

Correlation between Vitamin D deficiency and nonspecific chronic low back pain: A retrospective observational study

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ABSTRACT

Context: Chronic lower back pain (CLBP) and Vitamin D deficiency are two common conditions presenting to primary care physicians. **Aims:** To study the vitamin D status in North Indians presenting with nonspecific CLBP and the correlation between vitamin D levels and pain severity by the Visual Analogue Scale (VAS). **Settings and Design:** An observational study. Record of all CLBP patients presenting to the outpatient department in 2019, were analyzed, retrospectively. **Methods and Materials:** All the patients of age 18 to 65 and either sex with nonspecific CLBP were included. Patients were divided into two: Vitamin D deficient (Group 1) and normal (Group 2) with cut off Serum Vitamin D values at 30 ng/mL. Demographic data and Visual Analogue Scale scores (VAS) of both groups were recorded. **Statistical Analysis Used:** Correlations between Vitamin D values and VAS scores were investigated using the Spearman coefficient, and the results with P of ≤ 0.05 were contemplated significant. **Results:** Of total 376 patients with nonspecific CLBP, the majority were adults, females, married, vegetarians, overweight or obese, and had a mean sun exposure time of two hours. Vitamin D deficient Group 1 had 302 (80.32%) patients with significantly lower ($P < 0.0001$) mean vitamin D levels compared to Group 2 (74 patients i.e., 19.68%). Spearman's rho coefficient between vitamin D and VAS, showed a negative correlation (-0.554), with a P value < 0.00001 . **Conclusions:** This study indicated a high probability of vitamin D deficiency in the nonspecific CLBP population and a negative correlation between vitamin D status and pain severity.

Keywords: 25-OH-vitamin D, CLBP, low back pain, VAS, Vitamin D

Introduction

Vitamin D is among the most profoundly studied vitamins of our time. Several studies done previously have correlated Vitamin D deficiency with many chronic conditions producing musculoskeletal pain like osteoarthritis, rheumatoid arthritis, arthralgia, osteoporosis, soft tissue rheumatism, and low backache.^[1-3] Chronic low back

pain (CLBP) is a major health condition affecting adversely the quality of life of the patients. In the literature review, few studies have been found indicating no relationship between chronic musculoskeletal pain and vitamin D. However, a significant link between vitamin D status and chronic pain syndromes has been indicated by some studies.^[4-6] Considering these conflicting thoughts, careful evaluation of Vitamin D correlation with LBP is required. This study was designed specifically to check the vitamin D levels in North Indian persons presenting with nonspecific CLBP and finding a relationship between vitamin D levels and pain severity score by the Visual Analogue Scale (VAS).

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Subjects and Methods

This was a single centered retrospective observational study at a tertiary care teaching hospital. Record of all the patients over one year between January 2019 to December 2019, presenting to the outpatient department with CLBP were analyzed. Appropriate ethical permission for the retrospective record-based study was taken from the Institutional Review Board. Inclusions were patients of both sexes, 18–65 years of age with CLBP for ≥ 12 weeks, without any radiculopathy. Exclusion criteria were patients with clinical or diagnostic evidence of disc herniations; spondyloarthritis; osteoporosis; symptomatic osteoarthritis of joints of the lower extremity; psychiatric disorders; metabolic bone disease, chronic renal problems, disorders of vitamin D metabolism like gastric surgery, chronic liver problems, malabsorption syndrome, severe infections, tumors, patients taking drugs affecting the metabolism of bone like bisphosphonates or corticosteroids, pregnant and lactating mothers, persons taking supplements with vitamin D throughout last three months. Serum 25-OH-vitamin D levels, by enzyme-linked immunosorbent assay (ELISA) method, were noted in all the patients with nonspecific CLBP. More than 30 ng/mL of serum 25 (OH) D was considered normal, and if it was less than 30 ng/mL, a Vitamin D insufficiency or deficiency was considered. Patients were divided into two groups as Vitamin D deficient (Group 1) with a Vitamin D level below 30 ng/mL and normal (Group 2) with a value above 30 ng/mL. All the socio-demographic entries, including age, gender, marital status, educational level, sun exposure time, and dietary preferences, as noted during clinical history, were recorded. Body mass index (BMI) measured, were categorized as underweight for BMI < 18.4, normal for 18.5–24.99, overweight as 25–29.99, and BMI ≥ 30 kg/m² was classified as obese.^[7] Assessment of the Visual Analogue Scale score (VAS) of both the groups was done for noting the severity of pain. Mean \pm SD and median were used for continuous variables and number and percentage (%) were used for categorical variables. Kolmogorov-Smirnov test was utilized for checking the normality of data. Quantitative variables were compared using the Paired t-test and qualitative variables by the Chi-Square test. Values of $P \leq 0.05$ were contemplated as statistically significant. Correlations were investigated using the Spearman coefficient for the ordinal data. The analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

