

Serum Vitamin D and Vaspin Levels Among Patients with Acute Myocardial Infarction and Their Association with Risk Factors

Mukhtiar Baig ¹, Kamal Waheeb Alghalayini ², Zohair Jamil Gazzaz³, Manal Abdulaziz Murad⁴

¹Department of Clinical Biochemistry, Faculty of Medicine, Rabigh, King Abdulaziz University, Jeddah, Saudi Arabia; ²Department of Internal Medicine, Consultant Cardiologist, King Abdulaziz University Hospital, Jeddah, Saudi Arabia; ³Department of Internal Medicine, Faculty of Medicine, Rabigh, King Abdulaziz University, Jeddah, Saudi Arabia; ⁴Department of Family and Community Medicine, Faculty of Medicine, Rabigh, King Abdulaziz University, Jeddah, Saudi Arabia

Correspondence: Mukhtiar Baig, Department of Clinical Biochemistry, Faculty of Medicine in Rabigh, King Abdulaziz University, Jeddah, Saudi Arabia, Tel +966581083289, Email drmukhtarbaig@yahoo.com

Purpose: The current study investigated and compared serum levels of vitamin D (VD) and vaspin in AMI patients and healthy subjects and correlated these biomarkers with other biochemical risk factors for AMI.

Patients and Methods: The research was carried out at King Abdulaziz University Hospital (KAUH) in Jeddah. Blood samples and additional information were gathered from 110 admitted AMI patients in the Intensive Coronary Care Unit (ICCU) (ages 40–65 years) and 50 adult, healthy volunteers whose BMI and age were similar to those of the patients.

Results: AMI patients had significantly lower vaspin ($p < 0.001$) and VD levels ($p < 0.001$) than the control group. Fasting plasma glucose (FPG), hemoglobin A1C (HbA1c), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C) levels were shown to be significantly different between AMI patients and controls. Among the AMI patients, 15 (13.6%) had deficient serum VD levels (≤ 20 ng/mL), 60 (54.5%) had insufficient levels ($>20 - <30$ ng/mL), and 35 (31.8%) had sufficient levels (≥ 30 ng/mL). In healthy subjects, VD levels were deficient in 4 (8%), insufficient in 13 (26%), and sufficient in 33 (66%). VD insufficiency was more prevalent in AMI patients compared to the healthy group (54.5% vs 26%; $p < 0.001$). In AMI patients, serum vaspin was found to be related to age and HbA1c in the control group. VD did not show a significant correlation with any variable in AMI patients and healthy subjects. Serum vaspin ($p = 0.89$) and VD levels ($p = 0.29$) did not differ significantly between female and male control groups.

Conclusion: Compared to the healthy group, AMI patients showed significantly lower vaspin and VD levels. Additionally, AMI patients had a higher prevalence of VD deficiency and insufficiency, suggesting its possible role in the occurrence of AMI.

Keywords: vitamin D, vaspin, myocardial infarction, BMI, vitamin D deficiency, HDL-C

Introduction

Acute myocardial infarction (AMI) stands as a leading trigger for fatalities and disabilities globally, emphasizing a significant health risk and imposing substantial fiscal burdens.¹ The American Heart Association's report (2021) indicates that coronary heart disease (CHD) alone accounts for approximately 9.1 million annual deaths globally.² Among the factors contributing to cardiovascular diseases (CVDs), reduced levels of vaspin and vitamin D (VD) have gained recent attention as coronary artery disease (CAD) risk factors.^{3,4}

While socio-economic improvements in the Kingdom of Saudi Arabia (KSA) have been noted, there has been a rise in chronic non-communicable diseases due to reduced physical activity, including diabetes mellitus (DM), obesity, and CHD. A recent Saudi study highlighted alarming obesity rates—1 in 4 individuals is obese, and 1 in 3 is overweight.⁵ The National Medical and Health Research Strategy (NMHRS) reports that approximately 26% of Saudis suffer from CVDs. The economic impact of CVDs is estimated to reach 80 billion Saudi riyals (21.33 billion dollars) by 2032.⁶

Vaspin, a small visceral adipose tissue-derived adipokine (containing 415 amino acids), has been associated with insulin sensitivity, exhibiting negative associations with waist-hip ratio, waist circumference, serum glucose, and body mass index (BMI).⁷ A review paper reported serum vaspin is positively linked with BMI and insulin response and enhances glucose tolerance, implying an alternative role in reactions to decreased insulin signaling in adiposity.⁸

