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RESEARCH ARTICLE

Effect of vitamin-D and other factors on the presence and severity of urinary incontinence and overactive bladder in elderly individuals

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ABSTRACT

Objective: This study aimed to investigate the effect of serum vitamin D levels on urinary incontinence and overactive bladder in elderly individuals.

Methods: The study included 106 elderly individuals who had their serum vitamin D levels measured in the past year. Sociodemographic characteristics, habits, medical histories, medications used, height, and weight data were collected. The ICIQ-UI short form and Overactive Bladder-V8 form were administered. Participants were grouped based on their vitamin D levels.

Results: Among participants, 17.9% had severe vitamin D deficiency, 28.3% had vitamin D deficiency, 18.9% had vitamin D insufficiency, and 34.9% had normal vitamin D levels. No significant association was found between vitamin D levels and the presence of urinary incontinence and overactive bladder. When participants were grouped by vitamin D levels, there was no significant difference in the presence of urinary incontinence and overactive bladder among the groups. However, a significant difference was found in the severity of overactive bladder. Individuals with normal vitamin D levels had significantly higher rates of urinary incontinence and overactive bladder compared to those with lower levels.

Conclusion: Urinary incontinence increases with age and may be associated with aging-related comorbidities. Although reports in the literature suggest a relationship between vitamin D deficiency and urinary incontinence and overactive bladder, this relationship was not confirmed in our study. This discrepancy may be due to differences in the characteristics of the populations studied in the literature.

Keywords: Vitamin D, urinary incontinence, overactive bladder

ÖZET

Vitamin D ve diğer faktörlerin yaşlı bireylerde üriner inkontinans ve aşırı aktif mesane varlığı ve şiddetine etkisi

Amaç: Bu çalışmada, yaşlı bireylerde serum vitamin D düzeyinin üriner inkontinans (UI) ve aşırı aktif mesane (OAB) üzerindeki etkisi araştırılmıştır.

Yöntem: Çalışmaya, son bir yıl içinde serum vitamin D düzeyi ölçülmüş 106 yaşlı birey dahil edilmiştir. Katılımcıların sosyodemografik özellikleri, alışkanlıkları, tıbbi geçmişleri, kullandıkları ilaçlar, boy ve vücut ağırlığı verileri toplanmış, ICIQ-UI kısa formu ve Aşırı Aktif Mesane - V8 formu uygulanmıştır. Katılımcılar vitamin D düzeylerine göre gruplandırılmıştır.

Bulgular: Katılımcıların %17,9'u ciddi D vitamini eksikliği, %28,3'ü D vitamini eksikliği, %18,9'u D vitamini yetersizliği gösterirken, %34,9'unun vitamin D düzeyi normaldi. Vitamin D düzeyi ile üriner inkontinans ve aşırı aktif mesane varlığı arasında anlamlı bir ilişki bulunmamıştır. Katılımcılar vitamin D düzeylerine göre gruplandırıldığında, gruplar üriner inkontinans ve aşırı aktif mesane varlığı açısından anlamlı bir farklılık göstermedi. Ancak, aşırı aktif mesane şiddeti açısından anlamlı bir farklılık tespit edildi. Vitamin D düzeyi normal olan bireylerde üriner inkontinans ve aşırı aktif mesane görülme oranı, düşük düzeyde olanlara göre anlamlı şekilde yüksekti.

Sonuç: Üriner inkontinans yaşla birlikte artmaktadır ve yaşlanma ile artan komorbid hastalıklarla ilişkilendirilebilir. Vitamin D eksikliği ile üriner inkontinans ve aşırı aktif mesane arasında ilişkiye dair literatürde raporlar bulunmasına rağmen, bu ilişki çalışmamızda doğrulanmamıştır. Bu fark, literatürdeki çalışmalarda incelenen popülasyonların farklı özelliklere sahip olmasından kaynaklanabilir.

