"CHRONIC LOW BACK PAIN AND ITS ASSOCIATION WITH SERUM VITAMIN D LEVEL IN AN INDIAN TERTIARY CARE CENTRE".

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Abstract

Introduction: Vitamin D has a significant role to play in bone metabolism and neuromuscularfunction. Several researchers have indicated that Vitamin D deficiency may be possiblyrelated to musculoskeletal pain including chronic low back pain.

Aim: We aimed to examine the relationship between the levels of vitamin D and patients with chronic low back pain and to investigate its effects on pain and functional capacity.

Materials and Methods: Two hundred and sixty patients (Female/Male:110/150) with complains of low back pain for more than three months, aged between 18 to 60 years and both genders, participated in the study. Visual Analog Pain Scale (VAS) was used to measure the state of pain. Pain-related functional capacity was evaluated using Modified Oswestry Disability Questionnaire (MODQ). Patients were classified into three groups based on their serum vitamin D levels: Sufficient (≥ 30 ng/mL), insufficient (20.1-29.9 ng/mL) and deficient (≤ 20 ng/mL).

Results: We found that 77.31% of patients (n:201) were vitamin D deficient, 17.31% (n:45) were insufficient, and 5.38% (n:14) had sufficient levels. VAS scores were 5.95 ± 1.71, 5.67

± 1.77 and 6.00 ± 2.04 for patients with vitamin D deficient, insufficient, and sufficient levels, respectively. MODQ scores were 46.32 ± 5.85, 30.98 ± 5.89 and 14.43 ± 4.45 for patients with vitamin D deficient, insufficient, and sufficient levels, respectively. We found that there was significant association between vitamin D levels and MODQ score (P = < 0.001), body mass index (P = 0.013), occupation (P = < 0.001), religion (P = 0.0013) and lifestyle of the patients (P = 0.002). And there was no significant association between vitamin D levels and age (P = 0.499), gender (P = 0.501), history of smoking (P = 0.121), VAS score (P = 0.256) and socioeconomic status of the patients (P = 0.408).

Conclusion: The result of this study provides a message about the high prevalence of vitamin D deficiency in Indian population with chronic low back pain and may lead to lower functional capacity. Clinical guidelines for managing chronic low back pain should include assessment of vitamin D status, together with advice on appropriate vitamin D supplementation in those found to be deficient.

Key-words: Chronic low back pain; Vitamin D levels; VAS score; MODQ.

Introduction

Low back pain is the most common orthopaedic problem affecting most individuals at some point of time in their lives.[1] According to World Health Organization (WHO) low back pain is rated as the leading cause of disability and is the most common cause of outpatient department consultation.[2] According to some estimates approximately 60-80% of the general population will suffer from low back pain at some point in their lifetime and 20-30% are suffering from low back pain at any given time.[3]

Low back pain brings down the quality of life and reduces the individual's work performance with higher days of absence from work.[2] Due to the limitation of activity and work absence, it also causes an economic burden on individuals, their families, industry and government. Hence there is a significant socioeconomic impact caused by low back pain.[4]

In addition to physical infirmity, the psychological impact of lower back pain is profound. There is a high prevalence of anxiety and depression in Indian patients with low back pain.5

Low back pain affects all ranges of the population, but since it is not a life-threatening illness it is often considered trivial and ignored.

Vitamin D, sunshine vitamin is one of the most intensely investigated nutrients of the 21st century. It plays a crucial role in the development and maintenance of a healthy skeleton throughout life. Experts largely agree that this fat-soluble pro-hormone is vital to bone health. Due to the important role it plays in calcium homeostasis and bone mineralization. A number of studies have been done to assess the vitamin D status in subjects with nonspecific low back pain where no organic cause could be ascertained. Studies hint towards a cause effect relationship between vitamin D levels and pain.6,7

It has been reported by various researchers that Indians have a very precarious vitamin D balance inspite of ample sunlight exposure due to dietary imbalances and aesthetic reasons.8 Hence evaluation of vitamin D status among Indians with chronic low back pain may reveal interesting trends. So, this study is designed to assess specifically the levels of vitamin D presenting with idiopathic chronic low back pain and to investigate its effects on pain and functional capacity.

Subjects and Methods

- Type of study: Observational study
- Study period: 2 years
- Sample size: 260
- Inclusion criteria:

    1. Patients referred to orthopaedic department with complaints of low back pain > 3 months.
    2. Patients aged 18 - 60 years and both genders.

