Original Article

VITAMIN D AND MYOCARDIAL INFARCTION…IS THE LINK REAL?

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ABSTRACT

Background: Vitamin D has assumed even more importance in recent years because of its diversity of actions. One of the most recently discovered effects of vitamin D is on the vascular system, through which it can produce an impact on cardiovascular health. Multiple studies have been done in this regard, but it still requires further exploration. The objective of our study was to explore any existing association of vitamin D deficiency with myocardial infarction (MI) and to make a comparison of levels of vitamin D in patients with recent MI and healthy individuals.

Material and Methods: A comparative cross-sectional study was carried out in the Cardiology Department of Shaikh Zayed Hospital and Punjab Institute of Cardiology. The study measured serum Vitamin D levels in 64 participants belonging to two categories: patients with recent myocardial infarction and healthy controls. Serum vitamin D levels in both groups were compared.

Results: showed Serum Vitamin D was sub-optimal in all study participants, including myocardial infarction patients and the healthy controls. A clear association between vitamin D deficiency and myocardial infarction could not be seen. Mean±SD Vitamin D levels were 18±7.8ng/L in myocardial infarction patients and 19.1±9.3ng/L in healthy individuals. This study did not establish an association between myocardial infarction and vitamin D levels.

Conclusion: Our study failed to show a link between Vitamin D and myocardial infarction. Further exploration is needed in this regard.

Key Words: Vitamin D, Myocardial Infarction, Hypertension

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INTRODUCTION

Vitamin D is a versatile hormone that was first identified and named for its role in calcium metabolism in 1922.[1] Since then, innumerable skeletal and extra-skeletal effects of this hormone have been identified, and its deficiency has been associated with a potential risk for many ill conditions like increased risk of hypertension and other cardiovascular diseases, increased incidence of cancers, migraine, musculoskeletal pain, headache, autoimmune diseases, asthma, atopic dermatitis, neuropsychiatric conditions like dementia, depression or even schizophrenia.[1, 2]

Many cells in the human body possess vitamin D receptors (VDR), which are responsible not only for gene modulation and proliferation but also regulation of gene expression, immune function, and inflammation.[3] Studies indicate that vitamin D influences the expression of almost 3% of the human genome through vitamin D receptors. Vitamin D, directly or indirectly, affects cellular functions like cell growth, apoptosis, DNA repair, differentiation and metabolism of cells, transport across the cellular membrane, and oxidative stress.[4]

Besides other effects, vitamin D is also thought to affect lipid metabolism, thrombogenicity, fibrinolysis and

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regeneration and growth of smooth muscle cells and endothelial cells.[4,5] Vitamin D deficiency can be associated with an increased risk of atherosclerosis, cardiovascular diseases, and even post-acute coronary syndrome complications.[5] The mechanism underlying these involves the anti-thrombotic and anti-inflammatory effects of vitamin D. As a result, vitamin D deficiency has been found to promote chronic inflammation, atherosclerosis, arterial calcification, and endothelial dysfunction.[6] Another important mechanism linking vitamin D deficiency with the risk of cardiovascular diseases is the up-regulation of the renin-angiotensin system, thereby leading to increased extracellular fluid volume. It also causes an increase in the level of metalloproteinases which is a marker of myocardial remodeling.[3,5] Therefore, the dynamic effects of vitamin D cannot be denied. Despite all these observations, an association between vitamin D deficiency and myocardial infarction could not be established, and evidence of the beneficial effect of vitamin D supplementation in the treatment of cardiovascular disorders is still lacking.[1,3]

The deficiency of vitamin D is a global health problem. Studies indicate that vitamin D deficiency is around 40%, even in Europe.[6] Moreover, almost 13% are severely deficient there. This, combined with the multi-system effects of vitamin D, necessitates further studies to link its deficiency with possible health hazards.

This study aims to identify vitamin D levels in patients with myocardial infarction so that a possible association can be established between the two, and thereby, supplementation can be instituted to improve cardiovascular outcomes.

MATERIAL AND METHODS

This cross-sectional comparative study was carried out at Punjab Institute of Cardiology, Cardiology Department, Shaikh Zayed Hospital, and Physiology Department of Shaikh Zayed Postgraduate Medical Institute, Lahore, after seeking permission from concerned authorities. The study population was divided into two groups. One group (group A) included diagnosed patients with myocardial infarction above 40 years of age, and another (group B) included age and gender-matched healthy controls. However, patients with renal disorders or those on vitamin D supplementation were excluded from the study.

