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Original Article

Prevalence of Vitamin D Deficiency in Patients With Acute Coronary Syndrome

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ABSTRACT

Background: Vitamin D receptors are present in many tissues throughout the body, including vascular smooth muscle, endothelium, and cardiomyocytes. Therefore, vitamin D deficiency may adversely affect the cardiovascular system.
We aimed to measure the prevalence of vitamin D3 deficiency among patients with acute coronary syndrome (ACS) and to determine the relationship between this deficiency and other risk factors.

Methods: Serum vitamin D3 levels were measured in 200 patients with ACS, and its role in this patient group was evaluated through a cross-sectional study.

Results: The mean age of all patients was 53.4 ± 9.6 years, and the mean age of those with vitamin D3 deficiency was also 53.4 ± 9.6 years. Among the patients, 56% were male, 59.5% were smokers, 67.5% were hypertensive, 57.5% were diabetic, 50% had high total cholesterol, 57.5% had low HDL levels, 60% had high LDL levels, and 70.5% had high triglyceride levels. The mean vitamin D3 level for all patients was 20.8 ± 9.5 ng/dL. Among these patients, 10% had sufficient vitamin D3 levels, 22% had insufficient levels, and 68% were deficient.

Conclusions: Vitamin D3 deficiency was present in 68% of patients with ACS, indicating its prevalence in this patient population. Age, hypertension, and high triglyceride levels were statistically associated with vitamin D3 deficiency (OR 0.543, OR 0.582, and OR 0.618, respectively; P = 0.001, P = 0.001, and P = 0.001, respectively). ***(Iranian Heart Journal 2025; 26(2): 33-38)***

KEYWORDS: Acute coronary syndrome, Vitamin D3 deficiency, Ischemic heart disease

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Despite substantial advancements in managing coronary artery disease, it remains the primary cause of mortality worldwide. [1–3] Consequently, identifying new modifiable risk factors is essential for reducing cardiovascular morbidity and mortality rates. Vitamin D deficiency has been identified as one such factor potentially linked to an increased risk of cardiovascular diseases. [1–3] Research involving vitamin D3 suggests that it plays a crucial role in organ functions, including the

cardiovascular system. [2] A decrease in vitamin D levels may impact the cardiovascular system by altering calcium-phosphate metabolism or influencing the renin-angiotensin-aldosterone system. [4] Furthermore, vitamin D plays a role in various cells involved in atherogenesis, including immune cells, endothelial cells, smooth muscle cells, and cardiomyocytes. [5–10] The effects of vitamin D deficiency have been observed throughout all stages of atherosclerotic plaque formation, destabilization, and rupture. [11] Notably, vitamin D also impacts blood extravasation at ruptured atherosclerotic plaques, which is the primary cause of acute coronary syndrome (ACS). [11] Further, the Third National Health and Nutrition Examination Survey (NHANES III) involving American adults revealed that individuals with low levels of 25-OH vitamin D (the primary circulating form of vitamin D) (< 21 ng/mL) have a higher likelihood of hypertension, diabetes, obesity, and high triglyceride levels. [12,13] Similar associations between low vitamin D levels and these cardiovascular risk factors have been demonstrated in other studies as well. [14–17] Recent studies have also demonstrated that children with rickets and severe heart failure can be effectively treated with vitamin D3 supplementation in conjunction with calcium. In adult populations, nearly all patients with heart failure exhibited decreased levels of 25-OH vitamin D. The impact of vitamin D on cardiac contractility, electrophysiology, and structure suggests that vitamin D3 deficiency may play a causal role in myocardial diseases. [18] Moreover, additional studies have observed a significant association between vitamin D3 supplementation and improved survival rates, particularly among patients with established deficiency. [19]

Objective

The primary objective of this cross-sectional study was to examine the prevalence of vitamin D3 deficiency among patients with ACS and to evaluate the association between vitamin D3 deficiency and other risk factors in this patient population.

Study Design and Setting

This cross-sectional study was conducted in the Cardiology Department at Tanta University. Two hundred patients presenting with ACS were recruited from the Cardiology Department at Tanta University between July 2022 and September 2023.

Sampling design: A convenience sampling method was employed to recruit participants from the Cardiology Department at Tanta University between July 2022 and September 2023. A total of 200 patients presenting with ACS were selected for the study.

