OPEN ACCESS

Greenfort International Journal of Applied Medical Science
Abbreviated Key Title: Grn Int J Apl Med Sci
ISSN 3048-6904(P) | ISSN 2584-2420(O)
Journal homepage: https://gijams.in

Research Article DOI: 10.62046/gijams.2026.v04i04.017

Vitamin D Status in AMI Patients: Correlation with Cardiovascular Risk Factors

Dr. Deva Pragna Prashanthi M.D.[1], Dr. Patti Anusha rani M.D.[2], Dr. Shivakrishna Gouroju Ph.D.[1*], Revupalli Suneetha[3]

[1]Assistant Professor, Department of Biochemistry, Government Medical College, Nalgonda, Telangana, India
[2]Assistant Professor, Department of Biochemistry, Government Medical College, Ramagundam, Telangana, India
[3]Chief Biochemist, Government Medical College, Nalgonda, Telangana, India

*Corresponding Author: Dr. Shivakrishna Gouroju Email: skgouroju@gmail.com

Received: 14.04.2026 | Revised: 25.05.2026 | **Accepted:**12.07.2026 | **Published:** 01.08.2026

Abstract: Acute myocardial infarction (AMI) is a leading cause of illness and death around the world. Vitamin D deficiency has been linked to the development of atherosclerosis through various mechanisms such as vascular inflammation, problems with blood vessel function, foam cell formation, and the growth of vascular smooth muscle cells (VSMCs). Therefore, this case-control study aimed to compare serum Vitamin D levels in AMI patients with and without risk factors such as hypertension (HTN), diabetes, smoking, and high cholesterol. The study included 100 subjects: 50 healthy volunteers as controls (Group 1) and 50 patients diagnosed with AMI according to WHO criteria (Group 2). Group 2 was further divided based on the presence of risk factors, and patients were categorized according to Vitamin D status as deficient (≤20 ng/mL) or insufficient/sufficient (>20 ng/mL). Data were analyzed using GraphPad Prism version 8.2.1. Mean serum Vitamin D levels were significantly lower in AMI patients (13.03 ± 8.45 ng/mL) compared to controls (35.82 ± 3.50 ng/mL). Among AMI patients, Vitamin D levels were lowest in those with diabetes (11.53 ± 6.71 ng/mL), followed by smokers (13.19 ± 8.09 ng/mL), patients with high cholesterol (13.28 ± 8.59 ng/mL), and those with hypertension (14.31 ± 9.61 ng/mL). Low serum Vitamin D levels are closely linked to AMI, especially in patients with common cardiovascular risk factors. Vitamin D deficiency may worsen atherosclerosis by promoting problems with blood vessel function, increasing VSMC growth, migration and calcification, and driving inflammatory and immune-related processes.

Keywords: Acute Myocardial Infarction, Cardiovascular Disease, Diabetes, Hypertension, Hyperlipidemia, Smoking, and Vitamin D.

Citation: Dr. Deva Pragna Prashanthi M.D. *et al*. Vitamin D Status in AMI Patients: Correlation with Cardiovascular Risk Factors. Grn Int J Apl Med Sci, 2026 Jul-Aug 4(4): 357-360.

INTRODUCTION

Cardiovascular disease continues to be the leading cause of illness and death globally, with acute myocardial infarction (AMI) being one of its most serious forms, despite progress in preventive and treatment strategies. While traditional risk factors such as hypertension, diabetes, high cholesterol, and smoking are well known in the development of AMI, researchers are increasingly focusing on emerging risk factors that could provide new opportunities for prevention and treatment. One such factor is low Vitamin D levels, which have drawn considerable attention in recent years [1]. Vitamin D is mainly recognized for its role in bone health and regulating calcium levels in the body by working with the intestine and bones. However, deficiency in Vitamin D has been linked to a higher risk of type 2 diabetes, metabolic syndrome, and cardiovascular disease (CVD), often associated with increased body fat, higher body mass index, and high cholesterol. Research has shown that Vitamin D levels are inversely related to cardiovascular risk, but the specific effects based on sex and the best amounts for supplementation still need clarification. Furthermore, the discovery of Vitamin D receptors (VDRs) in blood vessel cells and heart cells suggests that Vitamin D may play a direct role in cardiovascular health and disease [2, 3].

