Original Article

Vitamin D Levels: Do We Need to Assess Only in Disease?

Sunil Jamwal, Kapil Gupta[1], Tanvir Kaur Sidhu[2]

Department of Biochemistry, Centre for Interdisciplinary Biomedical Research, Adesh University, Departments of [1]Biochemistry and [2]Community Medicine, AIMSR, Adesh University, Bathinda, Punjab, India

Abstract

Background: Vitamin D is conventionally known as sunshine vitamin and is synthesized endogenously in sunlight. Vitamin D is known to be a key regulator of bone metabolism, the function of genes, and essential for the development of the whole body. Deficiency of Vitamin D is now become a major worldwide epidemic health problem. **Aim:** The present study was conducted with the objective of determining the prevalence of Vitamin D deficiency (VDD) in urban population of a district in south Punjab, across various characteristics of population such as gender, age, and socioeconomic status. **Materials and Methods:** A cross-sectional population survey was conducted in the urban population of the district. A total of 120 healthy volunteers of either sex participated and their 25-hydroxy Vitamin D concentrations in serum samples were estimated using ELISA. The participants were divided into three categories as follows: Vitamin D deficient, insufficient, or sufficient, on the basis of normal standardized serum levels of Vitamin D <20, 20–30, and >30 ng/ml, respectively. **Results:** Of 120 healthy individuals, 95% of the study participants had VDD or insufficiency and only 5% had adequate Vitamin D levels. In each age group, females showed lower Vitamin D levels as compared to males. Furthermore, high body mass index value was associated with low Vitamin D. Upper-class individuals also showed low levels of Vitamin D as compared to other socioeconomic classes' individuals. **Conclusions:** Overall, high prevalence of VDD among the apparently healthy urban population of the district was observed and gives an alarming sign about continuously increasing prevalence of hypovitaminosis D among healthy population.

Keywords: *25 (hydroxycholecalciferol) D, body mass index, deficiency, prevalence, Vitamin D*

Introduction

Vitamin D a fat-soluble compound is present in two forms as follows: Vitamin D_2 (ergosterol) in plants and Vitamin D_3 (cholecalciferol) in human beings. It acts like steroidal hormone and regulates the functions of over 200 genes, essential for growth and development of the body, normal mineralization of bone, muscle contraction, and nerve conduction.[1] It is introduced in the body through food, but major synthesis occurs through exposure of skin to solar ultraviolet radiations which is dependent on multiple factors such as latitude and atmospheric pollution.[2] The best and ultimate source of Vitamin D is sunlight, so normally Vitamin D is not required in the diet, so long as there is ample exposure of skin to sunlight. Of two active metabolic intermediates of Vitamin D, 25-hydroxycholecalciferol and 1,25-dihydroxycholecalciferol, former is the best indicator of Vitamin D status in the human body because of its half-life of about 3 weeks.[3]

Vitamin D deficiency (VDD) is one of the new major global health problems with over a billion people worldwide deficient or insufficient.[4] It is the most underdiagnosed and undertreated nutritional deficiency.[5,6] Low levels of Vitamin D are reported to be associated with increased cancer incidences and mortality in men[7] and a risk factor for type 1 diabetes, multiple sclerosis, Crohn's disease, and rheumatoid arthritis.[8-12] VDD has been a neglected disorder in India although the majority of the population in India, particularly in Punjab resides in sunny areas where ample amount of sunlight remains throughout the year; still, VDD is a problem of growing concern. Punjab has a flourishing different class society with a mix of agrarian, business, and service communities. Economic growth has brought about a change in the lifestyle of peoples in the society as regards the work types, dietary habits, and schedules. Whether these population characteristics influence the Vitamin D levels and its risk factors need to be explored.