Anahtar kelimeler: Vitamin D, üriner inkontinans, aşırı aktif mesane

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INTRODUCTION

Due to the increase in average life expectancy both in Turkey and worldwide, the elderly population is steadily growing. This steady growth has led to an increased prevalence of chronic diseases, including urinary incontinence (UI) and lower urinary tract dysfunctions, which are more commonly observed due to physiological changes associated with aging. UI is not merely a consequence of aging; it is a pathological condition that affects individuals across all age groups[1]. While urinary incontinence may not directly cause mortality, it can lead to decreased quality of life, psychological stress, depression, and social isolation [2].

Urinary incontinence is defined as any involuntary urine leakage regardless of volume, whereas overactive bladder (OAB) is characterized by increased urinary frequency, urgency, and nocturia, with or without UI [3]. OAB and UI can have overlapping symptoms, and while OAB may or may not include UI, it shares similar negative impacts on quality of life. Temporary or permanent UI can develop for various reasons.

In Europe, the prevalence of OAB is observed to be 10.8% in men and 12.8% in women. Interestingly, while there is no significant gender difference in the overall frequency of OAB, urgency incontinence is reported to be more common in women. The prevalence of OAB in women with UI was found to be 6.3%, while in men it was 3.1% [4]. In Turkey, however, the focus has been predominantly on women, with studies reporting UI prevalence as high as 44.8% [5].

Another common condition in the elderly is vitamin D deficiency. This deficiency is particularly concerning given the role of vitamin D in various bodily functions beyond bone health, including muscle function. The reason for the high prevalence of vitamin D deficiency is thought to be the limited number of foods containing vitamin D, with only a small portion (10-20%) being obtainable through diet, and minimal absorption from the gastrointestinal tract. Furthermore, the majority (80-90%) of vitamin D is synthesized in the skin under the influence of UVB radiation [6].

It is estimated that nearly one billion people worldwide have vitamin D deficiency. Vitamin D levels vary widely across different populations and geographical regions. Studies have shown that vitamin D levels vary between different countries and even within the same country. Numerous studies conducted in Turkey have confirmed that vitamin D deficiency is widespread [7].

In addition to its effects on electrolyte balance and skeletal muscles, vitamin D is known to have an effect on smooth muscles [8]. Recent research has also suggested that vitamin D plays a critical role in the function of pelvic floor muscles, which are essential for maintaining urinary continence [9]. The NHANES study showed that individuals with serum 25(OH) Vitamin D levels below 30 ng/ml had more frequent pelvic floor weakness-related conditions [10]. Moreover, the presence of vitamin D receptors in the prostate and bladder further supports the hypothesis that vitamin D may influence lower urinary tract function. Additionally, the presence of Vitamin D receptors in the prostate and bladder is known, and vitamin D receptor agonists are believed to have anti-inflammatory and antiproliferative properties [11].

In light of all this data, the question arises as to whether serum 25(OH) vitamin D deficiency affects UI and OAB. Several studies have suggested a potential link between vitamin D levels and the severity of UI and OAB symptoms [12]. Moreover, some cases have been reported where UI symptoms improved following vitamin D supplementation [13]. It is quite remarkable to see that a condition causing social distress as UI may be associated with a easily treatable condition of Vitamin D deficiency.

This study aimed to investigate the relationship between vitamin D deficiency and UI and OAB. By understanding this relationship, we hope to contribute to the growing body of evidence on the role of vitamin D in managing UI and OAB, particularly in elderly populations.

MATERIALS and METHODS

This observational study included individuals aged 65 years and older. Participants were selected based on their serum 25(OH) Vitamin D levels measured at Çanakkale Onsekiz Mart University Hospital between June 1, 2016, and May 31, 2017. The study was approved by local ethics committee.

