

Prevalence of the Most Frequent Risk Factors in Iraqi Patients with Acute Myocardial Infarction

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Abstract

Background: Coronary artery disease (CAD) and its major manifestation of acute myocardial infarction (AMI) are the most common causes of mortality and disability worldwide. **Objectives:** The major aim of this study was to assess the prevalence of the most frequent risk factors for AMI in Iraqi patients, including hypertension, hyperlipidemia, diabetes mellitus, smoking, family history, insufficient physical activity, obesity, and abnormal coronary artery characteristics. **Materials and Methods:** In this study, 74 patients presented with AMI (51 males and 23 female) were enrolled. Laboratory investigations were carried out using enzymatic immunoassay technique. **Results:** The mean age was 55.5 ± 12.47 years, with an age range of 20–90 years. The incidence of AMI in male patients was significantly higher than that in female patients. Major findings showed that 85.1% of AMI patients were insufficiently physically active and 74.3% were hypertensive. High level of low-density lipoprotein was seen in 50% of patients, high triglycerides in 41.9%, low high-density lipoprotein in 39.2%, and high total cholesterol in 34%. Nearly 39.2% were smokers, 35.1% were obese, and 29.7% were diabetic. Interestingly, 51.4% of the AMI patients had a positive family history of CAD. The left anterior descending artery was the most common vessel involved during AMI. **Conclusions:** The findings of this study conclude that AMI occurs in older age and in male gender among Iraqi population, and ST-elevation MI is the main presentation. Hypertension, hyperlipidemia, and smoking are the major risk factors. This study shed light on the primary prevention and control of these cardiovascular risk factors for CAD through healthy lifestyle, increased physical activity, and healthy dietary choices, which can reduce the prevalence of CAD.

Keywords: Acute myocardial infarction, cardiovascular risk factors, diabetes mellitus, hyperlipidemia, preventive cardiovascular

INTRODUCTION

Coronary artery disease (CAD) has become the most prevalent serious global burden of morbidity and mortality in industrialized countries and is a rapidly growing problem in developed countries. According to the Third Report by the World Health Organization, 12 million people die annually of CVD worldwide, and it is estimated that by 2025, cardiovascular mortality on worldwide scale will likely surpass that of every major disease group, including infection, cancer, and trauma.^[1,2] Similar to many high-income countries during the 20th century, low- and middle-income countries are seeing an alarming increase in the rates of CVD, and this change is accelerating that is responsible for 80% of global deaths. Atherosclerosis is considered the main cause of acute myocardial infarction (AMI), in which 70% of fatal events among patients with AMI are caused by occlusion from atherosclerotic plaques.^[3]

Atherosclerosis is characterized by endothelial dysfunction, vascular inflammation, and the formation of atherosclerotic plaque. This buildup of atherosclerotic plaque causes an inadequate supply of oxygen to myocardial tissue, leading to myocardial hypoxia. Consequently, the plaque rupture and atherothrombosis cause further narrowing of coronary arteries and almost occluding the blood flow, leading to fatal acute coronary syndromes. The most evident manifestation of CAD is the AMI. For instance, the ruptured atherosclerotic plaques

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followed by thrombosis and loss of blood flow in the coronary vessel cause the predominant signs and symptoms of AMI in the coronary arteries.^[4]

Clinical trials have demonstrated that the early detection and lowering these risk factors by aggressive treatment reduce cardiovascular risks. There are current worldwide variations in the global burden of ischemic heart disease. For instance, the prevalence of most cardiovascular risk factors has declined in the high-income nations such as in most European countries and the United States over the past 40 years. However, most Eastern Mediterranean countries have undergone the shift in the burden of CAD.^[5] CAD is estimated to increase more dramatically in the next decade than any other global regions.^[6]

According to epidemiological reports by the WHO in 2016, the highest prevalence rate of ischemic heart disease was observed in Saudi Arabia (46%) and Kuwait (41%).^[7] In Iraq, the epidemiological data on the incidence and prevalence of CAD as evidence of awareness are limited due to the unavailability of evidence-based national guidelines for the management of cardiovascular disease and surveillance studies as compared to other Eastern Mediterranean countries.^[5] In a recent study in 2014, cardiovascular disease mortality was estimated to account for 33% in Iraq.^[8] A better understanding of the burden of cardiovascular disease and associated risk factors in this region and increasing the public knowledge and awareness of CAD symptoms and its risk factors are highly imperative to control and prevent this disease.

There are multiple conventional cardiovascular risk factors of AMI. These include behavioral (modifiable) risk factors such as insufficient physical activity, smoking, poor diet, and harmful alcohol consumption and clinical (nonmodifiable) risk factors such as hypertension, dyslipidemia, diabetes, and obesity.