- Exclusion Criteria:

1. Clinico-radiological evidence of tuberculosis of spine, degenerative changes of spine, prolapsed intervertebral disc requiring surgery, lumbar canal stenosis, fractures of spine, spondylolisthesis, kyphoscoliosis, tumours of spine, inflammatory arthritis of spine like ankylosing spondylitis, sacroiliitis, rheumatoid arthritis.
2. Prior vitamin D supplementation.
3. History of corticosteroid usage (more than one year), bisphosphonates, teriparatide.
4. History of usage of anti-epileptic / anti–tubercular drugs in the past one year.
5. Presence of systemic diseases like chronic liver failure / chronic renal failure / inflammatory bowel disease or malabsorption syndromes / chronic diarrhoea and chronic pulmonary disease.
6. History of malignant diseases, anti-cancer drugs and radiotherapy.
7. Pregnant and lactating women.
8. History of psychiatric illness.
9. Symptomatic osteoarthritis of the hip and knee.

- Scheme of the study:

A total of 260 patients were considered for the study. Patients meeting the inclusion were enrolled for the study after obtaining a written informed voluntary consent. They were subjected to detailed history including age, sex, religion, occupation, lifestyle, socioeconomic status and history of smoking. Back pain was analyzed regarding onset, course, duration, type, location, radiation, diurnal variation, associated with morning stiffness, exercise and rest. Past medical illness, drug history and personal history was obtained. General physical examination including height, weight and BMI was obtained. Clinical examination of the spine was done which included: Presence or absence of back deformities, tenderness, motor examination, reflexes, sensory examination, straight leg raising test, Lasegue's maneuver, Schober's test, chest expansion, Tests for sacroilitis and gait abnormalities.

Pain assessment was done using visual analogue scale (VAS). Functional disability assessment was recorded using Modified Oswestry Low Back Pain Disability Questionnaire (MODQ).

Radiograph of Lumbosacral spine – anteroposterior and lateral views were obtained for all patients. Only patients with normal radiograph findings were included in the study. MRI of Lumbosacral spine was done for patients with suspected intervertebral disc prolapse and inflammatory arthritis based on signs and symptoms. Blood samples of patients were obtained and tested for serum vitamin D level and grading of vitamin D deficiency was done.

Vitamin D assessment: Fasting venous blood sample (5cc) from median cubital vein was collected using sterile phlebotomy techniques with informed consent of the patient participating in the study. The samples were centrifuged at 2500-3000 rpm for 5-10 minutes and serum was separated, and stored at -20°C until the time of analysis. Plasma 25 (OH) D levels of all patients were measured by chemiluminescence immunoassay (CLIA) on an automated analyser (BECKMAN COULTER Access 2 Immunoassay system).

The grade of deficiency of serum 25(OH) Dis calculated based on the internationally accepted Holick'sClassification.

Holick'sclassification:

- Sufficient: ≥ 30 ng/mL
- Insufficient: 20.1-29.9 ng/mL
- Deficient: ≤ 20 ng/mL

All the data was recorded according to a prepared proforma.

Statistical methods:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS version 22 software (IBM SPSS Statistics, Somers NY, USA).

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous data are presented on Mean ± SD (Min-Max) and categorical data are presented in the form of frequencies and proportions. Significance is assessed at 5 % level of significance.

The following assumptions on data is made,

Assumption: 1. Dependent variables should be normally distributed,

Assumption: 2. Samples drawn from the population should be random, Cases of the samples should be independent.

Chi-square test was used as test of significance for qualitative data.

Independent t test was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively.

Graphical representation of data: MS Excel and MS word were used to obtain various types of graphs such as pie chart diagram and bar diagram.

Significant: P value: ≤ 0.01

Results

A total of 260 patients were included in this observational study. In this study, 57.69% were males and 42.31% were females.

In this study among females, majority of patients were in the age group of 31 to 40 years (33.64%), whereas among males, majority of patients were in the age group of 21 to 30 years (34.67%). There was significant difference in age distribution between males and females (P = <0.001).

Mean age of females was 39.35 ± 11.48 years and among males the mean age was 32.73 ± 11.32 years. There was significant difference in mean age between two groups (P = <0.001).

In this study among females, 75.45% were Hindus, 20.91% were Muslims and 3.64% were Christians. Among males, 85.33% were Hindus, 11.33% were Muslims and 3.34% were Christians. There was no significant difference in religion distribution between males and females (P = 0.1022).

In this study among females, majority of patients were housewives and among males, majority of patients were businessman. There was significant difference in occupation between males and females (P = <0.001).

In this study among females, 13.64% were heavy workers, 58.18% were moderate workers and 28.18% were sedentary workers. Among males, 29.33% were heavy workers, 50% were moderate workers and 20.67% were sedentary workers. There was significant difference in lifestyle between males and females (P = 0.010).