A few studies have identified reduced levels of vaspin in patients with atherosclerosis.^{9,10} A Turkish study found a link between vaspin rs2236242 polymorphism and CAD and noted significantly lower serum vaspin levels in CAD patients.¹¹ A meta-analysis suggested that an elevated risk of atherosclerosis was linked to lower vaspin levels.³ Despite its complex metabolic roles, vaspin shows promise as a potential prognostic biomarker in post-MI individuals.¹²

Vitamin D deficiency (VDD) is a recognized worldwide issue, with prevalence rates of 42.7%, 40.4%, 36.8%, and 24.0% in KSA, Europe, Canada, and the United States, respectively.^{13–15} A Turkish study reported VDD among T2DM individuals, and they observed an inverse relationship between HbA1c levels and VD.¹⁶

Despite the fact that KSA has sunny weather, VD insufficiency is common among its population. The high frequency of VDD can be due to numerous causes. These causes include lifestyle changes such as daytime sleep and evening activity, the deskbound nature of the job, the use of veils among females, high temperatures that restrict sun exposure, and depleted utilization of vitamin D-rich foods and supplements.¹³ Several non-skeletal metabolic dysfunctions associated with vitamin D deficiency in the Saudi population, such as obesity, metabolic syndrome, T2DM, and autoimmune diseases, could improve with vitamin D correction. However, a Saudi expert panel did not support population-based screening. Instead, it advocated limited vitamin D testing for those individuals at the highest risk for VDD and who will benefit the most from vitamin D status correction.¹⁷

The literature consistently indicates higher occurrences of VDD in AMI patients compared to control groups.^{18,19} Interestingly, a multicenter study reported VDD in all AMI patients.²⁰ However, conflicting reports exist; a study found no significant difference in VD levels among AMI patients and controls,²¹ while other correlated elevated VD levels with increased risks of ischemic heart disease (IHD) and AMI.²² A study by Qi L et al reported vitamin D levels to be inversely associated with coronary heart disease and concluded that higher levels of vitamin D were linked to a lower risk of CHD.²³

Given the high prevalence of atherosclerotic disease and its associated fatalities, ongoing efforts target traditional risk factors. However, exploring new cardiovascular risk factors continues to enable early diagnosis and preventive treatments, ultimately reducing unwanted cardiovascular events.⁹

The existing literature presents conflicting findings regarding the implications of serum VD and vaspin levels in the AMI process. Hence, this research was conceived to investigate and compare serum levels of VD and vaspin in AMI patients and healthy subjects within the local population and to correlate these biomarkers with other biochemical risk factors for AMI.

Materials and Methods

Study Design and Setting

This cross-sectional investigation was executed in the ICCU at KAUH in Jeddah, KSA. Research Ethics Committee of KAU, Jeddah (Reference No. 292–18) gave their clearance for the study. All experiments were conducted in compliance with the relevant standards and laws and conformity with the Helsinki Declaration. The study protocol was fully clarified to all participants, and written informed consent was sought and documented from each participant. The patient data and blood samples were collected from March 2019 to March 2020.

General information and blood samples were collected from a total of 110 adults admitted as AMI patients, with ages ranging from 40 to 65 years. Additionally, samples were collected from 50 healthy adult subjects who had the same age and BMI as the AMI patients. The subjects in the control group were chosen from the general public. A two-day free blood sugar and lipid profile camp was arranged to recruit healthy participants from university teaching and non-teaching staff, as well as the general public. These free camp dates were publicized in brochures and panaflex banners two weeks before the camp. More than 100 healthy subjects' blood samples were collected after they provided written consent. A detailed history was taken, and the researchers performed a physical examination. All subjects' blood sugar and lipid profiles were performed. However, only healthy volunteers whose age and BMI matched those of the patients were included in the study, and their blood samples were

further analyzed for the research parameters. People who attended the camp, their blood sugar, history, and physical examination helped to select healthy volunteers for the research. In both groups, participants with systemic diseases such as Cushing disease, thyroid and parathyroid disorders, liver diseases, intestinal diseases, prolonged renal diseases, or those who were taking drugs that potentially influence vaspin and VD were eliminated from the research. Thirty AMI patients had T2DM. A proforma was used to gather information on age, level of education, marital status, history of any other disease, occupation, physical activities, and complete cardiovascular physical examination findings. BMI was computed after measuring height in meters and weight in kilograms. The waist-to-hip (W/H) ratio was determined using hip and waist circumference measurements. “Serum 25-hydroxyvitamin D [25(OH)D] level ≤ 20 ng/mL, >20 - <30 ng/mL, 30 ng/mL or more was considered deficient, insufficient, and sufficient, respectively”.²⁴

