Journal of
Babol University of Medical Sciences
JBUMS
e-ISSN: 2251-7170 p-ISSN: 1561-4107

Comparing the Assessment of Omentin-1 and Chemerin Levels in Acute Myocardial Infarction in Patients with Diabetes and Healthy Subjects

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Article Type
Research Paper

Received:
May 17th 2023
Revised:
Jun 24th 2023
Accepted:
Jul 26th 2023

ABSTRACT

Background and Objective: Acute myocardial infarction (AMI) is a serious and life-threatening disease caused by a sudden blockage of blood flow in the heart muscle. According to the contradictory results in studies investigating the levels of chemerin (with the role of enhancing inflammation) and omentin-1 (with anti-inflammatory properties) in patients with diabetes, this study aims to compare the levels of omentin-1 and chemerin in patients with acute myocardial infarction (AMI) with and without diabetes and its relationship with vascular lesions, HbA1c, blood pressure, CRP and serum creatinine.

Methods: In this cross-sectional study, a total of 80 AMI patients were randomly included in this study with the age range of 37-79 years old, categorized according to the presence (26 patients) or absence (54 patients) of diabetes and the number of arteries with lesions. The levels of omentin-1 and chemerin were measured using ELISA kits, and correlations between the adipokines and other parameters were evaluated using Pearson correlation analysis. ROC curve analysis was performed to assess the diagnostic value of omentin-1 and chemerin in distinguishing AMI patients with and without diabetes.

Findings: The demographic characteristics of patients of the two groups, including age, systolic and diastolic blood pressure showed non-significant differences. The levels of omentin-1 were not significantly different between AMI patients with and without diabetes, while chemerin levels were significantly higher in AMI patients with diabetes (1.212±0.232) as compared to the AMI patients without diabetes (0.72±0.116) ($p<0.01$). The AUC values for omentin-1 and chemerin were 0.603 and 0.640, respectively, in differentiating AMI patients with and without diabetes. There was no significant difference in the levels of both hormones according to the number of arteries with lesions. Significant correlations were found between omentin-1 and chemerin levels and HbA1c ($p<0.05$), while no significant correlations were found with blood pressure, CRP, or serum creatinine.

Conclusion: The results of this study showed that chemerin can be a useful biomarker for identifying patients with myocardial infarction with diabetes.

Keywords: *Omentin-1, Chemerin, Acute Myocardial Infarction, Diabetes, Hba1c.*

Cite this article: Sami Ali S. Comparing the Assessment of Omentin-1 and Chemerin Levels in Acute Myocardial Infarction in Patients with Diabetes and Healthy Subjects. *Journal of Babol University of Medical Sciences*. 2024; 26: e46.

[DOI: 10.22088/jbums.26.1.46]

Introduction

Acute myocardial infarction (AMI) is a serious and life-threatening condition caused by the sudden blockage of blood flow to the heart muscle, resulting in irreversible damage to the heart tissue. AMI is a major cause of death and illness worldwide, and its occurrence is increasing, especially among individuals with diabetes (1).

Adipokines are a group of biologically active substances released by adipose tissue that play a vital role in maintaining metabolic balance and managing inflammation. Among these adipokines, omentin-1 and chemerin have gained significant attention in recent years due to their potential involvement in the development of cardiovascular diseases, including AMI (2, 3). Omentin-1 is a newly discovered adipokine that possesses anti-inflammatory and insulin-sensitizing properties (4). In contrast, chemerin is an adipokine that promotes inflammation and is involved in the regulation of adipogenesis, angiogenesis, and inflammation (5, 6).

Several studies have investigated the levels of omentin-1 and chemerin in AMI patients, but the results have been inconsistent. Some studies have found increased levels of these adipokines in AMI patients, while others have observed no significant changes (7, 8). Furthermore, the relationship between omentin-1 and chemerin levels in AMI patients with diabetes and the extent of artery damage remains unclear.

Omentin-1 has been found to enhance insulin sensitivity by facilitating the uptake and utilization of glucose in skeletal muscle and adipocytes (9, 10). This effect is mediated through the activation of the AMP-activated protein kinase (AMPK) pathway, which plays a crucial role in glucose metabolism. AMPK activation by omentin leads to the translocation of glucose transporter type 4 (GLUT4) to the cell membrane, allowing for increased glucose uptake and a reduction in high blood sugar levels (11). Omentin also exhibits anti-inflammatory effects by suppressing the production of pro-inflammatory cytokines like tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6), while promoting the release of anti-inflammatory cytokines like interleukin-10 (IL-10) (12, 13).