In this study among females, 0.91% were smokers and among males, 82.67% were smokers. There was significant difference in smoking between males and females (P = <0.001).

In this study among females, 81.82% were in APL and 18.18% were in BPL. Among males, 83.33% were in APL and 16.67% were in BPL. There was no significant difference in socioeconomic status between males and females (P = 0.750).

In this study among females, 4.55% were underweight, 73.64% had normal BMI, 21.82% were overweight. Among males, 4% were underweight, 66% had normal BMI, 30% were overweight. There was no significant difference in BMI distribution between males and females (P = 0.336).

In this study among females, 11.82% had VAS score of 1 to 3, 50.91% had score of 4 to 6 and 37.27% had score of 7 to 10. Among males, 9.33% had VAS score of 1 to 3, 46.67% had score of 4 to 6 and 44% had score of 7 to 10. There was no significant difference in VAS score between males and females (P = 0.519).

In this study among females, 8.2% had minimal grade of disability, 28.2% had moderate disability and 63.6% had severe disability. Among males, 4.0% had minimal disability, 38.0% had moderate disability and 58.0% had severe disability. There was no significant difference in grade of disability between males and females (P = 0.131).

In this study among females, 76.36% had deficient level, 16.36% had insufficient level and 7.27% had sufficient levels of vitamin D. Among males, 78% had deficient level, 18% had insufficient level and 4% had sufficient levels of vitamin D. There was no significant difference in vitamin D levels between males and females (P = 0.501).

In this study, there was no significant association between vitamin D levels and the age, gender, history of smoking, VAS score, socioeconomic status of the patient.

In this study, there was significant association (P = 0.0013) between vitamin D levels and religion of the patients. Among those with deficient levels, 80.6% were Hindus, 17.41% were Muslims and 1.99% were Christians. Among those with insufficient levels, 84.44% were Hindus, 11.11% were Muslims and 4.45% were Christians and among those with sufficient levels of vitamin D, 78.57% were Hindus, 0% was Muslims and 21.43% were Christians.

In this study, there was significant association (P = <0.001) between vitamin D levels and occupation of the patients. Among those with deficient levels, majority were housewives.

Among those with insufficient and sufficient levels of vitamin D, majority of subjects were farmers.

In this study, there was significant association (P = 0.002) between vitamin D levels and lifestyle of the patients. Among those with deficient levels, 27.36% were sedentary workers. Among those with insufficient levels, 11.1% were sedentary workers and among those with sufficient levels of vitamin D, 14.29% were sedentary workers.

In this study, among those with deficient levels, 28.86% were overweight. Among those with insufficient levels, 24.44% were overweight and among those with sufficient levels of vitamin D, 100% had normal BMI. There was significant association between vitamin D levels and BMI of the patients (P = 0.013).

In this study, among those with deficient levels, 21.89% had moderate grade of disability and 78.11% had severe disability. Among those with insufficient levels, 6.67% had minimal disability, 93.33% had moderate disability. Among those with sufficient levels of vitamin D, 85.71% had minimal disability and 14.29% had moderate disability. There was significant association between vitamin D levels and grade of disability in patients(P = <0.001).

In this study, there was significant negative correlation between vitamin D levels and MODQ score. i.e. with increase in vitamin D levels there was decrease in MODQ score and vice versa.

