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Pattern of Vitamin D Status in Patients with Non-Specific Bone Pains- A Single Centre Study

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ABSTRACT

Objective: To determine the pattern of Vitamin D status in patients presenting with complaints of non-specific bone pains and to correlate the association of sunlight exposure with Vitamin D deficiency/insufficiency

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Chemical Pathology, CMH, Abbottabad Pakistan, from Aug 2020 to Jul 2021.

Methodology: All patients with non-specific bone pain were asked about demographic, clinical and sunlight exposure. Vitamin D assays were performed after history taking.

Result: A total of 247 patients were tested for vitamin D levels. 103(41.7%) were male and 144(58.3 %) were females. 56(22.7%) had >60 minutes of daily sunlight exposure, 67(27.1%) had 30 to 60 minutes, and 124(50.2%) had less than 30 minutes of daily sunlight exposure. Vitamin D deficiency was found in 132(53.4%) patients, insufficiency was seen in 74(30.0%) patients and 41(16.6%) patients had normal vitamin D levels. Vitamin D deficiency correlated significantly with low sunlight exposure time.

Conclusion: Vitamin D deficiency was seen in 53.4% of patients with non-specific bone pains, while insufficiency was seen in 30.0% of patients. Moreover, our study showed association of Vitamin D deficiency with a decreased duration of sunlight exposure.

Keywords: Vitamin D deficiency, sunlight exposure, bone pain, muscle pain.

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INTRODUCTION

Vitamin D deficiency and insufficiency is a global health problem affecting all age groups. A careful estimate of South Asian countries revealed that 7 out of 10 people in this part of the world lack the normal amount of essential vitamin that is vitamin D, out of which Pakistan has the highest prevalence of people suffering from vitamin D deficiency (VDD) and Vitamin D insufficiency (VDI).[1] VDD affect around 1 billion people globally, and half of the world's population suffers from insufficiency.[2,3]

Several causes have been explored by researchers in past that could lead to vitamin D deficiency in the body. These include lack of proper sunlight exposure, food fortification, and decreased overall knowledge and perception regarding the use of sunlight.

Other causes include a sedentary lifestyle where people spend most of their time inside rooms, use of sunblock, ageing, obesity and clothing style.[4,5]

More than half of the Pakistani population is Vitamin D deficient; therefore, appropriate measures are suggested for the treatment.[6,7] A comparison study revealed that countries like Southern Europe, the Middle East, China, and Japan have more common VDD than Northern Europe and Southeast Asia. Moreover, children, the elderly and pregnant ladies are at the highest risk.[8,9] Vitamin D deficiency and insufficiency may cause health problems like brittle bones. Low vitamin D levels cause non-specific bone pain due to decreased mineralisation of bone, and this pain can be prevented by optimal vitamin D intake and sunlight exposure, thus minimising the prescription of analgesics.[10]

A large number of patients report to outpatient departments with undiagnosed non-specific skeletal pains and are often prescribed analgesics. This intrigued us, so we decided to assess the levels of Vitamin D in our patients presenting with non-specific bone pains that remained otherwise undiagnosed and correlate the association of sunlight exposure with vitamin D deficiency or insufficiency in these patients.

METHODOLOGY

The cross-sectional study was conducted at Department of Chemical Pathology Combined Military Hospital (CMH) Abbottabad, Pakistan, from August

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2020 to July 2021 after formal approval from the Institutional Ethics Committee. The sample size was calculated using a WHO sample size calculator with an anticipated disease frequency of 80%.[11]

Inclusion Criteria: Patients of either gender, with aged 5 to 80 years, reported to the Laboratory from Medical and Surgical Outpatient Departments with non-specific body pains that were not otherwise diagnosed were included.

Exclusion Criteria: Patients having renal or liver failure, on vitamin D supplementation, with other diagnosed causes of bone pains including injury, chronic malabsorption syndromes and patients using drugs that could potentially cause a decrease in vitamin D3 were excluded.

Patients were selected by consecutive sampling and data collection was started after informed consent. A detailed history was taken during phlebotomy, including their age, gender, presenting symptoms, treatment taken, any other specific diagnosis, body weight, and history of comorbidities, including diabetes, hypertension, fractures and thyroid disease. Sunlight exposure in terms of duration was asked. After fulfilling the clinico-demographic assessment, 05 ml of blood samples were collected from every patient in a plain vacutainer bottle to assess Vitamin D levels in a laboratory under aseptic techniques. The samples were shifted to the chemistry department. The serum was separated and analysed for serum 25(OH)D concentrations by Electrochemiluminescence immunoassay on Cobas e-411 random access auto analyser (Roche Diagnostics, USA). For quality control, Preci Controls Varia was used. Reference Ranges of vitamin D levels according to vitamin D status are shown Table-I.