On the other hand, chemerin has been shown to contribute to insulin resistance by impairing insulin signaling pathways. It inhibits the phosphorylation of insulin receptor substrate-1 (IRS-1) and Akt, thereby reducing downstream glucose uptake and glycogen synthesis. Additionally, chemerin induces the expression of suppressor of cytokine signaling 3 (SOCS3), an inhibitor of insulin signaling, further aggravating insulin resistance. These actions underscore the role of chemerin in the disruption of insulin sensitivity in type 2 diabetes mellitus (T2DM) (14).

Therefore, this study aimed to investigate the levels of omentin-1 and chemerin in AMI patients, with a specific focus on patients with diabetes and the severity of arterial lesions. Our hypothesis was that the levels of omentin-1 and chemerin would be altered in AMI patients and that these changes would be more prominent in patients with diabetes and a higher number of affected arteries. Additionally, we aimed to evaluate the potential of omentin-1 and chemerin as biomarkers for diagnosing AMI in patients with and without diabetes.

Methods

Study Design and Participants: This is a cross-sectional study which was conducted during 2021 and 2022 in the Cardiac center, Erbil, Iraq. The study population included 80 participants, with the range of age between 37-79 years old, who were diagnosed with acute myocardial infarction (AMI) (15) and admitted to the hospital. The participants were categorized according to having diabetes mellitus (DM) (Sample size= 26) or not (Sample size= 54), and according to the number of arteries with lesions (single-vessel disease or

[DOI: 10.22088/jbums.26.1.46]

multi-vessel disease) (No. of patients with one lesion= 33) (No. of patients with Two lesions= 27) and (No. of patients with one lesion= 20). The patients with history of heart diseases or any other diseases related to coronary arteries were excluded from the study.

Blood Sampling and Analysis: Blood samples were collected from each participant upon admission to the hospital. The samples were immediately centrifuged at 3000 rpm for 10 minutes, and the resulting serum samples were stored at -80°C until analysis. The levels of omentin-1 and chemerin were measured using enzyme-linked immunosorbent assay (ELISA) kits, according to the manufacturer's instructions. The HbA1c, serum creatinine, and C-reactive protein (CRP) levels were also measured using standard laboratory techniques.

Statistical Analysis: Data were analyzed using GraphPad prism version 9. The t-test was used to compare the means of the continuous variables between the two groups (DM and non-DM). The receiver operating characteristic (ROC) curve was used to evaluate the diagnostic value of omentin-1 and chemerin in predicting the presence of DM in AMI patients. Pearson correlation coefficients were used to evaluate the correlations between the adipokines and other clinical parameters. A p-value less than 0.05 was considered statistically significant.

Ethical Considerations: This study was approved by special committee of Ministry of health (Ethical approval code: ETHICS-6454). All procedures were conducted in accordance with the ethical standards of the Helsinki Declaration. Confidentiality was maintained throughout the study, and all data were de-identified before analysis.

Results

The demographic characteristics of the patients including age, systolic and diastolic BP showed non-significant differences between DM and Non-DM patients as shown in Table 1. No significant differences were observed between DM AMI and non-DM AMI patients regarding Age, Systolic and Diastolic blood Pressure (BP).

Table 1. Some demographic characteristics of studied patients categorized according to the presence or absence of DM

Variable	DM (54) Number(%) or Mean±SE	Non-DM (26) Number(%) or Mean±SE	p-value
Gender			
Male	15(57.7)	44(81.48)	-
Female	11(42.3)	10(18.12)	
Age	57.52±2.026	58.06±1.496	0.8387
Systolic BP	129.4±5.148	135.8±4.203	0.3613
Diastolic BP	75.05±2.796	80.98±2.134	0.1038

The t-test analysis of omentin-1 and chemerin levels between DM and non-DM AMI patients revealed that the level of omentin-1 was non-significant. The level of chemerin in DM AMI patients was (1.212±0.232) which was significantly ($p<0.01$) higher than non-DM AMI patients (0.72±0.116). Figure 1 illustrates the comparison of omentin-1 and chemerin levels in DM and non-DM AMI patients.

[DOI: 10.22088/jbums.26.1.46]

The ROC curve analysis for both omentin-1 and chemerin in DM and non-DM AMI patients showed that the area under the curve (AUC) was 0.603 and 0.640 for omentin-1 and chemerin, respectively. The AUC of chemerin was significantly higher than that of omentin-1 ($p<0.05$). Figure 2 displays the ROC curves for omentin-1 and chemerin in DM and non-DM AMI patients.

