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Original Research Article

Study of prevalence of vitamin d deficiency and its association with diabetes mellitus, hypertension, hyperlipidemia and cardiovascular diseases among the doctors of Belagavi City, India

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Abstract

Vitamin D (Vit D) deficiency has been studied among various Indian populations with conflicting results. There is a paucity of data connecting the link between Vit D deficiency among the doctors who are particularly at risk of developing and causes of increase in insulin resistance, hypertension, inflammation, and increased cardiovascular risk. Also, the association between Vit D deficiency and diabetes mellitus, hypertension, hyperlipidemia, and cardiovascular diseases is unclear. Given these observations, we would like to study the prevalence of Vit D deficiency among the doctors of Belagavi city of India.

Materials and Method: It was a cross-sectional study. The study was conducted by the department of General Medicine, Belagavi Institute of Medical Sciences Belagavi, during the period from April 2016 to March 2017. All the doctors residing in Belagavi city were included in the present study after meeting appropriate exclusion criteria. The detailed history, risk factors, and laboratory finding was noted. The informed consent was taken from each participant before inclusion in the study.

Results: 100 doctors aged between 40 to 70 years were studied. The male-to-female ratio was 62:38. Predominantly males were in the age range of 41-50 years of age. The mean age for men was 51 years with SD 6.36 years and for women were 49 years with SD 6.07 years. Cardiovascular risk factors such as diabetes was seen in 58%, hypertension in 63%, and hyperlipidemia seen in 33%.

Conclusion: The prevalence of vitamin D deficiency observed in our study was 40%. There was a significant association between diabetes mellitus and hypertension in vitamin D deficiency compared with vit D sufficiency individuals. Vitamin d deficiency is commonly seen in all age groups, therefore, strategies such as increasing awareness, and educating the masses about adequate exposure to sunlight. The need for dietary rich in vitamin D sources and fortification of foods with Vitamin D.

Keywords: Cardiovascular diseases, vitamin D, risk factors, hyperlipidemia

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Introduction

India is one of the most religiously, ethnically, traditionally, culturally and lingually diversified country. It is a subtropical country extending from 8.4ºN (Degree Northern) latitude to 37.6° N. Majority of the Indian population lives in subtropical areas and receives ample amount of sunlight throughout the year hence there was a false belief that Vitamin D (Vit D) deficiency is very rare in India. However, the available data from literature, Vit D deficiency is very common in India in all age groups and both sexes across the whole country. The prevalence of Vit D deficiency with low dietary calcium intake in the Indian population is varying from (50- 90%) according to various studies published earlier [1].

Apart from low dietary intake, people who suffering from hepatic, renal, dermatological disorders, alcoholics, and inflammatory rheumatologic conditions have Vit D deficiency. Vit D deficiency is a common problem in India due to several factors like change in food habits contribute to low dietary calcium and Vit D intake. A high fiber diet contains phosphates and phytates which can deplete Vit D stores and increase calcium requirement [2]. Genetic factors like having increased 25(OH) D-24-hydroxylase which degrades 25(OH) D to inactive metabolites [3]. It has been shown that an increment in serum 25(OH) D in response to treatment depends on the heritable property of Vit D binding protein [4]. With modernization, people spend their maximum time indoors and thereby preventing adequate exposure to sunlight. This is often seen in the urban Indians. Increased pollution can hamper the ultraviolet rays from adequately synthesizing Vit D in the skin [5]. Cultural and traditional habits prevalent in certain religions like “Burqa” and the “pardah” system in Muslims have been well known. Repeated and unplanned, unspaced pregnancies in dietary deficient patients can aggravate Vit D deficiency in the mother and the fetus.