Data was analysed using Statistical Package for Social Sciences (SPSS) version 27. Mean and standard deviations are computed for continuous variables. Frequencies and percentages were calculated for categorical variables. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was set as the cut-off value for significance.

RESULTS

A total of 247 patients who came to test for vitamin D levels were enrolled on the study. Of 247 patients, 144 (58.3%) were females, and 103(41.7%) were males. The mean age of patients was 38.7±15.12 years. 119(48.6%) of the patients had a 25 kg/m2 BMI and were non-obese. However, 102(41.6%) patients were overweight with a BMI between 25 to 29.9 kg/m2, and 24(9.8%) of patients were overweight having a BMI >30 kg/m2. Hence, around half of the patients were either obese or overweight. 23(9.3%) reported that they already had diabetes mellitus, and 32(13%) reported hypertension. Hypothyroidism was seen in 10(4%) patients, whereas 12(4.2%) reported a history of fractures in the past, as shown in Table-II 56(22.7%) had more than 60 minutes of approximately daily sunlight exposure, 67(27.1%) had sunlight exposure between 30-60 minutes and 124(50.2%) had less than 30 minutes of daily sunlight exposure.

Table-I: Reference Ranges of vitamin D levels according to Vitamin D status

Vitamin D Deficiency	<30 nmol/l (< 12 ng/ml)
Vitamin D Insufficiency	30 - 50 nmol/l (12-20 ng/ml)
Vitamin D Sufficiency	>50 - 250 nmol/l (>20-100 ng/ml)
Vitamin D Toxicity	>250 nmol/l (>100 ng/ml)

Table-II: Pattern of Clinico-Demographic and Vitamin D status in Patients presented with non- Specific Bone Pains (n=247)

Parameters		n(%)
Gender	Female	144(58.3%)
	Male	103(41.7%)
Marital Status	Married	202(81.8%)
	Un Married	45(18.2%)
Obesity	Non obese (BMI<25)	119(48.6%)
	Overweight (BMI25-29.9)	102(41.6%)
	Obese (BMI >30)	24(9.8%)
Fracture	No fracture	237(96.0%)
	Fracture	10(4.0%)
Diabetes Mellitus		23(9.3%)
Hypertension		32(13.0%)
Hypothyroidism	NO hypothyroidism	237(96.0%)
	Hypothyroidism	10(4.0%)
Sunlight exposure	>60 minutes	56(22.7%)
	30 min to 60 minutes	67(27.1%)
	< 30 minutes	124(50.2%)
Age Groups	Less than 40 years	149(60.3%)
	40-60 years	67(27.1%)
	More than 60 years	31(12.6%)
Status of Vitamin D levels	Vitamin D deficiency	132(53.4%)
	Vitamin D insufficiency	74(30.0%)
	Normal vitamin D levels	41(16.6%)

Decreased vitamin D levels were significantly associated with high BMI and less time spent in sunlight, as shown in Table-III. Mean vitamin D levels in patients were 32.5± 17.8 nmol/l, ranging from a minimum of 06 nmol/l to a maximum of 117 nmol/l. 132(53.44%) were found to have vitamin D deficiency. 74(29.96%) cases had vitamin D insufficiency; the other 41 individuals (16.6%) had normal vitamin D levels.

Table-III: Association of Clinico-Demographic Features according to Vitamin D status (n=247)