A sample population of 32 myocardial infarction patients and 32 healthy control subjects were used to compare their vitamin D levels. Sampling was done based on a convenient, non-probability technique, and blood samples were taken from patients visiting the outpatient department after detailed history and examination. Informed consent was also taken from participants of the study. They were later informed of their serum vitamin D levels via mail. The study was completed in six months.

Estimating vitamin D levels was done using the ELISA technique after centrifuging and separating serum.

RESULTS

The study was conducted on 64 participants. Of these, 32 participants were myocardial infarction patients, and 32 were healthy controls. Results were analyzed using SPSS (version 20). Data for serum vitamin D levels were expressed in terms of Mean $\pm$ SD for both groups.

Among the two groups, variables were compared using a t-test. The deficiency of vitamin D was expressed in terms of percentage and frequency. Vitamin D levels were categorized for comparison with the help of a chi-square test.

The mean age for myocardial infarction patients and controls was 54.8±6.9 and 51.5±7.8 years, respectively. No significant difference was seen in gender distribution between the groups (p-value 0.174).

As shown in figure-1, body mass index ranged from a minimum of 22.7 to a maximum of 33.5 in the myocardial infarction group, which is quite comparable to BMI ranging from 19 to 33.5 in the healthy

control group. This difference was insignificant, with a p-value of 0.079.

A history of cardiovascular diseases in the family was seen for 8(26.7%) of healthy participants and 16(53.3%) cases of myocardial infarction patients.

As shown in figure-2, the mean vitamin D level was 18±7.8ng/ml in the myocardial infarction group and 19.1±9.3ng/ml in the control group. Therefore, no significant difference was found between the two groups, with a p-value of 0.997. For further analysis, vitamin D levels were divided into three categories, i.e., <15, 15-25, and ≥25, and a comparison was made using the chi-square test, as shown in Table 1. There were 13(43.3%) myocardial infarction patients with deficient vitamin D levels and the same number, 13(43.3%) of healthy participants, showed deficient levels. In short, no difference in vitamin D status was evident between the two groups, with a p-value of 0.997.

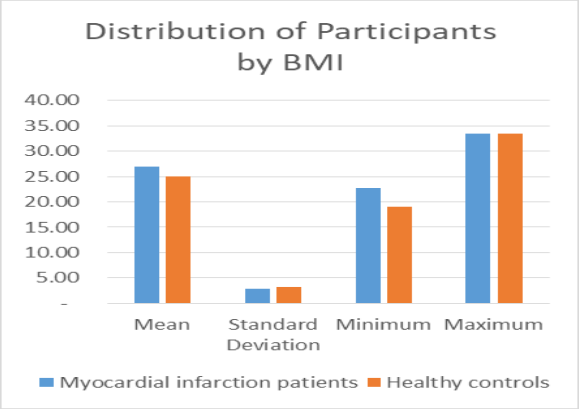

Figure-1: Comparison of groups participants according to BMI

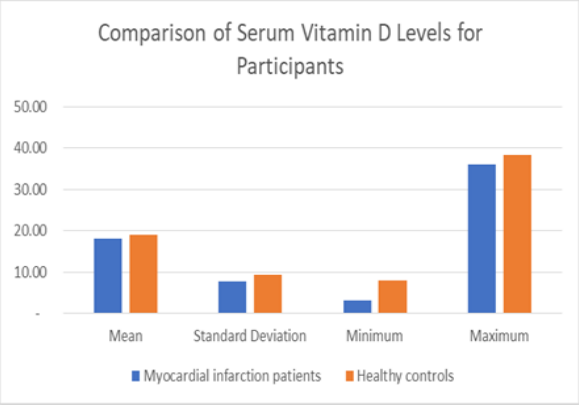

Figure-2: Showing comparison of Serum Vitamin D levels in two group

Table-1: Showing comparison of categorized vitamin D levels using the Chi-square test

	Serum Vitamin D Levels (ng/ml)			Total
	< 15 n (%)	15 - 25 n (%)	> 25 n (%)	
Group A	13 (43.3%)	11 (36.7%)	6 (20.0%)	30 (100%)
Group B	13 (43.3%)	12 (40.0%)	5 (16.7%)	30 (100%)

DISCUSSION

This study aimed to explore the physiological effects of vitamin D. A comparison of serum 25(OH)D levels was made between age and gender matched two groups, one of which included myocardial infarction patients and the other one consisted of healthy control subjects. Serum vitamin D levels were found to be comparably low in both myocardial infarction patients and healthy controls. In this study, the mean vitamin D level was measured to be 18±7.8ng/ml in myocardial infarction patients and 19.1±9.3ng/ml in healthy controls.

