CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.casjournal.org/index.php/CAJMNS
*Volume: 07 Issue: 01 | January 2026 ISSN: 2660-4159*

*Article*

# Evaluation of Serum Osteopontin and Growth Differential Factor-15 in Patients with Acute Myocardial Infraction

**Mohammed Saeed Ali AL-Obaidy[1], Ameen M. Aljuraisy[2]**

1. College of health and medical techniques , University of Al maarif , Iraq.
2. Kirkuk Education Directorate, Iraqi Ministry of Education, Kirkuk, Iraq.

* Correspondence: ameen.aljuraisy@gmail.com

**Abstract:** Acute myocardial infraction (AMI), is irreversible heart muscle necrosis caused by a prolonged shortage of oxygen. The most prevalent cause of AMI is atherosclerosis . It is thought to be a component of the acute coronary syndrome . In this study Osteopontin (OPN) and Growth differential factor -15 (GDF-15) were measured in patients' with myocardial infraction and healthy control people, and the results were compared. This study was conducted on 38 patients with myocardial infraction who attended to cardio care unit (CCU) in Al-Ramadi teaching hospital in period from August to October 2025. The results were compared with 30 healthy control subjects. About four milliliters of venous blood were collecting in gel tube from patients and controls to estimate OPN and GDF-15 by ELISA method. Furthermore, fasting blood sugar (FBS) and total cholesterol (CHO) were measured for patients and control groups. The level of OPN was significantly high in AMI patients (36.44± 25.72 ng/ml) compared to control group (1.07±0.41 ng/ml), GDF-15 was very high in patients group (431.68±132.25 ng/ml) when it compared with control group (85.89±14.64 ng/ml), furthermore FBS and CHO mean concentrations were significantly high in AMI patients (195.46±89.16 mg/dl), (167.93±53.88 mg/dl) respectively, compared with control group (FBS 97.08±13.84 mg/dl), (CHO 112.18±10.64 mg/dl).

**Keywords:** Acute Myocardial Infarction, Osteopontin, Growth Differential Factor -15.

**Citation:** AL-Obaidy M. S. A., Aljuraisy A. M. Evaluation of Serum Osteopontin and Growth Differential Factor-15 in Patients with Acute Myocardial Infraction. Central Asian Journal of Medical and Natural Science 2026, 7(1), 682-687

Received: 10th Nov 2025
Revised: 21th Dec 2025
Accepted: 14th Jan 2026
Published: 04th Feb 2026



## 1. Introduction

Acute myocardial infraction (AMI), often known as a heart attack, is the irreversible necrosis of heart muscle caused by a lack of oxygen for an extended period (ischemia) [1]. Atherosclerosis is the most common cause of AMI [2]. it is a kind of acute coronary syndrome . The importance of early diagnosis in the care of AMI patients cannot be overstated [3] . AMI is caused by a combination of illness causes such as Hyperlipidemia, Obesity, smoking, hypertension, and diabetes mellitus. AMI symptoms are characterized by chest pain which may travel into shoulder, arm, neck, or jaw, dizziness, Nausea, discomfort, and cold sweat [4,5]. The electrocardiogram (ECG) is used to determine whether a patient has acute myocardial ischemia or infarction. The administration of reperfusion treatment may be influenced by a careful examination of ST-segment elevation patterns [6]. Aspartate transaminase, alanine transaminase, Troponin-I, creatine kinase-MB, and myoglobin are some of the cardiac markers that are increased and can be utilized to diagnose AMI [7]. The signs that can be used to make an early diagnosis between 1 and 6 hours following The most reliable marker after 12 hours after symptoms beginning is

myoglobin; CK-MB testing is appropriate between 6 and 24 hours after symptoms start; and the other markers are most accurate after 12 hours after symptoms start [8]. Clinical history, physical examination, and precise ECG findings are the gold standard for detecting and confirming AMI [9].