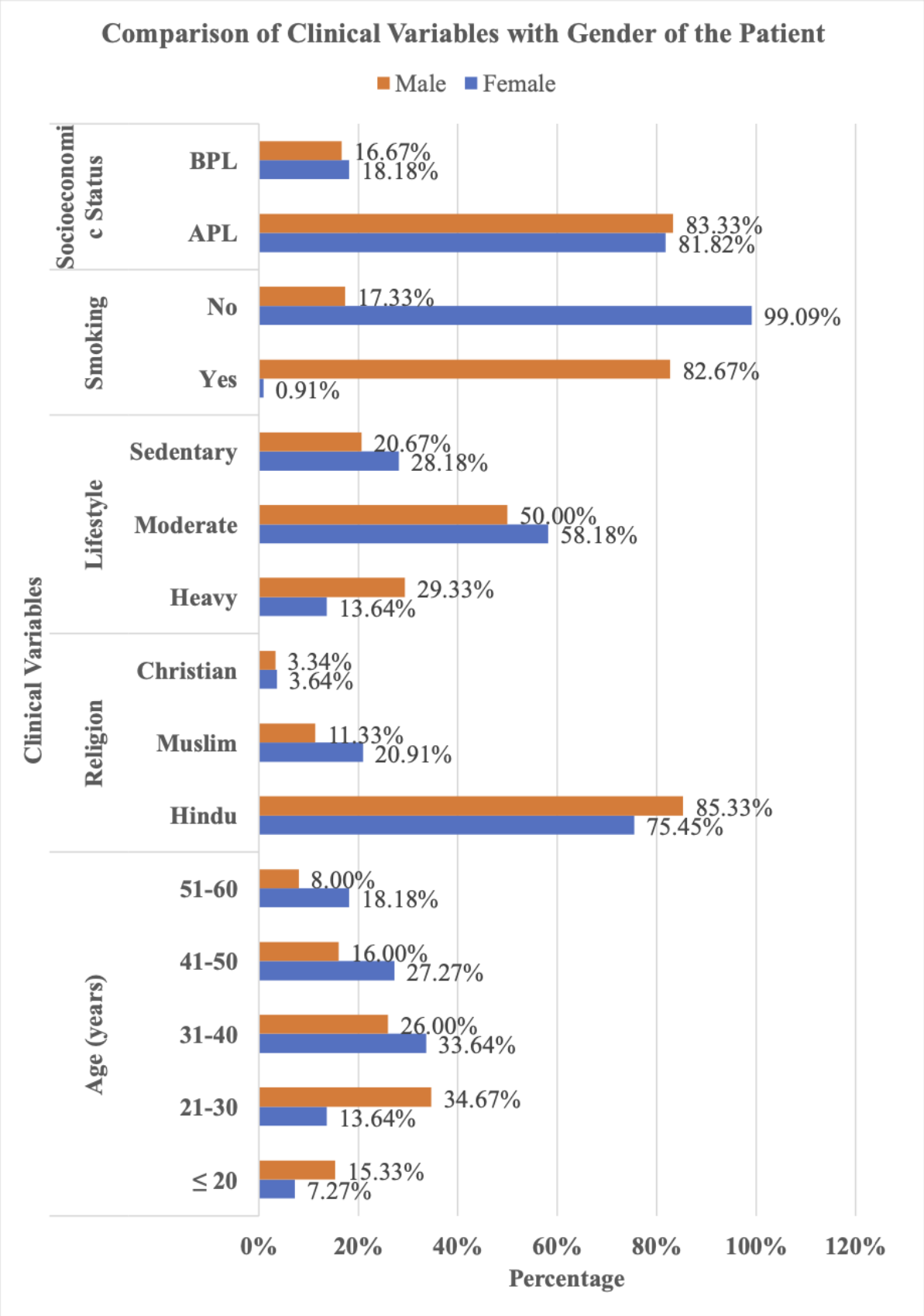

Figure 1: Column Diagram for Comparison of clinical variables with gender of the patient