Records of Çanakkale Onsekiz Mart University Hospital were scanned, and patients aged 65 and over who had their serum 25(OH) Vitamin D levels measured within the last year were identified. Participants were then contacted via telephone, using the contact information available in the hospital's patient registry. Patients were informed about the study's purpose and methodology. Inclusion criteria were carefully applied, ensuring the selection of a homogenous study group. Participants who met the inclusion criteria and agreed to participate were scheduled for face-to-face interviews at the Family Medicine Polyclinics. Exclusion criteria were strictly enforced to minimize potential confounding factors. Excluded individuals included those on diuretics, those who had undergone significant urological or gynecological surgeries, and those with benign prostatic hyperplasia or significant hearing impairments. A standardized questionnaire was administered, covering sociodemographic information, medical history, and lifestyle factors relevant to the study's objectives.

The initial pool of 1,145 patients was narrowed down due to various reasons, including outdated contact information, failure to reach participants after multiple attempts, and patient refusal to participate. Among the patients who could be reached, 105 individuals refused to participate in the study, 519 individuals were using diuretic drugs, 34 individuals had a known diagnosis of benign prostatic hyperplasia, 14 individuals could not be communicated with directly due to hearing problems, 56 individuals had a history of genitourinary surgery, 43 individuals had a history of dementia or psychiatric illness that could affect their compliance with the study, 17 individuals had deceased, 13 individuals did not attend their appointment, and 1 individual did not speak Turkish, thus they were excluded from the study.

Collected data included comprehensive sociodemographic details, medical histories, and physical measurements such as height and weight. The presence of drugs that could influence UI or OAB (such as ACE inhibitors, antimuscarinics, antipsychotics, calcium channel blockers, cholinesterase inhibitors, estrogen, GABAergic agents, narcotic analgesics, sedative-hypnotics, tricyclic antidepressants, thiazolidinediones, α-adrenergic blockers, α-adrenergic agonists) was particularly noted. The questionnaire's reliability and validity had been previously confirmed in similar population groups.

To assess participants' UI an OAB status, the ICIQ-UI short form and AAM-V8 were used. These validated instruments provided a reliable measure of UI and OAB severity and impact on daily life. **The International Consultation on Incontinence Questionnaire Short Form (ICIQ-UI)** is one of the

scales developed to measure the impact of urinary incontinence symptoms on quality of life and the effectiveness of treatment. The Turkish version of the ICIQ-UI was validated by Çetinel et al. [14]. This short and simple questionnaire facilitates the screening of incontinence for physicians in both primary and secondary healthcare settings, summarizes the level, impact, and perceived cause of symptoms in a short but comprehensive manner. The ICIQ-UI assesses the frequency, severity, and impact of UI, with a scoring system ranging from 0 to 21. Although a score value for diagnosis is not defined, as patients' complaints increase, the obtained score increases.

The Overactive Bladder Questionnaire (OAB-V8) was developed based on the OAB-q (overactive bladder questionnaire) form by Coyne et al. in 2002 for the OAB syndrome [15]. The OAB-V8 includes 8 items scored from 0 ("not bothered at all") to 5 ("bothered a very great deal"), with an additional 2 points for male participants. Individuals scoring ≥8 points are considered to be at risk for OAB. The questionnaire was translated into 14 languages and tested for validity and reliability by Acquadro et al. in 2006 [16]. The validity and reliability study of the questionnaire in Turkish was conducted by Tarcan et al. [17].

Statistical Analysis: Participants were grouped according to their serum 25(OH) Vitamin D levels as follows: sufficient (>30 ng/ml), insufficient (20-30 ng/ml), deficient (<20 ng/ml), and severely deficient (<10 ng/ml) [18]. After the data was transferred to digital format, the conformity of continuous variables to normal distribution was checked by histograms. Appropriate statistical tests were applied to compare groups based on vitamin D levels, UI, and OAB severity Test constants and p-values were reported for all tests. A significance level of $p<0.05$ was accepted. The effect size of the correlation was interpreted based on the magnitude of the correlation coefficient (r) and categorized as follows: A correlation coefficient between 0.10 and 0.29 indicates a small effect, a coefficient between 0.30 and 0.49 indicates a medium effect, and a coefficient of 0.50 or higher indicates a large effect.