A five-milliliter blood sample was drawn in the morning following a 12–14 hour fast from each subject. After centrifugation, the samples were kept at -70°C for subsequent analyses. Serum vaspin and serum 25-hydroxyvitamin D [25(OH)D] (VD) were analyzed using the Enzyme-Linked Immunosorbent Assay (ELISA) method with kits provided by Beijing Mesochem Technology Co. Ltd. (Beijing, China). ELISA is a method used to identify the existence of antigens in biological materials. Like other forms of immunoassays, it operates on the principle that specific antibodies attach to the target antigen, allowing for the identification and measurement of the bound antigens. According to the provided kits booklet, the difference in intra-assay and inter-assay was less than 9% and 15%, respectively, for vaspin and vitamin D kits. TG, TC, (HDLc, LDLc, FPG, and HbA1c were measured in the KAUH laboratory using readily available autoanalyzer kits (Roche Modular P-800, Germany).

Statistical Analysis

The frequency and percentage of qualitative data are shown, while quantitative data are characterized by median and interquartile range (IQR). The Kolmogorov–Smirnov test showed a non-normal data distribution ($p < 0.05$). The Mann–Whitney *U*-test was applied to assess the variance between the two groups. The Spearman correlation was also utilized to investigate the relationships between vaspin, VD, and baseline clinical and biochemical characteristics. Significance was established at a *p*-value less than 0.05. Data analysis was conducted using SPSS version 26.

Results

A total of 110 adults admitted as AMI patients (93 males and 17 females) and 50 healthy volunteers (25 males and 25 females) were recruited for the study. AMI patients had significantly lower vaspin ($p < 0.001$) and VD levels ($p < 0.001$) than the control group. Additionally, FPG, HbA1C, TG, HDLc, and LDLc levels were shown to be significantly altered between AMI patients and the control group (Table 1).

Among the AMI patients, 15 (13.6%) had deficient serum VD levels (≤ 20 ng/mL), 60 (54.5%) had insufficient levels (>20 - <30 ng/mL), and 35 (31.8%) had sufficient levels (≥ 30 ng/mL). In contrast, among the control group, it was deficient, insufficient, and sufficient in 4 (8%), 13 (26%), and 33 (66%), respectively. Insufficiency of VD was more prevalent among AMI patients in comparison to the control group (54.5% vs 26%; $p < 0.001$) (Table 2).

Serum vaspin and VD were significantly decreased in normal weight, overweight, and obese groups in AMI patients compared to control subjects (Table 3). Serum vaspin was correlated with age in AMI patients and with HbA1c in the control group. VD did not show a significant correlation with any variable in AMI patients (Table 4).

The gender-based VD comparison between male patients and male controls was significantly lower in AMI male patients ($p < 0.001$). Similarly, female AMI patients had significantly lower VD than female controls ($p < 0.001$) (Figure 1). Serum VD level was significantly higher in male patients than in female patients ($p = 0.01$). Nevertheless, there was no discernible difference between the control groups of females and males ($p = 0.29$) (Figure 2).

For serum vaspin, the gender-based comparison between male patients and male controls showed that it was significantly lower in AMI male patients than in healthy males ($p < 0.001$). On the contrary, no statistically important disparity in serum vaspin levels between female AMI patients and the female control group ($p = 0.89$) (Figure 3). Among patient categories, female patients had considerably greater serum vaspin levels than male patients ($p < 0.001$). The control groups of males and females showed no notable difference ($p = 0.79$) (Figure 4).

Table 1 Comparison of Baseline Parameters Among Study Groups

Parameters	Control Group (n = 50)		Patients (n = 110)		P-value
	Median	IQR	Median	IQR	
Age (yrs)	53	9	53.5	11	0.849
BMI (kg/m ²)	27.54	6.30	27.23	7.30	0.688
Waist circumference (cm)	94	13.50	94	22.25	0.340
FPG (mmol/L)	5.14	0.32	5.5	1.15	<0.001*
HbA1c (%)	5.00	0.41	5.9	1.78	<0.001*
TC (mmol/l)	4.23	1.02	4.28	1.65	0.138
TG (mmol/l)	1.24	0.80	1.96	1.01	<0.001*
HDL-C (mmol/l)	1.13	0.32	0.82	0.24	<0.001*
LDL-C (mmol/l)	3.01	0.93	3.26	1.14	0.008*
VD (ng/mL)	34	11.67	24.80	10.16	<0.001*
Vaspin (pg/mL)	452.07	138.36	372.02	90.51	<0.001*

Note: *Significance was determined by a p-value less than 0.05.