Smoking has been shown to accelerate atherosclerosis and precipitate AMI by multiple mechanisms, such as (a) increases the levels of serum low-density lipoprotein-cholesterol (LDL-C) and triglyceride concentrations and reduces serum high-density lipoprotein-cholesterol (HDL-C); (b) stimulates the free radical to oxidize LDL-C molecules, this leads the oxidized LDL-C molecules to accumulate within the arterial wall; (c) induces vascular inflammation characteristic of atherosclerosis, as reflected by higher serum C-reactive protein levels in smokers; and (d) The nicotine and free radicals in the cigarette activates the sympathetic nervous system (SNS) and leads elevation of heart rate, contractility and wall tension. Consequently, this increase causes high myocardial oxygen demand to heart. The high activity of SNS due to nicotine effect results in increased oxygen demand to myocardium. The myocardial oxygen flow is decreased through coronary arterial vasoconstriction. In addition, cigarette smoking causes increase in the levels of carboxyhemoglobin in the blood, with the potential to further reduce myocardial oxygen delivery from oxyhemoglobin.^[9]

Hypertension is considered a strong risk factor of fatal CAD. Its prevalence is dramatically on rise and its effective

treatment remains challenging, highlighting the need for preventive program.^[10] Several mechanisms can account for the increased coronary risk in hypertensive patients. Hypertension accelerates the effects on atheroma, increases shear stress on plaques, exerts adverse functional effects on the coronary circulation, and impairs endothelial function and control of sympathetic tone.^[11] Dyslipidemia, including high levels of LDL-C, elevated triglycerides (TG), and low levels of HDL-C, is associated with an increased risk of cardiovascular events.^[12] Moreover, diabetes mellitus (DM) ranks among the major cardiovascular risk factors. Diabetic patients have 2-8 fold higher rates of CVD risks as compared to nondiabetic patients, and 75% of mortality in patients with DM result from CVD.^[13]

Due to the importance of CAD, especially AMI, this study aimed to determine the prevalence of most frequent cardiovascular risk factors, including hypertension, hyperlipidemia, smoking, family history, insufficient physical activity, and obesity among Iraqi patients with AMI.

MATERIALS AND METHODS

Study population

The study population comprised 74 consecutive patients with acute MI, admitted to the causality department of the Surgical Specialty Hospital – Cardiac Center – within 12 h of the onset of clinical signs and symptoms from March to May 2018.

All patients aged between 20 and 90 years were included in this study. The control group consisted of 240 age- and gender-matched individuals without ischemic heart disease. Diagnostic criteria of acute MI were followed according to the guidelines of the European Society of Cardiology, such as when the patient is presented with typical chest pain, diagnostic electrocardiogram (ECG) changes, and a significant elevation of cardiac enzymes. Exclusion criteria for patients and controls included pregnancy, anemia, and kidney failure.

Ethical considerations

This study was approved by the Ethics Committee of Hawler Medical University, and written informed consent was obtained from all patients and controls. Cases and controls filled in a standard questionnaire about their personal histories, major risk factors, and history of ischemic heart disease and provided blood samples for laboratory analysis.

Laboratory analysis

The serum levels of lipid profile parameters, including total cholesterol (TC), HDL-C, LDL-C, and TG, were determined at the admission of the patient presented with AMI. These laboratory tests were carried out using Cobas c311 chemistry analyzer (Roche Diagnostics, Basel, Switzerland) for sample analysis.

We defined high serum levels as TC ≥ 200 mg/dL, LDL-C ≥ 200 mg/dL, and TG ≥ 130 mg/dL; low serum HDL was defined as ≤ 35 mg/dL.^[14] The blood sample was transferred into ethylenediaminetetraacetic acid tubes and centrifuged

immediately at 4000 ×g for 10 min. The serum was separated and immediately stored at −20°C until further analysis. Moreover, HbA1c was measured using a fully automated glycohemoglobin analyzer.

Statistical analysis of data

Data were analyzed using the Statistical Package for Social Sciences version 21 (SPSS, IBM, Chicago, IL, USA). Differences in variables were tested using Student's *t*-tests. $P \leq 0.05$ was considered statistically significant.

RESULTS

The most common cardiovascular risk factors in patients with AMI were hypertension, dyslipidemia, DM, smoking, family history, physical inactivity, and abnormalities of coronary arteries.

Prevalence of myocardial infarction in relation to age and gender

In this study, 74 patients with AMI, of which 51 male (68.91%) and 23 female (31.08%) patients, were enrolled. The mean age of the AMI patients was 55.5 ± 12.47 years, with a age range of 22–83 years. The mean $\pm$ standard deviation of age was 55.7 ± 14.1 years in male and 57.1 ± 9.2 years in female patients. The incidence of AMI in male patients was higher than that of female patients with a statistically significant difference ($P < 0.0001$). This indicates that male gender experiences AMI at an older age as compared to female gender [Table 1].

The highest prevalence rate of AMI was detected in older patients at the age group of 60–69 years (33.8%) and 50–59 years (28.4%). Moreover, it was observed that majority of the male patients (31.4%) with AMI were in the age group of 60–69 years. On comparison, 39.1% of female patients with AMI were detected in the age group of 60–69 years.