RESULTS

The study included 106 participants, comprising 80 (75.5%) females and 26 (24.5%) males. The mean age of the participants was 71.7 ± 5.6 [65-88] years, with no significant difference between genders (U=922.5; p=0.387).

Of the participants, 5 (4.7%) were illiterate, 59 (55.6%) had completed primary school, 9 (8.5%) had completed middle school, 18 (17.0%) had completed high school, and 15 (14.2%) had completed university education. Regarding their current employment status, 54 (50.9%) were housewives, one (0.9%) was a civil servant, one (0.9%) was a laborer, and 50 (47.3%) were retired. Among the participants, 66 (62.3%) were married, 5 (4.7%) were single or divorced, and 35 (33%) were widowed. Twenty-two participants (20.8%) were living alone.

Regarding body weight status, one participant (0.9%) was underweight, 31 (29.2%) had normal weight, 46 (43.5%) were overweight, 27 (25.5%) were obese, and one (0.9%) was morbidly obese.

Among female participants, 8 (10.0%) had never been pregnant, 3 (3.8%) had been pregnant once, and 69 (86.2%) had been pregnant at least twice. Regarding their childbirth history, 8 (10.0%) were nulliparous, 6 (7.5%) were primiparous, and 66 (82.5%) were multiparous. The mean number of pregnancies among female participants was 3.4 ± 1.8 [0-9], and the mean number of childbirths was 2.5 ± 1.3 [0-6]. The mean age of menopause among participants was found to be 46.9 ± 6.6 years. Nine (11.2%) participants reported receiving hormone replacement therapy during the postmenopausal period.

Regarding smoking habits, 75 (70.8%) participants had never smoked, 22 (20.8%) had quit smoking after a period of use, and 9 (8.5%) were still smoking. Alcohol consumption was reported by 14 (13.2%) participants, all of whom consumed alcohol in social settings, and none of the participants reported regular alcohol consumption. The mean daily consumption of tea, and coffee among participants was 2.4 ± 2.5 [0-12] cups, and 0.5 ± 0.8 [0-5] cups respectively.

Ninety-eight participants (92.5%) had a history of various chronic diseases. The most commonly observed comorbidities were hypertension in 56 (52.8%) individuals, musculoskeletal disorders in 50 (47.2%), diabetes mellitus in 26 (24.5%), and hypothyroidism in 25 (23.6%).

Furthermore, 102 participants (96.2%) reported regular medication use. The mean number of medications used among those who reported regular medication use was 3.5 ± 2.1 [1-11]. Among the group using regular medication, it was found that 39 (61.8%) individuals were using medications from categories that might increase the risk of UI.

Participants had a mean serum 25(OH) Vitamin D level of 25.2 ± 15.6 [3-70] ng/ml, with no significant difference between genders (U=925.0; p=0.398). When participants were classified according to their serum 25(OH) Vitamin D levels, 19 (17.9%) had severe deficiency, 30 (28.3%) had deficiency, 20 (18.9%) had insufficiency, and 37 (34.9%) had normal serum 25(OH) vitamin D levels. When the participants' serum 25(OH) vitamin D levels were examined in two subgroups as normal and lower than normal, 37 individuals (34.9%) had normal levels, while 69 individuals (65.1%) had levels lower than normal.

Among the participants, 93 had a mean serum calcium level of 9.6 ± 0.6 [7.7 - 12.7] mg/dl.

According to the ICIQ-UI short form, 57 (53.8%) individuals had no UI. Among the 49 (46.2%) participants with UI, the frequency of enuresis was as follows: 26 (24.5%) experienced once a week or less, 12 (11.3%) 2 or 3 times a week, 4 (3.8%) once a day, and 7 (6.6%) several times a day. Additionally, 37 (34.5%) participants experienced enuresis before reaching the toilet, 21 (19.8%) when coughing or sneezing, 5 (4.7%) while asleep, 11 (10.4%) with movement, 2 (1.9%) after urination, and 5 (4.7%) had unexplained enuresis. No participants reported continuous enuresis.