Abbreviations: BMI, body mass index; FPG, fasting plasma glucose; HbA1c, hemoglobin A1c; TC, total cholesterol; TG, Triglyceride; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; VD, Vitamin D.

Table 2 Comparison of Patients and Control According to Vitamin D Levels (Deficient, Insufficient, and Sufficient)

Variables	Control Group (n = 50)	Patients (n = 110)	Total	P-value
VD deficient (<=20 ng/mL)	4(8%)	15(13.6%)	19(11.9%)	<0.001*
VD insufficient (>20- <30 ng/mL)	13(26%)	60(54.5%)	73(45.6%)	
VD sufficient (≤30 ng/mL)	33(66%)	35(31.8%)	68(42.5%)	
Total	50(100%)	110(100%)	160(100%)	

Note: *Significance was determined by a p-value less than 0.05.

Abbreviation: VD, Vitamin D.

Discussion

In recent years, significant strides have been taken to identify biomarkers for the risk stratification of AMI patients. Among these biomarkers, vaspin has gained attention for its association with the occurrence of metabolic syndrome and atherosclerosis.²⁵

The current study observed that AMI patients exhibit significantly lower vaspin levels than healthy subjects. This finding corroborates the findings from various studies.^{9,11,26} The significance of maintaining optimal serum vaspin levels in cardiovascular diseases (CVDs) is highlighted in the literature. High vaspin levels have been associated with a substantial decrease in adverse cardiac events compared to low vaspin levels.²⁷ A meta-analysis further supported elevated vaspin levels being linked to a reduced risk of atherosclerosis.³ Zhou et al, in 1036 MI patients, reported an increased frequency of MI in individuals with low vaspin levels.²⁸

However, contrary to our findings, some studies have advocated that raised serum vaspin levels may contribute to atherosclerosis.^{29,30} This discrepancy in Results underscores the complexity of vaspin's role and the need for further research

Table 3 Comparison of Serum Vaspin and Vitamin D According to BMI Categories in AMI Patients and Healthy Control Subjects

Variables	Vaspin (pg/mL)		P-value	Vit D (ng/mL)		P-value
	Control (n=50)	Patients (n=110)		Control (n=50)	Patients (n=110)	
	Median (IQR)	Median (IQR)		Median (IQR)	Median (IQR)	
BMI						
^Underweight (BMI<18.5) Patient N=2 Control N=1	-	-		-	-	
Normal weight (BMI=18.5–24.9) Patient N=37 Control N=12	434.57(90)	361.11(120)	0.005*	29.13(9)	23.07(14)	0.013*
Overweight (BMI=25–29.9) Patient N=39 Control N=13	477.76(154)	384.75(76)	0.012*	36.50(10)	25.94(9)	<0.001*
Obese (BMI≤30) Patient N=32 Control N=14	452.07(141)	371.60(83)	0.027*	33.71(11)	25.85(9)	0.007*

Notes: ^Underweight comparison is not calculated because there was only one control and two patients in the underweight category, so median and IQR and comparison were not made. *Significance was determined by a p-value less than 0.05.

Table 4 Spearman Correlation of Vitamin D and Vaspin with Baseline Parameters Among Study Groups

Parameters	VD (ng/mL)		Vaspin (pg/mL)	
	Control Group (n = 50)	Patients (n = 110)	Control Group (n = 50)	Patients (n = 110)
	r (p-value)	r (p-value)	r (p-value)	r (p-value)
Age (yrs)	-0.069(0.63)	0.062(0.52)	-0.145(0.30)	0.209(0.03)*
BMI (kg/m ²)	0.201(0.16)	0.127(0.18)	0.007(0.96)	0.070(0.47)
Waist circumference (cm)	0.252(0.07)	0.091(0.34)	0.028(0.84)	0.13(0.17)
FPG (mmol/L)	0.01(0.94)	0.07(0.47)	-0.092(0.52)	0.001(0.99)
HbA1c (%)	-0.109(0.45)	0.110(0.25)	-0.360(0.01)*	-0.018(0.85)
TC (mmol/l)	0.054(0.70)	0.029(0.76)	-0.025(0.98)	-0.132(0.171)
TG (mmol/l)	-0.121(0.40)	0.019(0.85)	0.077(0.59)	-0.118(0.22)
HDL-C (mmol/l)	0.110(0.44)	0.006(0.94)	-0.075(0.60)	0.052(0.59)
LDL-C (mmol/l)	-0.153(0.28)	-0.001(0.98)	0.065(0.65)	-0.187(0.05)
VD (ng/mL)	1.000	1.000	-0.164(0.26)	0.009(0.92)
Vaspin (pg/mL)	-0.164(0.26)	0.009(0.92)	1.000	1.000