Clinical risk factors

Hypertension

According to the 2018 European Society of Cardiology guidelines for the management of arterial hypertension,^[15] the definition and classification of arterial hypertension is followed in this study as described in Table 2.

Table 1: Prevalence of Acute Myocardial Infarction in relation to age and gender

Age (Year)	Male		Female		Total	
	No.	%	No.	%	No.	%
20-29	3	5.9	0	0.0	3	4.1
30-39	4	7.8	0	0.0	4	5.4
40-49	8	15.7	4	17.4	12	16.2
50-59	13	25.5	8	34.8	21	28.4
60-69	16	31.4	9	39.1	25	33.8
70-79	5	9.8	2	8.7	7	9.5
>80	2	3.9	0	0.0	2	2.7
Total	51	68.9	23	31.1	74	100.0

The results observed that 55 (74.3%) patients with AMI were hypertensive, 3 (4.1%) were hypotensive, and 16 (21.6%) had normal blood pressure, as shown in Figure 1a. Among the AMI patients in this study, the prevalence of hypertension was higher among male patients (76.5%) than among female patients (69.6%) [Figure 1b]. These findings indicate that a high prevalence of hypertension occurred among Iraqi AMI patients.

The prevalence of hypertension of different age groups was determined. As shown in Figure 1c, the highest prevalence of hypertension was detected in older patients of age group 60–69 years (30.9%). This difference was statistically significant ($P < 0.001$). The prevalence of hypertension was greater in elderly male patients with AMI as compared to female patients, as shown in Figure 1d.

Furthermore, the results showed that 37 hypertensive AMI patients (67.3%) had high-normal hypertension level, followed by 11 (20%) as isolated systolic hypertension, 4 (7.3%) as Grade 1 hypertension, 2 (3.6%) as Grade 2 hypertension, and 1 (1.8%) as Grade 3 hypertension level, as shown in Figure 2.

Dyslipidemia

In the present study [Figure 3a], we showed that 37 AMI patients (50.0%) had high level of LDL (≥ 130 ng/dl), 31 AMI patients (41.8%) had high level of TG (≥ 200 ng/dl), and 25 AMI patients (33.7%) had high level of TC (≥ 200 ng/dl). While, low level of HDL (≤ 35 ng/dl) was observed in 29 AMI patients (39.1%).

The prevalence of hyperlipidemia in AMI patients according to gender is shown in Figure 3b. The prevalence of high level of LDL was greater in male AMI patients (52.9%) as compared to female patients (43.5%). Whereas, higher prevalence rate of low level of HDL was detected in female patients (45.1%) than in male patients (26.1%).

Figure 3c shows the prevalence of hyperlipidemia in AMI patients according to different age groups. In our study, the highest prevalence level of each of high level of LDL (40.5%), TG (33.3%), and TC (48.0%) was observed among AMI patients in the age group of 50–59 years. While, the prevalence of low level of HDL (37.9%) was observed in the age group of 60–69 years among AMI patients as compared to other age groups.

In addition, the mean level of lipid profile parameters in AMI patients among various age groups was determined. As shown in Figure 4. TG and TC levels in 50–59 years' age group were significantly higher than that of other age groups. Moreover, the LDL level in 30–39 years' age group was significantly higher compared to that of other age groups, whereas the HDL level was the lowest in 30–39 years age when compared to other age groups.

The mean concentrations of lipid profile parameters according to the gender of AMI patients are described in Figure 5. Our results showed that male patients with AMI have significantly