Exclusion criteria: Patients with the following conditions were excluded from the study: previous myocardial infarction, heart failure, arrhythmia, stroke, valvular heart disease, known malignancy, and renal diseases (serum creatinine > 1.6 mg/dL).

METHODS

All patients were evaluated based on the following parameters:

1. Demographic characteristics: Age and sex
2. Clinical history: Smoking status, hypertension, and diabetes mellitus
3. Serum vitamin D3 levels:
   - Sufficient: ≥ 30 ng/dL
   - Insufficient: 21-29 ng/dL
   - Deficient: ≤ 20 ng/dL [20]
4. Serum lipid profile:
   - Total cholesterol (high if > 200 mg/dL) [21]
   - High-density lipoprotein (HDL) cholesterol (low if < 40 mg/dL) [21]
   - Low-density lipoprotein (LDL) cholesterol (high if > 160 mg/dL) [21]
   - Triglycerides (high if > 150 mg/dL) [22]

5. Hypertension: Defined as blood pressure ≥ 140/90 mm Hg or current use of antihypertensive medications [23]
6. Diabetes mellitus: Defined as fasting blood sugar ≥ 126 mg/dL or current use of antidiabetic medications [23]

Ethical Considerations: Written informed consent was obtained from all patients participating in this study. Confidentiality was ensured for each patient. Permission to conduct this study was obtained from the Ethics Committee of the Faculty of Medicine at Tanta University.

Statistical Analysis: Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Quantitative data were expressed as mean ± standard deviation (SD), and qualitative data were expressed as frequency and percentage. The following tests were performed:

- **Independent-sample *t*-test:** Used to compare 2 means.
- **The χ^2 test:** Used to compare proportions between qualitative parameters.
- **Regression analysis:** Used to assess the influence of 1 or more independent variables on a dependent variable.

A *P*-value ≤ 0.05 was considered statistically significant.

RESULTS

This cross-sectional study involving 200 patients diagnosed with ACS was conducted at the Cardiology Department of the Faculty of Medicine at Tanta University between July 2022 and September 2023. The study population consisted of 136 males and 64 females, with ages ranging from 41 to 79 years and a mean age of 53.4 ± 9.6 years.

The mean serum vitamin D3 level among the study participants was 20.8 ± 9.5 ng/dL. The distribution of vitamin D3 levels among the patients was as follows:

- Sufficient level (≥ 30 ng/dL): 24 patients (12%)
- Insufficient level (21–29 ng/dL): 40 patients (20%)
- Deficient level (≤ 20 ng/dL): 136 patients (68%)

For the purpose of this study, patients with both sufficient and insufficient vitamin D levels were considered not to have a deficiency.

Table 1. The distribution of the studied patients according to demographic characteristics and risk factors

Variables		Vitamin D3				Total No. (%)	X^2 test	*P*
		Deficient (No. = 136		Non-deficient (No. = 64)				
Age, y		53.4 ± 9.6		45.8 ± 11.3		200 (100%)	T: 4.928	0.001*
Sex	Male	76	55.9	36	56.3	112 (56%)	0.012	0.961
	Female	60	44.1	28	43.8	88 (44%)		
Smoking	Positive	85	52.9	34	53.1	119 (59.5%)	1.587	0.208
	Negative	51	47.1	30	46.9	81 (40.5%)		
Hypertension	Positive	108	79.4	27	42.2	135 (67.5%)	27.486	0.001*
	Negative	28	20.6	37	57.8	65 (32.5%)		
Diabetes mellitus	Positive	77	56.6	38	59.4	115 (57.5%)	0.142	0.713
	Negative	59	43.4	26	40.6	85 (42.5%)		
High total cholesterol	Positive	69	50.7	31	48.4	100 (50%)	0.095	0.762
	Negative	67	49.3	33	51.6	100 (50%)		
High low-density lipoprotein	Positive	81	59.6	39	60.9	120 (60%)	0.032	0.853
	Negative	55	40.4	25	39.1	80 (40%)		
High triglycerides	Positive	112	82.4	29	45.3	141 (70.5%)	28.706	0.001*
	Negative	24	17.6	35	54.7	59 (29.5%)		

Low high-density lipoprotein	Positive	82	54.4	33	51.6	115 (57.5%)	1.362	0.244
	Negative	54	45.6	31	48.4	85 (42.5%)		

*: significant

Table 2. The multivariable analysis of vitamin D deficiency and other risk factors

