality of life (QuOL) is described as "subjective status of wellness." The World Health Organization describes health not only as "not being ill" but also as being physically, mentally, and socially well. This definition includes the wide concept of quality of life which is affected by physical health and psychological status of the individual besides his social life and interaction with the environment.[1,2]

Vitamin D insufficiency/deficiency is an important health issue in Turkey as well as it is in most parts of the world. The effect of vitamin D on calcium and bone metabolism is well-known whereas its role in cognitive functions is the subject of research in the last 10 years.

In postmenopausal women, vitamin D is important in QuOL not only because of its effect on bone mineral density but also because of the increase in the risk of other diseases in its deficiency.[3]

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The fact that vitamin D deficiency is preventable in majority of the patients who approached the primary care creates the priority of the subject for family medicine.

## Methods

This is a cross-sectional descriptive study. Postmenopausal women from the family medicine and internal medicine outpatient units whose vitamin D levels were already measured in the faculty central laboratory between December 2017 and July 2018 were admitted by random sampling method.

Informed consent was provided from all participants and ethical consent was received from İstanbul University-Cerrahpaşa Faculty's clinical research ethics committee (November 8, 2017-419349).

A demographical survey form developed by the researchers was applied to all participants. In the first part, age, height, weight, education, occupation, social insurance, income and social status, alcohol, smoking habits, number of births, duration of breastfeeding, menopause, previous use of 25(OH)D, physical activity type and frequency, and skin type according to Fitzpatrick category were analyzed.[4] In the second part, general knowledge about vitamin D and about controversies by its deficiency were

questioned. Surveys were conducted face to face in the outpatient clinic.

The other survey used in the study was the Nottingham Health Profile test (NHP) consisting of 45 questions for measuring QuOL. Nottingham Health profile test has been developed by a group of researchers in Nottingham University Queens Medical Center, Community Health department between the years 1875 and 1981.[5] Turkish validity and reliability study has been performed by Küçükdeveci et al[6] in 2000. The NHP is made of 2 parts. The first part consists of 38 expressions and there are questions on sleep, physical activity, energy, pain, emotional response, and social isolation. The second part of the profile is made up of 7 questions searching about how daily life is affected by health status, professional life, everyday tasks, social life, friends, sexuality, hobbies, areas of interest, and vacations. The maximum score in the first part is 100 in each field and the total maximum score is 600. In the second part, each question is 1 point and the maximum score is 7. The answers are yes/no. Best health status is expressed as 0 and worst health is indicated by 100. In a sample of 1063 individuals drawn from the general population, the internal consistency of the Social Isolation subscale was slightly below the acceptable lower limit of 0.70 (Cronbach's alpha 0.65) while the internal consistency of the remaining subscales ranged from 0.71 (energy) to 0.88 (pain). The Cronbach's alpha for the NHP is >0.70 in Küçükdeveci's study.

The serum 25(OH)D vitamin levels of the study participants had been analyzed at Istanbul University, Cerrahpasa, Cerrahpasa Medical Faculty, biochemistry laboratory by electrochemiluminescence immunologic test (ECLIA) method with Roche Cobas E601 instrument. The results were given as ng/mL.

The participants were separated into 3 groups according to their serum 25(OH) D vitamin levels[7]:

Group 1: 25(OH)D vitamin ≤20 ng/mL, deficient
Group 2: 25(OH)D vitamin 20.01-29.99 ng/mL, insufficient
Group 3: 25 (OH)D vitamin ≥30 ng/mL, normal

Another comparison was made between participants with 25(OH) D vitamin levels ≤20 ng/mL and >20 ng/mL.

Exclusion criteria of the study were patients having Alzheimer's disease, dementia, chronic renal insufficiency, chronic liver disease, rickets type 1, 2, and 3, autosomal dominant hypophosphatemic rickets, X-linked hypophosphatemic rickets, anticonvulsant and glucocorticoid use, malabsorption syndrome (Crohn's disease, celiac disease, cystic fibrosis, Whipple's disease, stereomalabsorption), and granulomatous diseases as sarcoidosis and tuberculosis.

Vitamin D intoxication threshold was accepted as 150 ng/mL and levels over 150 ng/mL were not included in the study.[7] Statistical analysis was performed by using International Business Machines Statistical Package for the Social Sciences software 25.0 package program.