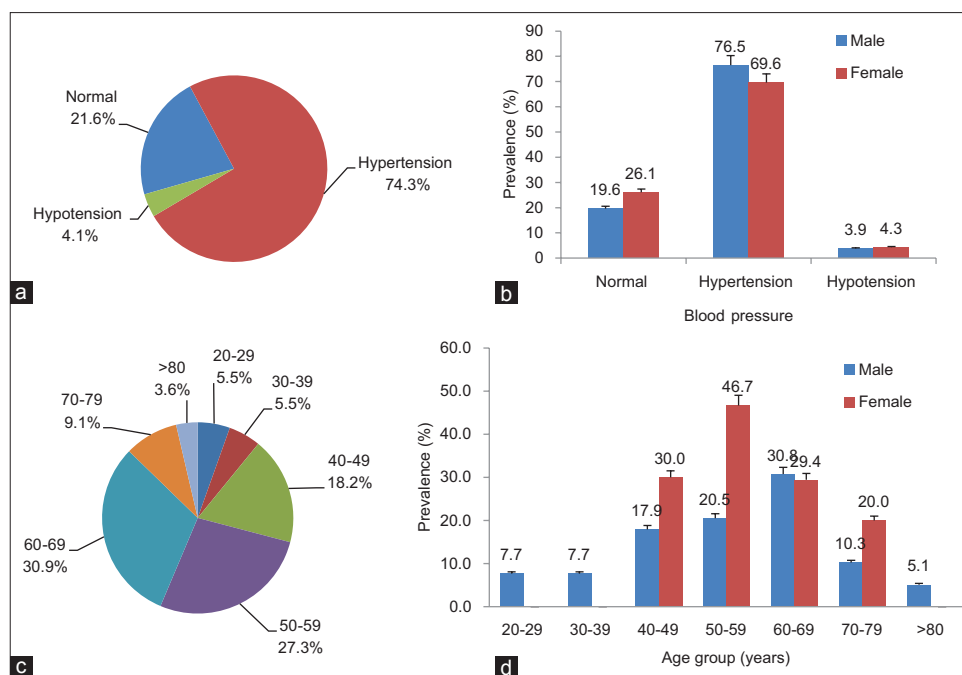


Figure 1: Correlation of hypertension risk factor in acute myocardial infarction patients. (a) Prevalence of blood pressure types in acute myocardial infarction patients. (b) Prevalence of blood pressure types in acute myocardial infarction patients in relation to gender. (c) Prevalence of blood pressure types in relation to age groups in acute myocardial infarction patients. (d) Prevalence of blood pressure types in acute myocardial infarction patients in relation to age and gender

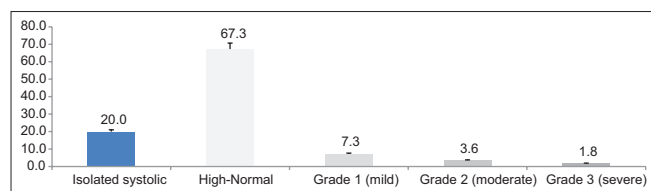


Figure 2: Prevalence of hypertension types among patients with acute myocardial infarction

lower level of HDL and higher levels of LDL, TG, and TC in all age groups in comparison to female patients.

Diabetes mellitus

Of 74 patients with AMI, 27.0% were diabetic, 9.5% were prediabetes, and 63.5% were nondiabetic, as shown in Figure 6a. It was observed that the prevalence of diabetes was higher in female patients with AMI as compared to male patients, as shown in Figure 6b. Furthermore, we determined the prevalence of HbA1c in AMI patients among various age groups. As shown in Table 3, the prevalence of diabetes was higher in older age groups, particularly in female patients with AMI in 50–59 years' (21.7%), 60–69 years' (13.0%), and 70–79 years' (4.3%) age groups as compared to male patients with AMI.

Smoking

The prevalence of smoking habit was high among AMI patients. Out of 74 patients with AMI, 36 (48.6%) were current smokers, 28 (37.8%) were nonsmokers, and 10 (13.5%) were prior smokers, as described in Figure 7a.

Table 2: Classification of arterial blood pressure and definitions of hypertension grades^b

Category	Systolic (mmHg)	Diastolic (mmHg)
Optimal	<120	and <80
Normal	120-129	and/or 80-84
High normal	130-139	and/or 85-89
Grade 1 hypertension	140-159	and/or 90-99
Grade 2 hypertension	160-179	and/or 100-109
Grade 3 hypertension	≥180	and/or ≥110
Isolated systolic hypertension ^b	≥140	and <90

BP=blood pressure; SBP=Systolic blood pressure. ^aBP category is defined according to seated clinic BP and by the highest level of BP, whether systolic or diastolic. ^bIsolated systolic hypertension is graded 1, 2, or 3 according to SBP values in the ranges indicated

The prevalence rate of smoking was higher in male AMI patients (52.9%) as compared to those in female AMI patients (39.1%), as shown in Figure 7b.

In relation to age groups of AMI patients, it was observed that the prevalence of smoking was the highest in the age group of 60–69 years (30.6%), as compared to those patients in other age groups, as described in Figure 7c.

Furthermore, the associations of smoking with conventional risk factors (hyperlipidemia, diabetes, and hypertension) were determined among AMI patients. As described in Figure 8, smokers with AMI had higher prevalence rates of hyperlipidemia, diabetes, and hypertension, as compared to nonsmokers or prior smokers.

