

Research article

VITAMIN D DEFICIENCY IN THE WELL FED CLASS OF PAKISTAN: THE POSSIBLE CAUSES AND TRENDS

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This population-based survey was conducted to determine frequency of vitamin D deficiency in the twin cities of Pakistan. 1000 patients were evaluated for tests of circulating 25-hydroxy-vitamin D (25-OHD) levels using electrochemiluminescence method. Median 25-OHD was 14.73 ng/ml, 14.12 ng/ml in females and 16.51 ng/ml in males. Their mean age was 45.02 years. 73 % had vitamin D deficiency (males 20.7% ; females 79.2%), 16 % had insufficiency (males 25.7%; females 72.9%) and only 11 % were vitamin D sufficient (males 29.1% ; females 70%). T-test and Chi-square test were done and a marked pattern observed in males was that after 50 they tend to be less vitamin D deficient. These data conclude that vitamin D deficiency is extensive in the twin cities of Pakistan and suggest that routine monitoring of vitamin D levels may be of benefit.

Key words: Vitamin D; Blood levels; Rickets; Osteomalacia; Bone problems

Introduction

Several important developments have regenerated interest in vitamin D. Serum 25-hydroxy-vitamin D (25-OHD) is widely recognized as the best measure of vitamin D status and its role in the maintenance of the immune, reproductive, muscular, skeletal and integumentary systems is being extensively acknowledged (Whiting and Calvo, 2005).

Vitamin D deficiency appeared during the industrial revolution and at the beginning of the twentieth century an outbreak of the vitamin D deficiency disease rickets occurred among urbanised young children on both sides of the Atlantic Ocean (Shrapnel and Truswell, 2006). Numerous studies have identified a high prevalence of vitamin D deficiency and insufficiency in people living in North America and Europe. Reports of extensive vitamin D deficiency are also well documented in literature in nursing home patients and ambulatory ones (Mosekilde, 2005; Zuberi et al., 2008).

It has been well established that vitamin D is essential to bone health, severe deficiencies leads to osteomalacia and rickets, mild to moderate deficiencies can result in osteoporosis and increased fracture risk (Pfeifer et al., 2002). But, in this country where numerous other major problems exist, little attention is given towards deficiency of such a major vitamin and it is generally assumed that the economically fit individuals do not suffer from this deficiency.

The present study was carried out to determine the frequency of vitamin D deficiency in the two major cities of Pakistan, Islamabad and Rawalpindi. These two cities are well developed in all respects, with modern infrastructure facilities and a high standard of living. Residents here have a healthy life style.

Materials and Methods

Setting

The second author collected all the data from patients enrolled at Excel Labs Pvt. Ltd., Islamabad, Pakistan, between November 2008 to March 2010, a time span of 17 months.

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Table 1: Features of patients with vitamin D deficiency

Features	<20 (n= 731) Deficiency	21-29 (n=159) Insufficiency	>30 (n=110) Sufficiency
Age (in years)	44.1± 15.8	48.1±17.5	47.2±17.3
Gender			
Male	152 (20.7%)	42 (27.5%)	34 (30.4%)
Female	581 (79.2%)	111(72.5%)	78 (69.6%)

(Results are printed as mean ± standard deviation, and number (percentages))

Table 2: Descriptive Statistics

	Minimum	Maximum	Mean ± SD
Age of patient (Years)	0.8	117	45.1 ± 16.3
Serum Vitamin D (ng/ml)	3	130	17.9 ± 13.3

Patients

The one thousand patients were unselected consecutive cases, with a clinical indication of blood sampling not related to the study.

Blood sampling and laboratory analysis

Blood samples were taken and sent to the laboratory and analyzed. Serum 25 -OHD was analyzed using electrochemiluminescence method (Elecsys 25 -OH-D3 assay) on Roche Modular E170 immunoanalyzer.

Statistical Analysis

Graph Pad Prism 5 (version 5.03) was used for unpaired T-test analysis. Whereas, chi-square test was done for finding out the distribution pattern of vitamin D deficiency among the different age groups and on the basis of gender using Freeman-Halton extension of Fisher Exact Probability Test for a two-rows by three-columns contingency table (Freeman and Halton, 1951). A p-value less than 0.05 were considered as statistically significant. Mean ± SD and Median values were also calculated.

Ethics

Blood samples were taken on clinical grounds and so no research ethics committee was involved and written informed consent was not obtained.

Limitation of the study

We were not able to calculate the daily dietary intake of vitamin D. Furthermore we did not check parathormone levels due to limitation of resources.

Results and Discussion

A total of 1000 patients were selected for final analysis. Their mean age was 45.02 years, ranging from 0.8 to

117, majority included females, in the ratio of 3.39 (Fig 1). For the purpose of this study, patients were divided into four clinical categories based on their serum 25 vitamin D levels. Those with levels below 20 ng/ml were categorized to have vitamin D deficiency, levels between 21-29 ng/ml as vitamin D insufficiency, equal to or greater than 30 ng/ml as vitamin D sufficiency and levels > 150 ng/ml were considered vitamin D intoxication. These reference ranges were chosen according to standards defined by Michael (Holick, 2007). Of the total, 73 % were deficient, 16 % had insufficiency and whereas only 11 % were shown to have normal levels. Table 1 shows the characteristics of these groups and Table 2 shows the descriptive statistics. Median 25-OHD was 14.73 ng/ml, 14.12 ng/ml in females and 16.51 ng/ml in males.

