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Vitamin D Status in a Random Population: a Comparative Study Between Males and Females

Biochemistry

KEYWORDS : Vitamin D; Osteoporosis; Random population; Vitamin D deficiency

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ABSTRACT

Abstract-. Vitamin D deficiency is a well-known cause of rickets in children,osteomalacia and osteoporosis in adults. Worldwide, an estimated one billion people have inadequate levels of vitamin D in their blood, and deficiencies can be found in all ethnicities and age groups.

Objective: The present study is a retrospective study and the objective is to compare the status of Vitamin D in a random population attending to a tertiary care hospital.

Materials & methods: The study included a sample size of 320 subjects. Out of this 160 were male subjects and 160 were female subjects of age groups 20-75 years. Population above 75 years and below 20 years are excluded from the study. The vitamin D levels were compared seperately in females including 100 subjects, criteria being pre-menopause and post-menopause. 100 male subjects were compared with age above and below 50 years.

Results: It is observed a higher prevalence of vitamin D deficiency is seen in general population, and deficiency being higher in females when compared to males ($p<0.0001$, $r=0.100$). No significant correlation was observed between males of above and below 50 years in this study ($p=0.45$, $r=0.100$). In females the prevalance of Vitamin D deficiency is found to be significantly higher in pre-menopausal than post-menopausal females ($p<0.0001$, $r=0.170$).

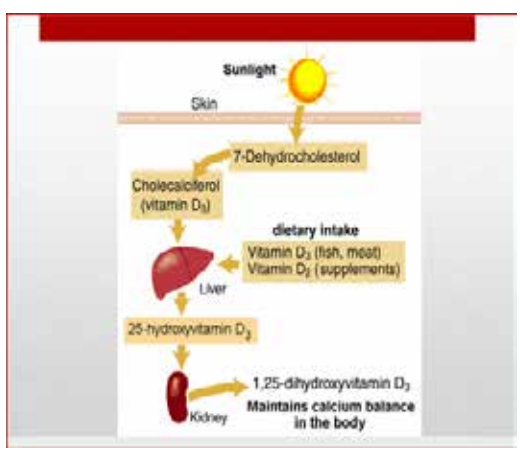
Conclusion: The serum 25(OH)D concentration is the best indicator for vitamin D deficiency, insufficiency, sufficiency, and toxicity. There is a high prevalence of vitamin D deficiency and insufficiency, even in normal populations, and there is growing evidence for the contribution of low circulating 25(OH)D levels to the development of a wide range of chronic diseases.

i Introduction

Vitamin D is the name given to a group of fat- soluble prohormones. The major biological function of vitamin D is to maintain normal blood levels of calcium and phosphate that are in turn needed for the normal mineralisation of bone, muscle contraction, nerve conduction, and general cellular function [1]. Vitamin D deficiency is suggested as a contributing factor in the development of several other conditions such as diabetes, few cancer types like colorectal, breast, prostate cancers and immunologic diseases [2]. Worldwide, an estimated one billion people have inadequate levels of vitamin D in their blood, and deficiencies can be found in all ethnicities and age groups [3-6].

Vitamin D3 can be produced photochemically by the action of sunlight on a cholesterol-like precursor, 7-dehydrocholesterol, present in the skin. Dietary intake is critical, when exposure to sunlight is limited, but only a few foods naturally contain vitamin D eg. oily fish and cod-liver oil.

Cholecalciferol from the skin, together with dietary cholecalciferol is transported to the liver bound to vitamin-D-binding protein where hydroxylation of cholecalciferol occurs to 25(OH)D [7]. 25(OH)D is the main circulating form of Vitamin D and is biologically inactive.The hepatic vitamin D-25-hydroxylase is not tightly regulated since its production is directiy dependent on the substrate vitamin D concentration. An increase in the cutaneous production of vitamin D, or ingestion of vitamin D will result in an increase in circulating levels of 25(OH)D [7]. Further hydroxylation of calcidiol into biologically active 1,25(OH)2D, by renal 1α-hydroxylase, takes place in the kidney [8]. This process is stringently regulated, by1,25(OH)2D, parathyriod hormone (PTH), and the serum concentrations of calcium and phosphate.The kidney is the main source of circulating 1,25(OH)2D.



1,25 (OH)2D stimulates intestinal absorption of calcium and phosphate and mobilises calcium and phosphate by stimulating bone resorption [8]. When the level of ionised calcium in plasma falls, PTH is secreted by the parathyroid gland and stimulates the tightly regulated renal 1α-hydroxylase to make more 1,25 (OH)2D. The increase in 1,25(OH)2D causes an increase in calcium transport within the intestine, bone, and kidney which raise plasma calcium levels.

II STUDY OBJECTIVE

The present study is a retrospective study and the objective is to compare the status of Vitamin D in a random population attending to a tertiary care hospital, KIMS Hospital, Secunderabad. The study included a sample size of 320 subjects.Out of this 160 were male subjects and 160 were female subjects of age groups 20-75 years. Population above 75 years and below 20 years are excluded from this study. The vitamin D levels were compared seperately in females including 100 subjects, criteria being pre-menopause and post-menopause. 100 male subjects were compared with age above and below 50 years.

III MATERIALS AND METHODS

The blood samples were collected from patients presenting to the sample collection, Department of Laboratory services, KIMS Hospital using BD vacutainers of gel type (yellow). Serum samples were separated by centrifugation and it is processed for Vitamin D estimation in Roche cobas e411 a fully automated analyser. The principle of the test is based on ELICA (Electro Chemiluminiscence Immunoassay) using a dedicated reagent of Elecsys Total Vitamin D 25-OH kit (Roche Diagnostics, Mannheim, Germany) [22]. The samples are processed for VitaminD only after running the Randox Quality control. The QC has to be with in the acceptable limits of performance to process the patient samples.This procedure is followed to provide reliable reports to the patients.The data was analysed statistically using SPSS (version 11.5, SPSS Inc, Chicago, IL).