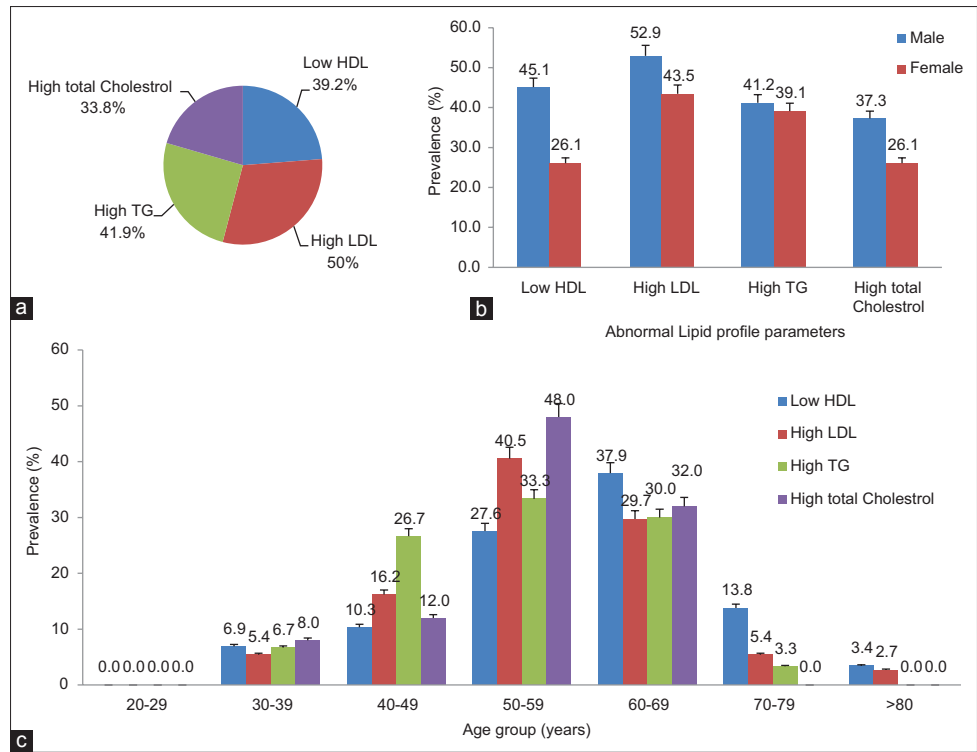


Figure 3: Correlation of hyperlipidemia risk factor among acute myocardial infarction patients. (a) Prevalence of hyperlipidemia types in acute myocardial infarction patients. (b) Prevalence of hyperlipidemia types in acute myocardial infarction patients in relation to gender. (c) Prevalence of hyperlipidemia types in acute myocardial infarction patients in relation to age groups

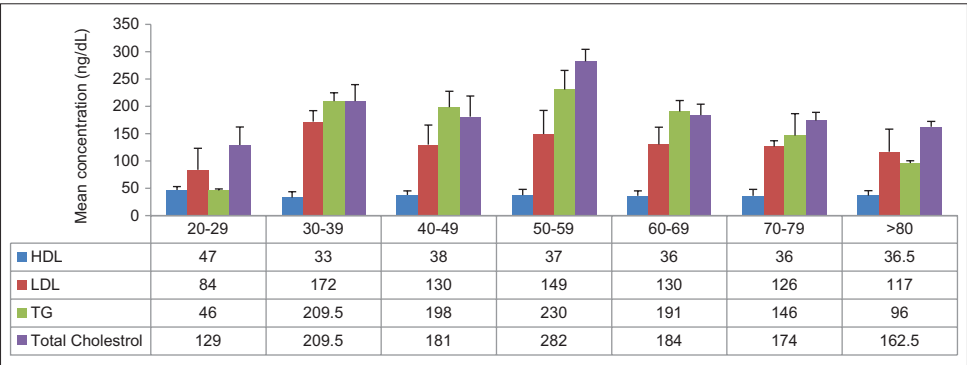


Figure 4: The pattern (mean ng/dL) of lipid profile parameters of acute myocardial infarction patients in various age groups

Family history

The prevalence rate of positive family history was higher among AMI patients than those without family history. As described in Figure 9a, 38 AMI patients (51.4%) had a positive family history of heart diseases and 36 AMI patients (48.6%) were having no family history of heart diseases. As it has been suggested that the effect of family history may differ in male and female genders,^[12] our results showed that the prevalence rate of AMI patients with positive family history was higher in male gender (52.9%) as compared to females (47.85%), as shown in Figure 9b.

To determine the role of family history of ischemic heart disease on the risk of AMI, we determined the prevalence

of positive family history among AMI patients, with specific attention to its association with hyperlipidemia in this study. The results showed that AMI patients with positive family history had higher levels of hyperlipidemia than those without family history. As shown in Figure 9c, the prevalence of abnormal lipid profile parameters was higher compared to those with no family history. These results indicate that family history of coronary heart disease is a potent risk factor for AMI.

Physical inactivity

The results showed that the majority of AMI patients did not engage regular exercise as only 14.9% of AMI patients were observed to be sufficiently physically active, as shown in Figure 10a. Moreover, the prevalence of insufficient