Parameters		Vitamin D levels			*p*-value
		Vitamin D Deficiency	Vitamin D Insufficiency	Normal Vitamin D Levels	
Age Groups	Less than 40 years	84 (34.0%)	39 (15.8%	26 (10.5%)	0.47
	40-60 years	31 (12.6%)	24(9.7%)	12 (4.9%)	
	More than 60 years	17 (6.9%)	11 (4.5%)	3 (1.2%)	
Gender	Female	77 (31.2%)	38 (15.4%)	29 (11.7%)	0.13
	Male	55 (22.3%)	36 (14.6%)	12 (4.9%)	
Marital status	Married	105 (42.5%)	61(24.7%)	36 (14.6%)	0.504
	Un Married	27 (10.9%)	13 (5.3%)	5 (2.0%)	
Obesity	Non obese (BMI<25)	74 (30.2%)	32 (13.1%)	13 (5.3%)	0.016
	Overweight (BMI25-29.9)	45 (18.4%)	32 (13.1%)	25 (10.2%)	
	Obese (BMI >30)	12 (4.9%)	10(4.1%)	2 (0.8%)	
Fracture	No fracture	125 (50.6%)	72 (29.1%)	40 (16.2%)	0.611
	Fracture	7 (2.8%)	2 (0.8%)	1 (0.4%)	
Diabetes Mellitus	No DM	122 (49.4%)	63 (25.5%)	39 (15.8%)	0.127
	DM	10 (4.0%)	11 (4.5%)	2 (0.8%)	
Hypertension	No HTN	116 (47.0%)	62 (25.1%)	37 (15.0%	0.562
	HTN	16 (6.5%)	12 (4.9%)	4 (1.6%)	
Hypothyroidism	No Hypothyroidism	126 (51.0%)	71 (28.7%)	40 (16.2%)	0.914
	Hypothyroidism	6 (2.4%)	3 (1.2%)	1 (0.4%)	
Sunlight exposure	>60 minutes approx.	20 (8.1%)	16 (6.5%)	20 (8.1%)	0.000
	30 minutes to 60 minutes approx.	19 (7.7%)	35 (14.2)	13 (5.3%)	
	< 30 minutes approx.	93 (37.7%)	23 (9.3%)	8 (3.2%)	

DISCUSSION

In our study, more than two-thirds of patients who reported to us for testing of vitamin D levels had hypovitaminosis (Vitamin D <50 nmol/l). Most of these patients were less than 60 years of age and with a higher preponderance of the female gender. The majority of patients were married and were either overweight or obese. Surprisingly, we also observed that this deficiency was irrespective of age, gender, and comorbidities like diabetes mellitus, hypertension, hypothyroidism or fracture. Vitamin D deficiency is a common problem globally with a slight variation in prevalence.[12,13]

Overall, there is a high prevalence of VDD, and this could be due to our social norms, a strict dress code where people cover most of their body parts that hinders absorbance of sunlight, a lifestyle where people avoid sunlight and use office work, lack of food fortification, malnourishment and imbalance nutrition and high levels of melanin in the body that restrict UV-B absorption. There is also a need for continuous awareness of the masses regarding the beneficial effect of balance and sunlight exposure.[14]

Researchers in Pakistan reported different VDD prevalences, which vary differently in different provinces. The high prevalence of VDD in our study is similar to previous studies done by other researchers. A systemic review of the geographical distribution of VDD in Pakistan mentioned a cumulative 58.17% overall deficiency. The highest deficiency was found in Sindh (62.15%), followed by 60.57% in Khyber Pakhtunkhwa (KPK) and 51.7% in Punjab. Unfortunately, no data about VDD could be found from Balochistan. The Same study found considerable heterogeneity among provinces (Cochran's Q test $p<0.001$) .[15]

VDD is one of the important causes of chronic non-specific musculoskeletal pain.[16] This pain affects the quality of life, and people are sometimes compelled to visit a pain clinic. A study done in India to assess the prevalence of VDD in patients with chronic non-specific skeletal pain revealed that 90% of patients were deficient in this vitamin, and this pain substantially decreased after administration of vitamin D supplementation.[17]

Another study was conducted to assess the knowledge attitude and practice toward VDD, which revealed that only 09% of university students knew the correct food source of vitamin D, and only 33% knew that this vitamin helped maintain bone health. 36% of university students knew that sunlight can cause vitamin D absorption. Despite the highest prevalence, this scarce knowledge demands intervention to increase awareness about the importance of this vitamin.[18]

Lastly, our study found a significant difference in the duration of sunlight exposure where daily sunlight exposure duration of more than 1 hour (approx.) had significantly high vitamin D levels. However, results obtained by other researchers contradict our results.[15]

RECOMMENDATIONS

Vitamin D levels should be advised to patients with non-specific bone pains. In this way, the prescription of analgesics and multiple hospital visits can be minimised by correcting the vitamin D deficiency in these patients. Dietary fortification of vitamin D and continuous education regarding optimum sunlight exposure must be implemented to curb this global issue and prevent the consequences of secondary hyperparathyroidism. Genetic studies are needed to explore the dietary and genetic perspective of Vitamin D deficiency/insufficiency.

CONCLUSION

Vitamin D deficiency was seen in 53.44% of patients, while insufficiency was seen in 29.96% of patients with non-specific bone pain. Moreover, our study significantly associated Vitamin D deficiency with decreased duration of sunlight exposure.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

MSA & JUR: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MG & SMM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

AA: Data acquisition, data analysis, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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