Note: *Significance was determined by a p-value less than 0.05.

Abbreviations: BMI, body mass index; FPG, fasting plasma glucose; HbA1c, hemoglobin A1C; TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; VD, Vitamin D.

to elucidate its mechanisms in cardiovascular diseases. Notably, the present study did not identify a significant gender variation in vaspin levels in healthy subjects, aligning with findings from another study.³¹ Conversely, a study reported significantly higher vaspin levels in females than males,³² but the underlying reasons for this gender difference remain unclear.

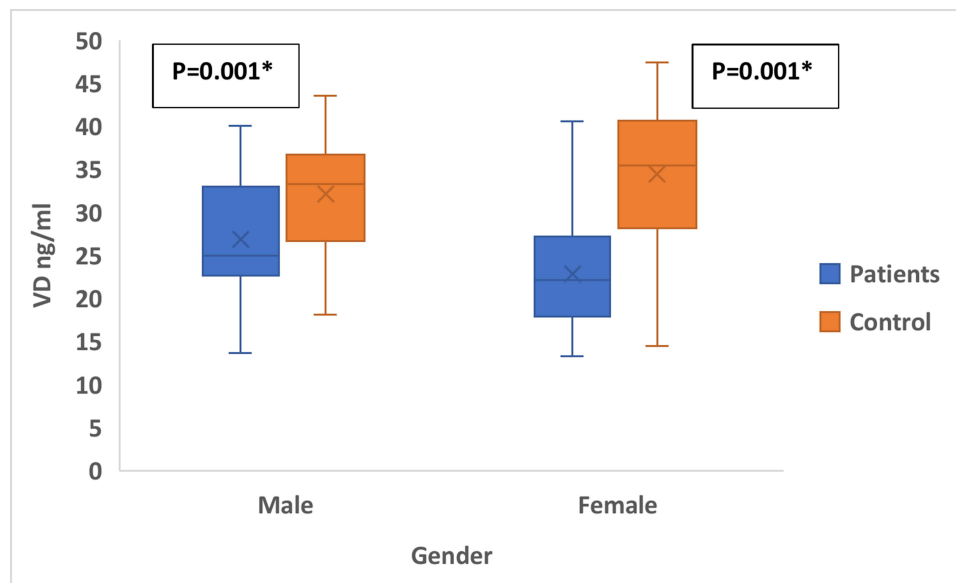


Figure 1 Comparison of vitamin D levels in male and female patients compared to controls (Clustered boxplots). *Significance was determined by a p-value less than 0.05.