The rate of UI among females (53.8%) was significantly higher than that among males (23.1%) (X^2=7.427; p=0.006). The distribution of variables among participants with UI is presented in Table 1.

The participants' OAB-V8 total score was calculated as an average of 8.4 ± 4.9 [0 - 25]. According to these scores, 50 (47.2%) individuals had OAB syndrome. The distribution of variables for those with OAB syndrome is presented in Table 2. When evaluating only patients with OAB, the severity score of postmenopausal hormone replacement therapy users (9.4 ± 1.5) was significantly lower than those who did not use it (13.3 ± 4.7) (U=52.0; p=0.032).

Participant characteristics and the severity of UI and OAB scores are presented in Table 3. A significant positive correlation with small effect size was observed between OAB severity and age (tau_b=0.220; p=0.002). A positive correlation with small effect size was also found between OAB severity and the number of childbirths (tau_b=0.176; p=0.041).

Participant Characteristics	Urinary Incontinence Present	No Urinary Incontinence	Statistics
Gender (Female)	43 (87.8%)	37 (64.9%)	**X^2=7.427; p=0.006**
Age	72.5 ± 6.2	71.0 ± 5.1	t=1.322; p=0.189
Smoking	11 (22.4%)	20 (35.1%)	X^2=2.034; p=0.154
Alcohol Use	4 (8.2%)	10 (17.5%)	X^2=2.023; p=0.155
Postmenopausal HRT Use	6 (14.0%)	3 (8.1%)	X^2=0.681; p=0.409
Hypertension	29 (59.2%)	27 (47.4%)	X^2=1.476; p=0.224
Diabetes	12 (24.5%)	14 (24.6%)	X^2<0.001; p=0.993
Hypothyroidism	12 (24.5%)	13 (22.8%)	X^2=0.041; p=0.839
Musculoskeletal Disorders	23 (46.9%)	28 (49.1%)	X^2=0.050; p=0.822
Use of Urinary Incontinence Facilitating Drugs	20 (40.8%)	19 (35.8%)	X^2=0.266; p=0.606

HRT: hormon replacement therapy

Table 1. Presence of Urinary Incontinence According to Participant Characteristics

Urinary incontinence patients' serum 25(OH) Vitamin D levels (28.2±16.6 ng/ml) were not significantly different from those without complaints (22.6±14.4 ng/ml) (t=1.879; p=0.063). Of those with normal serum 25(OH) vitamin D levels, 23 (62.2%) experienced urinary incontinence, while among those with levels lower than normal, 26 (37.7%) experienced it (X^2=5.807; p=0.016).

The serum 25(OH) Vitamin D levels of patients with OAB (28.0±17.2 ng/ml) did not significantly differ from those without OAB (22.7±13.7 ng/ml) (t=1.786; p=0.077). Of those with normal serum 25(OH) vitamin D levels, 22 (59.5%) had an overactive bladder, while among those with levels lower than normal, 28 (40.6%) had it. The difference between the two groups was not significant (X^2=3.445; p=0.063).

Participants' UI and OAB statuses according to Vitamin D level groups are shown in Table 4. There was no significant difference in the rates of urinary incontinence or OAB among the groups when participants were classified based on their serum 25(OH) vitamin D levels (X^2=6.673; p=0.083, X^2=4.585; p=0.205, respectively).