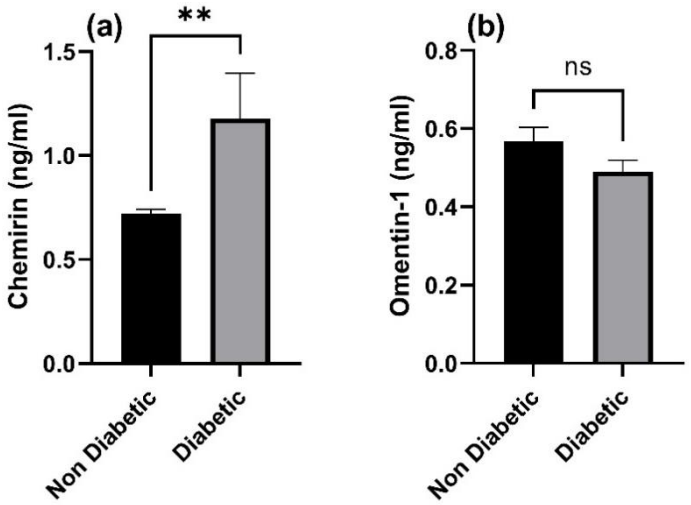

Figure 1. Comparison of Omentin-1 and chemerin levels in DM and non-DM AMI patients

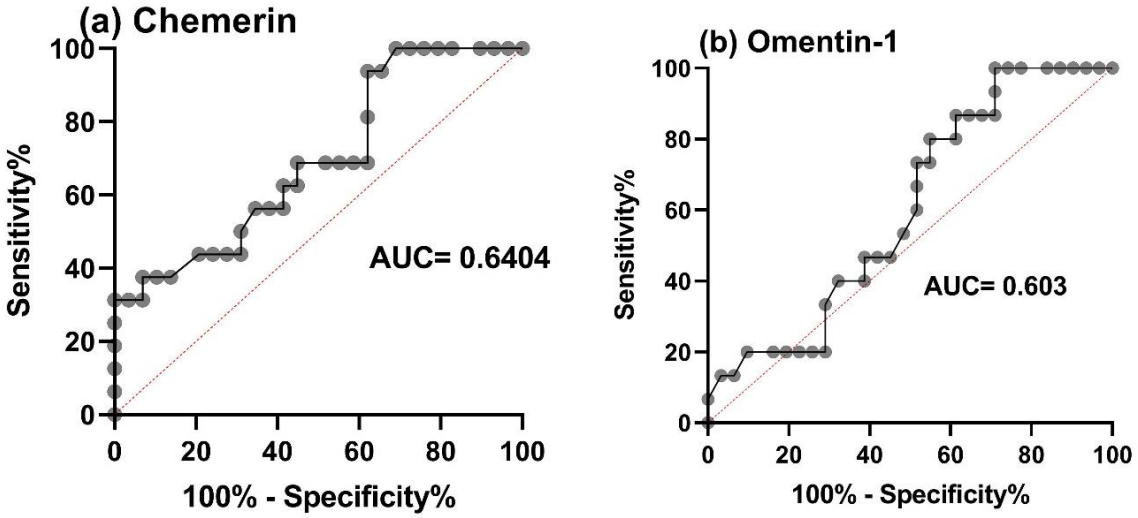

Figure 2. ROC curve analysis for (a) Chemerin and (b) Omentin-1 levels in DM and non-DM AMI patients

No significant changes were observed in the levels of both omentin-1 and chemerin regarding the number of arteries with lesions (Figure 3). The correlation matrix analysis between the adipokines (omentin-1 and chemerin) and HbA1c, systolic, and diastolic blood pressure (BP), C-reactive protein (CRP), and serum creatinine showed significant correlations only between the adipokines and HbA1c ($p<0.05$). Figure 4 shows the correlation matrix between the adipokines and clinical parameters.

[DOI: 10.22088/jbums.26.1.46]

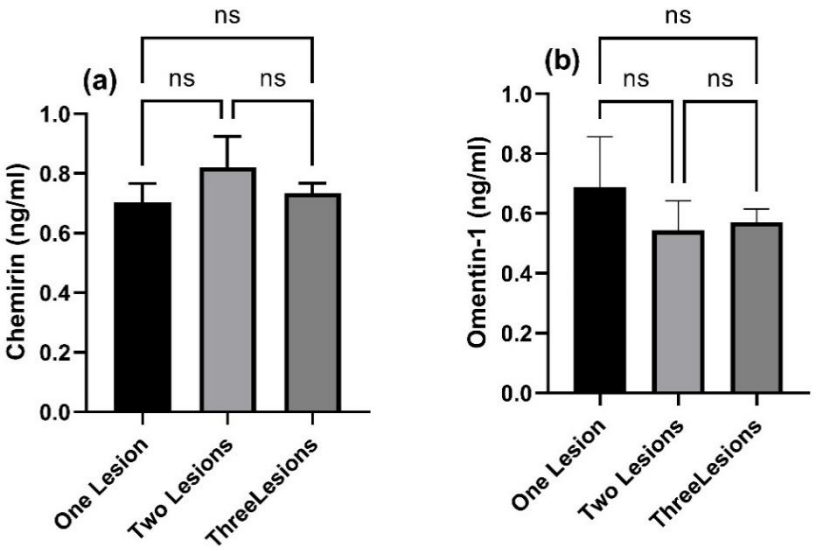

Figure 3. Comparison of Omentin-1 and chemerin levels regarding the number of arteries with lesions in AMI patients