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Address for correspondence:
Dr. Sunil Jamwal, Department of Biochemistry, Centre for Interdisciplinary Biomedical Research, Adesh University, Bathinda, Punjab, India.
E-mail: sunil86jamwal@gmail.com

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Materials and Methods

The present study was conducted on 120 healthy volunteers of either sex belonging to different backgrounds with the age 18–60 years of a district in south Punjab, and investigations were carried out in the Biochemistry Department of a tertiary care center attached to a medical college. Healthy individuals taking any drugs or supplements which can influence the Vitamin D levels in the body and those suffering from any chronic disease such as diabetics, hepatic, renal, and dermatological disorders were excluded from the study. A signed informed consent form and a questionnaire regarding age, weight, height, body mass index (BMI), and genders were obtained from all the participants before the study.

Two milliliters of blood sample were collected from participants in the fasting state under basal conditions using the standard procedure for blood sample collection, and levels of Vitamin D were measured using enzyme immunoassay (ELISA) method. Levels of Vitamin D were categorized as normal (>30 ng/ml), insufficient (20–29 ng/ml), and deficient (<20 ng/ml). The results of laboratory tests in the study groups were encapsulated as mean ± standard deviation.

Results

Table 1 shows the frequency and prevalence of Vitamin D levels among 120 healthy individuals of the present study. On the basis of frequency distribution, 39 individuals were in deficiency zone, 75 individuals were in insufficiency zone, and only six individuals were in sufficiency zone. On the basis of the prevalence, around 95% of the total selected individuals were in deficiency or insufficiency zone and only 5% was in sufficiency zone.

On the basis of age group, we found that mean Vitamin D values of age group 18–29, 30–40, 41–50, and 51–60 were 25.20, 21.50, 16.30, and 7.30 ng/ml, respectively. The upper age group individuals were more severe deficient, whereas lower age group showed insufficiency. On comparison, male of age group 18–29, 30–40, 41–50, and 51–60 had Vitamin D content of 26.92, 22.08, 17.95, and 10.56 ng/ml and female of the same age pattern had 23.65, 20.83, 14.74, and 4.93 ng/ml, respectively [Table 2].

Comparison of Vitamin D with BMI indicated Vitamin D levels of male and female 26 and 22.91 ng/ml, 28 and 27.60 ng/ml, 22.90 and 21.70 ng/ml, 13.80 and 11.08 ng/ml having BMI level <18.5 kg/m^2, between 18.6–24.9 kg/m^2, 25–29.9 kg/m^2, and 30–34.9 kg/m^2, respectively [Table 3]. The result reflects that normal weight individuals were insufficient of Vitamin D content.

Comparison of the socioeconomic status of individual also influenced the Vitamin D levels. Higher socioeconomic status individuals have lower mean Vitamin D levels of 15 ng/ml, middle status has mean levels of 22.20 ng/ml, while in lower 22.90 ng/ml, mean levels of Vitamin D were observed in healthy population [Table 4].

Discussion

The aim of the current study was to check the status of serum Vitamin D levels in healthy volunteers in the population of a district of south Punjab and also to examine the associated hidden risk factors such as age, gender, socioeconomic status, and BMI. Vitamin D plays a vital role in the body of human beings, and its deficiency or insufficiency may result in several chronic diseases and disorders. Therefore, it is of utmost necessity to keep the adequate amount of Vitamin D in the healthy human body for proper functioning. The present study was conducted on 120 healthy participants of which 60 were male and 60 were female of different age groups in the same area. The result showed that of 120 healthy individuals, 114 individuals were deficient or insufficient, and only six individuals had sufficient levels of Vitamin D, with a deficiency prevalence of around 95% in the healthy population.

Table 1: Frequency and prevalence in healthy population

Condition	Frequency (120)	Prevalence (%)
Sufficiency (>30 ng/ml)	6	5
Insufficiency (>20-<30 ng/ml)	75	62.5
Deficiency (<20 ng/ml)	39	32.5

Table 2: Vitamin D levels between male and female of different age groups

Age group	Vitamin D (mean±SD) ng/ml		
	Male	Female	Average
18-29	26.93±2.10	23.65±4.97	25.20±2.90
30-40	22.08±7.25	20.83±8.35	21.50±1.93
41-50	17.95±3.29	14.74±4.90	16.30±4.23
51-60	10.56±8.90	4.93±9.80	7.30±6.29