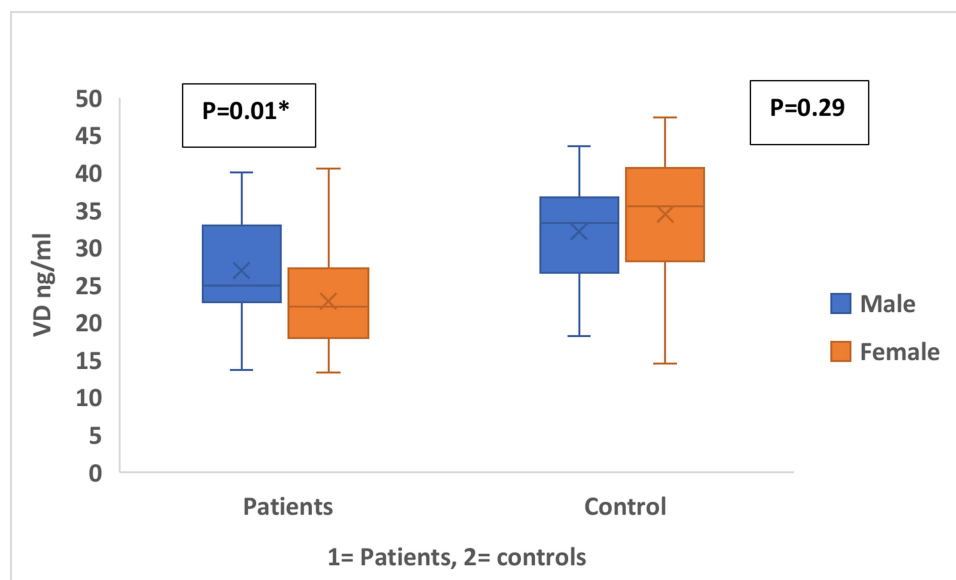


Figure 2 Comparisons of vitamin D levels between male and female patients and controls (Clustered boxplots). *Significance was determined by a p-value less than 0.05.

The present study did not find a significant correlation between serum vaspin and HbA1c in AMI patients. However, a negative correlation between serum vaspin and HbA1c was observed in the control group. Similar to our study, an Egyptian study also reported no correlation between vaspin and HbA1c in diabetic subjects and those with diabetes and cardiovascular diseases (CVD).²⁹ On the other hand, another study reported a positive correlation between serum vaspin levels and HbA1c in diabetic individuals, suggesting a compensatory response.³³ The exact explanation for this association is still unclear. Interestingly, the present study found a positive correlation between age and serum vaspin in AMI patients. A Korean study reported a positive correlation between age and serum vaspin in healthy individuals.³⁴ We do not have an exact explanation of this relationship.

Vaspin emerges as a promising predictive biomarker among MI patients, with low levels associated with an augmented risk of adverse cardiac events.¹⁰ Additionally, the study suggested that vaspin may be protective by improving

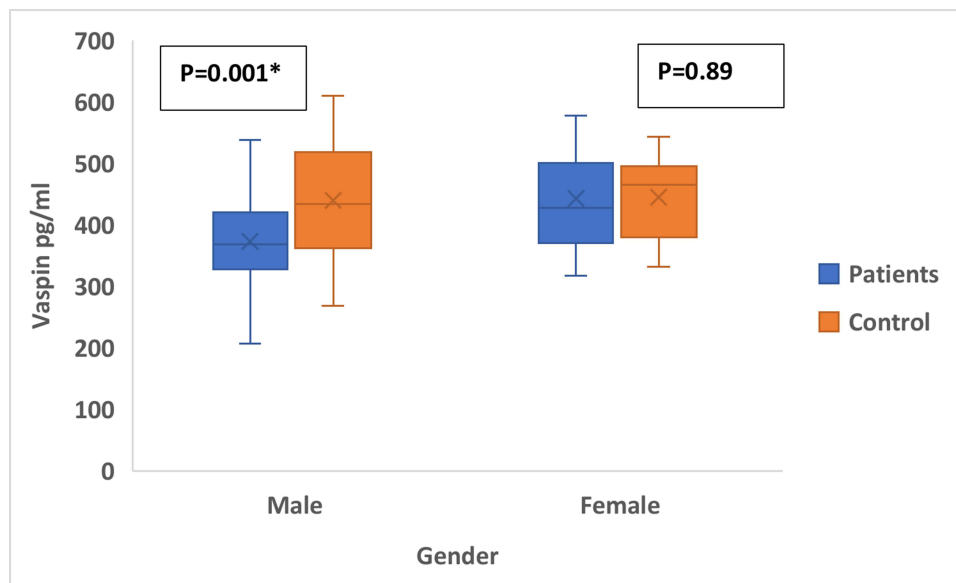


Figure 3 Comparison of vaspin in male and female patients compared to controls (Clustered boxplots). *Significance was determined by a p-value less than 0.05.

