ORIGINAL ARTICLE

VITAMIN D PROFILE OF OUTDOOR PATIENTS PRESENTING WITH ACHES AND PAINS

Muhammad Idris, Jamila Farid, Nasreen Gul
Department of Pathology Ayub Medical College Abbottabad-Pakistan

Background: Vitamin D, a fat-soluble vitamin, plays regulatory role in more than 300–800 genes. Daily requirement of vitamin D depends upon the age and exposure to sun. Approximately one billion people in different parts of the world including Pakistan are either Vitamin D deficient or have insufficient levels of vitamin D. The present study, a descriptive cross-sectional study, aimed at knowing the status of vitamin D_3 in outdoor patients from Hazara division, having aches and pains. It was conducted over a period of four years on 453 outdoor patients of either sex and all the age groups presenting to Ayub Teaching Hospital. Sample was selected by non-random convenience sampling technique **Methods:** Common causes of aches and pains other than Vitamin D deficiency were excluded by history, examination and basic laboratory tests. Vitamin D_3 estimation was done by immunoassay. **Results**: Mean age of the participants was 40±19.62 years; the mean level of vitamin D was 21.88±14.12 ng/ml. As much as 398 (87%) participants aged 20–60 years were either vitamin D_3 deficient 330 (69.9%), or had vitamin D insufficiency 68 (17.7%). Gender wise, 295 (65%) were females and 158 (35%) males, with female to male ratio of 1.29:1. Normal vitamin D_3 level was detected in 55 (12.5%) participants with male predominance. **Conclusion:** Vitamin D deficiency is alarmingly high in patients presenting with aches and pains, in all age groups, effecting females more than males.

Keywords: Vitamin D; Cholecalciferol; Ergocalciferol; Sunlight; Rickets; Osteomalacia

Citation: Idris M, Farid J, Gul N. Vitamin d profile of outdoor patients presenting with aches and pains. J Ayub Med Coll Abbottabad 2019;31(1):51–4.

INTRODUCTION

Vitamin D plays an important role in calcium metabolism, especially its absorption from gut, and deposition or mobilization in or from bones.[1]

It has been estimated that as much as one billion people in different parts of the world are either Vitamin D deficient or have insufficient levels of vitamin D.[2] A study revealed that 13 % of the participants were vitamin D deficient.[3] Vitamin D deficiency is prevalent throughout the Indian subcontinent in epidemic form. It has an overall prevalence of 70–100% in the general population.[4] A worldwide study revealed high prevalence of vitamin D deficiency throughout the world, including Europe, Middle East, Asia, Africa, Oceania, North America and south America.[5] In Pakistan, Vitamin D deficiency was noted in general population in about 76.2% people, majority being females.[6]

The present study focused upon the status of vitamin D(sufficient/insufficient/or deficient) in patients who presented with the main complaints of rib pain, hip pain, thigh and foot pain, muscle pains, weakness of proximal muscles of shoulder and pelvic girdles, bowing of legs and nocturnal leg pains in children (commonly called growing pains).After exclusion of the patients with other possible causes of this spectrum of clinical presentations, vitamin D deficiency was considered the most likely cause of aches and pains. Such a study has never been conducted in Hazara in the past. Studying the association of other health problems with vitamin D deficiency, (weather being cause or effect of it), was beyond the scope of this study.

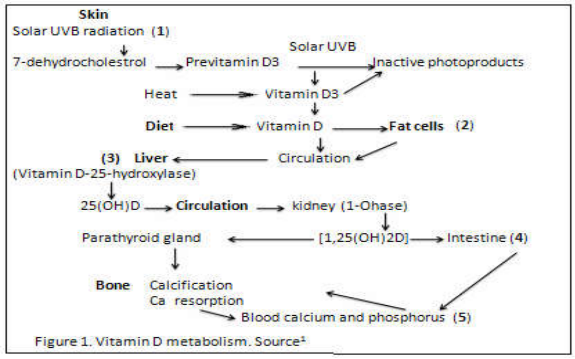

Figure 1. Vitamin D metabolism. Source[1]

