Section: Biochemistry

Original Research Article

EVALUATION OF VITAMIN D STATUS AND CALCIUM-PHOSPHORUS METABOLISM IN POST-MENOPAUSAL WOMEN WITH OSTEOPOROSIS: A TEACHING HOSPITAL BASED STUDY

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Abstract

Background: The most prevalent systemic skeletal condition, osteoporosis is characterised by bone mass loss and compromised microarchitecture of the bones. **Materials and Methods:** Examined were two sets of menopausal women. 45 menopausal women over 49 who had recently been identified osteoporosis but had not received treatment made up the experimental group. A DXA of the spine with a T score above -2,5 was used to identify them. Twenty menopausal women over the age of 49 who did not have osteoporosis and had typical bone densities as determined by DXA made up the control group. **Result:** Twelve (26.7%) of the women with osteoporosis had vitamin D deficiency (17.24±8.5 nmol/l), 15 (33.3%) had vitamin D insufficiency (39.6±11.6 nmol/l), and 18 (40.0%) had normal vitamin D levels (72.04±15.8 nmol/l). Only three of the healthy controls (15.0%) had vitamin D deficiency (13.5±6.4 nmol/l), while 10 (50.0%) had vitamin D insufficiency (35.2±10.4 nmol/l). Of the healthy controls, 7 had normal vitamin D levels (64.21±12.6 nmol/l). **Conclusion:** According to the findings of tests on vitamin D levels, 65.0% of healthy controls and 58.7% of osteoporosis patients are both vitamin D deficient and insufficient.

INTRODUCTION

The most prevalent systemic skeletal condition, osteoporosis is characterised by bone mass loss and compromised microarchitecture of the bones. In 1993, the World Health Organization's consensus meeting produced the following definition of osteoporosis: Low bone density and microarchitectural deterioration of bone tissue are its hallmarks. As a result, there is an elevated risk of fractures and bone fragility.[1] The progression of osteoporosis is either asymptomatic or oligosymptomatic, most frequently without recognisable signs until a vertebra or bone spontaneously fractures. Osteoporotic fractures cause severe disability, a decline in quality of life, and a higher risk of serious complications and death for the patients who sustain them. As the world's population ages and life expectancies rise, osteoporosis is a condition that places a growing burden on health care institutions. We should focus our efforts on early diagnosis of patients with osteoporosis and their timely and ongoing treatment before fractures and disability occur, according to the societal significance of the condition and the significant costs associated with treating its complications. 20% of hip fracture victims pass away about a year after the injury. More than 38 000 new osteoporotic fractures occur in India each year, and their therapy costs account for 1,6% of general medical costs. Osteoporosis affects roughly 200 million people annually worldwide.[2] According to WHO, developing nations have relatively little quantitative information on the incidence and prevalence of osteoporosis.[3] Studies from India indicate that 8 to 62% of women have osteoporosis, depending on the study.[4] This demonstrates the huge disparity in frequency across India. In women between the ages of 45 and 65, postmenopausal osteoporosis develops as a result of declining reproductive function. Progressive bone mass loss and following fractures are its defining features. Most commonly, the vertebral bodies are impacted. The main pathogenetic factors are the increased loss of bone mass during the first 5–10 years following menopause and the hormonally determined increase in bone resorption during this time. The findings of measuring bone mineral density (BMD) using dual-

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energy X-ray absorptiometry are used by the WHO to make the diagnosis. (DXA). function of vitamin D. A hormone and a fat-soluble nutrient, vitamin D is. It is essential for the metabolism of bones and the interchange of calcium and phosphorus. Osteoporosis can occur as a result of vitamin D deficiency. The three elements calcium, phosphorous, and parathormone (PTH) control how vitamin D is made. PTH affects calcium absorption in the small intestine and its reabsorption in the kidney tubules by increasing the production of 1.25(OH)2D in the kidneys. Vitamin D levels are closely related to the stimulation or the suppression of PTH secretion through the levels of calcium. By supplying the body with calcium and some of its other immediate effects, vitamin D encourages osteoid mineralization and modulates the activity of osteoblasts and osteoclasts. Hypocalcemia, secondary hyperparathyroidism, bone destruction that can result in osteoporosis and fractures, mineralization flaws that may eventually lead to osteomalacia, and muscular fatigue that can result in falls and fractures are all effects of vitamin D deficiency. Vitamin D affects muscular tone as well. It encourages calcium influx, which is necessary for muscular contraction, as well as protein synthesis in muscle cells. Muscle soreness and fatigue are signs of vitamin D deficiency, which can contribute to frequent accidents and fractures.[5] The serum level of 25(OH)D, which represents both vitamin D intake and skin synthesis, is deemed by the committee of medicine to be the best functional indicator of vitamin D status in 1997.[6] In this research, menopausal healthy women and women with postmenopausal osteoporosis will have their vitamin D levels checked.