### Statistical Analysis

Categorical variables were expressed as frequency (n) and percentage. Numeric variables were expressed depending on their distribution as mean ± standard deviation or median (min-max). Kolmogorov–Smirnov and Shapiro–Wilk tests were used to test the normal distribution of numeric variables. Categorical variables were evaluated by chi-square test or Fisher's exact test. Continuous variables were compared with Student's *t*-test and Mann–Whitney *U* test. One-way variance analysis (ANOVA) was used for comparing continuous variables of ≥2 independent groups if they were normally distributed and if not, Kruskal–Wallis test was used. Statistical significance was accepted as $P < .05$.

## Results

A total of 102 postmenopausal women were included in our study, of which 37 (36.30%) were in group 1 (deficiency), 27 (26.50%) were in group 2 (insufficiency), and 38 (37.30%) were in group 3 (normal). The mean age of the participants was 56.28 ± 8.32 years; the mean body mass index (BMI) was 27.97 ± 4.96 kg/m$^2$. Regarding their reproductive history, 15 participants (14.70%) were never pregnant. The details of demographic factors and relationships with vitamin D are shown in Table 1.

The dressing style, skin type, and physical activity of the participants were significantly different between the 3 groups. Covered type of dressing with the exception of face and hands was prevalent in group 1 whereas dressing style with arms and legs naked was dominant in group 3 ($P = .001$). The percentage of participants who were exercising or walking besides daily activity was 18.90% in group 1, 40.70% in group 2, and 40.40% in group 3 ($P = .028$), respectively. The most common skin type was "light brown" with 38.30% frequency while the least common was "dark brown or black" skin type with 5.90% frequency. Vitamin D levels were significantly lower in the participants with light brown or darker skin types when compared with white or fair skin types ($P = .013$).

Regarding knowledge about vitamin D, 59.80% of the participants declared that they had general knowledge. Health staff was the source of information in 36.30% and the internet, close acquaintances, or mass media were the other information sources in descending order. Crucial questions such as "food containing vitamin D," "vitamin D activation by sun radiation," and "role of vitamin D in diseases" were more correctly answered by group 3, the normal group, with significance ($P = .001$, $P = .049$, and $P = .012$) (Table 2).

In our study, NHP scores were not significantly different between the 3 groups ($P = .54$) (Table 3).

There was a significant correlation between NHP part 1 and part 2 ($r = 0.88$, $P < .05$).

## Discussion

Etgen et al[8] after analyzing 5 cross-sectional and 2 longitudinal studies arrived at the conclusion that low vitamin D levels were associated with a major increase in the risk of cognitive dysfunction.

Other authors in their research also indicated that a decrease in vitamin D levels was related to impaired cognitive functions,[9,10,11] which obviously will affect QuOL negatively.

Most of the clinical studies have indicated that vitamin D supplementation was associated with the reduction of symptoms of depression and anxiety, particularly in individuals with an MDD diagnosis.[12]

It has been found that 25(OH)D levels played a role in increasing the QuOL of patients with osteoarthritis and chronic obstructive pulmonary disease in 2 different studies.[13,14]

Vitamin D deficiency, besides deterioration in bone formation, causes proximal muscular weakness and disturbed neuromuscular coordination, therefore increasing the risk of falls and fractures causing pain and functional restriction, influencing QuOL negatively.[15] In a recent study on patients with fibromyalgia, it was observed that vitamin D supplementation was essentially supportive in reducing pain and increasing QuOL.[16]

An Indian study has declared that vitamin D deficiency causing somatization disorder decreased QuOL.[17] Akpınar et al.[2] have detected a significant association between QuOL and vitamin D in 110 participants in their research.