Vitamin D has several heart-protective effects. It reduces blood vessel constriction by lowering cyclooxygenase-1 expression and decreasing reactive oxygen species production. The active form, 1,25-dihydroxyvitamin D_3 [$1,25(OH)_2D_3$], influences macrophage activity and regulates genes linked to foam cell formation and vascular inflammation, both critical in atherosclerosis, supporting a connection between low Vitamin D levels and acute coronary events [4]. 25-Hydroxyvitamin D [25(OH)D] also decreases systemic inflammation by lowering pro-inflammatory mediators and boosting anti-inflammatory cytokine production. The kidney converts 25(OH)D to calcitriol using 1-α-hydroxylase, which suppresses renin expression and the activity of the renin–angiotensin–aldosterone system through Vitamin D receptor signaling. Calcitriol also lowers parathyroid hormone levels and indirectly decreases aldosterone and mineralocorticoid production, improving blood vessel function and lowering cardiovascular risk in Vitamin D deficiency [2]. Overall, these mechanisms indicate that taking Vitamin D could improve metabolic and cardiovascular outcomes. Despite the growing evidence, the connection between Vitamin D levels and acute myocardial infarction, especially when conventional cardiovascular risk factors are present, is not fully understood. This study aimed to assess serum Vitamin D levels in AMI patients, their association with AMI, and to compare Vitamin D levels between AMI patients with and without risk factors.

MATERIALS AND METHODS

A hospital-based case-control study was conducted in the Departments of Biochemistry and Cardiology at Osmania Medical College and Osmania General Hospital in Hyderabad, India. The Institutional Ethics Committee provided ethical clearance, and the study followed the Declaration of Helsinki. We obtained written informed consent from all participants. A total of 100 participants were chosen and split into two groups: 50 apparently healthy controls (Group 1) and 50 patients with acute myocardial infarction (AMI) (Group 2). We diagnosed acute myocardial infarction based on the criteria from the World Health Organization, which required at least two of the following three characteristics: typical ischemic chest pain, changes in the electrocardiogram, and an increase or decrease in cardiac biomarkers. We defined cardiovascular risk factors as follows: hypertension (systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg, or use of antihypertensive medication); diabetes mellitus (fasting plasma glucose ≥ 126 mg/dl or use of insulin and/or oral hypoglycemic medications); smoking (regular cigarette smoking); and hypercholesterolemia (total cholesterol ≥ 200 mg/dl). The AMI patients were also categorized based on their risk factors and serum vitamin D status, which was classified as deficient (<20 ng/mL), insufficient (>20-30 ng/mL), and sufficient (>30 ng/mL). We excluded patients with chronic kidney disease who had serum creatinine levels above 1.6 mg/dl, those with neurological disorders who were on antiepileptic drugs, patients with bone disorders, and individuals with rheumatic heart disease. We collected 5 ml of venous blood under sterile conditions using serum vacutainers with a clot activator and stored it at -20°C until analysis. We measured serum 25-hydroxyvitamin D [25(OH)D] using a chemiluminescence immunoassay. We estimated fasting blood glucose using the hexokinase method and total cholesterol via the cholesterol oxidase peroxidase (CHOD-POD) method. We performed the statistical analysis using GraphPad Prism version 8.2.1. The results were reported as mean ± SD. We conducted statistical tests and considered a p-value of less than 0.05 as statistically significant.

A total of 100 patients were included in the study, which included 50 healthy individuals as controls (Group-1) and 50 AMI patients as cases (Group-2). The distribution of cardiovascular risk factors among in these patients according to serum vitamin D levels. Among patients with vitamin D deficiency <20 ng/mL; (n = 34 (68%)), smoking was observed in 27 (54%) patients, diabetes mellitus in 20 (40%) patients, hypertension in 19 (38%) patients, and hypercholesterolemia in 30 (60%) patients. In contrast, among patients with vitamin D levels >20 ng/mL (n = 16 (32%)), smoking was present in 13 (26%) patients, diabetes mellitus in 6(12%) patients, hypertension in 14 (28%) patients, and hypercholesterolemia in 15 (30%) patients.

Table-1: Showing the Mean, SD, p-values and t-values of Serum Vitamin D (ng/ml), Fasting Plasma Glucose (mg/dl), Serum Total Cholesterol (mg/dl) in cases and controls

	Serum Vitamin D (ng/ml)		**Fasting Plasma Glucose (mg/dl)**		**Serum Total Cholesterol (mg/dl)**	
	Group-2	Group-1	Group-2	Group-1	Group-2	Group-1
Mean	13.03	35.82	149.9	84	226.8	188.3
S.D	8.451	3.5	40.27	8.291	24.71	8.271
p-value	<0.0001		<0.0001		<0.0001	
t-value	17.61		11.33		10.46	

In order to assess the significance of the differences observed in the mean values of different parameters observed in group-2 vs group-1 studied, the data is subjected to unpaired t - test. The significance of the difference in mean values of different groups and within the groups is represented by a p values and a p value<0.05is considered as significant.

Table-2: Showing the Mean and SD of serum Vitamin D in Cardiovascular risk factors like Diabetes Mellitus, Smoking, Total Cholesterol, and Hypertension in Group-2 and Group-1.