Key (1) Solar energy produces vit D3 from cholesterol in skin **(2).** Ditary vitamin D and that produced in skin goes to liver via circulation. **(3).** Liver converts it into 25-hydoxycalciferol **(4).** 25-hydroxycalciferool is transported to kidney where it is converted to 1, 25- dihydroxycalciferol. **(5).** 1,25- dihydroxycalciferol is transported to intestine and bones to perform its actions

MATERIAL AND METHODS

The present study, a descriptive cross-sectional study, aimed at knowing the status of serum vitamin D_3 in patients belonging to different parts of Hazara division (both urban and rural) and presenting with aches and pains. The study was conducted over a period of four years from May 2013 to May 2016, on 453 outdoor patients of either sex and all the age groups, presenting to outdoor clinics at Ayub Teaching Hospital Abbottabad. The sample was selected through non-probability convenience sampling technique; from the table of minimum sample size[7], which were 380. It was enhanced to 453, keeping in view the lack of previous epidemiological surveys conducted in the study area. The main presenting complaints of the patients were rib pain, hip pain, thigh and foot pain, muscle pains, weakness of proximal muscles of shoulder and pelvic girdles, bowing of legs and nocturnal leg pains in children (commonly called growing pains).

The patients had no clinical evidence of any other disease presenting with aches and pains, based upon history, examination and laboratory tests already performed elsewhere. These tests were performed, however, on all those patients who were not previously investigated for the causes of aches and pains. The patients were symptomatic for a period of more than one month and did not respond to conventional treatment of aches and pain by the general practitioners. They were not taking any medicines for ailments like diabetes, hypertension, thyroid diseases, arthritis, osteoporosis, dyslipidaemia, psychiatric ailments, renal disorders, hepatobiliary or gastrointestinal diseases, haematological disorders, malignancies, thyroid or parathyroid disorders and any other known acute or chronic ailment at the time of enrolment in the study. They had not used vitamin D_3 in any form in the last three months.

An informed written consent was obtained from each patient at the time of enrolment and approval from the institutional review committee was also taken. After history and examination, blood samples (five ml) were collected under strict aseptic conditions in a plain bottle and serum was extracted within 30 minutes. The samples were processed in a reference laboratory for vitamin D_3 studies. Vitamin D_3 estimation was done by immunoassay on an automated special chemistry analyser using vitamin D_3 test kit from a reputed manufacturer. The test was performed according to the recommendations of the kit manufacturer. Serum levels of below 20 ng/ml were labelled as deficient, serum levels of 20–29 were taken ass insufficient while serum levels of 30ng/ml or more were labelled as sufficient. Data was collected through a *pro forma* especially designed for this purpose. Data processing was done by SPSS 18

RESULTS

Results of the study are presented in tables 1–2. Mean age of the participants was 40±19.62 years. As much as 398 (87%) participants aged 20–60 years were either vitamin D_3 deficient 330 (69.9%), or had vitamin D insufficiency 68 (17.7%), no statistically significant difference, was observed in this group (p=0.315).

Out of 453 participants, 295 (65%) were females and 158 (35%) males (table-2), with female to male ratio of 1.29:1. Statistically significant difference was not seen in vitamin D profile of male and female participants (p-0.617). Normal vitamin D_3 level was detected in 55 (12.5%), participants with male predominance. The mean level of vitamin D was found 21.88±14.12 ng/ml, with the highest value being 88.16 ng/ml and the lowest value of 8.18 ng/ml.

