

VITAMIN D DEFICIENCY–AN EMERGING PUBLIC HEALTH PROBLEM IN PAKISTAN

Zahid Masood¹, Qaiser Mahmood², Khizar T. Ashraf³

¹Assoc. Professor, Department of Community Medicine, University Medical & Dental College, Faisalabad.

²Assoc. Professor, Department of Pathology, Punjab Medical College, Faisalabad.

³WHO focal person for Nutrition in Pakistan, WHO, Islamabad.

ABSTRACT

Objectives

1. To study the Prevalence of Vitamin D deficiency in the sample population.
2. To study the correlation of Serum Ca, Phosphorus and Alkaline Phosphatase with Vitamin D Deficiency in sample population.

Study Design

Descriptive Study

Setting

Local Private Clinic from 1st May to 30th Nov 2009.

Material and Methods

600 subjects in the sample included 300 males and 300 females presenting due to any illness or subjects with or without body aches were enrolled. Blood samples were collected in the morning (over night fasting sample) by venepuncture by disposable syringes and 5 ml blood sample was taken and samples were stored at -20 °C till they were analyzed. Variables of interest were age, gender, serum calcium, phosphate, alkaline phosphatase, serum vitamin D levels and history of bone or body aches. The study was analyzed on SPSS-Version-10 for windows. P – Value < 0.05 was considered statistically significant.

Results

Results reflected that 77.50% of the sample showed Vitamin D deficiency. Further 18% were in the category of Vitamin D insufficient. Only 4.5% were having values in the normal range. Overall prevalence of Vitamin D deficiency and insufficiency was 95.5%. Among the sample patients only 185 (30.83%) were having bone or body aches as a presenting feature while remaining 415 individuals (69.16%) were having no pains. In our sample all had normal values for serum Ca and Phosphates. However, only 20 patients had modestly elevated level of serum alkaline phosphatase.

Conclusion

Prevalence of Vitamin D deficiency is of magnitude which poses a public health problem. It is suggested that due to its multi system implications patients presenting with different signs & symptoms and especially when to establish a diagnosis is difficult, serum Vitamin D3 levels may be requested. Health education should be imparted to population and awareness should be created to increase the exposure to sunlight to permissible limits. Screening and vitamin D supplementation should be planned to decrease its varied and multidimensional ill effects on health.

Keywords: Vitamin D deficiency, Faisalabad, Serum alkaline phosphatase

Corresponding Author: Dr. Zahid Masood,
Department of Community Medicine,
University Medical & Dental College, Faisalabad.
E-mail: zahidmd27@gmail.com

INTRODUCTION

Vitamin D is formed in skin by ultra violet light which is the major source (80%) of Vitamin D and its dietary sources are egg yolk, oily fish, butter and milk.⁽¹⁾ There are a few research publications available to prove that Vitamin D deficiency is not uncommon in Pakistan. Faisalabad is the 3rd most populous city of Pakistan. It is located at 31°N latitude and 73°E longitude with abundant sunshine throughout the year.

The consequences of vitamins D deficiency upon the skeleton are well known.⁽²⁾ In adults prolonged deficiency of vitamin D (Calciterol) can lead to osteomalacia^(3,4) while lesser deficiency (insufficiency) is associated with various non-specific symptoms.⁽³⁾

Vitamin D deficiency has been observed in developed and developing countries including Middle East.⁽⁵⁾ Many studies show high prevalence of vitamin D deficiency. Skin pigmentation has negligible contribution in reduction of vitamin D formation from sunlight. Avoidance of sunshine or inadequate intake of vitamin D⁽⁵⁾ and malnutrition⁽⁶⁾ may be the main causes. There is increasing evidence that vitamin D insufficiency, by leading to sustained hyperparathyroidism, is prejudicial to the skeleton, particularly cortical bone; it is without symptoms until fractures occur.⁽²⁾

Because of high prevalence of vitamin D deficiency in Asia its multi system implications, and as serum calcium and phosphorus levels do not predict exactly its deficiency⁽⁷⁾, with a few studies available in this regard in Pakistan resulted in initiation of this study. The criteria for interpretation of vitamin D3 values are appended below.⁽²²⁾

Vitamin D deficiency	Less then 20 ng/ml
Vitamin D insufficiency	21-29 ng/ml.
Vitamin D sufficiency	Equal to or more then 30 ng/ml.
Vitamin D intoxication	More then 150 ng/ml.

MATERIAL AND METHODS

The study was performed on 600 patients 300 males and 300 females of different socioeconomic background and coming from rural and urban setup. The age groups ranged

from 20 to 80 years, mean age being 50 years. Subjects were predominantly married and majority living in their houses or offices and when outdoor most of them only exposed face and hands. Duration to sun exposure was 1 to 3 hours as reported by the subjects.