Vitamin D has been tagged as a very important triggering factor for cardiovascular disease (CVD). Vitamin D affects vascular smooth muscle cell proliferation, inflammation, vascular calcification, Renin-Angiotensin Aldosterone System (RAAS), and blood pressure all of which can lead to CVD. Low vitamin D level causes an increase in insulin resistance, hypertension, inflammation, and increased cardiovascular risk. Although 1, 25 dihydroxy vitamin D is the biologically active form of vitamin D, serum 25(OH) D is regarded as the best indicator of vitamin D status in individuals without kidney disease [6].

Vitamin D deficiency has been studied among various Indian populations with conflicting results. There is a paucity of data about Vit D deficiency among the doctors who are particularly at risk of developing the Vit D deficiency concerning the causes mentioned above. Also, the association between vitamin D deficiency and diabetes mellitus, hypertension, hyperlipidemia, and cardiovascular diseases is unclear. In view of these observations, we would like to study the prevalence of Vit D deficiency and its association with the above-mentioned diseases among the doctors of Belagavi district, India.

Aims & Objectives

To study the prevalence of vitamin D deficiency and associated disorders i.e. diabetes mellitus, hypertension, hyperlipidemia, and cardiovascular disease among doctors in Belagavi city.

Materials and Methods

It was a cross-sectional study conducted by the department of General Medicine, Belagavi Institute of Medical Sciences Belagavi, during the period from April 2016 to March 2017. All the doctors residing in Belagavi city were included in the present study after meeting appropriate exclusion criteria. The informed consent was taken from each participant before

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inclusion in the study. The approval from the Institutional Ethical committee had taken, BIMS IEC/51/2015-16 dated 24-05-2016. All the procedures were followed under the Helsinki declaration 1975 which was revised in 2013.
Doctors aged between 40 to 70 years practicing in the Belagavi city were included in the study. Doctors with advanced renal failure, Vitamin D/calcium supplementation, Pregnancy, and corticosteroid therapy were excluded. A total of 100 doctors practicing in the Belagavi city satisfying the inclusion and exclusion criteria were included in the study. From all the participants, full clinical history was obtained, and underwent physical examination, systemic examination, blood pressure measurement, electrocardiography and echocardiography. 5 ml of fasting blood sample and 5 ml of random blood samples were drawn from one of the peripheral veins taking all the aseptic precautions. The serum sample was separated and stored at -20 ^{o}C till the following investigations were carried out. Fasting blood glucose, postprandial blood glucose, fasting lipid profile (total cholesterol, triglycerides, HDL, LDL, VLDL), Serum urea, Serum creatinine, Vitamin D, Electrocardiogram (ECG), Echocardiography.

Statistics

Percentage, mean and SD and Chi square test were used in statistical analysis using SPSS version (25). $p \leq 0.05$ was considered statistically significant.
Diabetes mellitus was taken FBS >126 mg/dl, PPBS >200 mg/dl or HbA1c >6.5%. Hypertension was taken the systolic BP >140 mmHg and diastolic BP ≥90 mmHg while hyperlipidemia was taken as TG >150 mg/dl, HDL <35 mg/dl, and LDL >100 mg/dl.
Diagnostic cut-offs of levels of serum Vitamin D are deficiency < 20 ng/dl, insufficiency 21-29 ng/dl, sufficiency 30-149 ng/dl, toxicity > 150 ng/dl.

Results

Table 1: Age and Sex distribution in the study population

Age in years	Male (%)	Female (%)	Total
41-50	32(56)	25(44)	57
51-60	27(68)	13(32)	40
>60	03(100)	00(00)	03
	62	38	100