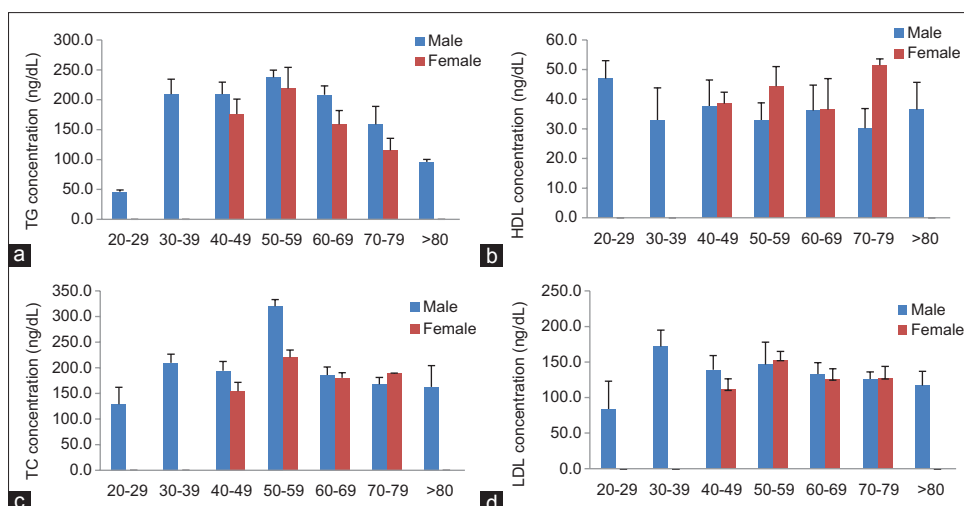


Figure 5: Gender-related difference of lipid profile in acute myocardial infarction patients in various age groups. (a) Mean triglycerides concentration, (b) mean high-density lipoprotein concentration, (c) Mean total cholesterol concentration, (d) mean low-density lipoprotein concentration

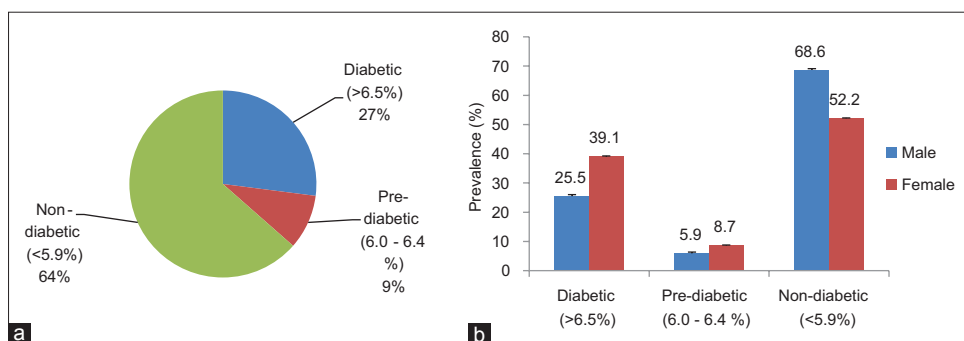


Figure 6: Diabetes mellitus risk factor in acute myocardial infarction patients. (a) Prevalence of Diabetes mellitus among acute myocardial infarction patients. (b) Prevalence of DB risk factor according to gender of acute myocardial infarction patients

Table 3: Prevalence of HbA1C% level in AMI patients according to gender and age

Age group		Male			Female			Total
		Diabetic	Pre-diabetic	Non-diabetic	Diabetic	Pre-diabetic	Non-diabetic	
20-29	No.	0	0	3	0	0	0	3
	%	0.0	0.0	5.9	0.0	0.0	0.0	5.9
30-39	No.	0	0	4	0	0	0	4
	%	0.0	0.0	7.8	0.0	0.0	0.0	7.8
40-49	No.	2	1	5	0	1	3	12
	%	3.9	2.0	9.8	0.0	4.3	13.0	33.1
50-59	No.	6	1	6	5	1	2	21
	%	11.8	2.0	11.8	21.7	4.3	8.7	60.3
60-69	No.	4	0	12	3	0	6	25
	%	7.8	0.0	23.5	13.0	0.0	26.1	70.5
70-79	No.	1	1	3	1	0	1	7
	%	2.0	2.0	5.9	4.3	0.0	4.3	18.5
>80	No.	0	0	2	0	0	0	2
	%	0.0	0.0	3.9	0.0	0.0	0.0	3.9
Total	No.	13	3	35	9	2	12	74
	%	25.5	5.9	68.6	39.1	8.7	52.2	100.0

physical activity was higher in female AMI patients (91.30%) as compared to that in male gender (82.4%), as shown in

Figure 10b. Although the level of sufficient physical activity was low among AMI patients, the highest rate of physical