They presented to a private clinic due to any disease; whether presentation was with or without bone or body aches from May 2010 to November 2010.

Blood samples were collected in the morning (over night fasting sample) by venepuncture by disposable syringes and 5 ml blood sample was taken and samples were stored at -20°C till they were analyzed in one of the standardized laboratory of the country.

Their serum calcium, phosphate, alkaline phosphatase and serum vitamin D level were measured by one the most standardized laboratory of the country.

The study was analyzed on SPSS-Ver-10 for windows. P <0.05 was considered statistically significant. In the study variable of interest were age, gender, serum calcium, phosphate, alkaline phosphatase, serum vitamin D levels and history of bone or body aches.

RESULT

The results of the study were alarming and are appended below. Out of total 600 patients 50% (n=300) were males and 50% (n=300) were female. Among these 28 patients (4.66%) were below age of 20 year, 272 patients (45.33%) were having age between 20-40 year, 220 (36.66%) were between 41-60 year, 78 (13%) were between 61-80 year and 2 patients (less than 1%) were above 80 year (Table 1).

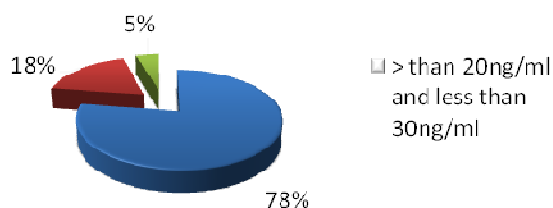
Table 1.

Age	Vitamin D levels (ng/ml)			Total
	<20ng/ml 77.50%	21-29ng/ ml 18%	>30ng/ ml 4.5%	
<20yrs	22	1	5	28
20-40yrs	210	52	10	272
41-60yrs	169	42	9	220
61-80yrs	64	12	2	78
>80yrs	0	1	1	2
Total	465	108	27	600

It was observed that 77.50% of the sample showed Vitamin D deficiency. Further 18% were in the category of Vitamin D insufficient.

Only 4.5% were having values in the normal range (See Chart below). It can be observed that overall Prevalence of Vitamin D deficiency was 95.5%. Similar studies done earlier revealed prevalence closer to our study.⁽²¹⁾

RESULTS OF THE STUDY SHOWING PREVALENCE OF VIT- D DEFICIENCY



Among the sample patients only 185 (30.83%) were having bone or body aches as a presenting feature while predominant individuals 415 (69.16%) were having no pains (Table 2). Moreover pain has got insignificant relation to any level of serum vitamin D level ($P=0.251$) (Table 2). However younger deficient patients were having lesser chance of bone or body aches as compared to age more than 60 year ($P < 0.001$). It's worth noting that in our sample all had

30ng/ml. Alternatively 573 (95.50%) had Vitamin D levels less than 30ng/ml.

It is evident from Table 3 that statistically significant ($P < 0.05$) number of patients presented without any bone pain or body aches.

Table 3.

ge	Bones or body aches		Total
	Presentation	Was no presentation	
<20yrs	00	23	23
20-40yrs	21	190	211
41-60yrs	64	147	211
61-80yrs	97	54	151
>80yrs	03	01	04
Total	185	415	600
$P < 0.05$			

DISCUSSION

Vitamin D deficiency is not an uncommon disease in the world; it has been widely reported in all age groups in recent years. Rickets has never been eradicated in developed countries as well⁽⁹⁾. Hypovitaminosis and Vitamin D deficiency has been in developed and developing countries including several in the Middle East⁽⁵⁾. Vitamin D is important for calcium absorption and bone growth⁽⁵⁾. Beside disease of bones it has

Table 2.

Vitamin D levels	Serum Ca levels		Serum PO ⁴ levels		Serum alkaline phosphate levels		Bones or body aches	
	8.6-10.5 mg/dl	<8.6 mg/dl	2.7-4.8 mg/dl	>4.8 mg/dl	27-132 iu/dl	>132 iu/dl	Yes* n=185(30.83%)	No** n=415(69.16%)
<20ng/dl n=465	465	-	465	-	445	20	155	310
21-30 ng/ml n=108	108	-	108	-	108	-	30	78
>30ng/ml n=27	27	-	27	-	27	-	0	27
Total	600		600		580		185	415
P-value					$P < 0.05$		$P > 0.05$	

normal values for serum Ca and Phosphates. However, only 20 patients had modestly elevated level of serum alkaline phosphatase. In the sample population only 27 (4.50%) patients had Vitamin D levels more than

wide range of health implication; early life vitamin D inadequacy is a causative factor in development of certain autoimmune disease^(9,10,11) like type 1 diabetes^(10,11), rheumatoid arthritis⁽¹²⁾ and certain cancers later in life⁽⁹⁾. Vitamin D deficiency exists in

patients with tuberculosis and it is possibly a cause rather than effect of the disease.⁽⁷⁾ It is part of the pathology of Alzheimer's, Parkinson's and some peripheral neuropathies including Restless legs syndrome.⁽¹³⁾ Vitamin D deficiency may also be linked to an increased susceptibility to several chronic diseases such as high blood pressure⁽¹⁴⁾, periodontal disease, multiple sclerosis⁽¹²⁾, chronic pain, depression, schizophrenia, seasonal affective disorder, peripheral artery disease.⁽¹³⁾

