ORIGINAL RESEARCH PAPER

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"ASSOCIATION BETWEEN VITAMIN D STATUS AND CORONARY HEART DISEASE AMONG ADULTS IN CHHATTISGARH: A CASE-CONTROL STUDY"

KEY WORDS: Obesity, Cardiovascular disease and Vitamin D deficiency.

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ABSTRACT

Cardiovascular disease(CVD) is consists of variety of heart disease, illnesses and events that impact the heart & circulatory system, including high blood pressure & coronary artery disease." Our aim was to the Association between Vitamin D Status and Coronary Heart Disease among Adults in Chhattisgarh. There was a statistically highly significant difference in mean vitamin D levels between the control and the case groups. The mean vitamin D level in the case group being very low as compared to the control group patients. We observed a stepwise increase in risk of ischemic heart disease, myocardial infarction, and early death with stepwise decreasing levels of plasma 25-hydroxyvitamin D.

Introduction:

Cardiovascular disease(CVD) is consists of variety of heart disease, illnesses and events that impact the heart & circulatory system, including high blood pressure & coronary artery disease." (CAD) According to the World Health Organization (WHO), almost 23.6 million deaths will be attributed to cardiovascular diseases (CVD), mainly stroke and heart diseases by the year 2030. CVDs include coronary heart disease (CHD), cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart diseases, deep vein thrombosis and pulmonary embolism. (WHO, 2011).[1] In USA, Cardio Vascular disease including heart attack & stroke remains the nation no.1 killer of men & women causing more than 36% of all deaths {American heart association heart disease & stroke statistics 2008].[2] Every year about 1.5 million Americans suffer a heart attack. An estimated 73 million adult Americans having high blood pressure. An estimated 16 million adult American having CAD, CVD was the largest cause of the death in males (20.3%) as well as females (16.9%) & led to about 2 million deaths annually.

Vitamin D has long been known to be an essential part of bone metabolism, although recent evidence suggests that vitamin D plays a key role in the pathophysiology of other diseases, including CVD. The vitamin D receptor (VDR) is ubiquitously expressed in almost all body cells, such as immune, vascular or myocardial cells, suggests an involvement of vitamin D-mediated effects in several other systems apart from musculoskeletal tissues.[3] This has led to extensive research on vitamin D as a potential influencing factor in the pathogenesis of cardiovascular diseases (CVD).[4–6] Therefore, the present study was designed to examine the Association between Vitamin D Status and Coronary Heart Disease among Adults in Chhattisgarh.

Material and Methods:

This present case control study was conducted in department of Biochemistry, Sri Aurobindo Medical College & P.G. Institute. With the help of Cardiology department during period April 2013s to October 2014. The study was approved by institutional ethics committee for research work. The study population consists of 100 subjects out of which 50 subjects were case (CAD patients) and 50 subjects were control (normal, healthy subjects). All subject of study population, selected for present study had attended and admitted to SAIMS hospital & research centre. Study group consists of subjects having age >20 years. The diagnosis of CAD patients was done by Cardiology department based on ECG, ECHO, CAG and serum TROP I findings.

INCLUSION CRITERIA

- Presence of CAD proven by electrocardiography, echocardiography or angiography
- Age more than 20 years of both genders.

EXCLUSION CRITERIA

- Patients who are taking vitamin D supplementation or replacement therapy.
- Endocrine disorder like hypoparathyrodism etc.).
- Renal rickets.
- Known CKD stage 5th/ 6th.
- Significant chronic Liver disease.
- Malabsorbtion.

After taking verbal/written consent from the subjects, venous blood was collected in Vacutainer, allowed to clot and then immediately sent to the biochemistry lab. Where the samples will be centrifuged at 4000rpm× for 10 minutes, then serum will be separated and analyzed for the following tests:

1. Serum vitamin D level measure by ELFA TECHNIQUE{ENZYME LINKED FLUORESCENT ASSAY METHOD, by VIDAS, full automatic analyser
2. Serum troponin I by IMMUNOCHROMATOGRAPHIC METHOD

Results and Discussion:

This present study was conducted in the department of Biochemistry, Sri Aurobindo Medical College & P.G. Institute. With the help of Cardiology department. Table:1 shows the age wise distribution of patients. In the control group 8 (16%) patients were in the age group 21-30 years, 11 (22%) were in the age group 31-40 years, 13 (26%) were in the age group 41-50 years, 7 (14%) were in the age group 51-60 years and 11 (22%) were more than 60 years of age.

Table No. 1 Distribution of Patients According to Age Group

N=100)

Age Group	Control Group (N=50)		Case Group (N=50)	
	No.	%	No.	%
21-30 years	8	16.00	0	0.00
31-40 years	11	22.00	2	4.00
41-50 years	13	26.00	21	42.00
51-60 years	7	14.00	18	36.00
> 60 years	11	22.00	9	18.00
Total	50	100.00	50	100.00

Similarly, in the case group, 2 (4%) were in the age group 31-40 years, 21 (42%) were in the age group 41-50 years, 18 (36%) were in the age group 51-60 years, 9 (18%) were in the age group more than 60 years. Thus in the control maximum number of patients were in the age group more than 40 years and similarly the same trend was seen in the case group too.

