

VITAMIN D AND PAIN: THE LINK- A STUDY IN ODISHA AMONGST URBAN POPULATIONAmbika Prasad Dash¹, Sushree Sangeeta Kar²¹Senior Consultant, Department of General and Laparoscopic Surgery, Apollo Hospitals, Bhubaneswar, Odisha.²Assistant Professor, Department of Physiology, Srirama Chandra Bhanja Medical College and Hospital, Cuttack, Odisha.**ABSTRACT****BACKGROUND**

Vitamin D is necessary for calcium homeostasis, skeletal growth, development, maintenance and overall wellbeing. It is synthesized in the body by exposure to UV-B rays of the sunlight by the skin. India though is a tropical country with no scarcity of sunlight; vitamin D deficiency/insufficiency is more common than is suspected.

The study was designed to assess vitamin D levels in patients complaining of non-specific chronic pain of more than six months duration in urban population.

MATERIALS AND METHODS

A total number of 50 subjects in the age group of 20 to 60 years were included in the study. Out of the study population, 14 were males and 36 were females. Plasma level of 25-OH-D was assessed by chemiluminescence method after overnight fasting.

RESULTS

We found in the male study population, 14.28% were vitamin D deficient and 64.28% were vitamin D insufficient. In the female study population, 19.44% were vitamin D deficient and 72.22% had vitamin D insufficiency. Improving vitamin D status by counselling them for more midday sunlight exposure and taking supplementation of vitamin D would certainly benefit them.

CONCLUSION

Vitamin D insufficiency/deficiency is mischievously more prevalent than is previously thought. As it mimics a wide spectrum of clinical conditions such as chronic pain, diabetes mellitus, myopathies, heart disease, stroke, depression and cancer in different organs like breast, prostate, colon and ovary in addition to well associated or established conditions like osteoporosis, osteoarthritis and periodontal diseases; a high level of suspicion should be maintained.

KEYWORDS

25-OH-Vit-D, Pain, Urban population, insufficiency/deficiency.

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BACKGROUND

Vitamin D, the sunshine vitamin, is not strictly a vitamin since it can be synthesized in the body by the skin. 7-Dehydrocholesterol which is an intermediate in the synthesis of cholesterol that accumulates in the skin, undergoes a further reaction over a period of hours to form cholecalciferol which is absorbed to bloodstream¹ the UVB rays of sunlight between 290nm to 310nm wavelength received by an individual during the time period of 10AM to 2PM is the major source of this fat soluble vitamin. Only when sunlight exposure is inadequate, the dietary source is required.¹ Whether the source is skin or diet, cholecalciferol undergoes two hydroxylation processes to yield 1,25(OH)₂ cholecalciferol or calcitriol.¹ Ergocalciferol from fortified foods undergoes similar hydroxylation to yield

Ergocalciferol.¹ In the liver cholecalciferol undergoes the first hydroxylation at 25 position to form the 25-OH derivative calcidiol. Calcidiol then undergoes second hydroxylation at 1 position mostly in the kidneys and other tissues to yield 1,25 dihydroxy cholecalciferol or calcitriol which has got most physiological activity.^{1,2,3} Second hydroxylation also occurs at 24 position to yield 24,25 dihydroxy cholecalciferol which is much less in quantity and does not have the physiologic activity.^{1,2} The first hydroxylation product 25-OH cholecalciferol which is released into the circulation is bound to Vitamin-D binding globulin.^{1,2} This first hydroxylation product circulates at a 1000 fold higher concentration than 1,25 dihydroxy cholecalciferol. 25-OH cholecalciferol has a half-life of 2-3 weeks as compared to 1, 25 dihydroxy cholecalciferol which has half-life of 4 hours. This form thus is the main storage form and hence is measured to get an estimation of Vitamin-D.^{1,2}

Its main function is in the regulation of calcium absorption and homeostasis.¹ Apart from calcium homeostasis activated form of Vitamin-D is involved in insulin secretion, synthesis and secretion of parathyroid and thyroid hormones, inhibition of production of interleukins by activated T-lymphocytes and of immunoglobulins by

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activated B-lymphocytes. It is helpful in differentiation of monocyte precursor cells.¹ Vitamin D thus has a lot of role to play in the body's different systems. Therefore Vitamin-D receptors (VDR) are expressed in a number of cells in the body like osteoclastic precursors, enterocytes, keratinocytes.³ VDR are also seen in colon, breast, prostate and ovary where the effects are local like decreased proliferation and increased differentiation and survival of cells.^{1,2,4,5,6} So its deficiency has a spectrum of clinical presentation varying from the relatively innocent looking pain to cancers in different organs apart from the well-established conditions like rickets and osteomalacia.^{1,2}