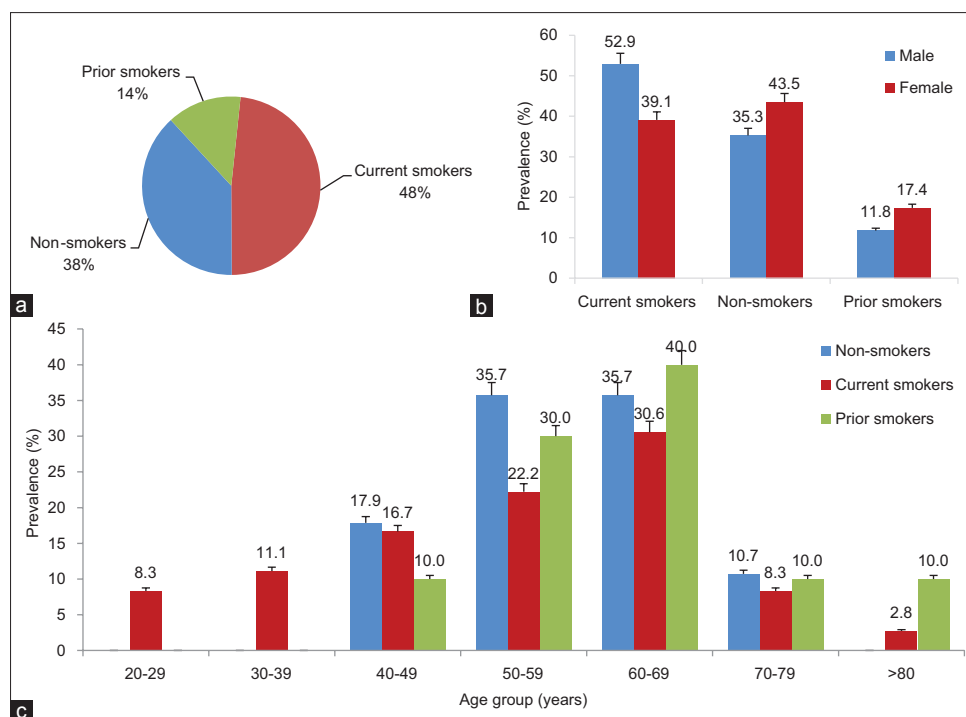


Figure 7: Prevalence of smoking status in patients with coronary artery disease in relation to gender. (a) Prevalence of smoking risk factor in acute myocardial infarction patients. (b) Prevalence of smoking risk factor in acute myocardial infarction patients in relation to gender. (c) Prevalence of smoking risk factor in acute myocardial infarction patients in relation to age

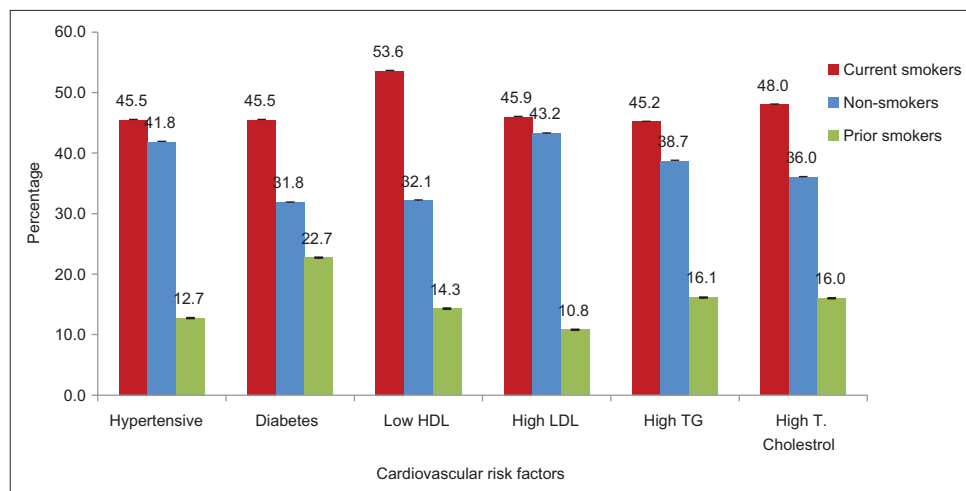


Figure 8: Correlations of smoking status in patients with coronary artery disease with cardiovascular risk factors

activity performance was detected in the age group of 60–65 years among AMI patients, as described in Figure 10c. It has been noted that the rate of performance of physical activities was the highest in male AMI patients at the age group of 50–59 years (44.4%), whereas in female patients, it was in the age group of 40–49 years (65%), as shown in Figure 10d and e, respectively.

Abnormalities of coronary arteries

In this study, the most common vessels affected during AMI are as follows [Figure 11a]: left anterior descending (LAD) was present in 50% of AMI patients, Right Coronary Artery (RCA)

in 30%, followed by Left Circumflex Artery (LCX) (13%), and Obtuse Marginal branch (OM) (7%). However, no D1 was observed in AMI patients. Moreover, LAD was seen most frequently in male AMI patients (42%) at older age above 50 years old, as described in Figure 11b and c. The most common ECG presented during AMI in patients was STEMI (97%) [Figure 11d], 98% in males and 95% in females [Figure 11e]. The most common STEMI presented during AMI in patients is shown in Figure 11f and g.

