

## Vitamin D deficiency and possible link with Bony pain and onset of Osteoporosis

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### Abstract

**Objective:** To explore if vitamin D deficiency had a direct correlation with bone pain or if it contributes in any way to the onset of osteoporosis.

**Methods:** The cross sectional Study was conducted from February to May 2014, presented at Liaquat National Hospital, Karachi, and comprised Orthopaedic outpatients. Who were questioned, examined and counselled, before a questionnaire was filled that included questions about their complaint, and its severity. Several blood test reports were incorporated including serum Vitamin D, to evaluate kidney and liver functions. Dual energy X-ray absorptiometry scans of the lumber and hip regions were also included. Data was collected manually and analysed using SPSS version 16.

**Results:** The mean age of the 65 subjects, was  $52 \pm 16$  SD years, and 54(83.1%) were overweight with body mass index of  $29.7 \text{ kg/m}^2$ . Besides, 61(93.8%) had a positive association of low vitamin D levels as a causative agent for bone pain with mean pain severity index  $6 \pm 1$  SD. On the other hand 25(38.5%) were diagnosed as cases of osteoporosis, and, of them, 21(84%) had low vitamin D levels.

**Conclusion:** Deficiency of vitamin D was directly related to the intensity of bone pain. Some patients had vitamin D deficiency along with osteoporosis, which may have aggravating effect in this context.

**Keywords:** Vitamin D deficiency, Osteoporosis, Adults. (JPMA 64: S-100 (Suppl. 2); 2014)

### Introduction

It is not a mere coincidence that vitamin D deficiency has sprung up as a major cause of widespread concern in many specialties of Medicine and Surgery throughout Pakistan. Osteoporosis is a common disorder in Pakistan typically amongst post-menopausal women, with a survey conducted in 2010 suggesting 6.7 million patients of osteoporosis in the country and it will increase to in excess of 7.1 million by 2020.<sup>1</sup> A lot of thought process has gone into finding the exact cause for this pervasive problem as it leads to various ailments for the patient. Besides, vitamin D is a fat soluble vitamin necessary for bone mineralisation and is found primarily in egg yolk, fish, liver, milk and dark green vegetables. It is first converted in the skin by the action of ultraviolet rays of sunlight. From there it undergoes two metabolic phases in the liver and kidney respectively to be converted to its active form 1, 25-Dihydroxycholecalciferol which is then utilized within the body. The nutritional importance of vitamin D in maintaining bone health is unarguable as is the development of rickets and osteomalacia caused by its deficiency. Over the past decade, the importance of 25-hydroxyl- vitamin D [25(OH)D] in maintaining health and the function of the immune, reproductive, muscular, skeletal, and integumentary systems of people of all ages

and races have come to the forefront.<sup>2</sup> Evidence supports strong association between vitamin D status and risk of chronic disease that can now be linked to vitamin D intake and reduced sun exposure.<sup>3</sup>

Vitamin D deficiency is a well prevalent problem faced by physicians in several subspecialties of both Medicine and Surgery. It is rising rapidly and no particular causative factor has yet been identified for its predominance. On the other hand osteoporosis is a bone disease in which the amount of bone is decreased and the structural integrity of trabecular bone is impaired. Cortical bone becomes more porous and thinner. This makes the bone weaker and more likely to get fractured. It is common in post-menopausal women due to the decreased levels of circulating levels of the hormone oestrogen. It is associated with an increase in osteoclast (OCL) activity without an adequate compensatory increase in osteoblast (OB) activity. While the cause of the disease and the uncoupling between the actions of the OB and OCL are not clear, estrogen replacement therapy appears to reinstate the homeostasis between the OB and OCL and prevents bone loss.<sup>4,5</sup>

Both vitamin D deficiency and osteoporosis cause debility for the patient. This study was planned to find a possible correlation between the low serum levels of vitamin D and the complaint of bone pain (back ache, knee pain, pain in the hip joint, wrists) so that correction of the deficiency may alleviate such the symptoms. Also the stud

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planned to find a link of low vitamin D levels with the presence of osteoporosis as a possible aetiological factor for the disease.