OAB: Overactive Active Bladder	**OAB Present**	**OAB Absent**
Gender (Female)	38, 76.0%	42, 75.0%
Age	73.0±6.0	70.5±5.1
Smoking	17, 34.0%	14, 25.0%
Alcohol Use	7, 14.0%	7, 12.5%
Postmenopausal Hormone Replacement Therapy	7, 18.4%	2, 4.8%
Hypertension	32, 64.0%	24, 42.9%
Diabetes	9, 18.0%	17, 30.4%
Hypothyroidism	8, 16.0%	17, 30.4%
Musculoskeletal Diseases	26, 52.0%	25, 44.6%
Use of Incontinence Facilitating Drugs	23, 46.9%	16, 30.2%

Table 2. Presence of Overactive Active Bladder according to participant characteristics

Participant Characteristic	Urinary Incontinence Severity	OAB Severity
Age	tau_b=0.105; p=0.161	**tau_b=0.220; p=0.002**
BMI	tau_b=0.130; p=0.075	tau_b=0.106; p=0.068
Parity (Number of Pregnancies)	tau_b=0.087; p=0.324	tau_b=0.149; p=0.076
Number of Births	tau_b=0.142; p=0.118	**tau_b=0.176; p=0.041**
Age at Menopause	tau_b=0.043; p=0.609	tau_b=-0.027; p=0.735
Number of Medications	tau_b=0.115; p=0.147	tau_b=0.112; p=0.131
Tea Consumption	tau_b=-0.135; p=0.084	tau_b=-0.066; p=0.363
Coffee Consumption	tau_b=-0.047; p=0.581	tau_b=-0.111; p=0.162
OAB: Overactive Active Bladder		

Table 3. Variation and Relationships of Participant Characteristics with Urinary Incontinence Severity and OAB Severity Scores

Vitamin D Level Group	Total Participants	Participants with Urinary Incontinence	Participants with OAB
Normal	37 (35.0%)	23 (46.9%)	22 (44.0%)
Vitamin D Insufficiency	20 (18.8%)	6 (12.2%)	9 (18.0%)
Vitamin D Deficiency	30 (28.3%)	13 (26.5%)	10 (20.0%)
Severe Vitamin D Deficiency	19 (17.9%)	7 (14.3%)	9 (18.0%)
Total	106 (100.0%)	49 (100.0%)	50 (100.0%)
		X^2=6.673; p=0.083	X^2=4.585; p=0.205

Table 4. Urinary incontinence and Overactive Active Bladder statuses according to Vitamin D level groups

There was no significant correlation between participants' serum 25(OH) Vitamin D levels and UI severity scores (tau_b=0.099; p=0.174). However, there was a significant positive correlation with small effect size between OAB severity and serum 25(OH) Vitamin D levels (tau_b=0.148; p=0.030).

Urinary incontinence patients' calcium levels (9.7±0.8 ng/ml) did not significantly differ from those without UI (9.5±0.5 ng/ml) (t=1.368; p=0.175). Similarly, there was no significant difference in calcium levels between patients with OAB (9.6±0.8 ng/ml) and those without OAB (9.7±0.6 ng/ml) (t=0.736; p=0.463). There was no significant correlation between calcium levels and the severity of UI (tau_b=0.119; p=0.130) or OAB severity (tau_b= -0.065; p=0.373).

DISCUSSION

Urinary incontinence is a significant condition that affects the social life of individuals, particularly in the elderly where functional decline due to various reasons is more prevalent. The increasing prevalence of this condition, which adversely affects individuals physically, psychologically, and socially, necessitates the investigation of possible associated factors and the identification of preventable causes. In the elderly Vitamin D deficiency is commonly observed. Given its effects on the detrusor muscle of the bladder and the prostate gland, it is thought that UI and OAB may be more common in individuals with Vitamin D deficiency.

In our study, which aimed to evaluate the relationship between Vitamin D deficiency and UI in 106 elderly individuals, those with normal serum 25(OH) Vitamin D levels were found to have a significantly higher prevalence of UI compared to those with low levels. While no significant difference in the occurrence of OAB was observed among the participants based on serum 25(OH) Vitamin D level categories, there was a significant positive correlation between serum 25(OH) Vitamin D levels and OAB severity.

