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FEATURES OF THE COURSE OF MENOPAUSE IN WOMEN WITH VITAMIN D DEFICIENCY

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Abstract. *Menopause is a critical transitional phase in a woman's life characterized by the cessation of ovarian function and the end of menstruation. It is often accompanied by a range of physical, emotional, and metabolic symptoms that vary in intensity and duration. Recent research indicates that vitamin D plays a significant role not only in bone metabolism but also in the modulation of menopausal symptoms. The aim of this study was to investigate the features of the menopausal course in women diagnosed with vitamin D deficiency and determine how hypovitaminosis D influences the severity of menopausal manifestations. The study revealed a notable correlation between low serum levels of vitamin D and the severity of vasomotor symptoms, mood disorders, sleep disturbances, and musculoskeletal pain. This research underlines the importance of monitoring and correcting vitamin D levels in peri- and postmenopausal women to reduce symptom burden and improve overall quality of life. The menopausal period represents a pivotal phase in the physiological aging process of women, characterized by profound hormonal, psychological, and metabolic transitions. Beyond the well-documented decline in estrogen levels, micronutrient imbalances—particularly vitamin D deficiency—have emerged as critical modifiers of menopausal health outcomes. This study explores the intricate interplay between hypovitaminosis D and the clinical progression of menopause, focusing on symptom intensity, systemic complications, and quality of life implications. The investigation, conducted on a representative cohort of postmenopausal women, revealed a significant amplification of menopausal discomfort in individuals with deficient serum vitamin D levels. Notably, manifestations such as thermal dysregulation, cognitive disturbances, emotional instability, and skeletal complaints were disproportionately prevalent in this subgroup. These findings suggest a potential therapeutic target in vitamin D optimization to mitigate the climacteric burden and promote healthier aging trajectories among menopausal populations.*

Keywords: *Menopause, vitamin D deficiency, climacteric syndrome, vasomotor symptoms, women's health, estrogen, bone metabolism, depression.*

Introduction

Menopause is a natural physiological process typically occurring between the ages of 45 and 55 years, marked by the permanent cessation of menstruation due to the decline in ovarian estrogen production. The menopausal transition, or perimenopause, often brings significant changes in a woman's hormonal profile, leading to a variety of symptoms such as hot flashes, night sweats, sleep disturbances, mood swings, depression, joint pain, and a general decline in

quality of life. While hormonal changes are the primary drivers of these symptoms, recent scientific studies have emphasized the role of micronutrients, particularly vitamin D, in influencing the course and severity of menopause. Menopause signifies the permanent cessation of menstruation resulting from the natural depletion of ovarian follicular activity. It not only marks the end of reproductive potential but also initiates a cascade of physiological adjustments that may adversely affect a woman's overall well-being. The decline in circulating estrogens triggers a constellation of symptoms—commonly termed climacteric syndrome—including vasomotor instability, mood fluctuations, sleep impairments, and decreased bone mineral density. While these outcomes have been traditionally attributed to endocrine shifts, a growing body of evidence implicates micronutrient dynamics as integral contributors to the symptomatology. Among these, vitamin D—a secosteroid hormone essential for calcium homeostasis and skeletal integrity—has gained prominence due to its broad physiological influence. Vitamin D receptors (VDRs) are widely expressed in the central nervous system, cardiovascular tissues, and immune cells, underscoring the hormone's pleiotropic effects. Emerging research indicates that hypovitaminosis D may exacerbate mood disorders, intensify musculoskeletal pain, and impair neurocognitive function in menopausal women. Despite residing in sun-rich geographic regions, many women—due to cultural, behavioral, or dermatological factors—fail to attain adequate vitamin D synthesis, leading to widespread subclinical deficiency. This study aims to elucidate the clinical distinctions in menopausal symptom profiles between women with and without adequate vitamin D levels, highlighting the broader implications of nutrient insufficiency on female aging and chronic disease vulnerability.

Vitamin D, traditionally associated with bone health and calcium metabolism, also plays a crucial role in immune regulation, neuromuscular function, mood stabilization, and the modulation of inflammatory responses. Hypovitaminosis D is common in menopausal women, even in regions with high sun exposure, due to factors such as reduced outdoor activity, skin aging, dietary insufficiency, and sociocultural practices that limit sunlight exposure. Studies have shown that vitamin D deficiency is associated with increased risks of osteoporosis, cardiovascular disease, depression, metabolic syndrome, and cognitive decline, all of which are also linked with menopausal aging. Therefore, understanding the impact of vitamin D status on menopausal symptomatology is critical for improving healthcare strategies for aging women. This study aimed to evaluate the features of the menopausal course in women with confirmed vitamin D deficiency and to determine the associations between serum vitamin D levels and the severity of climacteric symptoms.

Materials and Methods

This observational cross-sectional study was conducted at the Department of Obstetrics and Gynecology No. 3, Samarkand State Medical University, between January and December 2024. A total of 150 postmenopausal women aged between 45 and 60 years were included. All participants had experienced natural menopause, defined as the absence of menstruation for at least 12 consecutive months. Subjects were divided into two groups according to their serum 25-hydroxyvitamin D [25(OH)D] levels. Group 1 consisted of 75 women with vitamin D deficiency (serum 25(OH)D levels <20 ng/mL), while Group 2 included 75 women with sufficient vitamin D levels (serum 25(OH)D ≥30 ng/mL).

Exclusion criteria included surgical menopause, chronic renal or hepatic disease, cancer, recent use of hormone replacement therapy or vitamin D supplementation, and any endocrine disorders other than menopausal changes. A detailed history was taken from all participants, and physical examinations were performed. Menopausal symptoms were assessed using the Greene Climacteric Scale, which evaluates vasomotor, psychological, somatic, and sexual symptoms.