### Subjects and Method

The cross-sectional Study was conducted from February to May 2014 at Liaquat National Hospital, Karachi, and comprised Orthopaedic outpatients coming from various socioeconomic backgrounds and both rural and urban settings. The inclusion criteria comprised any patient with vitamin D levels dual energy X-ray absorptiometry (DEXA) scan evaluations already conducted. Patients who were to be operated upon and those who did not have the two afore-mentioned investigations done were excluded.

A questionnaire was filled to takedown the patient's the demographic data, height, weight, body mass index (BMI), co-morbid, chief complaint and its severity (on a scale of 1 to 10), menopausal history in case of women, drug history, serum levels of vitamin D, calcium. Also included were results of tests done previously to assess kidney and liver. These included liver function test (LFT's), urea/creatinine levels, rheumatoid arthritis (RA) factor, erythrocyte sedimentation rate (ESR), alkaline phosphatase, to rule out any rheumatoid disease as well. Data was collected manually and analysed using SPSS version 16.

Serum vitamin D levels were grouped in to three broad categories:

Class 1:  $\leq 20$ ng/ml= Vitamin D Deficient;

Class 2: 21-29ng/ml= Vitamin D Insufficient; and

Class 3:  $\geq 30$ ng/ml= Vitamin D Sufficient.

To assess the severity of the subject's pain complaint, they were asked to rate it on scale of 1(low) to 10(severe, unbearable).

Further, DEXA scan hip and spine scores were broadly classified as:

Class A  $> -1.5$  (Normal);

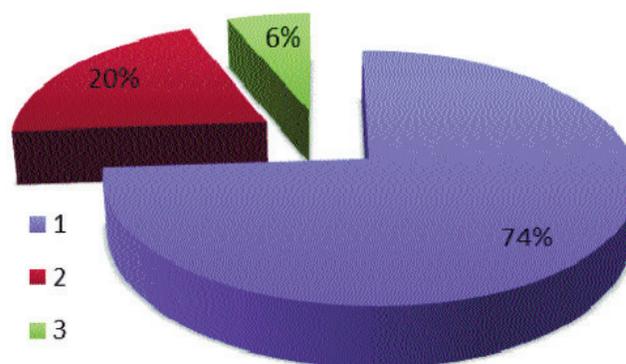
Class B  $-1.5$  to  $-2.5$  (Osteopenia); and

Class C  $< -2.5$  (Osteoporosis).

On the other hand, 25(38.5%) were diagnosed as cases of osteoporosis, and of them, 21(84%) had low vitamin D levels.

### Results

The mean age of 65 subjects was  $52.3 \pm 16$  SD years, and



Class 1: 48(74%) subjects — Class 2: 13(20%) subjects — Class 3: 4(6%) subjects

Figure: Percentage of subjects in class 1, 2, and 3 of vitamin D levels.

Table-1: Correlation of Bone pain with Vitamin D deficiency & Osteoporosis.

Age	Body Pain	Osteoporosis	Vitamin D
N-65	N-65	N-25	Deficiency N-61
20-35 Years N-12	10	—	10
36-50 Years N-15	18	03	14
50-60 Years N-20	22	08	19
60-70 Years N-12	10	09	12
>70 Years N-06	05	05	06

54(83.1%) were overweight with body mass index of  $29.7 \text{ kg/m}^2$ . Besides, 61(93.8%) had a positive association of low vitamin D levels as a causative agent for bone pain. In term of severity, 48(73.8%) patients had vitamin D deficiency and 13(20%) had vitamin D insufficiency (Figure). The mean severity of the pain reported was  $6 \pm 1$  SD. The patients complained mostly of backache and knee-pain with some also complaining of pain in hip, ankle and generalized body ache.