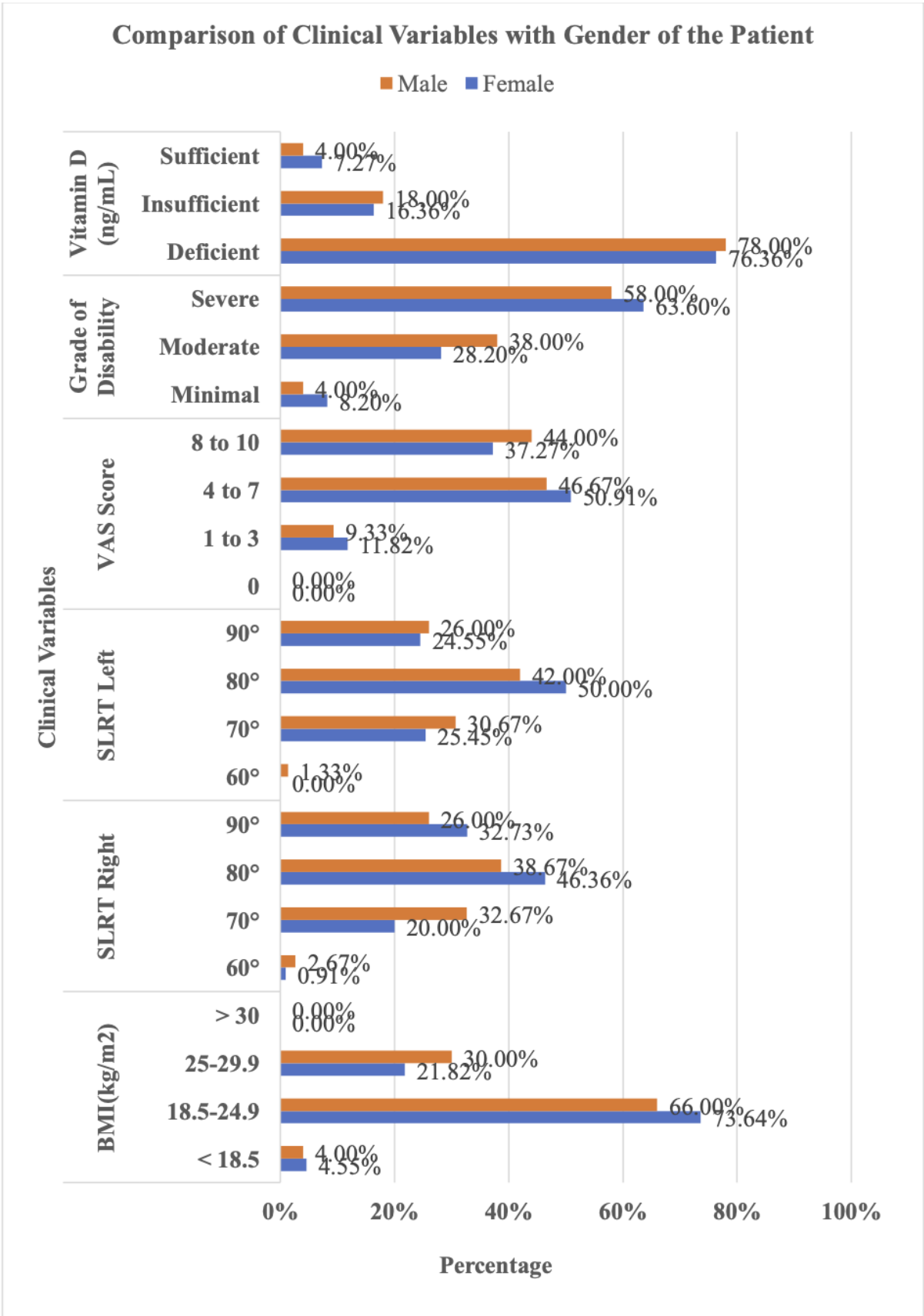

Figure 2: Column Diagram for Comparison of clinical variables with gender of the patient