Osteopontin (OPN) is a noncollagenous protein found in the matrix of bones and other organs, even those lacking a matrix. It is also found in plasma [10]. OPN, also known as early T-Lymphocyte Activator 1 (ETA1) protein and bone sialoprotein 1 (BSP1), is a strongly negatively charged glycoprotein that was originally discovered in osteoblasts [11]. It is found in fibroblasts [12], preosteoblasts, osteoblasts, osteocytes, odentoblasts, dendritic cells, macrophages, certain bone marrow cells [13], skeletal muscle [14], myoblasts [15], T-cells, hepatocytes, endothelial cells, and epithelial cells, as well as certain bone marrow cells [16], and non- bone cells in the inner ear, brain, kidney, endometrium during pregnancy, placenta, and mammary glands, OPN created by cells and enters the bloodstream via inflammatory cytokines, which promotes the transcription and expression of the OPN gene [17]. TNFa, Angiotesin II, Nitic oxid (NO), Interleukin-1b (IL-1B), hypoxia, and hyperglycemia are all variables that might cause OPN transcription and expression [18,19]. The function of osteopontin as a linkage protein [20]. OPN is an extracellular structural protein containing 314 amino acid residues and about 30 carbohydrate residues, including 10 sialic acid residues [21. It has a molecular weight of around 32 KDa, but due to substantial post-translational modification, it has a molecular mass of 45 to 75 KDa [22]. OPN is considered aspartic acid-rich N-linked glycoprotein that depending on the cell type, can be heavily phosphorylated on serine and threonine [23].

Growth differential factor-15 (GDF-15), also known macrophage inhibition cytokine-1 (MIC-1) [24], is a member of the transforming growth factor- (TGF-) cytokine superfamily . It is a cytokine reacts to stress in normal and pathological states, it is abundantly expressed in cardiomyocytes, macrophages, vascular smooth muscle cells, adipocytes, and endothelial cells at different levels [25]. GDF-15's roles remain unknown, however it appears to have a role in inflammatory regulatory pathways, as well as apoptotic control, cell development, and cell repair, all of which are biological processes implicated in cardiovascular and neoplastic illnesses [26-28]. GDF-15 is expressed at extremely low levels in most parenchymal tissue [29], although its levels rose because of damage to organs such as the lung, heart [30], kidneys [31], and liver [32] . Ischemia increases the expression of GDF-15 in cardiomyocytes [33]. Cardiomyocyte has been identified as the primary source of GDF-15, which has been found to be high in the human heart within hours of M.I and remains increased for many days [34]. GDF-15 is also significantly expressed in diabetes, renal failure, and a variety of cancers, including prostate cancer, colon cancer, pancreatic cancer, and breast cancer [35,36].

## 2. Methodology

From August to October 2020, this research was conducted in the AL-Ramadi teaching hospital. It involved thirty eight patients with acute myocardial infraction (AMI) and thirty healthy people as control subjects. The information regarding the patients in this study came from the hospital records of the patients. The blood samples were taken from patients with AMI and hypertension at AL-Ramadi Teaching Hospital's Cardio Care Unit (CCU) and Osteopontin, Growth differential factor-15, Fasting blood sugar, and total cholesterol were measured for them in laboratory department of Al-Ramadi teaching hospital. This research involved thirty seemingly healthy sex age matched controls . In all cases, patients with cancer, liver illnesses, autoimmune illnesses, renal illnesses, covid-19, bone abnormalities, or other inflammatory conditions were excluded.