Overall, 25(38.5%) subjects were as having osteoporosis and amongst those, 21(84%) were vitamin D deficient, suggesting a possible correlation of low levels of vitamin D with disease. Four (16%) had no link of vitamin D deficiency with osteoporosis.

### Discussion

Vitamin D deficiency or insufficiency is not very uncommon in our community in all age groups, but it is more prevalent in women than in men and especially in post-menopausal women. In this study, 61 subjects out of 65 presented with bone pain having low levels of vitamin D (level  $< 30$ ng/ml) in which 29 had osteoporosis on the basis of DEXA scan. Our emphasized was not only on the relation of vitamin D deficiency with intensity of bone

pain, but also on exploring any possible links with osteoporosis.

Vitamin D is a very important factor in maintaining calcium and phosphorus level in blood and for musculoskeletal health. In adults, deficiency of vitamin D can result in secondary hyperparathyroidism, osteomalacia, osteoporosis, decreased bone mineral density (BMD) and increase risk of fragility fractures.<sup>6</sup> Chronic vitamin D deficiency results in secondary hyperparathyroidism which increases bone turnover and bone loss with increased risk of fragility fractures.<sup>7</sup> The pathology is that increase in parathyroid hormone (PTH) levels results in osteoclastogenesis which in turn increases numbers and activity of osteoclasts. The osteoclastic activity results in increased skeletal porosity, defective bone mineralisation, decreased BMD, osteoporosis, and increased fragility-fracture risk.<sup>8,9</sup> Studies suggest that serum vitamin D levels more than 30 ng/ml may be needed to increase calcium absorption from the gut and plays a role in the prevention of secondary hyperparathyroidism-induced skeletal conditions.<sup>9,10</sup> It is noticed that adults presenting with bone pain especially in the hip and back region have decreased BMD and an association with vitamin D deficiency.<sup>11,12</sup>

Vitamin D deficiency is directly associated with musculoskeletal pain, and patients with osteomalacia often complain of more bone pain than osteoporosis.<sup>13,14</sup> Such pain in osteomalacia patients can be elicited by applying minimal pressure with the thumb on the sternum or anterior tibia. The exact cause of such pain is unknown, but it is possible that the collagen-rich osteoid that is laid down on the periosteal surface of the bone may become swollen. Such swelling produces outward pressure on the periosteal covering that is innervated with nociceptors.<sup>15</sup> Osteomalacia is often misdiagnosed and patients are treated inappropriately with non steroidal anti-inflammatory drugs (NSAID) for fibromyalgia, chronic fatigue syndrome, or myocytis.<sup>15,16</sup>

Patients with low level of vitamin D, if untreated may suffer bone loss and it increases the risk of fracture, but this is further compounded with ageing. Peak bone mass and rate of bone loss are important in the development of osteoporosis. However when there is low level of vitamin D and bone resorption is amplified, it further increases the risk of fracture. This pathophysiological process has been recognised in patients presenting with osteoporotic hip fractures and it also occurs in fit elderly persons with established vertebral osteoporosis.<sup>16</sup>

Osteoporosis is a very common public health issue in

post-menopausal women, and if untreated it can lead to increased risk of fragility-fractures. Vitamin D deficiency along with diet insufficient in calcium which is very common in our community further aggravates the osteoporosis because it may leads to chronic secondary Hyperparathyroidism which is associated with bone resorption.<sup>18,19</sup> Maintenance of adequate serum vitamin D level is crucial to prevention of future bone loss in women once they have crossed the menopausal age. The significance of serum vitamin D level even in childhood has been demonstrated in terms of better BMD.<sup>20</sup>

In our study we observed that patients with muscle and bone pain had not only association with low level of vitamin D but also some of them presented with osteoporosis representing possible link between low levels of vitamin D and osteoporosis.

## Conclusion

Vitamin D deficiency was directly related to the intensity of bone pain experienced by our patients, especially of the back and knee region. Some patients with low levels of vitamin D also had osteoporosis, which may have a contributory effect to the severe bone pain, But this needs further research globally to be taken with any degree of assurance.

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