Table-1: Age group- wise Vitamin D3 profile of participants (n=453)

Age Group (in years)	Deficient		Insufficient		Sufficient	
	n	%	n	%	n	%
<20	17	26.2	15	23.1	33	50.87
20–40	125	78.13	30	18.75	05	03.13
4160	102	73.9	21	15.22	15	10.87
>60	86	95.56	02	02.22	02	02.22
Total	330	69.9	68	17.70	55	12.50

Table-2: Gender-wise Vitamin D profile of participants and female to male ratio (n=453)

Group	Vitamin D	Female	Male	Total
1	Deficient	200 (60.6%)	130 (39.4%)	330 (69.9%)
2	Insufficient	40 (58.8%)	28 (41.2%)	68 (17.7%)
3	Sufficient	15 (27.2%)	40 (72.8%)	55 (12.5%)
Total		255 (56.3%)	198 (43.7%)	453
Female to male ratio		1.29:1		

DISCUSSION

The study has revealed vitamin D_3 deficiency or insufficiency in alarmingly higher percentage of males and females of all the age groups who were symptomatic too. Gender-wise analysis of the participants revealed female predominance. This finding may be attributed to higher number of female study participants. Another reason of this seems to be higher prevalence rate (79%) of vitamin D deficiency in females as is evident from another study.[8] A notable finding is that majority of these females were in the 2nd and 3rd age group of present study. These two age groups include females of child bearing age and vitamin D deficiency in this age may have adverse effects not

only on the mother but also on the developing foetus. This age group also comprises the earning hands of families and vitamin D deficiency in this segment of population can have socioeconomically dire consequences.

As much as fifty percent patients in group one had normal vitamin D level on one hand, but on the other hand, this group also had close to half of the patients with subnormal vitamin D level. This is the growing age group and micronutrient deficiency in this age group may adversely affect physical and mental capabilities, leading to poor educational performance.

Other studies conducted on vitamin D have revealed varying results. A study conducted on asymptomatic healthy individuals has shown vitamin D_3 deficiency in as much as 79% individuals, female predominating.[9] Another study conducted on outdoor patients revealed marked deficiency of vitamin D_3 (92%).[10] Two similar studies conducted at Islamabad and Peshawar also reported higher prevalence of vitamin D_3 deficiency in general population (71% and 65% respectively).[11,12]

The studies cited above have highlighted the increasing magnitude of vitamin D_3 deficiency. Findings of the present study are in accordance to those of the previous researchers. It is important to note here that most of the above cited local studies have addressed adequately the high prevalence of vitamin D in their areas except one, which has addressed the importance of finding out the causes of high prevalence of vitamin D in different parts of Pakistan.[13] An expert clinical review depicting the prevalence of vitamin D deficiency in different parts of Pakistan has also stressed upon the investigation for the cause of vitamin D deficiency. The survey revealed high prevalence rate of vitamin D deficiency in all the age groups, males and females, areas and socioeconomic groups of Pakistani population. Findings of the present study are also in accordance with these observations. Some of the other studies conducted in Pakistan highlighted the association of different conditions with vitamin D deficiency including non-metabolic disorders, metabolic disorders, and children with growing pains, psychiatric ailments, cardiometabolic syndrome and pelvic floor disorders). This was not considered in the present study, as it was beyond the scope of our research.[14–19] We agree with the idea of countrywide, population-based studies on larger sample size to investigate for the common causes of vitamin D deficiency in Pakistan.

The main limitations of this study were: Lack of knowledge of the difference between co-morbidity status of the responders and non-responders, and demographics can lead to selection bias. Drawing a single blood sample in winter months, when there is low exposure to sun, is also a proven limitation in drawing a discrete conclusion.

Recommendations: Heath education and awareness campaigns regarding vitamin D deficiency and its prevention are required to be planned at national level to tackle this important health issue effectively. We also recommend that evaluation of vitamin D level in foods commonly labelled as "vitamin D fortified" may be done to find out whether it is adequate or otherwise.

CONCLUSION

Vitamin D deficiency and insufficiency is alarmingly high in patients presenting with aches and pains, in all age groups, effecting females more than males.

AUTHORS' CONTRIBUTION

MI, JF, NG: Data collection, literature review, Final write up

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Submitted: 3 june, 2017	*Revised: 27 August, 2017*	*Accepted: 5 September, 2018*

Address for Correspondence:

Dr. Muhammad Idris, Department of Pathology, Ayub Medical College, Abbottabad-Pakistan
Cell: +92 333 503 7762
Email: midris63@yahoo.com