Table No. 2 Distribution of Patients According to Positive Findings of ECG, ECHO and Troponin-I

(N=100)

Positive Findings	Control Group (N=50)		Case Group (N=50)	
	No.	%	No.	%
ECG	-	-	44	88.00
ECHO	-	-	41	82.00

Troponin-I	-	-	28	56.00

Table:2 shows the positive findings on ECG, ECHO and Troponin-I in the case group patients. Positive findings on ECG was seen in 44 (88%) patients, positive findings on ECHO were seen in 41 (82%) of the patients and raised Troponin-I was seen in 28 (56%) of the patients (cases)

Table No. 3 Mean Vitamin D levels in Both the Groups

(N=100)

Vitamin D Levels	Control Group (N=50)	Case Group (N=50)	Z value
	(mean ± SD)	(mean ± SD)	
Vitamin D (mean ± SD)	36.94 ± 18.34	20.36 ± 12.29	5.31, p value = 0.000, H. Sig.

Z-Value = 5.31 P-Value = 0.000 Highly significant

Table:3 shows the mean Vitamin D levels in both the control as well as the case group patients. The mean vitamin D level in the control group was 36.94 ± 18.34, while in the case group it was 20.36 ± 12.29. The Z value for computing the statistical difference between the groups was 5.31 with a P value of 0.000, which is highly statistically significant. Thus, we see that the there was a statistically highly significant difference in mean vitamin D levels between the control and the case groups. The mean vitamin D level in the case group being very low as compared to the control group patients.

Coronary artery disease is a narrowing or blockage of the arteries and vessels that provide oxygen and nutrients to the heart.It is caused by atherosclerosis, an accumulation of fatty materials on the inner linings of arteries. The resulting blockage restricts blood flow to the heart. When the blood flow is completely cut off, the result is a Myocardial infarction (heart attack).

The findings of the present study revealed that the subjects with vitamin D deficiency, when defined as serum 25(OH)D < 20 ng/mL, were 6.5 times more likely to suffer from CHD than the subjects with adequate vitamin D status (serum 25(OH)D _ 20 ng/mL). Several studies conducted in developed countries have also demonstrated similar results[7,8]. For example, an inverse association between vitamin D deficiency and myocardial infarction (MI) was reported among adults in New Zealand[9].

In the United States, an NHANES study stated that the participants with vitamin D deficiency had a higher prevalence of angina and MI compared to that in the participants with adequate levels of vitamin D (OR: 1.20 (95% CI: 1.01, 1.36) [10]. In a Gulf country, Qatar, a study indicated that males with vitamin D deficiency had a three times higher risk of MI than males with an adequate vitamin D levels [11]. It is important to note that different studies across the globe have used different criteria for defining vitamin D deficiency, and the reason for this is that the accurate cut-off value for defining vitamin D deficiency remains controversial. There is disagreement surrounding serum PTH, which is inversely associated with low levels of vitamin D. Some studies have suggested that the production of PTH escalates when serum levels of 25(OH)D are less than 10 ng/mL, which leads to bone loss and fractures[12]. However, other studies have indicated that levels of serum 25(OH)D ranging from 18 ng/mL to 30 ng/mL lead to increased PTH levels and cause bone loss[13]. Nevertheless, regardless of the definition used to assess the association between vitamin D status and CHD, a large majority of the studies showed an inverse association similar to what was found in the present study.

The protective role of vitamin D against CHD could be explained by the wide distribution of vitamin D receptors (VDRs) in the vascular walls, which plays a crucial role in cardiac physiology[14]. Animal studies have shown a direct effect of the absence of VDRs on cardiac function. These studies, which genetically modified the animals to have no vitamin D receptors or no 1, 25 (OH)2 D, indicated that they developed left ventricular hypertrophy and heart failure[14]. The results of animal studies were corroborated by the findings observed in patients with end-stage renal disease (ESRD)[15]. Human ESRD studies provided one of the first pieces of evidence that supported the role of vitamin D deficiency in the development of CHD. Due to damage in the kidneys, ESRD patients failed to convert 25 (OH) D into 1, 25 (OH)2 D, which in turns leads to increased levels of PTH. The high level of PTH causes elevated blood pressure and cardiac contractility, which contributes to myocardial dysfunction, arterial hypertension, and heart failure[14,15,16].

In this case control study we had included patients of CAD proven by Angiography/ Echo / ECG at a tertiary care hospital,our data noted that vitamin D deficiency has been associated with CAD , vitamin D deficiency can adversely affect metabolism of myocardial tissue ,we also found cases subjects with high TG and high cholesterol levels eventhough not significant are associated with vitamin D deficiency and CAD. The mean 25(OH)D level was 20.36 ± 12.29 ng/mL. 60% of the patient population was categorized as deficient in vitamin D; an additional 32% had vitamin D insufficiency, while only 8% had normal vitamin D levels. The evaluation of vitamin D deficiency in our patient population is reflection of the generalized high prevalence rates of hypovitaminosis D in India (64-66). The high prevalence rates in our country despite its sunny climate and proximity to the equator are explained by the darker skin complexion of the population, generalized malnutrition, vegetarian food habits, inadequate sun exposure, and lack of vitamin D food fortification program.

In case control study,we had evaluated vitamin D deficiency,vitamin D insufficiency and vitamin D sufficiency and its correlation with proven CAD patients. Despite the more extensive pattern of angiographic CAD, the prevalence of risk factors like diabetes, hypertension, smoking, lipid profile, and mode of clinical presentation of CAD was not significantly different in patients with or without vitamin D deficiency.

Conclusion:

In conclusion, we observed a stepwise increase in risk of ischemic heart disease, myocardial infarction, and early death with stepwise decreasing levels of plasma 25-hydroxyvitamin D. These findings were substantiated in meta-analyses and were independent of the extent of vitamin D fortification of food.

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