



## ASSOCIATION OF VITAMIN D DEFICIENCY IN PATIENTS WITH ACUTE CORONARY SYNDROME

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### ABSTRACT

**Introduction:** Several studies have associated a link between Vitamin D deficiency and acute coronary syndrome. There is an on going controversy on this association. In this research article, we tried to find a co-relation between Vitamin D deficiency and acute coronary syndrome in Indian population. **Methods:** In this study, 200 established cases of acute coronary syndrome were taken and Vitamin D3 levels were tested in these patients from a period of January 2019 to Sep 2019. **Results:** The odds ratio of being affected by coronary artery disease in individuals with Vitamin D was 3.12(1.89-5.84) after adjustment of most of the cardiovascular risk factors i.e. hypertension, diabetes, smoking, BMI, high cholesterol when compared to the control group. **Conclusion:** Low levels of Vitamin D are associated with increased prevalence of acute coronary disease independent of other cardiovascular risk factors. Further investigations needs to be done to see whether supplementation of Vitamin D reduces the development of atherosclerosis or not.

### INTRODUCTION

Vitamin D deficiency is common in many parts of the world. There are 2 forms of Vitamin D: Ergocalciferol i.e. Vitamin D2 and Cholecalciferol i.e Vitamin D3. Ergocalciferol is obtained from herbal resources and cholecalciferol is obtained when Ultraviolet B radiation reacts with skin. The two most common sources of vitamin D in humans are sunlight or dietary intake, like fish oil and nutritional supplements.<sup>[1]</sup> 1,25- dihydroxy cholecalciferol is the active form of Vitamin D but it is not used to measure the serum level of Vitamin D as it has short half-life. 25-hydroxy cholecalciferol has a longer half life and hence it used to measure serum level of Vitamin D3.

Vitamin D level higher than 30ng/dl is considered desirable level. A level between 20-30ng/dl is considered insufficient levels and <20ng/dl is considered to be a low level of Vitamin D. Most body cells have Vitamin D receptors. The important ones amongst these receptors are the ones located in cardiomyocytes, vascular smooth muscles and endothelium of blood vessels.<sup>[2,3,4]</sup> Many studies have concluded that there is a strong association between Vitamin D deficiency and cardiovascular

disease, increased blood pressure, insulin resistance, myocardial infarction and CV stroke.<sup>[5,6,7,8]</sup> One study also found an inverse co-relation between sunshine hours in winters and ischemic heart disease due to vitamin D deficiency.<sup>[9,10]</sup>

The exact mechanism which shows the protective effects of Vitamin D in cardiovascular diseases is not fully understood but several mechanisms have been proposed. Few of the theories are effects of Vitamin D on renin-angiotensin system, vessel compliance, blood pressure, parathyroid hormone level and glycemic control. Vitamin D is also believed to have anti-inflammatory effects. It prevents cholesterol plaque formation and cholesterol removal by macrophage and foam cell activation.

In the modern world, the prevalence of cardiovascular diseases has increased. Many studies have showed deficiency of Vitamin D in Indian population. Considering that there is a high prevalence of Vitamin D deficiency in India and the increased incidence of cardiovascular diseases, it is essential to find a potential co-relation between the two.

## MATERIALS AND METHODS

This is a cross-sectional study. The inclusion criteria included all patients above the age of 40 with clinical and angiography diagnosed angina pectoris and myocardial infarction. The control group was matched for age and sex friends and family who did not have angina pectoris on clinical examination. The exclusion criteria was patients who had chronic liver or renal diseases.

Variables like age, sex, use of anti-hypertensives and anti-diabetics were gathered. Blood pressures and random blood sugar levels were tested in all the participants. For blood sampling, blood samples were

drawn from patient after 8hrs of fasting. Vitamin 25 hydroxycholecalciferol levels were measured. The cut off for Vitamin D was considered as Vitamin D level <30ng/dl. Diabetes was defined in patients with a known case of diabetes or FBS>126 and PP2bs>180. Hypertension was defined as patients with a known case of hypertension or systolic blood pressure of >140mmHg. Hypercholesterolemia was defined as blood cholesterol level of >240mg/dl or known case of dyslipidemia and consumption of anti-hyperlipidemic drugs. Statistical tests used were Chi-square, independent t test and log regression. The gathered information was analysed by SPSS software.

## RESULTS

The baseline characteristics of the population is showed in the table below.