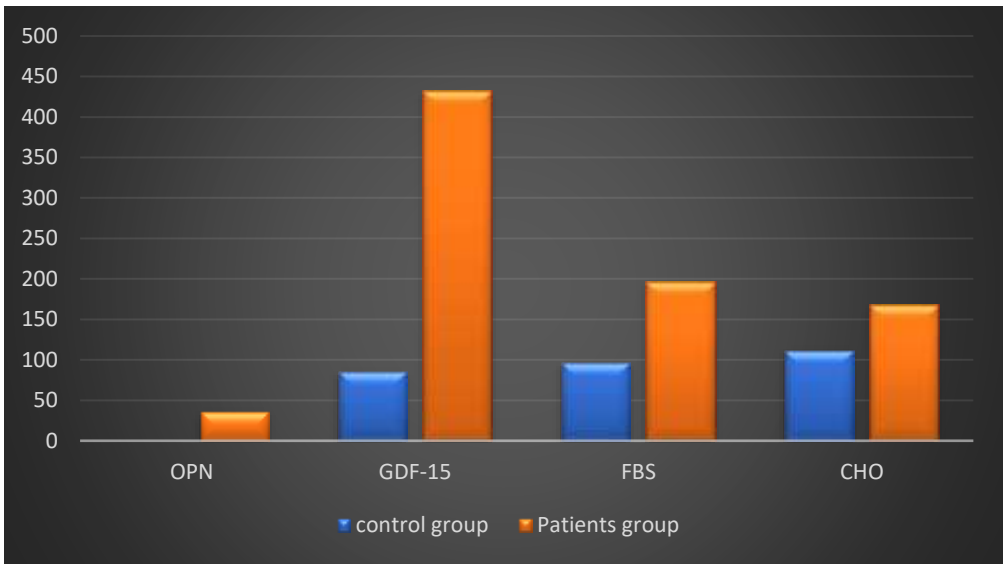
## 3. Results and Discussion

OPN level was significantly high in AMI patients (36.44±25.72 ng/ml) compared with control group (1.07±0.41 ng/ml). and there was a highly increasing in the level of GDF-15

in AMI patients' group (431.68±132.25 ng/ml) compared with healthy control group (85.89±14.64 ng/ml). the study found that 65.8% of AMI patients were smoking , whereas 34.2% do not. The level of FBS in the patients' group (195.46±89.164 mg/dl) was significantly higher than in the healthy control group (97.08±13.84 mg/dl). The levels of CHO in the AMI patients' group (167.93±53.88 mg/dl) was substantially higher than in the healthy control group (112.18±10.64 mg/dl). Table 1.

**Table 1.** Mean (±SD) Values of OPN and Biochemical Marker (FBS and CHO) in AMI patients and control group.

| Parameter | AMI patients' group | Control group |
|---|---|---|
| **OPN (ng/ml)** | 36.44 ± 25.72 | 1.07±0.41 |
| **GDF-15 (ng/ml)** | 431.68 ±132.25 | 85.89±14.64 |
| **FBS (mg/dl)** | 195.46 ± 89.16 | 97.08±13.84 |
| **CHO (mg/dl)** | 167.93 ± 53.88 | 112.18±10.64 |




**Figare 1.** OPN, GDF-15 and biochemical parameter in patients and control group.

**Discussion**

The measurement of OPN level in patients' group with AMI . was significantly higher (P=0.007) than that of the healthy control group. This discovery might be attributed to Angiotensin II, which promotes OPN expression in the damaged myocardium [37]. causing wound repair and cardiac remodeling. As a result, OPN is regarded a marker of fibroblast and myofibroblast maturation and differentiation following cardiac injury [38]. Increased OPN levels in patients might be attributed to hypoxia, which is caused by a prolonged reduction in blood flow to the body due to AMI [39]. These findings are consistent with those of (Lok et al.,2019) [40].who observed that OPN levels were significantly higher in AMI patients .

When compared to the healthy control group, the GDF-15 concentration in the patients' group was extremely high (P<0.005) . This could be due to the autocrine secretion of GDF-15 by cardiac myocytes and other cell types such as endothelial cells, cardiac fibroblasts, and vascular smooth muscle cells in response to stress on the cardiovascular system, hypertension, Angiotensin II, myotrophin, and vascular endothelial growth factor (VEGF) [41]. This conclusion was confirmed by (Xu et al., 2014) [42] and (Kempf et al., 2009) [43], who discovered that GDF-15 levels are elevated in a variety of CVDs, implying that GDF-15 can be used as a biomarker in the diagnosis and monitoring of CVDs.

The current investigation discovered that the concentration of blood glucose in the patients' group was substantially higher than in the healthy control group. (P<0.05) . and there was positive correlation between GDF-15 and FBS (R=0.369, p=0.004) and this finding is in agreement with (Bao et al., 2013) [44], So it suggest that hyperglycemia promotes GDF-15 expression which may modulates apoptosis of cells in negative feedback manner, Hyperglycemia is the main chronic symptom of diabetes, it increased reactive oxygen species (ROS) formation, which leads to cellular injury and death [45], ROS increasing can cause cells apoptosis, (Ho et al.,2006) [46], provides that GDF-15 protects endothelial cells against high glucose induced cellular injury by activation PI3,AKT, and eNOs signaling pathway.