SD: Standard deviation

Table 3: Vitamin D levels with body mass index range

BMI ranges (kg/m^2)	Vitamin D levels (mean±SD)	
	Male (ng/ml)	Female (ng/ml)
Below 18.5	26.0±1.71	22.91±3.06
Between 18.6 and 24.9	28.0±5.83	27.6±4.22
Between 25 and 29.9	22.90±1.37	21.7±1.07
Between 30 and 34.9	13.80±5.61	11.08±5.81

SD: Standard deviation; BMI: Body mass index

Table 4: Vitamin D levels between individuals with different socioeconomic status

Socioeconomic status	Vitamin D (mean±SD) ng/ml
Upper socioeconomic status	15.0±7.31
Middle socioeconomic status	22.2±5.21
Lower socioeconomic status	22.9±5.53

SD: Standard deviation

No studies until far have been conducted on Vitamin D levels in healthy population in this region; although, some studies are available in other areas of India showing the prevalence of 70%–90%.[13] In the previous study conducted among adults, the laboratory analysis showed that 83.7% of participants had vitamin deficiency, 8.7% had Vitamin D insufficiency, and 7.6% of participants have normal Vitamin D levels.[14] On the basis of age group, we noticed that as we proceed from younger to older age group (18–60), there was a decline in the levels of serum Vitamin D in the selected healthy individuals. On further comparison of Vitamin D levels on the basis of different age groups between individuals, it was observed that younger and middle-aged (18–50) individuals are in deficiency or insufficiency zone, while the older age group individuals lie in severe deficiency zone. Zargar *et al*. also observed that 83% of the participants have VDD among age of 18–40 years,[15] while Shivane *et al*. showed 70% prevalence of VDD in young healthy adults in the age group of 25–35 years in the western part of India.[16] Further, a previous study carried out among elderly persons also showed a higher prevalence of 91.2% of VDD in mean age of 58 years.[17] Most long-lived individuals are most prone to develop VDD because of impaired intestinal absorption, lesser outdoor work, and decreased metabolic activity of the body[18,19] associated with weakness in the muscles.[20] In the present study, on the basis of gender, the levels of Vitamin D were lower in females in all age groups compared to males, indicating that females are more prone to VDD in the region and these were in consistent with the recent reports of Harinarayan *et al*., which also indicated more prevalence of VDD in females,[21] may be because of higher cosmetic use, more indoor activity, or more coverage of skin in outdoors.[22]

Now a day, obesity has become major problem in every age group either due to change in lifestyle or dietary habits in our society. In the current study also, Vitamin D levels of overweight and obese individuals were much less (13.80 ng/ml in males and 11.08 ng/ml in females) than the normal and underweight individuals although persons with BMI level <18.5 kg/m^2 also indicated deficiency or insufficiency of Vitamin D levels. Several earlier studies have also shown that obesity is associated with Vitamin D insufficiency[23] since the distribution of fat in the human body is affected by Vitamin D content, and there is a strong inverse correlation between BMI and levels of Vitamin D.[24]

Further stratification of the study population of the basis of monthly income, the present study population was classified of upper socioeconomic (>45,000), middle socioeconomic (15,000–45,000), and lower socioeconomic (<15,000) status, and individuals belonging to upper socioeconomic status were observed to have lower Vitamin D levels in comparison to middle and lower socioeconomic status may be because of lifestyle and dietary habits. The Vitamin D levels of participants belonging to lower socioeconomic status were insufficient but were better in comparison to upper one contrary to reports of Weng *et al*. which found insufficient Vitamin D levels, especially in the lower socioeconomic background.[25,26] The better levels in this particular socioeconomic status in the current study may be because these strata of population mostly work outdoors, useless cosmetics, have less availability of facilities in day-to-day life, and different ethnic population.

Conclusions

The present study reveals that there is a high prevalence of VDD or insufficiency in healthy population of the district irrespective of age, gender, BMI, and socioeconomic status. This initial study may give important information for public health policy making in this region.

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Conflicts of interest

There are no conflicts of interest.

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