MATERIALS AND METHODS

The current research was carried out between January 2021 and March 2022 at the World College of Medical Sciences Research and Hospital, Jhajjar, in collaboration with the Department of Orthopaedics. Examined were two sets of menopausal women. 45 menopausal women over 49 who had recently been identified osteoporosis but had not received treatment made up the experimental group. A DXA of the spine with a T score above -2,5 was used to identify them. Twenty menopausal women over the age of 49 who did not have osteoporosis and had typical bone densities as determined by DXA made up the control group. BMI and anthropometric assessments were performed on both groups. Participants in both groups underwent biochemical and immunological tests on their venous blood to assess their amounts of parathormone, vitamin D, alkaline phosphatase, calcium, and phosphorus. The information was gathered between the fall and winter seasons. The biochemical analyzer Erba chemistry EM-200, Erba Diagnostic kits was used to perform the biochemical assays for calcium and phosphorus. The immunological analyser ELISA, Calbiotech diagnostic kits, was used to perform immunoassays for the immunological tests for parathormone, vitamin D (Vitamin D total), and alkaline phosphatase. The following list includes the referent numbers for the kits used:

Variables	Normal range
Vitamin D	≤ 26 nmol/I deficiency
	26-50.8 nmol/I Insufficiency
	≥ 50.8 normal
PTH	16-65.8 Pg/ml
Alkaline phosphatase	≤128.6 I/U
Calcium	2.16-2.56 mmol/I
Phosphorus	0.85-1.46 mmol/I
Reference values for different parameters	

RESULTS

Both the individuals with OP and the healthy controls had serum calcium, phosphorus, and alkaline phosphatase amounts that were within the referent values. The average AP values between the osteoporosis patients and the healthy controls were found to be different (P0.05), with the OP patients having greater AP values. Twelve (26.7%) of the women with osteoporosis had vitamin D deficiency (17.24±8.5 nmol/l), 15 (33.3%) had vitamin D insufficiency (39.6±11.6 nmol/l), and 18 (40.0%) had normal vitamin D levels (72.04±15.8 nmol/l). Only three of the healthy controls (15.0%) had vitamin D deficiency (13.5±6.4 nmol/l), while 10 (50.0%) had vitamin D insufficiency (35.2±10.4 nmol/l). Of the healthy controls, 7 had normal vitamin D levels (64.21±12.6 nmol/l).

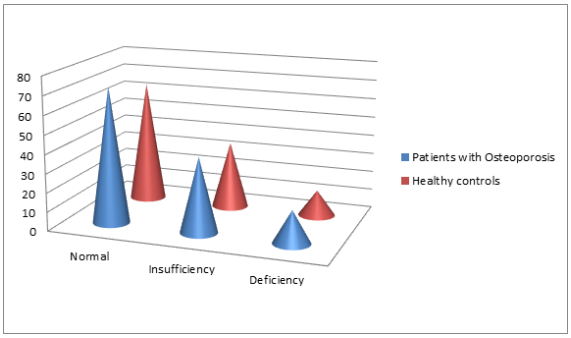

Figure 1:Shows the comparision of Vit.D levels between subject with osteoporosis and healthy control

Table 1: Shows the levels of vitamin D patients with osteoporosis.

Patients with Osteoporosis	Vitamin D levels		
	Normal	Insufficiency	Deficiency
No. of women	18 (40.0%)	15(33.3%)	12(26.7%)
Age in years	62.4±12.6	63.8±12.9	71.02±14.52
BMI	22.4±6.2	23.6±6.5	23.5±6.4

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Vitamin D	72.04±15.8	39.6±11.6	17.24±8.5
PTH	49.32±12.5	61.54±14.6	101.4±18.7
AP	80.24±19.56	91.54±21.6	88.4±20.6
Calcium	2.56±0.24	2.52±0.21	2.51±0.14
Phosphorus	1.32±0.6	1.25±0.4	1.24±0.3

Table 2: Shows the healthy subjects' vitamin D levels.