**Table 1.** Relation Between Vitamin D Levels and Demographic Features

| | Group 1 (%) (Vit. D ≤20 ng/mL), n = 37 | Group 2 (%) (Vit. D: 20.01-29.99 ng/mL), n = 27 | Group 3 (%) (Vit. D ≥30 ng/mL), n = 38 | Total (%), n = 102 | *P* |
|---|---|---|---|---|---|
| Age (mean) (SD) | 55.50 ± 6.42 | 56.20 ± 8.05 | 57 ± 10.13 | 56 ± 8.32 | .924** |
| Married | 26 (70.30) | 19 (70.40) | 21 (55.30) | 66 (64.70) | |
| Single | 11 (29.70) | 8 (29.60) | 17 (44.70) | 36 (35.30) | .307 |
| BMI | 29.40 ± 5.19 | 27.30 ± 4.86 | 27.05 ± 4.58 | 27.97 ± 4.96 | .085** |
| **Education** | | | | | |
| Middle or lower | 20 (54.10) | 12 (44.40) | 16 (42.10) | 48 (47.10) | |
| High school | 12 (32.40) | 4 (14.80) | 10 (26.30) | 26 (25.50) | .129 |
| University | 5 (13.50) | 11 (40.70) | 12 (31.60) | 28(27.50) | |
| **Occupation** | | | | | |
| Working | 8 (21.60) | 12 (44.40) | 13 (34.20) | 33 (32.40) | .149 |
| Unemployed | 29 (78.40) | 15 (55.60) | 25 (65.80) | 69 (67.60) | |
| **Income** | | | | | |
| Low | 5 (13.50) | 6 (22.20) | 8 (21.10) | 19 (18.60) | |
| Middle | 31 (83.80) | 20 (74.10) | 27 (71.10) | 78 (76.50) | .690** |
| High | 1 (2.70) | 1 (3.70) | 3 (7.90) | 5 (4.90) | |
| **Smoking** | | | | | |
| Yes | 12 (32.40) | 12 (33.30) | 13 (34.20) | 34 (33.30) | .987 |
| No | 25 (67.60) | 25 (66.70) | 25 (65.08) | 68 (66.70) | |
| **Alcohol** | | | | | |
| Yes/sometimes | 1 (2.70) | 6 (22.20) | 7 (18.40) | 14 (13.70) | .046 |
| No | 36 (97.30) | 21 (77.80) | 31 (81.60) | 88 (86.30) | |
| Menopause age (years) (mean) (SD) | 47.68 ± 4.32 | 47.56 ± 4.86 | 47.34 ± 4.58 | 47.52 ± 4.21 | .943** |
| Birth number (median) (min-max) | 2 (0-5) | 2 (0-5) | 2 (0-4) | 2(0-5) | .242* |
| Breastfeeding (months) (median) (min-max) | 24 (0-96) | 12 (0-132) | 12 (0-72) | 12(0-132) | .404* |

*Kruskal–Wallis test, **1-way ANOVA.
SD, standard deviation; BMI: body mass index.

There was no significant relationship between vitamin D levels and part 1 of the NHP, its subgroups, and part 2 of the NHP in our study. This may be due to the wide age range (44-98 years) of the participants which caused an abnormal distribution of the life quality scales due to the confounding effect of concomitant comorbidities

There is research in favor of the fact that obesity is related to vitamin D deficiency.[18,19] In our study, there was no correlation between vitamin D levels and the BMI of the participants. This may probably be due to the low distribution range of BMI values which were very similar between the groups.

The details of alcohol use were asked if the participant used it frequently or moderately or never. Participants with a moderate level of alcohol consumption had significantly higher vitamin D levels compared with non-users in this study. There are other researchers who supported this finding in both genders.[9,20] Since only 14% of the participants consumed alcohol moderately, it was not possible to generalize this result.

A study conducted in Azerbaijan on women between 47 and 54 years confirmed that vitamin D deficiency was related to less physical activity, dress style (closed garments and headscarves), and season of the year, spring with the least vitamin D levels.[21]

The participants who spent time outside their homes between hours 8:00 AM and 5:00 PM were significantly found more in the vitamin D >20 ng/mL group. This fact has been revealed by different studies.[22,23] Hekimsoy et al[22] have used this parameter for creating a sunbath score.

Gerdheim et al[24] in their study on 986 women with 3 years of follow-up found out that low vitamin D levels were associated with low physical activity, a decrease in walking speed, and disturbed balance. In our study, the fact that vitamin D levels were higher in participants who were physically active may be due to spending time outside in the sun, but there are other studies arguing that physical activity had a positive effect on vitamin D independent of sun exposure.[10,20,21,23,25]

Another study in Turkey found out that participants who dressed in covered style in summer and winter except for face and hands had vitamin D levels significantly lower than the participants whose extremities, distal extremities, and heads were naked in summer.[26] Other studies stated that especially veil use with covered dressing style caused vitamin D deficiency and insufficiency.[27,28] In our study, in accordance with the literature, participants with covered style of dressing except hands and face were significantly more present in the group with low vitamin D levels.

