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Comparison of Calcium, Phosphorous and 25 (OH)D₂ Levels in Sedentary and Labourer Females

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Abstract

Aim: To compare serum calcium, serum phosphorous and serum 25 (OH)D₂ levels in sedentary less exposed to sun and heavy working females exposed to sun.

Materials and methods: The study was performed in the Biochemistry Department, Subharti Medical College, Swami Vivekananda Subharti University, Meerut. 50 females, 21-50 years of age as labourers (control); 50 other healthy females of same age group sedentary (cases) were included. All the samples were processed in related automatic machines Vidas and Vitros 350/Fusion by Biomerieux.

Results: In our study we found that the levels of serum calcium were 7.25 ± 1.14 , serum phosphorous 3.99 ± 0.69 and vitamin D 8.39 ± 2.86 in cases and levels of serum calcium were 8.72 ± 0.58 , phosphorous 4.44 ± 0.59 and vitamin D 32.51 ± 6.92 in the control group respectively.

Conclusion: Our study perceived that the level of serum Calcium, Phosphorus and vitamin D were significantly decreased in females, less exposed to sun as compared to heavy working females exposed to sun. Thus we could conclude that the maintenance of normal levels of vitamin D is contributed not only by adequate exposure to sun light and exercise, but also to the dietary habits.

Keywords: Calcium; Phosphorus; Vitamin D

Introduction

Vitamin D deficiency or insufficiency is normally not expected to be a problem in a country like India because of the abundance of sunlight throughout the year except in some states [1,2]. Vitamin D, known as the "Sunshine Vitamin," has been taken for granted, and until recently little attention has been focused on its important role for adult bone health and for the prevention of many chronic diseases. It has been assumed that vitamin D deficiency is no longer a health issue in the United States and Europe alone. However, it is now

recognized that everyone is at risk for vitamin D deficiency [1,2].

Vitamin D is actually a fat-soluble prohormone steroid that has endocrine, paracrine and autocrine functions [3]. The endocrine effects of vitamin D are mainly involved in serum calcium homeostasis. Vitamin D and calcium are almost always framed together. Vitamin D's primary role is to control the levels of calcium found in the bloodstream by constantly allowing calcium and phosphate absorption from the intestine or taking calcium from bones. Furthermore, vitamin D is an enabling agent that, when present in optimal concentrations, has no perceptible effect on calcium absorption in its own right; however, it permits or facilitates flexible physiologic response to varying calcium need [4-7].

Rickets in children and osteomalacia in adults are the classic manifestations of profound vitamin D deficiency. In recent years, however, non-musculoskeletal conditions including cancers, metabolic syndrome, infectious disease and autoimmune disorders have also been found to be associated with low vitamin D levels [8]. The spectrum of these common disorders is of particular concern because observational studies have demonstrated that vitamin D insufficiency is widespread in many northern regions of the world, including industrialized countries [9].

Materials and Methods

The study was performed in the Biochemistry Department, Subharti Medical college, Swami Vivekananda Subharti University, Meerut from August 2016 to August 2019 on 100 females (50 females who were desk workers working indoor offices for 6 hours, 6 days a week from 8 A.M. to 4 P.M. and less exposed to sun served as study group (cases) and heavy working females exposed to sun for a maximum of 7-8 hours in sun-light and for a minimum of 3 years served as control. Their age range was 21-50 years. Total serum Calcium, Phosphorus and vitamin D levels were analysed. The study was approved by the institutional ethical Committee.

5 ml of venous blood was taken in plain vials under all aseptic conditions from all subjects. Usually all samples were processed on the same day in a group of 5-6 subjects. All samples were first centrifuged at 2000 g for 10 minutes to

obtain serum. Unprocessed samples after obtaining serum were stored in Eppendroff tubes to avoid contamination and evaporation at -20°C.

All the samples were processed with the help of technical staff and technical laboratory methods, in related automatic machines Vidas and Vitros 350/Fusion by Biomerieux.

Selection criteria

Inclusion criteria: Subjects include 100 females in the age group of 21-50 (50:50) years were included who were working as day time labourers and had maximum exposure to sunlight, other 50 females who were indoor desk workers with sedentary way of living, minimum work load and probably once a week exposure to sunlight.

Exclusion criteria: Subjects with any pathological conditions or any other medical history based on signs and symptoms, with no use of sunscreens in any form were excluded from the study.