Results

Total 492 CLBP cases were presented in the OPD in 2019, of which 376 did not have any specific cause for CLBP. Of the total 376 patients of nonspecific CLP, 143 were males (38.03%), and 233 were females (61.97%); 325 (86.4%) were married, whereas 51 (13.6%) were unmarried. In dietary preferences, vegetarians were 198 (52.7%) and 178 (47.3%) were nonvegetarians. The majority of the patients, i.e., 266 (71%), were educated only up to high school. With respect to vitamin D levels, 302 (80.32%) patients were Vitamin D deficient (Group 1), and in 74 (19.68%) patients, Vitamin D levels were normal (Group 2). Group 1 had a

mean vitamin D level of 14.11 ± 5.14 ng/mL, whereas Group 2 mean vitamin D level was 37.11 ± 7.11 ng/mL. Group 2 had a statistically significantly higher ($P < 0.0001$) level of vitamin D than group 1. In group 1, the mean age was 39.84 ± 12.17 and in group 2, it was 40.38 ± 12.97 whereas the mean sun exposure time in the two groups were 2.01 ± 0.85 vs. 2.05 ± 0.97 , respectively. About 258 (69%) of patients had a BMI >24.99 in the category of overweight or obese. All the patients were of the same ethnicity. Both groups were statistically similar with respect to demographic characteristics. In the comparison of VAS scores of the two groups, vitamin D deficient Group 1 (5.71 ± 0.97) had statistically significantly higher ($P < 0.00001$) pain severity than vitamin D normal Group 2 (4.88 ± 1.23). Spearman's rho coefficient between vitamin D and VAS scores, showed a statistically significant negative correlation (-0.554), with a P value < 0.00001 [Tables 1-4].

Discussion

Chronic low back pain (CLBP) is defined as a pain present between the costal margins and the inferior gluteal folds for \geq three months and it may be associated with pain in legs or

Table 1: Demographic characteristics of the patients

Variable	Group 1	Group 2	Total	P of Group 1 vs Group 2
No of patients	302	74	376	
Age (mean \pm SD)	39.84 \pm 12.17	40.38 \pm 12.97		0.747
Gender				
Female	192	41	233	0.19
Male	110	33	143	
Educational level				
Illiterate	15	8	23	0.06
Primary	68	7	75	
Secondary	74	20	94	
High school	59	15	74	
Intermediate	62	14	76	
Graduation	24	10	34	
Marital status				
Married	263	62	325	0.46
Single	39	12	51	
Dietary preferences				
Vegetarian	161	37	198	0.61
Non vegetarian	141	37	178	
Sun exposure time	2.01 \pm 0.85	2.05 \pm 0.97		0.69
Body Mass Index				
<18.5	16	4	20	
18.5-24.9	74	24	98	0.17
25-29.9	176	43	219	
>30	36	3	39	

Table 2: Vitamin D status in both groups

	Group 1	Group 2	P
Mean \pm std dev	14.11 \pm 5.14	37.11 \pm 7.1	<0.0001
Median	14	35	
Min - max	4.1 to 29	30.29-100.7	