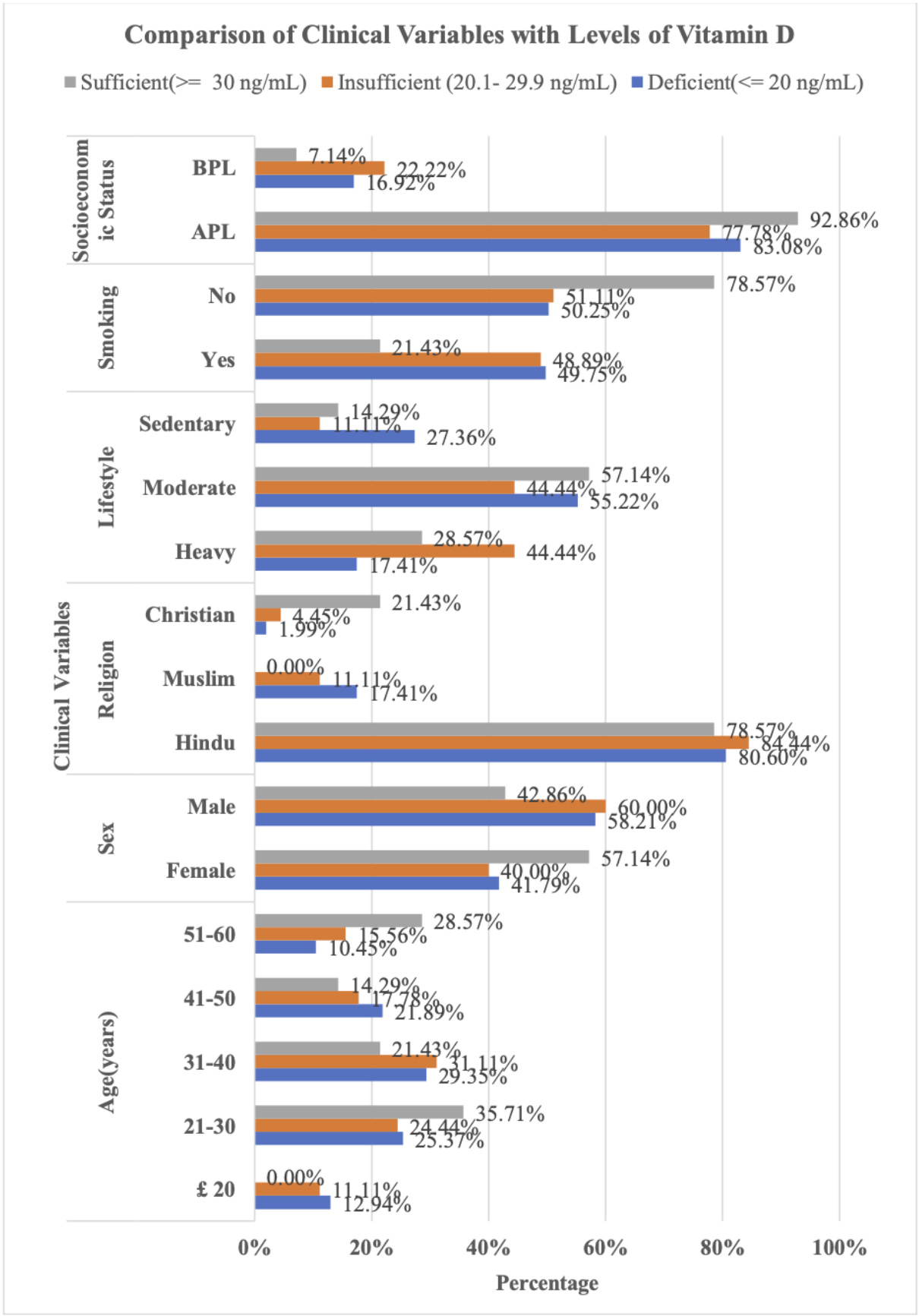

Figure3 : Column Diagram for Comparison of Clinical variables with Levels of Vitamin D