According to numerous studies, the optimal serum vitamin D level is more than 30 ng/ml. Adequate exposure to sunlight is very helpful for the dermal synthesis of vitamin D, but the presence of melanin in dark-skinned individuals necessitates more exposure for synthesis. That's why Asians of the Indo-Pak subcontinent need three times more exposure than Caucasians.[1,2] Worldwide, about 1 billion people suffer from vitamin D deficiency, while 50% of the global population is deficient in vitamin D.[3]

Different studies reveal variable data regarding the role of vitamin D in the development of coronary artery diseases. Some studies have attributed vitamin D receptor gene polymorphism, particularly the lack of Fok1, BsmI, and Taq1, as a risk factor for coronary artery disease. In contrast, others consider the role of Fok1 controversial in this regard.[4,5] Nevertheless, multiple mechanisms are responsible for linking vitamin D deficiency with coronary artery disease like its effect on the renin-angiotensin system, vascular compliance, hypertension,

parathyroid hormone regulation and glycemic control.[6,7]

One study conducted in 2018 in Iraq by Muhammed et al. led to the finding that vitamin D deficiency was prevalent in Iraq. Still, no statistically significant difference was found in vitamin D levels between patients with acute MI and healthy controls.[7] On the contrary, a study conducted in 2017 in Italy led to the notion that vitamin D is a cardiac risk factor and its deficiency is associated with worse short-term and long-term outcomes.[8] Similarly, a study conducted in Bangladesh in 2019 confirmed that vitamin D deficiency was considerably more severe in patients of acute myocardial infarction < 40years of age than in control subjects.[9]

A review based on numerous types of research was conducted in 2021, which led to the consistent finding that vitamin D deficiency was observed in almost 75%-90% of patients hospitalized with acute myocardial infarction.[10]

Another study in Egypt in 2020 concluded that primary percutaneous intervention was followed by better microvascular reperfusion in patients with normal vitamin D levels compared to those with abnormal vitamin D levels.[11] This showed that management outcome also improves with better vitamin D levels.

One study conducted in the USA in 2021 led to the finding that supplementation with vitamin D in vitamin D deficient patients with no prior history of myocardial infarction was associated with a significantly lower risk of mortality.[12] However, despite ample evidence on the importance of vitamin D as a regulator of multiple skeletal and extra-skeletal mechanisms, some studies still support that vitamin D must be considered a nutrient and not a medicine. Therefore, its supplementation is beneficial only when its deficiency has been established. Only then can its use as a supplement be justified, thereby causing a financial burden on society. In this regard, a consensus on the cutoff of deficiency also needs to be made, which can be followed universally.[13]

This study could not reveal an inverse association between serum vitamin D levels and myocardial infarction. However, a lot of ambiguous data on this topic needs further exploration.

CONCLUSION

This study led to the following conclusions:

Generally, our population is deficient/insufficient in vitamin D. Since serum vitamin D level is equally low in patients with myocardial infarction and healthy controls in this study, an association between cardiovascular diseases and vitamin D levels could not be established. Further large-scale studies are needed to explore the effects of vitamin D deficiency.

LIMITATIONS

Our study had a few limitations:

- The sample size was not large enough to give more accurate results.
- Ideally, all known risk factors for cardiovascular diseases must be excluded from the study to carry out a more reliable study. Our study did not remove this limitation.

AUTHOR'S CONTRIBUTION

QM: Conducted and presented the research. Also finalized the manuscript
MR: Designed the questionnaires and helped in the conduction of research
SK: Prepared the initial draft of the manuscript
TK: Helped in the conduction of research
SS: Helped in the conduction of research
QW: Reviewed the manuscript and improved it

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