	MEAN	SD
Diabetes Mellitus	11.53	6.706
Smoking	13.19	8.090
Total Cholesterol	13.28	8.590
Hypertension	14.31	9.609
Group-1	35.82	3.500

The Mean and SD of serum Vitamin D differed in four subgroups. The level of serum Vitamin D was lowest in Diabetes followed by Smoking, total, Cholesterol and hypertension. Mean and SD didn't show any significant difference among the risk factors, but the levels were significant when risk factors were compared with control groups. In order to assess the significance of the differences observed in the mean values of Serum Vitamin D in different risk factors, the data was subjected to ANOVA test. The significance of difference of mean values of different sub groups is represented by p value. A p value <0.05 is considered significant.

Table-3: showing the p-value and R square in vitamin D

Parameter	P Value	R square
Vitamin D	<0.0001	0.6463

The ANOVA test has shown that the differences in mean values of serum Vitamin D in different risk factors are significant with a p value of <0.0001.

DISCUSSION

This case-control study shows a strong link between low serum Vitamin D levels and acute myocardial infarction (AMI). AMI patients had significantly lower serum 25-hydroxyvitamin D [25(OH)D] levels compared to age- and sex-matched healthy controls. Vitamin D deficiency was very common among AMI patients. These results contribute to the growing evidence that low Vitamin D is closely related to negative cardiovascular outcomes.

In this study, 68% of AMI patients were found to have Vitamin D deficiency, and average serum Vitamin D levels were much lower in AMI patients compared to controls (13.03 ± 8.45 ng/mL vs. 35.82 ± 3.50 ng/mL; p < 0.0001). Although the higher rates of Vitamin D deficiency in our cases agree with previous studies, findings by Amen SO *et al*. indicate a significant level of Vitamin D deficiency in AMI patients compared to controls, suggesting it is an important emerging risk factor for coronary artery disease (CAD) [5]. Baig M *et al*. also found that AMI patients had lower Vitamin D levels than healthy individuals, indicating its possible role in AMI development [6]. Similarly, Haghighatafshar M *et al*. found a correlation between Vitamin D levels below 10 ng/mL and severe myocardial ischemia, as shown by Summed Stress Scores [7]. A recent population-based cohort study by Dudenkov *et al*. established that 25(OH)D levels below 20 ng/mL were associated with a higher risk of newly diagnosed cardiovascular disease. However, no significant link was found between 25(OH)D levels above 50 ng/mL and cardiovascular disease [8].

An important finding in this study is the connection between Vitamin D deficiency and known cardiovascular risk factors. Among AMI patients, serum Vitamin D levels were lowest in those with diabetes, followed by smokers, patients with high cholesterol, and those with hypertension. While the differences among individual risk-factor groups were not statistically significant, all groups had lower Vitamin D levels compared to controls, as confirmed by ANOVA analysis. Several studies from 2015 to 2025 support these findings, showing that Vitamin D deficiency often occurs alongside metabolic and cardiovascular risk factors. Mitri *et al*. [9] showed an inverse relationship between Vitamin D levels and insulin resistance and type 2 diabetes. Zittermann A *et al*. [10]. concluded there is strong evidence that certain groups, such as those with severe Vitamin D deficiency or low Vitamin D levels combined with specific genetic traits and/or poor nutrition and lifestyle habits, could benefit from Vitamin D (or its metabolites).

The biological reasons for the observed association are well supported. VDRs are found in vascular endothelial cells, heart cells, and vascular smooth muscle cells, indicating that Vitamin D directly contributes to cardiovascular regulation [11]. Vitamin D has been shown to enhance blood vessel function, reduce oxidative stress, lower inflammatory cytokines, and prevent the growth of vascular smooth muscle [11]. Experimental and clinical studies indicate that Vitamin D can negatively affect the renin–angiotensin–aldosterone system, impacting blood pressure, heart remodeling, and blood vessel stiffness [12]. Moreover, 1,25-dihydroxyvitamin D_3 influences macrophage activity and foam cell formation, which are key in the process of atherosclerosis [13].

Smoking and high cholesterol were also commonly associated with Vitamin D deficiency in this study. Smoking-related oxidative stress and inflammation can affect Vitamin D metabolism, while high cholesterol may influence its transport and storage. Low Vitamin D levels due to smoking may pose a growing public health concern, especially among aging populations. Evidence suggests that smoking negatively impacts Vitamin D levels in a cumulative and dose-dependent manner, with significant interactions involving the Vitamin D-parathyroid hormone (PTH) pathway. The rising smoking rates among younger individuals could lead to an increase in issues like osteoporosis, as well as cardiovascular, lung, infectious, and immune-related diseases in the future [14]. Smoking consistently lowers 25-hydroxyvitamin D levels. Importantly, Vitamin D levels tend to recover to those similar to non-smokers after quitting. Given the harmful effects of smoking on vitamin D, bone metabolism, and overall health, efforts to prevent Vitamin D deficiency and promote quitting smoking should be a key part of public health initiatives and clinical practices [14].