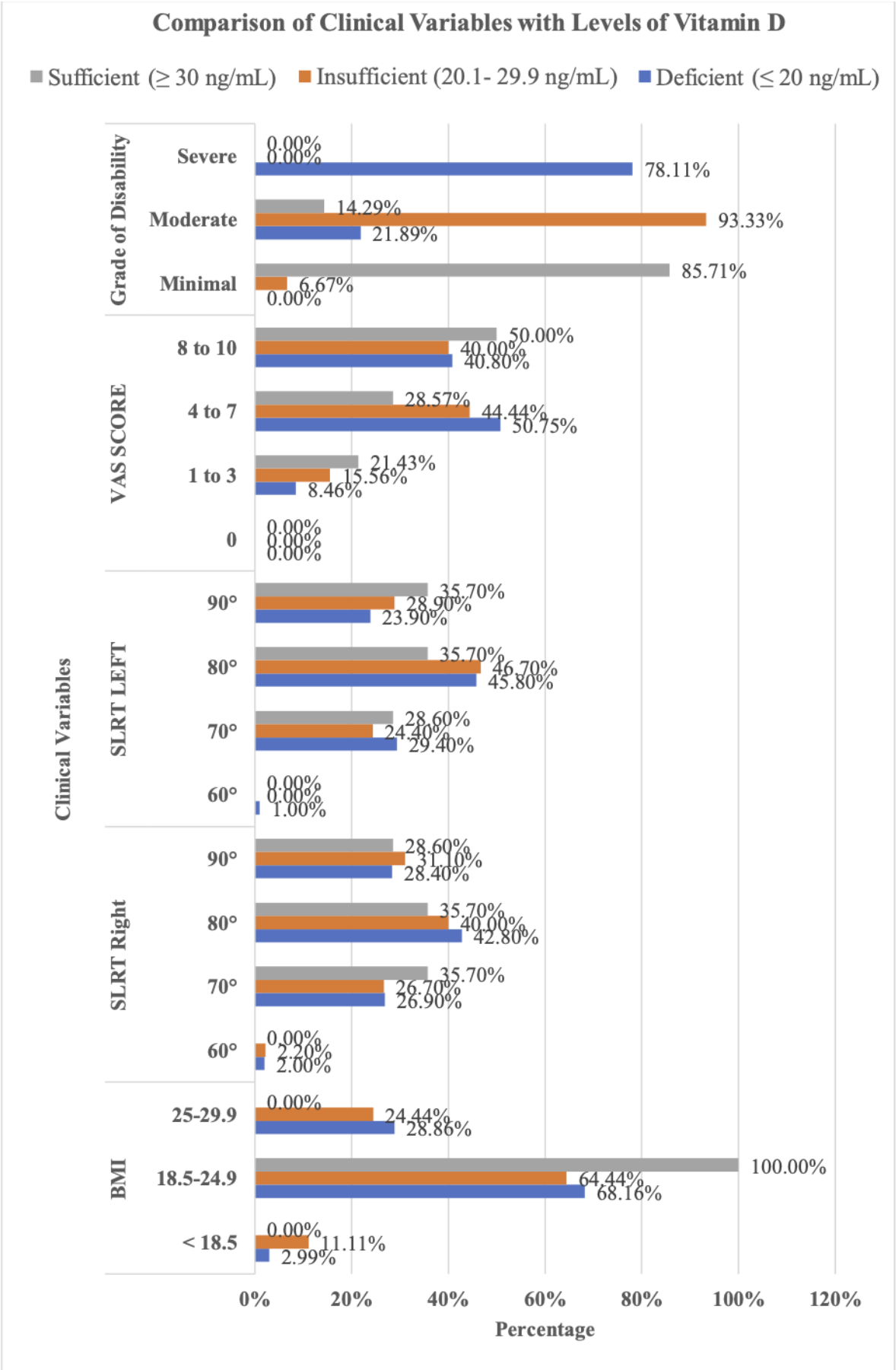

Figure 4: Column Diagram for Comparison of Clinical variables with Levels of Vitamin D

Discussion

Chronic low back pain is a common complaint seen in Indian population and it is also a common presenting symptom to orthopaedic outpatient department.

In our study, the percentage of subjects according to different cut off points for serum vitamin D level were:

Vitamin D ≥ 30 ng/mL which is normal or sufficient levels were observed in 5.38% of the cases, vitamin D 20.1 to 29.9 ng/mL which is insufficient levels were observed in 17.31% cases, vitamin D ≤ 20 ng/mL which is deficient levels were found in 77.31% cases. The mean serum vitamin D (Mean ± SD) level was 14.63 ± 9.27 (range: 3.9 to 76.73 ng/mL).

Alfaraj et al.found that 83% of patients with CLBP had vitamin D deficiency,[9] whereas this percentage was 81.7% in the study conducted by Lotfi et al.,[10] 74.3% in the study by Hwan-Kim et al.,[11] and 22.5% in eSilva et al. study.[12]

Kalra Sanjay et al. also studied vitamin D deficiency in orthopaedic outpatient department in 234 female patients with musculoskeletal symptoms and found that there is a high prevalence of vitamin D deficiency (55.55% cases) and insufficiency (38.46% cases) (combined: 94.01%) in general population of North India.[13]

Elamin IE Abdelgadir et al.observed that 63.9 % patients had vitamin D deficiency, 17.9 % had vitamin D insufficiency, whereas vitamin D sufficiency was evident in 18.1 % of the studied sample.[14]

Zeliner BS et al.observed that 86.2% of subjects were insufficient in 25-hydroxyvitamin D (< 30 ng/mL) and among insufficient cases 53.2% were vitamin D deficient (< 20 ng/mL).[15]

In our study,males (57.69%) were more as compared to females (42.31%) patients. The mean level of vitamin D in females was 9.96 ± 5.13, 23.33 ± 2.97 and 41.00 ± 15.57 among deficient, insufficient and sufficient levels of vitamin D respectively. And in males it

was 11.76 ± 4.57, 22.70 ± 2.33 and 38.17 ± 13.27 among deficient, insufficient and sufficient levels of vitamin D respectively.

No significant association between vitamin D levels and gender (p = 0.501) was observed in our study.

A study conducted by Hwan-Kim et al. on 350 patients with CLBP, no significant correlation was found between vitamin D levels and gender, which is in accord with our findings.[11]

Bogunovic L. et al.reported the prevalence of low vitamin D levels was significantly higher in men.[16]

Elamin IE Abdelgadir et al.observed that the vitamin D deficiency tended to be more marked in males; mean 25(OH) D was 18.6 ± 12.4 ng/mL and in females, mean vitamin D level was 20.6 ± 16.5 ng/mL, but the difference did not quite reach statistical significance.[14]

Mithal A. et al.observed that older age, female sex, higher latitude, winter season, darker skin pigmentation, less sunlight exposure, dietary habits, and absence of vitamin D fortification are the main factors that are significantly associated with lower 25(OH) D levels.[17, 18]

In our study, it is observed that Mean ± SD age of the cases is 35.53 ±11.83 (range 18 to 60 years). Majority of the subjects, 29.23 % belonged to 31-40 years of age group, 25.77 % subjects were in 21-30 years age group and least subjects were in extreme of age groups like 11.92 % in ≤ 20 years, followed by 12.31 % in 51-60 years.No significant association between vitamin D levels and age (p = 0.499) was observed in our study.