Risk of Myocardial Infarction (MI) doubles in patients with 25 OH Vitamin D levels <34ng/ml. Studies have shown that Congestive Heart Failure patients have much lower 25 OH Vitamin D levels than controls.^(15,24) Low Vitamin D level has association with insulin resistance and Beta-cell dysfunction. Highest Vitamin D levels associated with 60% improvement in insulin sensitivity.⁽⁹⁾ A study showed that 48% of patients with Multiple Sclerosis (MS) were found to be having vitamin D deficiency.⁽¹⁶⁾ Out of 299 patients with Low Back Pain (LBP) 83% had vitamin D deficiency.⁽¹²⁾ Study with 150 patients with persistent, nonspecific musculoskeletal pain at Mayo clinic revealed that 93% had vitamin D deficiency.⁽¹⁷⁾

As data of adult Pakistani population, as far as deficiency of vitamin D is concerned, is lacking so this study was conducted to determine the prevalence of vitamin D deficiency in out patient clinic, its relation to presenting symptom of bones or body aches and to the serum level of calcium, phosphate and alkaline phosphates.

The study showed significantly high prevalence of vitamin D deficiency in the Target population of Faisalabad in month of July; peak summer season in Faisalabad. Deficiency recorded in our study in sample population was 95.5% (79% deficient and 20% were having insufficient levels). These results do not match the existing international data, showing 14.5% in U.K reaching to more than 30% in age above 65 years⁽³⁾, 24.3% in United States⁽⁴⁾, 12.5% in Italy⁽⁴⁾, 55% in Irish females 20% and 83% in Saudi Arabia.⁽¹⁸⁾ Possible factors may be due to decreased intake or lack of sun exposure due to social, cultural or religious reasons.⁽¹⁷⁾

Vitamin D deficiency is one of the important risk factors for hip fractures, but the easiest to correct.⁽¹⁹⁾ Vitamin D deficiency is not uncommon in the elderly, especially in patients with hip fracture. Elderly people infrequently stay outside in the sunshine, and nutrition is deficient in vitamin D.⁽¹⁹⁾ The results of the present study were different to the mentioned international data as in this study. There were only 155 (25.8%) patients above age 60 year remaining 445 (74.16%) patients were below 60 year of age and all were deficient in vitamin D. This difference perhaps may be attributed to fact that majority of sample presented in the clinic was below 60 year. However, vitamin-D deficiency in less than 60 year age group is really eye opener.

Vitamin D deficiency can occur without any symptoms. If symptoms are present, it indicates severe deficiency.⁽⁷⁾ Similar observations were made in this study, only 31% patients were having bones or body aches on presentation while remaining 69% were having no complains showing insignificant relation between deficiency and symptoms ($P > 0.05$). Hence, the concept that musculoskeletal pain are directly associated with vitamin D deficiency⁽¹⁷⁾ is not matched to the results of this study. However, young deficient patient were having lesser chance of having bones or body aches as compared to the above 60 year population (P -value < 0.05).

This study also establishes the fact mentioned in international literature that vitamin deficiency has no relation to the serum calcium, phosphate and alkaline phosphates levels.⁽⁷⁾ In our study all the vitamin D deficient population was having normal serum calcium, phosphate, while only 20 patients were having modestly elevated levels of Alkaline Phosphates. All this discussion endorses the fact that vitamin D is much more prevalent in this part of the world.

CONCLUSION

Vitamin D deficiency is much more prevalent in our community as compared to published Western data, particularly young population is more suffering to this new endemic, more ever often it is asymptomatic and also serum

calcium, phosphate and alkaline phosphates levels are not predictable indicator of its underlying deficiency. It is suggested that due to its multi system implications patients presenting with different signs and symptoms and where to establish a diagnosis is difficult, serum vitamin D3 levels may be requested. Moreover, to overcome this issue it is recommended that health education be imparted to population and awareness should be created to increase the exposure to sunlight to permissible limits. Mass level screening and vitamin D supplementation⁽²⁰⁾ should be planned to decrease its varied and multidimensional ill effects on health. Sample size in this study is very small. However, it may be taken as an inspiration to conduct more research work to address this important health issue and to prevent all the ill effects produced by its deficiency.