	Multivariate	
	OR (95% CI)	*P*
Age, y	0.543 (0.362 – 0.789)	0.001*
Sex	0.625 (0.527 – 2.548)	0.169
Smoking	0.845 (0.429 – 2.589)	0.184
Hypertension	0.582 (0.367 – 0.942)	0.001*
Diabetes mellitus	0.325 (0.149 – 0.753)	0.264
High total cholesterol	0.612 (0.419 – 4.628)	0.219
High low-density lipoprotein	0.784 (0.542 – 2.749)	0.127
High triglycerides	0.618 (0.418 – 0.864)	0.001*
Low high-density lipoprotein	0.517 (0.418 – 1.453)	0.098

*: significant

The relationship between demographic data, risk factors, and serum vitamin D3 levels is analyzed in Tables I and II. Age, hypertension, and high triglyceride levels were found to be statistically associated with vitamin D3 deficiency. The *P*-values for these associations were all significant at 0.001, with odds ratios (OR) of 0.543, 0.582, and 0.618, respectively.

DISCUSSION

This study enrolled 200 patients diagnosed with ACS and admitted to the Cardiology Department at Tanta University Hospital. The average age of the participants was 53.4 ± 9.6 years, with a sex distribution of 56% male and 44% female. Among the patients, 59.5% were smokers, 67.5% had hypertension, and 57.5% had diabetes.

The prevalence of vitamin D3 deficiency among the studied patients was 68%, while 32% had non-deficient levels. These findings align with those of an Iraqi case-control study, where 67.6% of patients had deficient vitamin D3 levels, [24] a Jordanian cross-sectional study reporting a 69.7% deficiency rate, [25] an Indian cross-sectional study finding 67.5% deficiency, [26] and a Baghdad cross-sectional study observing a 62% deficiency. [27]

In the current study, a statistically significant association was observed between vitamin D3 deficiency and age, as older patients were more likely to be in the vitamin D3 deficient group than those with sufficient vitamin D3 levels. This relationship between age and vitamin D3 deficiency aligns with the findings of the aforementioned Iraqi and Baghdad studies. [24,27]

Moreover, hypertension was also found to have a statistically significant relationship with vitamin D3 deficiency. Hypertensive patients had a higher prevalence of vitamin D3 deficiency than those without hypertension.

In line with the findings of the current study, the Iraqi and Baghdad studies also demonstrated a statistically significant relationship between hypertension and vitamin D3 deficiency. [24, 27] However, this finding contradicts the results of studies conducted in Canada and Iran, which did not report a significant association between hypertension and vitamin D3 deficiency. [28, 29]

In this study, an analysis of the lipid profiles of patients revealed that 50% had high total cholesterol levels, 57.5% had low HDL levels, 60% had high LDL levels, and 70.5%

had high triglyceride levels. A statistically significant relationship was identified between high triglyceride levels and vitamin D3 deficiency. This finding is in contrast to an Iranian study, which reported a significant association between total cholesterol levels and vitamin D3 deficiency. [29] Additionally, an Indian study demonstrated a significant relationship between total cholesterol levels and vitamin D3 deficiency but found no such association with low HDL, high LDL, or high triglyceride levels. [26]

A study conducted by Ewelina et al [30] examined 4 factors (age, sex, smoking habits, and hyperlipidemia) and found that only hyperlipidemia showed a significant relationship with serum vitamin D levels. Patients without hyperlipidemia were observed to have significantly higher serum vitamin D levels than those with hyperlipidemia. Nonetheless, these findings stand in contrast to the Baghdad study, which reported no statistically significant relationship between any of the lipid profile values and vitamin D3 deficiency. [27]

Limitations of the Study: A significant limitation of this study is the small sample size. Additionally, further research is needed to evaluate the severity of coronary artery disease and its relationship with vitamin D deficiency.

CONCLUSIONS

In this study, vitamin D deficiency was found to be prevalent in 68% of patients with ACS, indicating a high occurrence of this deficiency in this patient population. The factors significantly associated with vitamin D deficiency in these patients included age, hypertension, and hypertriglyceridemia.

RECOMMENDATIONS

1. Implementing strategies to correct vitamin D deficiency among patients with ischemic heart disease.
2. Routine screening of vitamin D levels among ischemic heart disease patients who are elderly, hypertensive, or have hypertriglyceridemia.

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