Vitamin – D Deficiency, Insufficiency and Sufficiency

Using endocrine society's guidelines vitamin-D deficiency is defined as a level less than 20ng/ml. vitamin-D insufficiency is defined as a level between 21-29 ng/ml. vitamin-D sufficiencies is defined as a level is equal to or more than 30 ng/ml.^{7,8}

Vitamin D deficiency is a common clinical entity. But a high level of suspicion should be maintained to diagnose it. About 6% of the population in Canada, Russia and UK suffer from vitamin D deficiency.⁹ In more cloudy and more smoggy places, people are more deficient in vitamin D i.e., synthesis from ultra violet rays in sunlight is not proper.^{1,2} Some other workers have suggested that there is a pandemic of vitamin D deficiency in otherwise completely healthy people.^{10,11} In subjects who complain of chronic pain vitamin D deficiency is commonly seen.^{12,13,14,15} Vitamin D deficiency might be causing the pain or it may make it worse.¹⁶ Fibromyalgia which is a type of chronic pain is a common differential diagnosis.¹⁷

The other differential diagnoses are:¹⁶

1. Muscle and bone pain.
2. Fatigue and weakness.
3. Lower pain threshold.
4. Depression.
5. Poor exercise recovery.
6. More proneness to respiratory infections.
7. Extreme skin dryness.

High level of suspicion should be there in:¹⁶

1. Dark skinned people as darker skin has reduced ability to produce vitamin –D from sunlight.
2. People with more indoor activities as they are less exposed to sun.
3. Female gender, as much of the body is covered by clothing, more use of sunscreen and avoidance of milk.
4. People who live at high latitude with shorter days in winter.
5. People with extremes of age.
6. Pregnant women, as the requirement is more in them.
7. Obese as greater amounts of subcutaneous fat sequester more of the vitamin and alter its release into the circulation in such subjects.

8. Impaired absorption- celiac sprue, short bowel syndrome, cystic fibrosis.

Vitamin D supplementation to be given more commonly to population under suspicion is a burning topic of debate amongst the healthcare providers. More concern is raised however regarding otherwise healthy subjects. Giving supplementation to otherwise healthy subjects without subjecting them to hyper vitaminosis-D and regarding the perfect dosage, more research is awaited.

MATERIALS AND METHODS

This study was an observational cross-sectional study. The study was conducted in the outpatients' door of Department of Surgery, Apollo Hospital Bhubaneswar. Patients in the age group of 20-60 years who were otherwise healthy and complaining of chronic pain of more than six months duration were included in the study. 50 cases were evaluated after excluding chronic diseases like hypertension and diabetes mellitus. None were having any acute illness during the time of evaluation.

Sample Collection and Bio Analysis

Blood sample was collected early in the morning (7-8 am) after overnight fasting under all aseptic measures. Plasma levels of 25-OH-D was assessed by chemluminescence method.

RESULTS

Out of the male study population (n=14), 14.28% (n=2) had vitamin D deficiency with an average vitamin-D level of 14.45ng/ml. In the same population 64.28% (n=9) had vitamin D insufficiency with an average of 26.52ng/ml. Only 21.43% (n= 3) had normal vitamin D level with an average of 35.76ng/ml.

Out of the female study population (n= 36), 19.44% (n= 7) had vitamin D deficiency with an average of 13.12ng/ml. In the same population 72.22% (n=26) had vitamin D insufficiency with an average of 24.85ng/ml. Only 8.34% (n= 3) had normal vitamin D level with an average of 33.15ng/ml.

Subject Male Population in sub-groups	Expressed in Number	Expressed in Percentage
Total Number	14	100
Subjects with Vit-D deficiency	2	14.28
Subjects with Vit-D insufficiency	9	64.28
Subjects with normal Vit-D level	3	21.43
Table 1. Distribution of Male Study Population into Different Sub-Groups		

Subject Female Population in sub-groups	Expressed in Number	Expressed in Percentage
Total Number	36	100
Subjects with Vit-D deficiency	7	19.44
Subjects with Vit-D insufficiency	26	72.22
Subjects with normal Vit-D level	3	8.34

Table 2. Distribution of Female Study Population into Different Sub-Groups

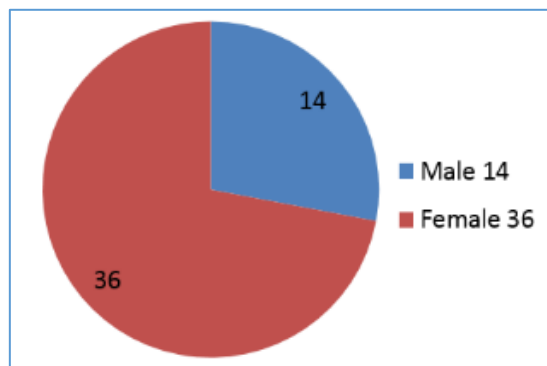


Figure 1. Distribution of Study Group into Male and Female Population

DISCUSSION

Chronic pain is complained more in females (n=36) than males (n=14) in our study. We found in the male study population 14.28% were vitamin D deficient and 64.28% were vitamin D insufficient. In the female study population 19.44% were vitamin D deficient and 72.22% had vitamin D insufficiency. This substantiates with the fact that vitamin D deficiency starts as insufficiency which is usually progressive. Proper advice for sun exposure and supplementation should be given as food fortification with vitamin-D is not a common practice in India.