There was positive correlation between OPN and FBS (R=0.210, P=0.03) and this study agreed with (Daniele et al.,2018) [47]. This result suggests that diabetes mellitus type 2 (DMT2) has a role in OPN expression and its relationship with CVD, so increased level of OPN can considers a biomarker for CVD in DMT2 patients .

This study found that the level of total cholesterol was significantly high in patients group compared with control group (P<0.005) and these results agreed with (Kwon et al., 2019) [48]. and has negative correlation with OPN (R= -0.136), and positive correlation with GDF-15 (R= 0.302).

High cholesterol levels in individuals cause atherosclerosis, resulting in cholesterol and fatty acid accumulation in the tunica intima of the arterial wall [49]. These deposits can build up over time, making it difficult for adequate blood to pass through arteries, or they might abruptly obstruct and form a clot, resulting in myocardial infarction . As a result, it is thought to be a risk factor for CVD. Hypercholesterolemia is associated strongly with CVD and considered as a traditional risk factor for incidence of CVD spatially M.I which may become to be H.F with time.

## 4. Conclusion

the study's results showed that a significant increase in levels of OPN and GDF-15 as a biomarker for AMI patients and there was a relationship between both OPN and GDF-15 with blood glucose concentration, also hyperlipidemia was present in AMI patients.

## REFERENCES


[1] A. E. Azab and A. S. I. Elsayed, "Acute Myocardial Infarction Risk Factors and Correlation of its Markers with Serum Lipids," J Appl Biotechnol Bioeng, vol. 3, no. 4, p. 00075, 2017.

[2] A. Long, B. Long, and A. Koyfman, "Non-traditional risk factors for atherosclerotic disease: A review for emergency physicians," Am. J. Emerg. Med., vol. 36, no. 3, pp. 494–497, 2018.

[3] C. E. Ugwu, S. E. Nwankwo, S. C. Meludu, and J. K. Nnodim, "Assessment of the risk of myocardial infarction among undergraduate students in a Nigerian tertiary institution," Int. J. Healthcare Med. Sci., vol. 2, no. 11, pp. 60–65, 2016.

[4] S. C. Smith Jr et al., "AHA/ACC guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update," Circulation, vol. 113, no. 19, pp. 2363–2372, 2006.

[5] T. H. Lee and L. E. E. Goldman, "Serum enzyme assays in the diagnosis of acute myocardial infarction recommendations based on a quantitative analysis," Ann. Intern. Med., vol. 105, no. 2, pp. 221–233, 1986.

[6] H. A. Al-Hadi and K. A. Fox, "Cardiac markers in the early diagnosis and management of patients with acute coronary syndrome," Sultan Qaboos Univ. Med. J., vol. 9, no. 3, p. 231, 2009.

[7] S. Mythili and N. Malathi, "Diagnostic markers of acute myocardial infarction," Biomed. Rep., vol. 3, no. 6, pp. 743–748, 2015.

[8] H. D. White and D. P. Chew, "Acute myocardial infarction," Lancet, vol. 372, no. 9638, pp. 570–584, 2008.

[9] M. Sharma, R. San Tan, and U. R. Acharya, "A novel automated diagnostic system for classification of myocardial infarction ECG signals using an optimal biorthogonal filter bank," Comput. Biol. Med., vol. 102, pp. 341–356, 2018.