Table 3: VAS status in both groups

	Group 1	Group 2	P
Mean±std dev	5.71±0.97	4.88±1.23	<0.00001
Median	6	5	
Min - max	3 to 8	3 to 7	

Table 4: Correlation of VAS according to vitamin D level

	Group 1 (n=302)	Group 2 (n=74)	P
Vitamin D status	14.11±5.14	37.11±10.10	<0.0001
VAS Score	5.71±0.97	4.88±1.23	<0.0001

(Spearman's correlation coefficient = -0.554)

sensory and motor deficits as per nerve root involvement.^[8] There are two diagnostic classes of Low Back Pain (LBP): nonspecific LBP and the other is specific LBP with or without radiculopathy. Nonspecific CLBP is characterized by low back pain without any clinical or diagnostic evidence of a specific cause, like, injury, disc herniation, infection, spondyloarthritis, spinal stenosis, and malignancy. About 80% of the patients presenting in the outpatient department with complain of LBP have nonspecific LBP.^[9,10] Several factors like old age, female sex, overweight or obese body habitus, smoking, adverse state of mind, and demanding physical activity have been associated with CLBP.^[11] In the treatment of CLBP often self-treatment with nonprescribed over the counter pain killers are used, or physiotherapy and other modes of alternative medicines have been utilized. Despite one of the most common causes for consultations to medical OPDs, ascertaining a cause to LBP is often difficult and even more stringent in treating it medically. CLBP causes significant interference in quality of life and job performance, thus leading to a notable disability and socio-economic burden.^[12]

About 50–90% of Indians are deficient in Vitamin D. The cause may be consumption of diet poorer in vitamin D or the darker color of skin or may be due to a transformative lifestyle.^[13] In human plasma, the two forms of vitamin D; cholecalciferol (vitamin D3) and ergocalciferol (vitamin D2) are transported to the liver after binding with vitamin D binding protein (VDBP). Both these forms are hydroxylated to form 25-OH-vitamin D (25-OH-D) in the liver. This 25-OH-D is about 1000 times more widespread than 1,25-dihydroxy vitamin D [1,25-(OH) 2D3], i.e., the active form of vitamin D. The half-life of 25-OH-D is two to three weeks, is biologically inert but immunologically active. Therefore, measuring 25-OH-D level is considered as the most reliable method for assessing vitamin D status.^[14]

Recent studies done on vitamin D have considered correlating vitamin D deficiency to easy fatigability^[15] and chronic pain syndromes like rheumatology patients (86%),^[16] pregnant women suffering from CLBP (81.7%),^[17] failed back surgery syndromes,^[18] nonspecific joint and muscle pain (93%),^[19] lumbar canal stenosis (97.1%) and a study on Saudi Arabian population suffering from chronic low backache (83%).^[20] A number of mechanisms are advocated for explaining the relationship between

chronic pain and deficiency of vitamin D. Vitamin D, a hormone regulates the minerals like calcium and phosphorus and thus helps in maintaining the bone strength. Within the condition of hypovitaminosis D, there is a change of calcium and phosphorus metabolism, causing the skeleton to become a significant source for maintaining the blood calcium levels. This might lead to osteomalacia and might intensify osteopenia and osteoporosis. Vitamin D also has anti-inflammatory characteristics by virtue of decreasing the cytokines involved in inflammation and increasing the cytokines having anti-inflammatory properties. In vitamin D deficiency, there might be an increased susceptibility to inflammation in bones with a higher metabolic turnover like vertebral endplates.^[21] Lastly, hypovitaminosis D causes an increased secretion of parathyroid hormone, thus increasing the bone metabolism and ultimately causing micro-fractures within the spinal bones.^[22]