Statistical Analysis

Statistical significance was evaluated by means of the unpaired Student's t-test, and comparisons were made between two groups. Further group analysis was done by using one-way analysis of variance (ANOVA) followed by Dunnet comparison test. The values were expressed as mean \pm SEM and $p < 0.05$ (significant).

Results and Discussion

The results in study indicated that the level of total serum Calcium, Phosphorus and vitamin D were significantly decreased in females who were less exposed to sun as compared to heavy working females exposed to sun (**Tables 1-4**).

Study included 100 females in two groups, namely controls and cases: consisting of 50 subjects each as per inclusion criteria. It was found that the level of vitamin D, serum calcium and serum phosphorous were 32.51 ± 6.92 , 8.79 ± 0.58 , 4.44 ± 0.59 respectively in the control group while these values were 8.39 ± 2.86 , 7.25 ± 1.14 , 3.99 ± 0.69 in cases respectively.

Table 1 Comparison of total serum Calcium, Phosphorus and vitamin D levels in study group and control group.

Parameters	Study group Mean \pm SD	Control group Mean \pm SD	p value
Serum total calcium (mg/dl)	7.25 \pm 1.14	8.72 \pm 0.58	P<0.01
Serum phosphorous (mg/dl)	3.99 \pm 0.69	4.44 \pm 0.59	P<0.01
Serum Vitamin D (ng/ml)	8.39 \pm 2.86	32.51 \pm 6.92	P<0.01

This can be attributed to the fact that decreased levels of vitamin D may be due to multiple factors like UV-B radiations,

factors affecting endogenous production of vitamin D, limited access to sunlight, air pollution, skin condition like pigmentation, skin type (Indian nationals have Fitzpatrick skin types IV to VI and because of which least absorbance of sun light is seen) [10], time of getting exposed to UV light, type of clothing, and sun protection practices. People with darker skin require more UV-B exposure (e.g. longer time outdoors) to produce vitamin D. Exogenous sources of vitamin D include food and supplements. Vitamin D is mostly found in non-vegetarian food like fatty fish (salmon or mackerel), meat, eggs and shellfish while this is relatively deficient in vegetarian food.

Table 2 Difference of vitamin D levels between cases and controls.

Status	25 (OH vitamin D) values	Cases	Controls
Deficient	<20 ng/ml	100%	None
Insufficient	20-29 ng/ml	None	32%
Sufficient	30-100 ng/ml	None	68%

Table 3 Difference in serum calcium levels between the groups.

Serum calcium levels	Cases	Controls
<8.6 mg/dl	90%	40%
8.6-10.3 mg/dl	10%	60%

Table 4 Status of serum phosphorous between two groups.

Serum phosphorous	Cases	Controls
<2.5 mg/dl	1%	none
>2.5-4.5 mg/dl	99%	100%

Similar to our findings it was reported by International Osteoporosis foundation that in north India 96% of neonates, 91% of healthy school girls, 78% of healthy hospital staff and 84% of pregnant women have hypovitaminosis D. On the other hand prevalence of vitamin D deficiency in southern India was estimated to be 70% among females. There was also a significant rural urban variation in the vitamin D deficiency status which was attributed to the diversity of occupation of the people [11].

Our results are also in accordance with Tandon et al. which show that the mean vitamin D levels of the study population were 26.86 ng/ml. While evaluating the vitamin D status of the study population, 53.35% of the population had vitamin D deficiency, 19.48% had insufficiency and 26.83% had adequate vitamin D levels [12].

Some other studies had also reported similar results. Zarger et al. stated that amongst 18-48 years old female groups in Kashmir valley 83% had vitamin D deficiency [13].

Goswami et al. also reported that women in Indian paramilitary forces in the age group 20-30 years had vitamin D levels of 25.3 ± 7.4 ng/ml in spite of good diet, exercise and exposure to sunlight 9.

Conclusion

Following conclusions are drawn from this study:

- Vitamin D levels are found to be increased by 74.18% in controls.
- Calcium levels are also increased by 16.88% in controls.
- Phosphorous levels are found to be increased by 10.04% in controls.

The control subjects were working in day sun light for almost 8 hours per day for more than 3 years and were found to be having nearing normal levels of vitamin D, and normal levels of calcium and phosphorous. As almost all the control subjects were taking vegetarian diet with no additional supplementation with vitamin D, their vitamin D levels were found to be insufficient among 32% of the subjects and sufficient in 68% of the subjects. Thus we could conclude that the maintenance of normal levels of vitamin D is contributed not only by adequate exposure to sun light and exercise, but also to the dietary habits.

Conflict of Interest

Authors declared no conflict of interest.

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