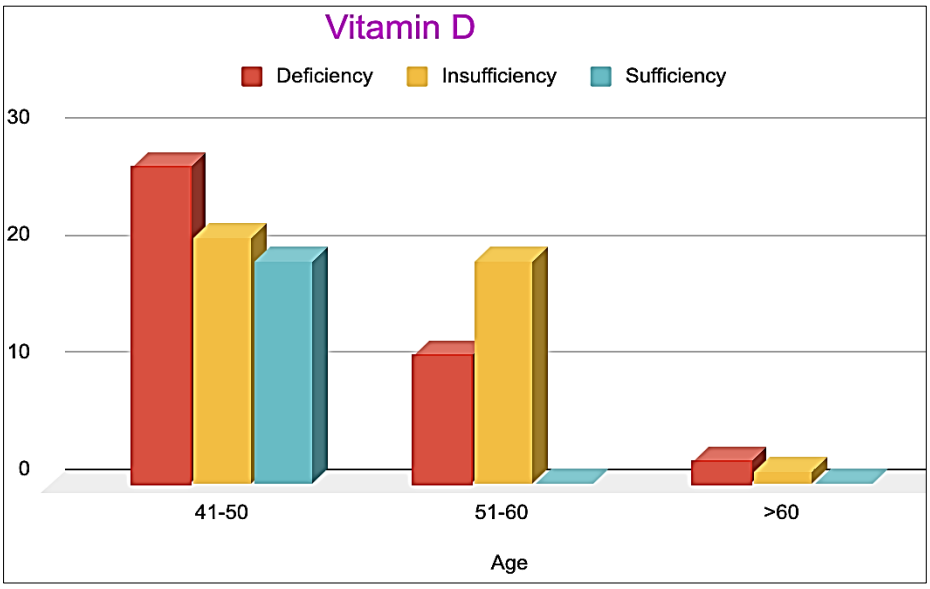

Fig 1: Vitamin D level in age wise distribution

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Table 2: Vitamin D level in diabetes mellitus

Diabetes Mellitus	Vitamin D level			
	Deficiency (%)	Insufficiency (%)	Sufficiency (%)	Total
Yes	30(52)	14(24)	14(24)	58
No	11(26)	26(62)	05(12)	42
	41	40	19	100

P=0.0007178 (Significant)

Table 3: Vitamin D level in hypertension

Hypertension	Vitamin D level			
	Deficiency	Insufficiency	Sufficiency	Total
Yes	23	32	08	63
No	18	08	11	37
	41	40	19	100

P=0.0005720 (Significant)

Table 4: Vitamin D level in Hyperlipidemia

Hyperlipidemia	Vitamin D level			
	Deficiency	Insufficiency	Sufficiency	Total
Yes	14	12	07	33
No	27	28	12	67
	41	40	19	100

P=0.8547

100 doctors aged between 40 to 70 years were studied. The male-to-female ratio was 62:38. Predominantly males were in the age range of 41-50 years of age. The mean age for men was 51 years with SD 6.36 years and for women were 49 years with SD 6.07 years. Cardiovascular risk factors diabetes were seen in 58%, hypertension in 63%, hyperlipidemia seen in 33% and Coronary artery disease in 2%. The prevalence of vitamin d deficiency was seen in 40%, it was more in the age group 41-50 years. Vitamin D insufficiency was 41%.Vitamin D sufficiency was observed in 19% individuals. Among 58 diabetic individuals, vitamin D deficiency were 52%, Vitamin D insufficiency were 24% and Vitamin D sufficiency were 24%. There was a statistically significant association between diabetes mellitus and hypertension in vitamin D deficiency compared with vit D sufficient individuals.

Discussion

The main objective of our study was to find Vitamin D levels in all participants and to evaluate Vitamin D, and CVD risk factors like diabetes mellitus, hypertension, hyperlipidemia, and Obesity. In our study the mean age for men was 51 years with SD 6.36 years and for women were 49 years with SD 6.07 years. The conclusions of our study were in coherence with the results of other studies, stating of CVD increases with aging, i.e., in men >55 years and women >45 years of age [7]. Age is an independent risk factor in the pathogenesis of atherosclerosis. Thus, the incidence of CVD in men increases with age between the ages of 40-60 years.