Our study population was selected from a gaggle of low back pain complaints, of which 76.5% had no specific cause for CLBP, similar to the previous studies.^[2,3] Mean age was 39.95 ± 12.32, and there were 233 females (61.97%) and 143 males (38.03%), matching with the previous study.^[23] This female preponderance might be due to the current status of females in the society; they are mostly restricted to household activities and have poor access to nutrients rich in vitamin D. Traditionally, vegetarians are considered a vitamin D deficient group compared to nonvegetarians. However, in our study, vegetarians were almost similar in number to nonvegetarians. Sunlight exposure with direct contact to skin is one of the foremost vital sources for manufacturing vitamin D. Darker skin color people require more exposure to ultraviolet B than the people with lighter skin color for maintaining the same vitamin D levels. India being a tropical country, is considered as a country with adequate sunlight exposure. But due to a recent increase in sedentary lifestyle and a decrease in mobility, vitamin D deficiency is increasing rampantly in the Indian population. Both the groups in this study had a mean sun exposure time of around two hours. Sunlight exposure time has correlated with hypovitaminosis D, but this is also seen that there may be low vitamin D status despite adequate sun exposure.^[24] Confounding factors might be clothing, age, seasonal variation, use of sunscreen, body habitus, smoking, and air pollution severity.^[25] Obesity, an independent risk factor for several health-related issues, is rapidly increasing in developing countries. Vitamin D being a fat-soluble vitamin, correlates negatively with BMI and total fat mass.^[26,27] Thus, obese and overweight persons have low levels of serum vitamin D levels. This study had most of the patients belonging to the overweight and obesity class concerning BMI.

There are lot of controversy regarding correlating chronic LBP with levels of vitamin D. This study found 82.30% patients with nonspecific CLBP to be Vitamin D deficient whereas in 19.68% cases Vitamin D levels were normal. The studies conducted by Bahinipati J *et al.* and Al Faraj *et al.* in patients with chronic LBP found the majority of patients were having low Vitamin D level, and its deficiency was considered as one of the important factors

for chronic LBP.^[20,28] Our study reaffirms this finding. Few studies have assessed the correlation between vitamin D level and the severity of chronic low back pain. As per the studies done by Lotfy *et al.*, Gokcek E *et al.*, and Xu HW *et al.*, serum 25 (OH) D levels correlate significantly with the pain severity,^[17,29,30] while the studies done by Johansen JV *et al.* and Ghai B *et al.* found no relationship between them.^[31,32] In our study, the VAS score of the vitamin D deficient Group 1 (5.71 ± 0.97) was statistically significantly higher ($P < 0.00001$) than the vitamin D normal Group 2 (4.88 ± 1.23) with spearman rho correlation value of -0.554 . Thus, implicating that a negative correlation exists between the severity of pain and levels of vitamin D, as supported by previous studies also.^[29,30]

The limitations of this study are that it has provided a single instance vitamin D data, and patients are representative of CLBP presenting to an outpatient clinic. Future studies with randomized controlled trial designs and with larger sample sizes, longer duration, and focused age groups can be done for further establishment of a cause-effect relationship.

In conclusion, Chronic low back pain (CLBP) is one of the most common conditions, for which patients consult a primary care physician. Most of these cases do not have any specific cause. This study showed that a significant number of patients with nonspecific CLBP were deficient in Vitamin D. Also, the severity of pain was more in those, who had lower values of Vitamin D levels. Thus, widespread screening of Vitamin D levels is highly recommended, as an easy and safe form of treatment of Vitamin D deficiency can help in managing a large number of patients presenting to primary care physicians with nonspecific CLBP. In the study, contrary to the old belief, many nonvegetarians and persons with adequate sunlight exposure also had Vitamin D deficiency. Thus, proving that multiple factors are responsible for this Vitamin D deficiency.

Key Messages

Primary care physicians have to see a large number of patients with chronic low back pain (CLBP) in their daily OPDs. Most of these cases do not have any specific cause. In this study, Vitamin D deficiency is linked to this nonspecific CLBP with a negative correlation to the pain severity.

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Conflicts of interest

There are no conflicts of interest.

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