A widespread deficiency/insufficiency of 25 -OHD levels was observed in our sample population. This was in accordance with the lifestyle of the population studied which have reduced sun exposure. Table 3 shows the results of the T-test analyzing the differences in vitamin D deficiency patterns before and after the age of 50, in both males and females. In males, contrary to what was expected, deficiency patterns tend to decrease after the age of 50. Table 4 shows the characteristic results of the chi-square test. However, females showed similar patterns, both before and after 50. In line with other studies (Zuberi et al., 2008; Dhesi et al., 2002) females were found to be more deficient than males. The probable reason being that they prefer to avoid sunlight due to the fear of darkening of their skin more than males. They tend to have an in-door lifestyle, but unknown biological factors may also contribute. Male

Figure 1: Prevalence of Vitamin D deficiency in Twin Cities

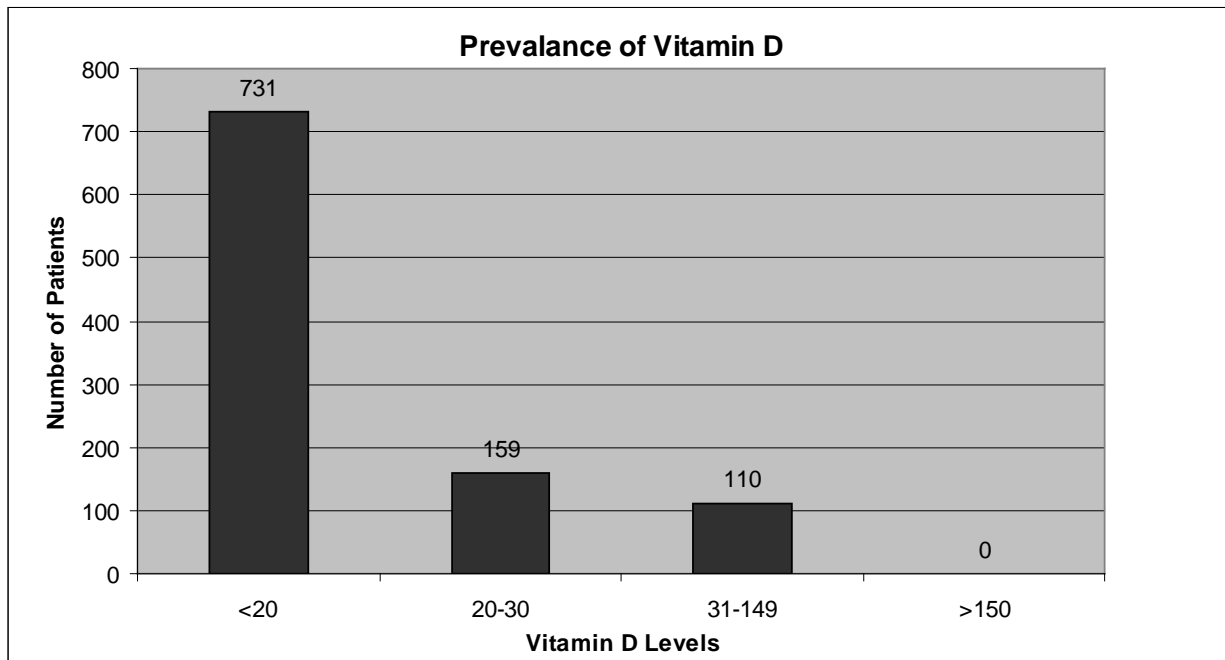


Table 3: Vitamin D deficiency patterns (T-test)

	Male	Female	P-value
Overall	20.4±16.5	17.1±12.2	0.0009
<50	18±15	16.8±13	0.3431
>50	23.8±18	17.7±11	0.0001

	<50	>50	P-value
Overall	16.6±12.2	19.3±13.3	0.0014
Male	18±15	23.8±18	0.0092
Female	16.8±13	17.7±11	0.3163

Table 4: Chi-square test

	Male			Female			X2	P-value
	N	S. Def	Def	N	S. Def	Def		
Overall	29	47	152	70	123	579	6.31	0.042638
<50	13	20	99	47	67	390	0.37	0.831104
>50	16	27	83	23	56	189	8.43	0.014772

	<50			>50			X2	P-value
	N	S. Def	Def	N	S. Def	Def		
Overall	60	87	489	39	83	242	15.14	0.000516
Male	13	20	99	16	27	53	9.83	0.007336
Female	47	67	390	23	56	189	7.55	0.022937

subjects only avoid sun exposure generally due to high temperature. Vitamin D plays a vital role in calcium homeostasis. It increases its intestinal absorption and is an essential factor in the mineralization of the skeleton (Bischoff et al., 2003; Dhesi et al., 2002). Thus, the importance of vitamin D deficiency is related primarily to bone integrity and the diagnosis calls for attention (Dhesi et al., 2002). Our findings call for focused observance of vitamin D status in the rich class, well-nourished and usually thought of lacking any deficiencies. Although Pakistan is not a sun-deprived country, high levels of vitamin D deficiency should alert clinicians to meet the specific needs of this population.

In conclusion, the previous optimistic view about the well-developed cities about vitamin D sufficiency does not stand true and like the rural areas, the major cities also need support and widespread awareness. It will be beneficial if these deficiencies are detected and treated before diseases like rickets, osteoporosis and other bone problems become widespread.

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