With increasing life expectancy and aging population, the prevalence of UI in the elderly is progressively rising due to

the increasing incidence of comorbidities and physiological changes associated with aging, such as pelvic floor muscle dysfunction and urinary system diseases. In our study, the prevalence of UI was found to be 46.2%. An epidemiological review by Hunskaar et al. observed UI prevalence ranging from 6% to 72% [19]. In the study conducted by Kılıç et al., urinary incontinence was detected in 49.7% of women and 28.6% of men [20]. In other studies conducted in Turkey, Çetinel et al. reported a UI prevalence of 35.7%, Koçak et al. reported 23.9%, and Ekin et al. reported 33.7% [21-23].

In a cross-sectional population-based survey by Irwin et al. it was found that 12.8% of women and 10.8% of men had OAB [4]. In our study, the prevalence of OAB was 47.2%, which is higher and predominantly observed in women. Zhu et al. conducted a review of 28 studies and similarly found that OAB is associated with age, consistent with our findings [24].

Tampakoudis et al. examined the urinary incontinence status between two groups of women, smokers and non-smokers, and found a higher incidence of UI in smokers [25]. Hannestead et al. reported a significantly higher prevalence of UI in active smokers and individuals who quit smoking [26]. The lack of association between smoking and UI in our study may be attributed to the inclusion of both genders and the lower prevalence of smoking among women in our country.

In a study by Tamanini et al., the most common comorbid pathologies and their prevalence rates in patients with UI or OAB were found to be similar to our study [27]. Öztürk et al. examined the UI status of women aged 35 and older and, similar to our study, demonstrated no association with diabetes and hypertension [28].

In a study conducted by Kaur et al. in India in 2017 among women aged 65 and older, the participants with UI had a mean vitamin D level of 11.2 ± 6.3 ng/ml, while in the control group it was found to be 14.6 ± 7.3 ng/ml, and a significant difference was observed between the groups [29]. Our study results are consistent with these findings. In our study, the vitamin D levels were determined to have a general average of 25.2 ± 15.6 ng/ml. It is well known that vitamin D is effective on muscle and bone physiology. The relationship between pelvic muscle function and vitamin D, which could affect the development of urinary incontinence, is frequently investigated. In women aged 50 and over, low vitamin D levels were found to be significantly associated with UI and at least one pelvic floor disorder [10].

In a study conducted by Kılıç et al. in 2016, it was found that UI was significantly higher in individuals with low vitamin D levels, diabetes, and high Ca levels, while OAB was significantly higher in individuals with low vitamin D levels and high serum Ca levels [20]. In our study, Ca levels and diabetes were not found to be associated with the presence of UI and OAB. When the participants in our study were classified into groups based on their serum 25(OH) Vitamin D levels as normal and low, it was found that the UI was significantly higher in the group with normal vitamin D levels compared to the group with low levels. Although an OAB was more commonly observed, the difference was not significant.

In a cohort study conducted by Vaughan et al., it was observed that out of 187 participants initially without UI, UI developed in 175 of them during follow-up. After adjusting for age, gender, and ethnic factors, a significant association was found between baseline vitamin D levels and UI [30].

Navaneethan et al. found in their prospective study among postmenopausal women that total pelvic floor dysfunction was significantly associated with Vitamin D levels and being in menopause for more than 5 years [9]. Isolated pelvic organ prolapse was also significantly associated with Vitamin D. Isolated stress UI, however, was found to be associated with obesity, sunlight exposure, and serum 25(OH) Vitamin D levels. In our study, since self-reported data were collected, the categorization of incontinence reported by participants may have been suboptimal, leading to the inability to identify similar relationships.

In a retrospective study conducted by Parker-Autrey et al., the relationship between vitamin D and pelvic floor dysfunction was investigated in women aged 18 and over. It was found that pelvic floor dysfunction was significantly higher in the group with low Vitamin D levels [31]. In a cohort study conducted by Dallosso et al., involving individuals over 40 years old, participants were queried about urinary symptoms and dietary habits annually for one year. It was observed that high Vitamin D intake significantly reduced the incidence of developing OAB [32].