[10] K. X. Wang and D. T. Denhardt, "Osteopontin: role in immune regulation and stress responses," Cytokine Growth Factor Rev., vol. 19, no. 5–6, pp. 333–345, 2008.
[11] S. P. Sase, J. V. Ganu, and N. Nagane, "Osteopontin: a novel protein molecule," Indian Med. Gaz., pp. 62–66, Feb. 2012.
[12] X. Qin et al., "Cancer-associated fibroblast-derived IL-6 promotes head and neck cancer progression via the osteopontin-NF-kappa B signaling pathway," Theranostics, vol. 8, no. 4, p. 921, 2018.
[13] T. Ikeda, T. Shirasawa, Y. Esaki, S. Yoshiki, and K. Hirokawa, "Osteopontin mRNA is expressed by smooth muscle-derived foam cells in human atherosclerotic lesions of the aorta," J. Clin. Invest., vol. 92, no. 6, pp. 2814–2820, 1993.
[14] P. P. Nghiem et al., "Osteopontin is linked with AKT, FoxO1, and myostatin in skeletal muscle cells," Muscle Nerve, vol. 56, no. 6, pp. 1119–1127, 2017.
[15] S. Vianello et al., "SPP1 genotype and glucocorticoid treatment modify osteopontin expression in Duchenne muscular dystrophy cells," Hum. Mol. Genet., vol. 26, no. 17, pp. 3342–3351, 2017.
[16] S. D. Ricardo, D. F. Franzoni, C. D. Roesener, J. M. Crisman, and J. R. Diamond, "Angiotensinogen and AT1 antisense inhibition of osteopontin translation in rat proximal tubular cells," Am. J. Physiol.-Renal Physiol., vol. 278, no. 5, pp. F708–F716, 2000.
[17] M. F. Young et al., "cDNA cloning, mRNA distribution and heterogeneity, chromosomal location, and RFLP analysis of human osteopontin (OPN)," Genomics, vol. 7, no. 4, pp. 491–502, 1990.
[18] M. Noda and G. A. Rodan, "Transcriptional regulation of osteopontin production in rat osteoblast-like cells by parathyroid hormone," J. Cell Biol., vol. 108, no. 2, pp. 713–718, 1989.
[19] N. S. Fedarko, A. Jain, A. Karadag, M. R. Van Eman, and L. W. Fisher, "Elevated serum bone sialoprotein and osteopontin in colon, breast, prostate, and lung cancer," Clin. Cancer Res., vol. 7, no. 12, pp. 4060–4066, 2001.
[20] M. Mazzali et al., "Osteopontin—a molecule for all seasons," QJM, vol. 95, no. 1, pp. 3–13, 2002.
[21] C. C. Kazanecki, D. J. Uzwiak, and D. T. Denhardt, "Control of osteopontin signaling and function by post-translational phosphorylation and protein folding," J. Cell. Biochem., vol. 102, no. 4, pp. 912–924, 2007.
[22] M. Scatena, L. Liaw, and C. M. Giachelli, "Osteopontin: a multifunctional molecule regulating chronic inflammation and vascular disease," Arterioscler. Thromb. Vasc. Biol., vol. 27, no. 11, pp. 2302–2309, 2007.
[23] Z. A. Al-Obaidy and A. L. Hussein Al-Zubaidi, "Evaluation of Serum Osteopontin Level and Growth Differential Factor Growth-15 in Chronic Renal Failure," Indian J. Public Health Res. Dev., vol. 11, no. 4, 2020.
[24] R. Adela and S. K. Banerjee, "GDF-15 as a target and biomarker for diabetes and cardiovascular diseases: a translational prospective," J. Diabetes Res., 2015.
[25] P. J. Emmerson, K. L. Duffin, S. Chintharlapalli, and X. Wu, "GDF15 and growth control," Front. Physiol., vol. 9, p. 1712, 2018.
[26] T. A. Zimmers et al., "Growth differentiation factor-15/macrophage inhibitory cytokine-1 induction after kidney and lung injury," Shock, vol. 23, no. 6, pp. 543–548, 2005.
[27] E. C. Hsiao et al., "Characterization of growth-differentiation factor 15, a transforming growth factor β superfamily member induced following liver injury," Mol. Cell. Biol., vol. 20, no. 10, pp. 3742–3751, 2000.
[28] K. C. Wollert et al., "Growth differentiation factor 15 for risk stratification and selection of an invasive treatment strategy in non ST-elevation acute coronary syndrome," Circulation, vol. 116, no. 14, pp. 1540–1548, 2007.
[29] T. Kempf et al., "The transforming growth factor-β superfamily member growth-differentiation factor-15 protects the heart from ischemia/reperfusion injury," Circ. Res., vol. 98, no. 3, pp. 351–360, 2006.
[30] M. Li, K. Song, X. Huang, S. Fu, and Q. Zeng, "GDF-15 prevents LPS and D-galactosamine-induced inflammation and acute liver injury in mice," Int. J. Mol. Med., vol. 42, no. 3, pp. 1756–1764, 2018.
[31] Z. A. Al-Obaidy and A. L. Hussein Al-Zubaidi, "Evaluation of Serum Osteopontin Level and Growth Differential Factor Growth-15 in Chronic Renal Failure," Indian J. Public Health Res. Dev., vol. 11, no. 4, 2020.
[32] M. Li, K. Song, X. Huang, S. Fu, and Q. Zeng, "GDF-15 prevents LPS and D-galactosamine-induced inflammation and acute liver injury in mice," Int. J. Mol. Med., vol. 42, no. 3, pp. 1756–1764, 2018.
[33] J. Jurczyluk, D. Brown, and K. K. Stanley, "Polarised secretion of cytokines in primary human microvascular endothelial cells is not dependent on N-linked glycosylation," Cell Biol. Int., vol. 27, no. 12, pp. 997–1003, 2003.
[34] J. B. Welsh et al., "Large-scale delineation of secreted protein biomarkers overexpressed in cancer tissue and serum," Proc. Natl. Acad. Sci. USA, vol. 100, no. 6, pp. 3410–3415, 2003.
[35] J. B. Welsh et al., "Large-scale delineation of secreted protein biomarkers overexpressed in cancer tissue and serum," Proc. Natl. Acad. Sci. USA, vol. 100, no. 6, pp. 3410–3415, 2003.