**Table 1: Baseline characteristics of the population.**

VARIABLES	PATIENT	CONTROL	P value
SEX			
MALE	134	136	0.65
FEMALE	66	64	
AGE			
40-49	28	30	0.36
50-59	64	68	
60-69	68	60	
OVER 70	36	42	
BMI			
<30	138	163	0.04
>30	62	37	
HYPERTENSION	74	78	0.067
DIABETES	56	32	0.032
SMOKING	86	54	0.021
HIGH CHOLESTEROL	114	72	0.024
VITAMIN D <30ng/dl	86(43%)	58(29%)	0.002

In the study population, there were 134 males and 66 females while in the control group, there were 136 males and 64 females. 28 participants were in the age group of 40-49 in study population and 30 in the control group. 64 participants were in the age group of 50-59 in study population and 68 in the control group. 68 participants were in the age group of 60-69 in study population and 60 in the control group. 36 participants were in the age group of >70 in study population and 42 in the control group. 138 participants in the study group had BMI<30 while 163 patients in the control group had BMI <30. 62

patients in the study group had BMI>30 and 37 patients in the control group had BMI>30. 74 participants in the study group were hypertensives and 78 participants in the control group were hypertensives. 56 participants in the study group and 32 participants in the control group had diabetes. Smoking was prevalent in 86 participants in the study group and 54 participants in the control group. 114 patients in the study group had high cholesterol and 72 participants in the control group had high cholesterol.

**Table 2: ODDS ratio (95% confidence interval) of coronary artery disease if Vitamin D deficient.**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Low Vitamin D3	3.59	3.41	3.22	3.14	3.48	3.87	3.12
P Value	0.002	0.003	0.001	0.003	0.001	0.002	0.005

(MODEL 1: without adjustments; MODEL 2: adjustments for hypertension; MODEL 3: Adjustment for diabetes; MODEL 4: Adjustment for smoking; MODEL 5: Adjustment for BMI; MODEL 6: Adjustment for high cholesterol; MODEL 7: Adjustment for all the risk factors)

In the above table, the odds ratio coronary artery disease in individuals with Vitamin D deficiency has been shown. There is a 3.59 chance of developing coronary artery disease in individuals with Vitamin D deficiency

without any adjustments. After adjustments for risk factors like hypertension, diabetes, smoking, BMI, high cholesterol the odds ratio of developing coronary artery disease in individuals with low vitamin D is 3.12.

**DISCUSSION**

In this study, we were able to show that deficiency of Vitamin D is significantly associated with increase in the risk for coronary artery disease. This is significant even after adjustment for cardiovascular risk factors like diabetes, smoking, hypertension and dyslipidemia.

Vitamin D has many physiological roles apart from calcium metabolism. Vitamin D receptors are present in skeletal muscles, brain, pancreas, blood vessels and immunity cells like T cells and B cells. The production of 1,25 dihydroxy cholecalciferol depends on the serum levels of 25 hydroxy Vitamin D and 1 alpha-hydroxylase enzyme. This acts by binding to the intranuclear receptors in the tissue in form of autocrine and paracrine causing renin-angiotensin system inhibition. This can in turn induce or inhibit cell apoptosis and proliferation and development of cells. Hence, Vitamin D deficiency can be considered to be linked to many cardiovascular diseases, malignancies and immune system dysfunction.<sup>[11]</sup>

A research in the Europe showed that those with serum levels of 25 hydroxy Vitamin D in the lowest quartile in patients who underwent coronary angiography had highest mortality rate after adjustment for all the risk factors.<sup>[1]</sup>

There are studies that show that low levels of Vitamin D are associated with increase in abdominal obesity, elevated blood pressure, high fasting sugars and metabolic syndrome.<sup>[12]</sup> This is more common in adolescents. Studies have also showed that low levels of Vitamin D are associated with risk factors of cardiovascular diseases like hypertension, hypercholesteremia, obesity and diabetes mellitus.<sup>[12,13,14]</sup> This study shows that Vitamin D status is more correlated to the unhealthy lifestyle in individuals but in our study, we were able to prove that Vitamin D deficiency increases chances of cardiovascular diseases even after adjustment for risk factors.

**CONCLUSION**

Low levels of Vitamin D are associated with increased prevalence of acute coronary disease independent of other cardiovascular risk factors. Further investigations needs to be done to see whether supplementation of Vitamin D reduces the development of atherosclerosis or not.

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