Moushumi L et al studied 200 patients with chronic low back pain and compared them with 200 healthy subjects as controls. Vitamin D levels when compared with controls (P< 0.0001). 50% of patient has vitamin D deficiency. CRP and RA levels tended to be increased. They concluded, "Our findings provide a plausible explanation as well as justification for advocating dietary supplementation as well as therapeutic medication to achieve envitaminosis D in musculoskeletal pain patients."¹⁸

Amar Kanekar et al studied 71 patients with low vitamin D level combined with musculoskeletal symptoms without the presence of osteomalacia. All patients who showed vitamin D deficiency may complicate a rheumatic disorder. They concluded that a subclinical low vitamin D state exists which is characterised by nonspecific musculoskeletal symptoms. This may complicate a rheumatic disorder. They further said that low vitamin D status runs across population and affects individuals in the prime of their life and affects their productivity. Females are affected more than males as they avoid milk and stay indoors. Large chunk of vitamin D

deficiency is subclinical. Nonspecific musculoskeletal symptoms are the only manifestation.¹⁹

Studies from Kashmir valley by Zargan AH et al have shown lower vitamin status of the group studied as cloud retains 10% of UV-B rays and snow absorbs 20% of the same.²⁰

Plotnikoff GA et al did a cross-sectional study of 150 patients to find out and they concluded that all patients with persistent, nonspecific musculoskeletal pain at high risk for the consequences of unrecognised and untreated severe hypovitaminosis D.¹³

Mc Beth J et al studied 3000 older men about 8% of them were suffering from chronic, widespread pain and they had 20% greater chance of having low vitamin D.¹⁵

Holick MF writes in this editorial for Mayo Clinic Proceedings where patients of 10 to 65 years were studied and all had symptoms of vitamin D deficiency.²¹

Dorland K. et al studied Vitamin -D status in patients of chronic pain and suggest that Vitamin-D levels when low heighten pain sensitivity. This study cites studies from Bern University Hospital and University of Bern in Switzerland which says that chronic pain may be related to central processing of pain, i.e. the brains interpretation of sensory signals from pain receptors throughout the body. As Vitamin-D has been linked to anti-inflammatory cells and their proper functioning, it is proposed that low Vitamin-D levels may increase the sensitivity to pain.²²

All Indian studies uniformly point to low 25(OH) D levels in the population studied despite abundant sunshine as India throughout its latitude and longitude gets generous amounts of sunlight.³

Optimal vitamin D level in the age group of 20 to 60 years is very essential as this age group is the working age group. Peak bone mass is achieved around the age of 30 years. Apart from this child bearing age group of women is within this age group. Vitamin D status in women during pregnancy and lactation has a direct effect on their bone and overall health particularly in the post-menopausal and old age. Reports available that show vitamin D level in this age group show universal vitamin D deficiency.²³⁻²⁶ In comparison to rural population urban population report poorer vitamin D status.²⁷⁻³⁰ This may be attributed to the fact that urban population are less exposed to UV-B rays of sunlight during 10 am to 2 pm unlike rural population who mainly work in agricultural fields and are more exposed to sunlight.²⁷⁻³⁰ Similar study shows high level of vitamin D in soldiers and Indian paramilitary forces that have proper exposure to sunlight.³¹ Urban population are more covered in comparison to rural population who have their chest and abdomen exposed have more area of skin exposure which has an effect on the vitamin D status of individuals.²⁷⁻³⁰

CONCLUSION

Vitamin D insufficiency/deficiency is mischievously more prevalent than is previously thought. As it mimics a wide spectrum of clinical conditions such as chronic pain, Diabetes mellitus, myopathies, heart disease, stroke, depression and cancer in different organs like breast, prostate, colon and

ovary³² in addition to well associated or established conditions like osteoporosis, osteoarthritis and periodontal diseases; a high level of suspicion should be maintained. A healthcare provider should always bear in mind the continuing importance of deficiency states particularly in a populous and diverse country like India, so as to effectively diagnose and treat vitamin D deficiency/insufficiency. As this clinical condition is a great mimic, the patient should not be blamed of malingering or should not be ignored altogether. A patient of chronic pain as such is liable for inattention. We should not do disservice to these groups of patients merely because we cannot diagnose the condition in right time due to lack of clinical suspicion.

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