**Table 2.** General Knowledge about Vitamin D

| | Group 1 (%) (Vit. D ≤20 ng/mL), n = 37 | Group 2 (%) (Vit. D = 20.01-29.99 ng/mL), n = 27 | Group 3 (%) (Vit. D ≥30 ng/mL), n = 38 | Total (%), n = 102 | *P* |
|---|---|---|---|---|---|
| **Knowledge about vitamin D** | | | | | |
| Yes | 16 (43.20) | 18 (66.70) | 27 (71.10) | 61 (59.80) | .139 |
| No | 7 (18.90) | 2 (7.40) | 3 (7.90) | 12 (11.80) | |
| **Source of knowledge** | | | | | |
| **Health staff** | | | | | |
| Internet | 9 (24.30) | 11 (40.70) | 17 (44.70) | 37 (36.30) | |
| Close circle | 4 (10.80) | 3 (11.10) | 3 (7.90) | 10 (9.80) | .386 |
| Radio/TV | 0 | 2 (7.40) | 2 (5.30) | 4 (3.90) | |
| Other | 3 (8.10) | 2 (7.40) | 3 (7.90) | 8 (7.80) | |
| | 21 (56.80) | 9 (33.30) | 13 (34.20) | 43 (42.20) | |
| **Food rich in vitamin D** | | | | | |
| Correct | 10 (27) | 16 (59.30) | 25 (65.80) | 51 (50) | .001 |
| Wrong | 0 | 0 | 1 (2.60) | 1 (1) | |
| No idea | 27 (73) | 11 (40.70) | 12 (31.60) | 50 (49) | |
| **Sunlight for activation** | | | | | |
| Yes | 17 (45.90) | 18 (66.70) | 19 (54.10) | 54 (53) | .049 |
| No | 0 | 1 (3.70) | 8 (29.60) | 9 (8.82) | |
| No idea | 20 (54.10) | 8 (29.60) | 11 (28.90) | 39 (38.20) | |
| **Diseases in deficiency** | | | | | |
| Yes | 13 (35.10) | 16 (59.30) | 26 (68.40) | 55 (53.90) | .012 |
| No | 24 (64.90) | 11 (40.70) | 12 (31.60) | 47 (46.10) | |

One-way ANOVA.

In the prevalence studies in our country, vitamin D levels were usually found in the borderline of deficiency and insufficiency levels, emphasizing the cruciality of patient education about sources of vitamin D like oily fish, egg yolk, milk and milk products, oat, mushrooms, and liver and diseases caused by its deficiency in the primary care setting.[22,29] In our study, participants' knowledge about 25(OH)D was significantly related with their serum levels of the vitamin.

There were some limitations to this study. Different definitions of vitamin D deficiency and insufficiency in various studies caused difficulty in making certain implications. Since the blood samples for vitamin D measurement were taken between December and June, it is probable that serum vitamin D levels were found lower than in summer and fall. Other factors of bias were the wide age range of participants, previous vitamin D intake among participants for osteoporosis, and other chronic diseases that may cause statistical errors.

There were no associations between QuOL and vitamin D deficiency or insufficiency in our study. When assessing demographic functions, neither did education level, income, marital status, BMI, and smoking correlate with vitamin D deficiency or insufficiency nor did the number of deliveries, menopause, or breastfeeding duration.

**Table 3.** NHP Scores of the Participants

| | Group 1 (Median) (Min-Max) (Vit. D ≤20 ng/mL), n = 37 | Group 2 (Median) (Min-Max) (Vit. D = 20.01-29.99 ng/mL), n = 27 | Group 3 (Median) (Min-Max) (Vit. D ≥30 ng/mL), n = 38 | *P* |
|---|---|---|---|---|
| NHP part 1 | 94.18 (0-410.99) | 79.11 (0-313.79) | 104.11 (0-408.34) | .620 |
| Pain | 10.49 (0-100) | 18.65 (0-100) | 19.38 (0-100) | .498 |
| Emotion | 0 (0-100) | 0 (0-86.01) | 10.11 (0-100) | .708 |
| Sleep | 0 (0-100) | 0 (0-100) | 6.28 (0-87.43) | .503 |
| Social isolation | 0 (0-80.64) | 0 (0-77.99) | 0 (0-80.61) | .182 |
| Physical activity | 0 (0-76.89) | 0 (0-66.01) | 0 (0-87.51) | .407 |
| Energy | 0 (0-100) | 0 (0-100) | 0 (0-100) | .235 |
| NHP part 2 | 0 (0-7) | 0 (0-4) | 0 (0-7) | .548 |

Kruskal–Wallis test was used because of abnormal distribution of the variables.
NHP, Nottingham Health Profile.

Light brown or darker skin type according to Fitzpatrick classification was associated with lower vitamin D levels. Covered type of dressing and lack of physical activity were also related to low levels of vitamin D. Being outside for work or other reasons between hours 8:00 AM and 5:00 PM was related to higher vitamin D levels.

**Ethics Committee Approval:** Ethical committee approval was received from the Ethics Committee of İstanbul University-Cerrahpaşa University (November 8, 2017 approval no: 83045809-604.01.02).

**Informed Consent:** Written informed consent was obtained from all participants who participated in this study.

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