In our study, we did not find a significant relationship between Vitamin D levels and UI measured by the ICIQ-UI short form or the presence of OAB measured by the OAB-V8 scale among participants aged 65 and above who presented to our hospital. However, we did find a significant association between Vitamin D levels and the severity of OAB measured by the OAB-V8 scale, where those with normal Vitamin D levels had significantly higher OAB severity compared to those with low levels.

The reasons for this discrepancy in results could be attributed to several factors. These include differences in the age groups of participants selected in different studies, the specific exclusion criteria applied in our study leading to a more specific group of participants, the use of different cutoff values for serum 25(OH) Vitamin D levels in classifying participants, and methodological differences in the evaluation of UI and OAB presence in studies (such as physical examination, urodynamic tests, different scales, etc.). Further research on this topic is warranted.

The relationship between vitamin D levels and various health outcomes remains controversial. This discrepancy may be due to limitations in study designs, such as inadequate dosing or baseline vitamin D levels [33]. The inconsistency in results may also stem from measuring different forms of vitamin D or using varying assay methods [34]. Despite extensive research, highly convincing evidence for a clear role of vitamin D does not exist for most outcomes [35]. Future studies should consider adjusting for long-term vitamin D supplementation, solar exposure, and other potential confounders.

This study has several limitations. Firstly, serum 25(OH) vitamin D levels were measured only once, without accounting for seasonal variations, duration of sun exposure, and dietary habits. As a result, the measured vitamin D levels may not fully reflect the participants' long-term vitamin D status. Additionally, the cross-sectional design of the study limits our ability to establish causality between vitamin D levels and health outcomes. The observed discrepancies between measured vitamin D levels and various health outcomes may also be attributed to the lack of measurement of different forms of vitamin D or the use of varying assay methods. Furthermore, the sample size in this study was limited, which may affect the generalizability of the findings. Specifically, the small number of male participants limits our ability to assess gender differences ef-

fectively, and this imbalance may have contributed to the lack of significant findings in gender comparisons.

In this study, participants aged 65 and above who had their serum 25(OH) vitamin D levels measured at our hospital in the past year were identified through hospital records and invited to participate. It is possible that those who agreed to participate and attended the interview were in better health, lived closer to the hospital, and were more health-conscious, potentially influencing the study results. Additionally, serum 25(OH) vitamin D measurements were not performed concurrently with the evaluation of UI. The limited number of participants, due to the strict inclusion and exclusion criteria, further restricted recruitment. Moreover, pelvic examination or urodynamic testing was not conducted, and the UI status was entirely based on self-reporting. These factors may have contributed to the possible suboptimal assessment of UI in this study.

There are very few studies in our country that investigate the effects of vitamin D on UI. The exclusion criteria in our study were carefully designed to minimize potential confounding factors. However, the results from studies investigating the relationship between vitamin D and UI, both in our country and internationally, remain contradictory. More controlled, prospective studies are needed to provide a clearer evaluation of this relationship and to confirm the findings.

Conclusion

According to the results of our study, there was no significant relationship between serum 25(OH) Vitamin D levels and the presence of UI and OAB. However, a significant positive correlation was found between the severity of OAB and serum 25(OH) Vitamin D levels. When participants were grouped according to their serum 25(OH) Vitamin D levels, no significant difference was observed in the presence of UI and OAB, but a significant difference was found in terms of the severity of OAB.

When participants were categorized based on their serum 25(OH) Vitamin D levels, it was observed that both UI and OAB were significantly more common in the group with normal Vitamin D levels. These findings suggest that the effects of vitamin D levels on UI and OAB may be complex and require further investigation.

Limitations of our study include the limited number of participants, the lack of simultaneous measurement of serum 25(OH) Vitamin D levels with UI, and the reliance on participant-reported UI status. Considering these limitations, future studies should be more comprehensive. In conclusion, further research is needed to better understand the relationship between Vitamin D deficiency and UI and OAB in the elderly.

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