[36] K. Unsicker, B. Spittau, and K. Krieglstein, "The multiple facets of the TGF-β family cytokine growth/differentiation factor-15/macrophage inhibitory cytokine-1," Cytokine Growth Factor Rev., vol. 24, no. 4, pp. 373–384, 2013.
[37] T. Nunohiro, N. Ashizawa, K. Graf, Y. S. Do, W. A. Hsueh, and K. Yano, "Angiotensin II promotes remodelling-related events in cardiac fibroblasts," Heart Vessels, pp. 201–204, 1997.
[38] P. Zahradka, "Novel role for osteopontin in cardiac fibrosis," 2008.
[39] T. R. Einarson, A. Acs, C. Ludwig, and U. H. Panton, "Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007–2017," Cardiovasc. Diabetol., vol. 17, no. 1, p. 1, 2018.
[40] Z. S. Y. Lok and A. N. Lyle, "Osteopontin in vascular disease: friend or foe?," Arterioscler. Thromb. Vasc. Biol., vol. 39, no. 4, pp. 613–622, 2019.
[41] C. Ruwhof and A. van der Laarse, "Mechanical stress-induced cardiac hypertrophy: mechanisms and signal transduction pathways," Cardiovasc. Res., vol. 47, no. 1, pp. 23–37, 2000.
[42] [42] X. Xu, Z. Li, and W. Gao, "Growth differentiation factor 15 in cardiovascular diseases: from bench to bedside," Biomarkers, vol. 16, no. 6, pp. 466–475, 2011.
[43] T. Kempf and K. C. Wollert, "Growth differentiation factor-15: a new biomarker in cardiovascular disease," Herz, vol. 34, no. 8, pp. 594–599, 2009.
[44] X. Bao et al., "Growth differentiation factor 15 is positively associated with incidence of diabetes mellitus: the Malmö Diet and Cancer–Cardiovascular Cohort," Diabetologia, vol. 62, no. 1, pp. 78–86, 2019.
[45] K. X. Wang and D. T. Denhardt, "Osteopontin: role in immune regulation and stress responses," Cytokine Growth Factor Rev., vol. 19, no. 5–6, pp. 333–345, 2008.
[46] [46] F. M. Ho et al., "High glucose-induced apoptosis in human vascular endothelial cells is mediated through NF-κB and c-Jun NH2-terminal kinase pathway and prevented by PI3K/Akt/eNOS pathway," Cell. Signal., vol. 18, no. 3, pp. 391–399, 2006.
[47] G. Daniele et al., "The potential role of the osteopontin–osteocalcin–osteoprotegerin triad in the pathogenesis of prediabetes in humans," Acta Diabetol., vol. 55, no. 2, pp. 139–148, 2018.
[48] D. Kwon, J. J. Yi, H. Ohrr, and S. W. Yi, "Total cholesterol and mortality from ischemic heart disease and overall cardiovascular disease in Korean adults," Medicine, vol. 98, no. 36, 2019.
[49] U. S. General, The health benefits of smoking cessation, Washington: Department of Health and Human Services, pp. 11–17, 1990.