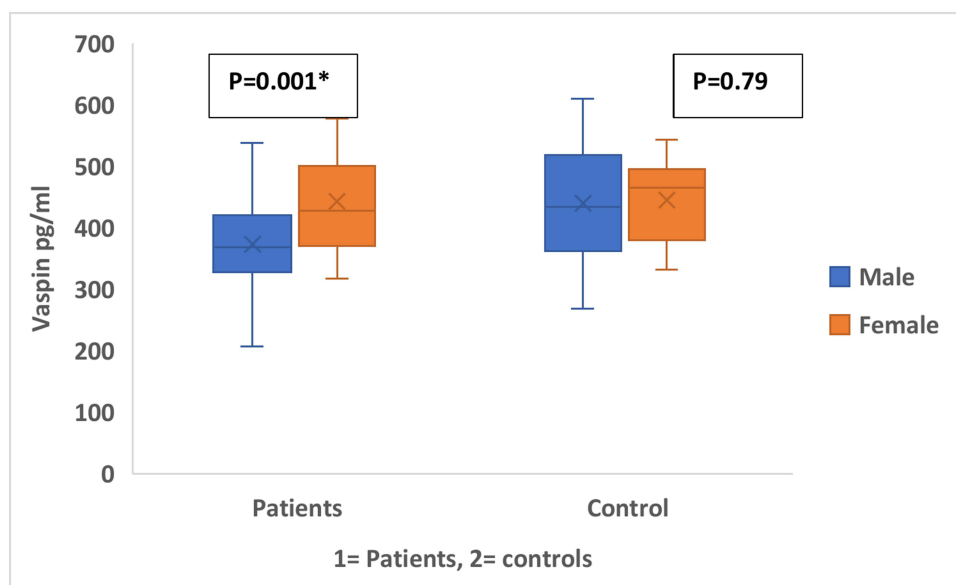


Figure 4 Comparisons of serum vaspin levels between male and female patients and controls (Clustered boxplots). *Significance was determined by a p-value less than 0.05.

left ventricular ejection fraction after MI. Studies have reported that vaspin, through targeting vascular cells, has the potential to exert anti-inflammatory and anti-apoptotic outcomes.³⁵

While the mechanisms of vaspin's involvement in the progression and prognosis of cardiovascular diseases are not completely described, studies indicate inflammation plays a vital role in cardiovascular disease pathogenesis.³⁶ Inflammation is also implicated in cardiac remodeling post-MI. Therefore, vaspin could contribute to myocardial remodeling while improving cardiovascular prognosis in MI patients, partly through its anti-inflammatory effects.³⁷ Another study reported that vaspin increases nitric oxide bioavailability among vascular endothelial cells, demonstrating a novel molecular mechanism for the anti-atherogenic action of vaspin.³⁸ A recent meta-analysis further highlighted the favorable role of high serum vaspin levels in preventing atherosclerosis in vascular smooth muscle cells (VSMCs) or

endothelial cells.³ The complexity of vaspin's role in cardiovascular health underscores the need for continued research to unravel its mechanisms and potential therapeutic applications.

Our study reports that AMI patients have considerably lower VD than the control group. The serum VD level was deficient, insufficient, and sufficient in 15 (13.6%), 60 (54.5%), and 35 (31.8%) AMI patients, respectively. Overall, 68% of the AMI patients had below-normal VD levels. The current results align with several other studies that found significantly lower VD levels among MI patients than in the control group.^{18,19} A recent Pakistani study reported that VDD was observed in nearly half of the AMI patients (45.5%) and patients who had reduced VD status were more inclined to have a poor hospital prognosis (60.6%) compared to individuals with adequate VD status.³⁹ An Iranian study reported VD insufficiency in 56% and deficiency in 6% of CAD patients.⁴⁰ Another study stated that 67.5% of those with reduced VD levels were deficient, whereas 16.5% had insufficient levels.¹⁸ A recent study investigated the correlation between serum VD and 10-year Atherosclerotic Cardiovascular Disease (ASCVD) risk in middle-aged and older persons and reported that reduced VD levels are linked with an elevated ASCVD risk.⁴¹ Another study reported an association of low VD levels with an elevated CAD risk.⁴

Across the control groups, there was no variation in VD levels based on gender. Our results contrast with a few studies.^{42–44} This variation may be attributed to factors such as the smaller number of females, dietary habits, or geographical differences. A recent study reported no gender-wise difference in VD levels between diabetic and non-diabetic individuals.⁴⁵ The frequency of VDD in individuals with AMI, as reported in our study and supported by others,^{4,18} underscores the importance of VD in cardiovascular health and its potential implications for adverse outcomes. The current study found that serum vaspin and VD levels were considerably lower in AMI patients, regardless of their weight category (normal weight, overweight, or obese), compared to control subjects. It seems that BMI did not influence serum vaspin and VD levels among our study participants.