Healthy controls	**Vitamin D levels**		
	Normal	**Insufficiency**	**Deficiency**
No. of women	07(35.0%)	10(50.0%)	03(15.0%)
Age in years	60.6±11.4	63.8±12.7	73.5±15.24
BMI	27.52±8.42	29.5±9.41	27.4±8.44
Vitamin D	64.21±12.6	35.2±10.4	13.5±6.4
PTH	42.52±10.4	75.4±15.6	65.4±12.8
AP	68.2±11.54	72.6±11.05	83.2±12.64
Calcium	2.52±0.25	2.56±0.28	2.58±0.34
Phosphorus	1.21±0.5	1.26±0.6	1.14±0.08

Patients with normal values and those who had vitamin D deficiency in both categories did not have significantly different average ages. However, there were age differences among vitamin D deficiency patients in both categories that were statistically significant. Both the osteoporosis group and the control group had considerably older vitamin D deficiency patients. ($r = -0.28$, $p<0.05$). A negative association between the rise in parathormone values and the group of osteoporosis patients with insufficient Vitamin D was discovered ($r = -0.38$, p0.02). In both groups, there were sizable variations in the average BMI readings. The average BMI in osteoporosis patients was 24.4 versus 29.6 in the healthy subjects (p=0.04). Women with osteoporosis and healthy controls showed a comparable tendency in vitamin D deficiency patients (24.6 compared to 28.5, respectively, p0.05).

DISCUSSION

Vitamin D deficiency is reasonably common, according to enough evidence in the international scientific literature. There is evidence that people with osteoporosis have low vitamin D levels. Numerous clinical studies on people with fracturacolli femoris show insufficient vitamin D levels.[7,8] There are also studies demonstrating how menopausal women's bone mineral density is preserved and even increased by regular vitamin D levels, increasing their chances of avoiding fractures.[9] Because of this, vitamin D is used to prevent osteoporosis both directly and indirectly as well as to cure it. The levels of vitamin D in various populations of healthy people have currently been formally published findings from several multicenter studies. Epidemiological statistics on vitamin D status in the Indian populace show that 21,3% had a deficiency, 54,5% had an insufficiency, and 24,2% had normal levels.[10] In general, a level of 25 (OH) D below the ideal value of 50 nmol/l is present in 75,8% of the examined individuals. This indicates that a significant portion of the Bulgarian populace suffers from a vitamin D deficiency or insufficiency. Our nation has a rather low vitamin D state, and this issue has thus far gone unnoticed.[11]Based on the DXA findings and data on prior fractures, we discovered during our research that 18 of the patients with osteoporosis had the disease in a severe form. (9 of them informed us about vertebral fractures and the other 9 informed us about nonvertebral fractures). Seven women who were fit controls told us they had previously experienced nonvertebral fractures. According to the findings of the study into vitamin D levels, 58.7% of osteoporosis patients and 65.0% of healthy controls have vitamin D levels that are either insufficient or deficient. Patients from both categories have statistically significantly older average ages for women with vitamin D deficiency. Most likely, a variety of variables play a role in this circumstance. It might be brought on by declining vitamin D production in the skin, low vitamin D intake from food, insufficient exercise, insufficient time spent outside, and coexisting diseases that prevent old people from engaging in their regular physical activity. It was anticipated that patients with vitamin D deficiency would have a negative correlation with the rise in parathormone. The formation of secondary hyperparathyroidism, a risk factor for the onset of osteoporosis and subsequent fractures, is linked to the deficiency of vitamin D caused by low calcium levels. Fracture risk is increased by a poor body mass index. Fracture risk is increased by two times for people with a BMI of 20 kg/m and four times for those with a BMI of 16 kg/m. The findings of our research demonstrate that the average BMI values for the two groups differ significantly. In comparison to the healthy controls, individuals with osteoporosis had an average BMI of 24.4 as opposed to 29.6 (p=0.04). Women with osteoporosis and healthy controls both exhibit the same trend (24,6 to 28.5, respectively, p0.05). The higher BMI is thought to be a protective element that shields women from developing osteoporosis.

CONCLUSION

According to the findings of tests on vitamin D levels, 65.0% of healthy controls and 58.7% of

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osteoporosis patients are both vitamin D deficient and insufficient. The findings of our research are in line with information on vitamin D deficiency and insufficiency gathered from investigations into vitamin D levels in healthy individuals. The low vitamin D levels found in osteoporosis patients point to the need for increased efforts to identify women at risk for the disease early and to implement preventive measures before fractures, complications, and disability arise.

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