Limitation of Study:

We had several limitations; study was done at one point of time. We were not able to calculate the daily dietary intake of vitamin D due to several reasons. Duration of sun exposure was based on recall rather than actual. In the study we also ignored the overcast and rainy spells during study period. Furthermore, we did not measure the serum parathyroid hormone level due to limitation of resources.

Conflict of Interest:

None

REFERENCES

- Holon R, Byers M, Walker BR, Summerton C. "Environmental and nutritional factors in diseases". *Davidson's Principles and Practice of Medicine*. 20th ed. Edinburgh; Churchill Livingstone, 2006; 93-125.
- Mawer E B, Davies M. "Vitamin D nutrition and bone disease in adults". *Rev Endocr Metab Disord*. 2001 Apr; 2(2):153-64.
- Primary vitamin D deficiency in adults. *Drug ther Bull* 2006 Apr; 44(4):25-9.
- Paul A, Fitzgerald. Endocrine Disorder. In: *Current medical diagnoses and treatment*. 47th ed. New York: McGraw Hill; 2008; 949-1031.
- Pournaghshband Z, Amini M. "Prevalence of vitamin D deficiency in Isfahani high school students in 2004". *Horm Res*. 2005 64(3):144-8. Epub 2005 Sep 27.
- Fraser. "Vitamin D deficiency in Asia". *J Steroid Biochem Mol Biol* 2004 May; 89-90(1-5): 491-5.
- Sasidharan PK, Rajeev E, Vijayakumari V. Tuberculosis and vitamin D deficiency. LINK "javascrpt: AL_get (this, %20' jour', % 20' J % 20 Assoc % 20 Physicians % 20 India');"*J Assoc Physicians India*. 2002 Apr; 50: 554-8. Comment in: *J. Assoc Physicians India*. 2003 Mar; 51:325-6.
- Nozza JM, Rodda CP. "Vitamin D deficiency in mothers of infants with rickets". Comments in: *Med J. Aust*. 2001 Sep 3; 175(5):253-5.
- Kamball S, Fuleihan Gel-H, Vieth R. "Vitamin D: a growing perspective". *Crit Rev Clin Lab Sci* 2008; 45(4):339-414.
- Travera-M., Luz E., White JH. "Cell Defenses and the Sunshine Vitamin". *Scientific American*, November 2007.
- Holick MF. "Sunlight and vitamin D for bone health and prevention of autoimmune disease, cancers and cardiovascular disease". *American Journal of Clinical Nutrition Full Text* 2004; 80 2004(6): 1678 S-1688S.
- Chatfield SM, Brand C., Ebeling PR, Russell DM. "Vitamin D deficiency in general medical inpatients in summer and winter". *Int Med J*. 2007 Jun; 37(6):377-82.
- Melamed ML, Muntner P, Michos ED, et al. "Serum 25-Hydroxyvitamin D Levels and the Prevalence of Peripheral Arterial Disease". Results from NHANES 2001 to 2004". *Arterioscler Thromb. Vasc. Biol* 2008.
- News wise: "Men with low vitamin D may have increased risk of heart attack" Retrieved on June 9, 2008.
- Lau KH, Baylink DJ. "Vitamin D therapy of osteoporosis: plain vitamin D therapy versus active vitamin D analog (D-hormone) therapy". *Calcify Tissue. Int* 1999 Oct; 65(4):295-306.
- Findings presented at the American Society of Clinical Oncology's annual meeting in Chicago on 30 May 2008, as reported in the *Sydney Morning Herald* on 1 June 2008.

17. Heath KM, Elovic EP. "Vitamin D deficiency: Implication in the rehabilitation setting". *An J. Phys Med Rehabil.* 2006 Nov; 85(11): 916-23.
18. Al Faraj S, Al Mutairi K. "Vitamin D deficiency and chronic low back pain in Saudi Arabia". *Spine* 2003 Jan 15; 28(2): 177-9.
19. Lips P, Netelenbos JC. "Vitamin D deficiency and hip fracture". *Tijdschr Gerontol.* 1985 Dec; 16(6): 239-45.
20. Garabedian M, Ben-Mekhibi H. "Deficiency rickets: The current situation in France and Algeria". *Pediatric.* 1989; 44(4): 259-64.
21. Mehmood K, Akhter ST. "Vitamin D Status in Population of Healthy Adults in Pakistan." *Pak J. Med Sci.* 2009; 25(4): 545-550.
22. Holick M F. "Vitamin D deficiency". *The New England J. of Medicine.* 2007; 357: 266-81.
23. Scragg R, Jackson, R., Holdaway M. "Myocardial Infarction is Inversely Associated with Plasma 25-Hydroxyvitamin D3 Levels: A Community-Based Study". *Int. J. Epidemiol.* (1990) 19(3): 559-563.