The lack of a significant relationship between VD levels and different biochemical parameters in AMI and control groups could be influenced by various factors, including geographical variation, small sample size, racial diversity, and cultural backgrounds. A study reported no significant heterogeneity in VD levels with respect to age and gender; however, VDD was reported to be more commonly observed in patients with low socio-economic status, low activity levels, DM, hypertension, hypercholesterolemia, and among smokers as well.⁴⁶

Although research has supported the fact that VD induces cardio-protective effects and their potential mechanisms have been identified, the studies have remained inconsistent.⁴⁷ A study reported that VD has no significant association with various biochemical, electrocardiographic, and echocardiographic cardiac structure and function measurements among elderly patients.²²

The literature presents intriguing perspectives on the relationship between VDD and CAD. While both conditions share risk factors like overweight, use of tobacco, and sedentary lifestyle, some suggest that their strong association might not necessarily imply a causal relationship but rather coexistence.⁴⁸

Studies showed VD's protective role against cardiovascular disease by mitigating inflammatory responses, regulating the renin-angiotensin-aldosterone pathway, and reducing oxidative stress.^{49,50} However, despite observational studies indicating a link between increased VD and a decreased risk of cardiovascular disease, interventional studies do not strongly advocate routine VD administration for treating or preventing cardiovascular diseases.^{51–53} It seems maintaining optimal VD levels is beneficial for a healthy heart.

While a number of studies have discovered a connection between CAD and VD levels, a substantial body of research has contradicted this association.^{48,54} Therefore, the association between VD levels and CAD remains contentious, with conflicting research findings. Some studies, like Jorde R et al, observed no disparity in VD levels between MI and non-MI controls,²¹ while others, such as Rajasree et al, suggested that high VD levels could increase the risk of IHD.⁵⁵

Plausible explanations for VD's pathophysiological role in MI involve its impact on various systems within the body. VD deficiency might lead to the upregulation of the Renin Angiotensin Aldosterone System (RAAS), resulting in hypertension, vascular smooth muscle cell hypertrophy, as well as the left ventricle, which is a marker of a cardiovascular adverse event.^{46,56} Moreover, VDD has been linked with T2DM due to its effect on insulin resistance, beta cell function, and inflammation, all of which contribute to cardiovascular disease risk.^{56,57}

The current study's findings emphasize the significance of exploring the roles of VD and vaspin in cardiovascular health, suggesting implications for AMI prevention and therapy. Those individuals who are at risk for AMI need to be monitored and regularly checked for their VD with other parameters. If the VD level is found below normal, it is possible

that supplementation of VD might reduce AMI risk in such cases. Additionally, the reduced levels of vaspin in AMI patients highlight the intricate interplay of various factors in cardiovascular health.

Recognizing CAD's high prevalence and severe consequences, ongoing exploration of risk factors and novel therapeutics remains crucial. Acknowledging that solely evaluating vaspin and VD might not offer a comprehensive estimation of AMI is crucial. A multi-marker method is becoming more popular, which integrates multiple biomarkers to more accurately stratify coronary atherosclerosis and forecast its prognosis.⁵⁸

Limitations and Recommendations

The cross-sectional design of the study, capturing data at a single point in time, presents challenges in establishing a causal relationship between VD, vaspin, and AMI. Several confounding variables may impact the present study results, such as other comorbidities, lifestyle factors, dietary habits, seasonal variations in VD, and individual exposure to sunlight. Additionally, VD concentration is influenced by cultural practices, dark complexion, hot climate, limited outdoor activity, obesity, and the lack of appropriate legal regulations regarding fortifying food with vitamin D.

Future research should consider these variables to enhance the study's robustness. Additionally, the single center setting at the ICCU of KAUH in Jeddah limits the generalizability of the findings. Future studies should consider multicentric approaches to include a broader demographic.

Recognizing and addressing these limitations is crucial for comprehensively interpreting the study's outcomes. Future research could address these limitations to strengthen the evidence base on the connection between VD, vaspin, and AMI.

Conclusion

The markedly lower levels of vaspin and VD observed in AMI patients emphasize the potential implications of these biomarkers for cardiovascular health. Additionally, the study sheds light on the prevalent inadequacy of VD among AMI patients, with over half falling into categories of deficiency and insufficiency. This highlights the importance of monitoring and addressing vitamin D status in individuals at risk for AMI.

Our findings add to the existing body of knowledge regarding the interplay between VD, vaspin, and cardiovascular health. The study paves the way for further investigations into the mechanistic aspects of these associations. Future research, particularly longitudinal studies, will be essential to unraveling the temporal sequence of events and better understanding causality. These insights may inform targeted interventions and therapeutic strategies to prevent and manage AMI.

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Disclosure

The authors report no conflicts of interest in this work.

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