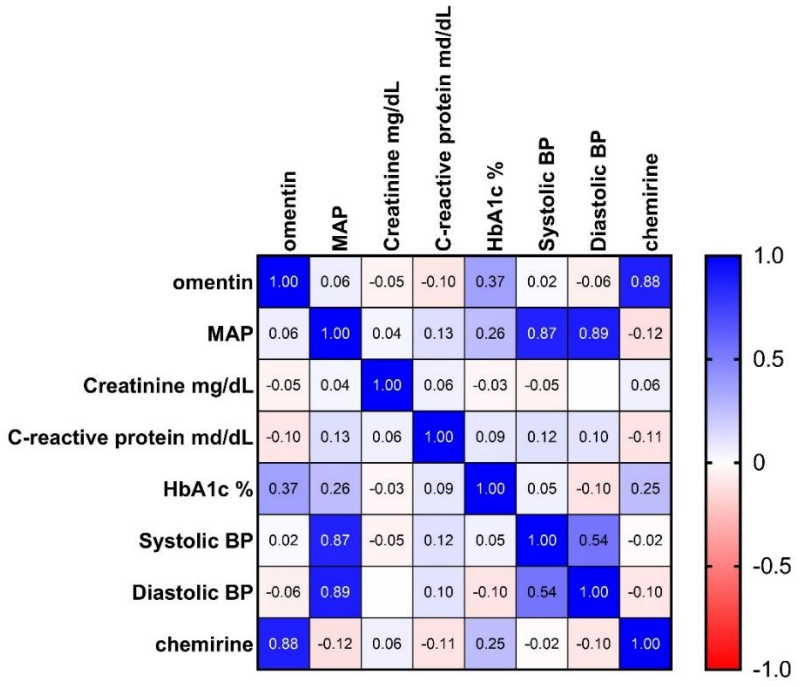

Figure 4. Heatmap correlation matrix between studied adipokines and some diabetic related measurements

Overall, these findings suggest that chemerin may be a more reliable biomarker than omentin-1 for detecting AMI in patients with diabetes. Additionally, both omentin-1 and chemerin may be useful biomarkers for monitoring HbA1c levels in AMI patients. However, the levels of both adipokines did not correlate with the number of arteries with lesions.

[DOI: 10.22088/jbums.26.1.46]

Discussion

The findings of this study revealed that the level of omentin-1 was non-significant between DM and non-DM AMI patients, while there was a significant increase in chemerin levels in DM patients compared to non-DM patients. Moreover, the ROC curve analysis showed that the diagnostic value of omentin-1 and chemerin for predicting DM in AMI patients recorded AUC of 0.603 and 0.640, respectively, however the result for chemerin was significant at the level of ($p<0.05$).

These findings are consistent with previous studies that reported an association between high chemerin levels and the presence of DM in AMI patients (16, 17). However, the non-significant difference in omentin-1 levels between DM and non-DM patients in our study is in contrast to some previous studies that reported a decrease in omentin-1 levels in DM patients (18). Chemerin acts as a pro-inflammatory adipokine, promoting the recruitment and activation of immune cells in adipose tissue. Chemerin also activates the nuclear factor-kappa B (NF-κB) pathway, a key regulator of inflammation, contributing to the systemic inflammation observed in T2DM (19).

Interestingly, the correlation analysis showed a significant positive correlation between omentin-1 and HbA1c levels in both DM and non-DM AMI patients. This finding is consistent with some previous studies that reported a positive correlation between omentin-1 and HbA1c levels in DM patients (20). The underlying mechanism of this correlation is not fully understood, but it may be attributed to the role of omentin-1 in regulating glucose metabolism and insulin sensitivity (21, 22).

In addition, there was no significant difference in the levels of omentin-1 and chemerin between single-vessel disease and multi-vessel disease in our study. This finding is consistent with a previous study that reported no significant difference in omentin-1 levels between single and multi-vessel disease in coronary artery disease patients (23). However, some studies reported a decrease in omentin-1 levels in multi-vessel disease patients (24).

In conclusion, our study showed a significant increase in chemerin levels in DM AMI patients compared to non-DM patients. However, the diagnostic value of omentin-1 and chemerin for predicting DM in AMI patients was poor. Our findings suggest a positive correlation between omentin-1 and HbA1c levels, regardless of the presence of DM.

Acknowledgment

We extend our heartfelt gratitude to all individuals who contributed to this research. Special thanks to the participants for their cooperation. We are grateful to the team of Cardiac center Lab for their guidance and support.

[DOI: 10.22088/jbums.26.1.46]

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