Statistical analysis

Data are presented as mean + standard error of mean (SEM). Student's't' test was used to compare the differences between the male and female subjects, premenopausal & postmenopausal women and males of above and below 50 years age. Pearson's coefficient was calculated for the correlation. P<0.05 was considered significant. Data was analyzed for the statistical significance using Pearson′s correlation, considering it significant at the $P < 0.05$.

IV RESULTS

In the present study we observed the vitamin D deficiency status is significantly higher in females when compared to males (p<0.0001). The vitamin D status in random population is shown in Table 1.

Table 1: Vitamin D status in a random population:

	N	Mean	St. Dev	SE Mean	p Value
Males	160	29.6	13.9	1.0989	<0.0001
Females	160	21.2	23.6	1.8657	

Table 2: Vitamin D status in premenopausal (pre M) & postmenopausal (post M) women:

	N	Mean	St. Dev	SE Mean	pValue
Postmenopause	100	55.4	18.17	1.817	<0.0001
Premenopause	100	28.7	35.65	3.565	

In this study it is observed that vitamin D deficiency status in postmenopausal women when compared to premenopausal women is significantly higher (p<0.0001) (Table 2).

Table 3: Males with age < 50 years and > 50 years:

	N	Mean	St. Dev	SE Mean	pValue
Males < 50Y	100	20.28	12.7	1.27	>0.45
Males > 50Y	100	20.05	15.1	1.51	

In this study although, the deficiency is higher in males below 50 years, there was no significant correlation between males of above and below 50 years of age (p=0.45) for deficiency of vitamin D status (Table 3).

V DISCUSSION

Though Vitamin D deficiency is presumed to be rare in a tropical country like India [7], In this study it is observed that there is a high prevalance of Vitamin D deficiency using gender SPSS evaluation. Evaluation of serum 25-hydroxyvitamin D [25(OH)D] is the most reliable indicator of vitamin D adequacy of an individual. The higher prevalance of vitamin D deficiency is seen in general population were also evidenced by Thuesen et al. [8], Wahl et al. [9] and Scharla SH et al. [10] Those findings also indicated that Vitamin D deficiency is higher in females when compared to males (p<0.0001, r=0.100). No significant correlation was observed in males, above and below 50 years in this study although high prevalence of 25(OH)D deficiency is seen in age < 50Y subjects compared to that of the males >50Y subjects (p> 0.45, r=0.100). In females the prevalance of vitamin D deficiency is found to be significantly higher in premenopausal than postmenopausal females (p< 0.0001, r=0.170,) [11, 12]. Similar studies were conducted by Need AG etal, [13].

There is an overall agreement that 25(OH)D should be measured to determine vitamin D status. This is the best indicator to define vitamin D deficiency, insufficiency, sufficiency, and toxicity [14]. There is no doubt that 25(OH)D levels below10 ng/ml can result in bone diseases such as rickets in infants and osteomalacia (soft bones) in adults [15,16&21]. It may also proceed to rickets and osteomalacia in longer term [17]. Vitamin insufficiency is characterised by serum levels of 25(OH)D below 20 – 30 ng/ml [17&19]. It has been suggested that serum 25(OH)D concentrations between 40 – 50 ng/ml can be regarded as 'hypovitaminosis D', where body vitamin D stores are depleted, and PTH levels can be slightly elevated, but are still in the normal range [16 &19]. Circulating 25(OH)D levels of 50 – 60 ng/ml can be considered as suitable for optimum health. However,a recent meeting presented at the conference "Women and Micronutrients: Addressing the Gap Throughout the Life Cycle," held in New York, NY, June 5, 2004, aimed at defining a consensus for vitamin D intake for osteoporosis, that the 25(OH)D concentration should exceed 32 ng/ml [18,19&20]. Subjects with a constant exposure to sunlight, living close to the equator, have been shown to have 25(OH)D serum levels of up to 65.2 ng/ml (mean of 42.8 ng/ml + 2SD) throughout the year [11]. There are no reports of vitamin D intoxication in healthy adults after intensive sunlight exposure, and thus, it can be assumed that the maximum 25(OH)D level corresponding to an intensive sunlight exposure is an upper safe level. Yet some people do not make enough vitamin D from the sun, among them, people who have a darker skin tone, who are overweight, who are older, and who cover up when they are in the sun [3]. This is probably due to occupation, dress code and due to lifestyle modification where duration of exposure to sunlight is decreased.

VI CONCLUSION

In this study it is observed that a higher prevalence of vitamin D deficiency is seen in general population and deficiency being higher in females when compared to males. 1,25(OH)2D, the most biologically active vitamin D metabolite, is a very potent steroid hormone, however, an adequate serum 25(OH)D level is also necessary to achieve full physiological vitamin D activity. The serum 25(OH)D concentration, is the best indicator for vitamin D deficiency, insufficiency, sufficiency, and toxicity. Only a few foods naturally contain vitamin D and, therefore, circulating 25(OH)D levels are normally largely depend on sunlight exposure. Reasons for a low vitamin D status include a seasonal lack of UVB irradiation, low outdoor activities, and the ageing process. There is a high prevalence of vitamin D deficiency and insufficiency, even in normal populations, and there is growing evidence for the contribution of low circulating 25(OH)D levels to the development of a wide range of chronic diseases.

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Conflicts Of Interest

The authors declare no conflict of interest.

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