Despite its strengths, this study has limitations. The sample size was relatively small, and the single-center design may limit how widely the findings apply. Factors like seasonal variation, sunlight exposure, dietary Vitamin D intake, and physical activity were not evaluated. Additionally, the case-control design does not allow for causal conclusions, so it remains unclear whether Vitamin D deficiency is a cause or an effect of acute myocardial infarction.

CONCLUSION

This study shows a clear link between low serum vitamin D levels and acute myocardial infarction, with many AMI patients having vitamin D deficiency, especially those with known cardiovascular risk factors. These results match with studies found on PubMed from 2015 to 2026 and highlight the increasing awareness of low vitamin D levels as a key indicator of cardiovascular risk. Future cohort studies and randomized controlled trials are needed to find out if fixing vitamin D deficiency can lower the occurrence or enhance the outcomes of acute myocardial infarction.

REFERENCES

1. Balasubramanian A, Kunchala K, Shahbaz A, Kar A, Sankar J, Anand S, *et al*. Association of Vitamin D Deficiency as an Independent Risk Factor for Myocardial Infarction and Its Therapeutic Implications: A Systematic Review. Cureus. 2025 Jan 13;17(1):e77375.
2. Renke, G., Starling-Soares, B., Baesso, T., Petronio, R., Aguiar, D., Paes, R. (2023). Effects of Vitamin D on Cardiovascular Risk and Oxidative Stress. Nutrients, 2023;15(3):769.
3. Li Q, Tong Y, Guo J, Liang X, Shao H, Yang L, *et al*. Vitamin D Receptor Regulates Oxidative Stress and Apoptosis Via the HIF-1α/HO-1 Pathway in Cardiomyocytes. Cell Biochem Biophys. 2025;83(3):2977-86.
4. Riek AE, Oh J, Sprague JE, Timpson A, de las Fuentes L, Bernal-Mizrachi L, et.al. Vitamin D suppression of endoplasmic reticulum stress promotes an antiatherogenic monocyte/macrophage phenotype in type 2 diabetic patients. J Biol Chem. 2012 Nov 9;287(46):38482-94.
5. Amen SO, Baban ST. Association of Vitamin D Deficiency with Acute Myocardial Infarction in Iraqi Patients. Eur Cardiol. 2020;15:e29.
6. Baig M, Alghalayini KW, Gazzaz ZJ, Murad MA. Serum Vitamin D and Vaspin Levels Among Patients with Acute Myocardial Infarction and Their Association with Risk Factors. Int J Gen Med. 2024;17:2907-17.
7. Haghighatafshar M, Shekasteband B, Firuzyar T, Etemadi Z, Farhoudi F, Shams M. The Impact of Vitamin D Deficiency on Coronary Artery Disease Severity Based on Myocardial Perfusion Imaging: A Cross-Sectional Study. Iran J Med Sci. 2025;50(1):31-6.
8. Dudenkov DV, Mara KC, Maxson JA, Thacher TD. Serum 25-hydroxyvitamin D values and risk of incident cardiovascular disease: A population-based retrospective cohort study. J Steroid Biochem Mol Biol. 2021;213:105953.
9. Mitri J, Pittas AG. Vitamin D and diabetes. Endocrinol Metab Clin North Am. 2014;43(1):205-32.
10. Zittermann A, Trummer C, Theiler-Schwetz V, Lerchbaum E, März W, Pilz S. Vitamin D and Cardiovascular Disease: An Updated Narrative Review. Int J Mol Sci. 2021;22(6):2896.
11. Pál É, Ungvári Z, Benyó Z, Várbíró S. Role of Vitamin D Deficiency in the Pathogenesis of Cardiovascular and Cerebrovascular Diseases. Nutrients. 2023;15(2):334.
12. Jensen NS, Wehland M, Wise PM, Grimm D. Latest Knowledge on the Role of Vitamin D in Hypertension. Int J Mol Sci. 2023;24(5):4679.
13. Wang D, Sun Z, Yin Y, Xiang J, Wei Y, Ma Y, *et al*. Vitamin D and Atherosclerosis: Unraveling the Impact on Macrophage Function. Mol Nutr Food Res. 2024;68(14):e2300867.
14. Yang L, Zhao H, Liu K, Wang Y, Liu Q, Sun T, *et al*. Smoking behavior and circulating vitamin D levels in adults: A meta-analysis. Food Sci Nutr. 2021;9(10):5820-32.