Maier S, Gerrit et al.reported that vitamin D levels did not vary according to age, sex, and disease.[19]

In our study,Hindus (81.15%) were more as compared to Muslims (15.38%) and Christians (3.47%) patients. No significant association was observed between vitamin D levels and religion.

Diamond TH, Levy S, Smith A, Day Plv et al.observed there were 68.1% muslim women with vitamin D deficiency (serum 25(OH) D levels < 30 nmol/L) among 600 subjects.[20]

In our study according to occupation, most of the patients were housewives (29.23%) followed by the farmers (20.38%) and businessman (19.62%). There was significant association observed between vitamin D levels and occupation ($p < 0.001$).

HarinJeong et al. observed thatamong the male patients, a significant correlation between vitamin D deficiency and working conditions was observed among shift workers, office workers, and permanent workers. No significant correlation with any type of working condition was observed among female subjects.[21]

In our study, 48.08% cases were smokers amongst 260 patients. We observed that smokers had significantly reduced levels of serum vitamin D. This finding corresponds with the findings of E C Brot , UgeniaCutillas-Marco et al.[22]

Eva N. Kassi et al.[18] also observed that smoking is a significant determinant of serum 25(OH) D, it increases significantly the likelihood of having vitamin D deficiency. Smoking has a significant effect on calcium and vitamin D metabolism, which is not likely to be explained by other confounding lifestyle factors. The depression of the vitamin D-PTH system seen among smokers may represent another potential mechanism for the deleterious effects of smoking on the skeleton and may contribute to the reported risk of osteoporosis among smokers.

In our study, patients in APL (82.69%) were more as compared toBPL (17.31%) patients. No significant association was observed between vitamin D levels and socioeconomic status ($p = 0.408$).

Davis, Shani Vann et al.observed in their study that the relationship between socioeconomic status and vitamin D levels was weak but consistent. No other measure of socioeconomic status was related to vitamin D level.[23]

The literature discusses many conditions associated with low socioeconomic status which are capable of limiting vitamin D intake and production but not all of these elements were included in the covariate analysis. Vitamin D levels ultimately were not well explained by any measure of socioeconomic status. Socioeconomic status does not predict vitamin D level.

In our study, most of the patients were in the normal range of BMI (69.23%) followed by overweight (26.54%).A significant association was observed between vitamin D levels and BMI ($p = 0.013$). Individuals with obesity, hypertension, and osteoporosis were more likely to have low vitamin D levels compared with their healthy counterparts.

Davis, Shani Vann et al. observed that BMI is a strong predictor of vitamin D level. Body mass index, on the other hand, it was shown to explain significant variance in the vitamin D level independently, even with vitamin D supplement use.[23]

In our study, 48.46% patients had moderate pain (VAS score: 4-7), followed by severe pain (VAS score: 7-10) in 41.15% patients. No significant association was observed between vitamin D levels and VAS score ($p = 0.256$) in our study.

Hwan Kim T et al. also found that severity of pain is higher in lumbar spinal stenosis patients with vitamin D deficiency.[11]

Johansen JV et al. showed that there is no relationship vitamin D deficiency and severity of LBP,which is in accordance with our findings.[24]

In our study, majority (60.4%) of patients had severe grade of disability and 33.8% patients had moderate grade of disability. There was significant negative correlation between

vitamin D levels and MODQ score (p = <0.001). i.e. with increase in vitamin D levels there was decrease in MODQ score and vice versa.

Bischoff et al. reported that muscle strength and functional capacity in 60 year old or older patients with vitamin D deficiency is lower than patients with normal levels of vitamin D.[25]

Panagiotis et al.stated that vitamin D deficiency affects muscles in postmenopausal women, thus causing reduced functional capacity.[26]

Study conducted by Hwan Kim et al. on patients with CLBP found no relationship between vitamin D deficiency and functional capacity.[11]

Limitation of the study:

- It was not possible to assess good quality data on sun exposure and vitamin D dietary intake in the study population.
- Bone scans were not done. So, the correlation of bone density with vitamin D levels could not be ascertained.
- We measured only plasma 25 (OH) D levels, and bone activity markers were not studied. Therefore, it is not possible to draw conclusions about increased bone turn over in the investigated patients.
- Since it is an observational study, a correlation between hypovitaminosis D and CLBP, but not causation, can be derived.
- Vitamin D levels could not be compared to patients with no chronic LBP as there was no control group.

Conclusion

The result of this study provides a message about the high prevalence of vitamin D deficiency in Indian population with chronic low back pain which leads to lower functional capacity. Clinical guidelines for managing chronic low back pain should

include assessment of vitamin D status, together with advice on appropriate vitamin D supplementation in those found to be deficient.

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