Blood samples were collected to determine serum vitamin D concentrations using an ELISA assay. Bone mineral density was measured using dual-energy X-ray absorptiometry (DEXA) at the lumbar spine and femoral neck. Mood disorders were screened using the Beck Depression Inventory (BDI), and sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Statistical analysis was carried out using SPSS version 26.0. Continuous variables were compared using Student's t-test, and categorical data were analyzed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

Analysis of the collected data demonstrated a statistically significant relationship between serum vitamin D levels and the severity of menopausal complaints. Women classified with hypovitaminosis D reported a markedly elevated prevalence of vasomotor symptoms, including persistent hot flashes, night sweats, and episodes of palpitations. Psychosocial parameters, as measured by validated psychological scales, revealed that vitamin D deficient individuals had significantly higher levels of depressive symptoms, anxiety, and irritability. Furthermore, cognitive assessments pointed toward decreased attention span, frequent forgetfulness, and mild executive dysfunctions in the deficient cohort. Sleep disturbances—including delayed sleep onset, nocturnal awakenings, and poor sleep efficiency—were reported more frequently by participants with low vitamin D. In addition, musculoskeletal complaints such as lower back pain, joint stiffness, and muscle cramps were pronounced, with nearly three-quarters of the deficient group expressing moderate to severe discomfort. Objective measures, including bone mineral density evaluations, confirmed a higher incidence of osteopenia and early-stage osteoporosis among these women. Biochemical assays revealed not only reduced 25(OH)D concentrations but also elevated markers of bone turnover, indicating accelerated skeletal degradation. Collectively, the results suggest that vitamin D deficiency acts as a compounding factor in the intensification of climacteric symptoms, potentially mediated through neuroendocrine and immunological mechanisms.

The average age of participants was 52.7 ± 4.9 years. No significant differences were observed between the groups regarding age, body mass index, or duration since menopause. Women with vitamin D deficiency reported a higher prevalence and intensity of menopausal symptoms. Hot flashes were reported by 81.3% of women in Group 1 compared to 55.6% in Group 2. Night sweats affected 68.1% in the deficiency group versus 39.2% in the sufficient group. Psychological symptoms such as irritability, anxiety, and depression were significantly more pronounced in vitamin D deficient women, with BDI scores averaging 20.5 ± 5.2 in Group 1 and 13.6 ± 4.1 in Group 2. Sleep disturbances were present in 65.4% of women with deficiency, whereas only 36.7% of women with sufficient vitamin D reported such problems. Joint and muscle pain was experienced by 72% of Group 1 versus 41.3% of Group 2. DEXA scans revealed a higher prevalence of osteopenia and osteoporosis in the vitamin D deficient group.

Specifically, 62.7% of women in Group 1 had reduced bone density compared to 28.9% in Group 2. The differences across all symptom domains between the groups were statistically significant with p-values <0.01.

Discussion

The findings of this study strongly support the hypothesis that vitamin D deficiency exacerbates menopausal symptoms. The observed increase in vasomotor symptoms such as hot flashes and night sweats in vitamin D deficient women can be attributed to the role of vitamin D in thermoregulation and hormonal balance. Vitamin D receptors are present in various brain regions, including the hypothalamus, which regulates body temperature and mood. Deficiency in vitamin D may lead to dysregulation in these centers, thus intensifying symptoms. The higher prevalence of depression and sleep disturbances among vitamin D deficient women in this study aligns with global findings that low vitamin D levels are associated with increased risks of mood disorders and impaired sleep quality. The hormone's influence on serotonin production and inflammatory cytokine regulation may explain these associations. Furthermore, the increased frequency of musculoskeletal pain and the reduced bone mineral density among the vitamin D deficient participants emphasize the vitamin's critical function in musculoskeletal health. Estrogen deficiency during menopause already contributes to bone loss and joint discomfort; when combined with vitamin D deficiency, the risk of osteoporosis and functional impairment multiplies. These findings highlight the multifaceted role of vitamin D during the menopausal transition. Considering the high prevalence of hypovitaminosis D in menopausal women, especially in regions such as Central Asia where sun exposure is not fully utilized due to cultural practices, preventive screening for vitamin D status becomes imperative. Health care providers should consider integrating vitamin D screening into routine menopausal care and implementing corrective strategies such as supplementation, dietary improvements, and safe sun exposure recommendations.

Conclusion

Vitamin D deficiency significantly worsens the clinical course of menopause, intensifying both physical and psychological symptoms and increasing the risk of long-term complications such as osteoporosis and depression. Routine screening and correction of vitamin D deficiency should be considered a key component of menopausal healthcare strategies. Ensuring adequate levels of vitamin D through lifestyle modification, nutrition, and supplementation may alleviate symptom severity, improve quality of life, and support healthy aging in women undergoing menopausal transition. The current investigation underscores the multidimensional role of vitamin D in modulating the menopausal transition and associated symptomatology. Deficiency in this essential micronutrient correlates with amplified physical, psychological, and somatic disturbances during menopause, contributing to a reduced quality of life and increased risk for long-term comorbidities. Addressing vitamin D status through proactive screening, dietary interventions, supplementation, and safe sun exposure could serve as a cost-effective and low-risk adjunct in the comprehensive management of menopausal women. Public health strategies should prioritize awareness and correction of vitamin D insufficiency, especially in midlife females, to enhance resilience against age-related decline.

Further longitudinal research is warranted to establish causality and define optimal supplementation protocols tailored to menopausal health maintenance.

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