The deficiency of Vitamin D is seen in persons with CVD. These persons are being less healthy and less active in outdoor activities prefer to stay indoors and unlikely to go outdoor and are less exposed to sunlight which may be mediated by a biological mechanism, whereby low Vitamin D causes an increased risk of CVD events. Norman and Powell described several mechanisms by which Vitamin D may be associated with atherosclerosis and CVD events [8, 9].

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A study by Anderson *et al*. also provided evidence from participants that there is a strong association between Vitamin D and CVD risk may be mediated by parathyroid hormone (PTH). Although PTH level may be one mechanism through which low Vitamin D concentration leads to increased CVD risk through increased vascular remodeling, there are many other pathways such as RAAS, the elevation of BP, adverse glucose metabolic profile, increased inflammation, and increased atherogenesis [10].

In our study hypertension is more prevalent in vitamin D deficiency/insufficiency (87%) individuals than vitamin D sufficiency (13%) hypertensive individuals. In the Framingham Off spring study, the rate of major CVD events was 53%-80% higher among those with low Vitamin D levels, with increased risk magnified among those with hypertension [11]. However, this study suggested a slightly increased risk at higher Vitamin D levels. Several studies have examined the relationship between vitamin D status and incident hypertension. Men and Women participating in the Health Professionals Follow-up Study and the Nurses' Health Study with vitamin D deficiency had 3- to 6 fold increased risk of developing incident hypertension during a 4-year follow-up period compared with subjects with optimal vitamin D status. Similar protection with having optimal vitamin D status and the development of incident hypertension was seen in the Nurses' Health Study II, a group of younger female subjects [12].

In clinical studies, vitamin D deficiency has been shown to cause impairment of insulin secretion and an increase in insulin resistance among patients with T2DM. Furthermore, when the concentration of serum 25-hydroxy vitamin D levels increased from 12.5 to 30 ng/ml, insulin secretion was shown to increase by almost 60% in patients with T2DM [13]. In our study among 58 diabetic individuals, vitamin D deficiency were 52%, Vitamin D insufficiency were 24% and Vitamin D sufficiency 24%. Anita Subramanian *et al*. study the results for concentration of serum 25(OH) D3 were significantly lower for the diabetes mellitus than non-diabetic (11.0 ± 7.5 vs 15.5 ± 9.8, $p = 0.00$). Severe vitamin D deficiency (%) was significantly more prevalent among the T2DM patients than the non-diabetic patients (57.6 vs 33.3, $p = 0.001$). Vitamin D deficiency and insufficiency (%) was more prevalent among non-diabetic patients than T2DM patients (44.4 vs 28.6 and 14.4 vs 11.9, respectively) [14].

In an analysis of 27,000 patients from the Intermountain Healthcare System, the prevalence of Vitamin D deficiency was 60%, and this deficiency was associated with highly significant increases in the prevalence of type 2 diabetes mellitus, hypertension, and dyslipidemia. Moreover, Vitamin D deficiency was highly associated with myocardial infarction, heart failure, and stroke, as well as total mortality [15, 16].

Conclusion

The prevalence of vitamin D deficiency observed in our study was 40%. There was a significant association between diabetes mellitus and hypertension in vitamin D deficiency compared with vit. D sufficiency individuals. We didn't find any association between vitamin D deficiency and hyperlipidaemia. The limitation in our study is comparably small population group, data regarding parathyroid hormone is not available, genetic study is not included to study relationship between vitamin D receptor polymorphism and a combination of genotypes associated with risk of developing diabetes mellitus. As there was less studies conducted in this topic, we could not compare all the result variables from our study. There is need for more elaborative research work towards this. Conflict of interest was Nil. Vitamin d deficiency is commonly seen in all age groups, therefore, strategies such as increasing awareness, and educating the masses about adequate exposure to sunlight. The need for dietary rich in vitamin D sources and fortification of foods with Vitamin D which are consumed by the majority of the Indian population irrespective of socioeconomic status can

be adopted and implemented for the prevention and control of VDD throughout the nation.

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