Obesity

The present study demonstrated high prevalence of overweight

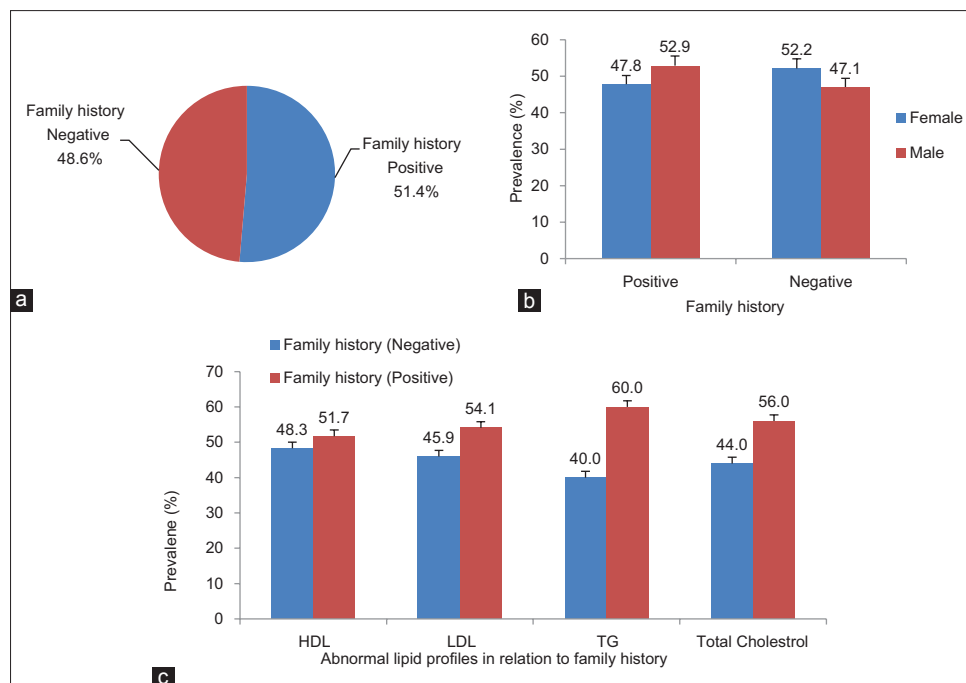


Figure 9: The correlation of family history risk factor with hyperlipidemia. (a) Prevalence of family history in acute myocardial infarction patients. (b) Prevalence of family history in acute myocardial infarction patients according to gender. (c) Prevalence of abnormal lipid profiles in relation to family history risk factor in acute myocardial infarction patients

and obesity among AMI patients. As shown in Figure 12a, 30 AMI patients (40.5%) had normal body mass index (BMI), 30 (40.55) were overweight, and 26 (35.1%) were obese. The prevalence of overweight was the highest among female AMI patients (43.5%), whereas the highest prevalence of excess obesity was observed in male AMI patients, as described in Figure 12b. The highest prevalence rate of overweight among AMI patients was observed in the age group of 50–59 years (33.3%), whereas excess obesity was observed in the age group of 60–69 years (38.55), as described in Figure 12c. We also determined the association of obesity with lipid profile parameters. It was observed that the rate of abnormal lipid profile parameters was higher among overweight and obese AMI patients as compared to those who have normal BMI, as shown in Figure 13a.

The prevalence of high LDL level was the highest in obese female patients with AMI, whereas high LDL level was the highest among overweight male patients with AMI, as described in Figure 13b and c. These results confirm that overweight and obesity play an important role in enhancing the risk of AMI, particularly in older patients above 50 years. Moreover, high rate of hyperlipidemia was observed among obese patients with AMI, indicating that excess obesity and hyperlipidemia together contribute in the increasing risk of AMI.

Prevalence of most frequent risk factors in patients with acute myocardial infarction

As described in Figure 14, findings of this study showed that the most prevalent modifiable risk factor was insufficient physical activity (85.1%) in the majority

of AMI patients. The second most prevalent risk factor was hypertension (74.3%) in AMI patients, followed by hyperlipidemia; as 50% of patients had high LDL and 41.9% had high TG. Moreover, smoking (30.6%), obesity (35.1%), and DM (29.7%) were found in nearly one-quarter of the AMI patients. Furthermore, the prevalence of nonmodifiable risk factors such as positive family history in AMI patients was 51.4%.

DISCUSSION

Due to the importance of AMI as a predominant type of CAD in clinical practice in Iraq, this study determined the prevalence of AMI and most frequent risk factors in Iraqi patients. In this study, the mean age of patients with AMI was 55.7 ± 14.1 years in males and 57.1 ± 9.2 years in females; it was lower in male than female patients. Interestingly, a significant higher trend of AMI occurrence was observed in patients below 60 years old (54%) when compared to patients 60 years old or more (46%). This indicates that the average age of patients hospitalized with AMI has been shifted toward younger age groups. The mean age of patients with AMI in Iraq is 10 years lower compared to that in developed countries.^[16] The mean age of AMI patients in Iran was 59 years in males and 62 years in females;^[17] in Japan was 61 in 2000 and 75 years in 2008;^[18] and in Switzerland was 66.5 ± 13.9 in 1998 and 67.6 ± 13.8 years in 2008, respectively.^[19] Higher incidence of AMI at an earlier age could be attributed to the poor management of modifiable AMI risk factors, inappropriate primary preventive measures, and low cardiovascular health awareness.

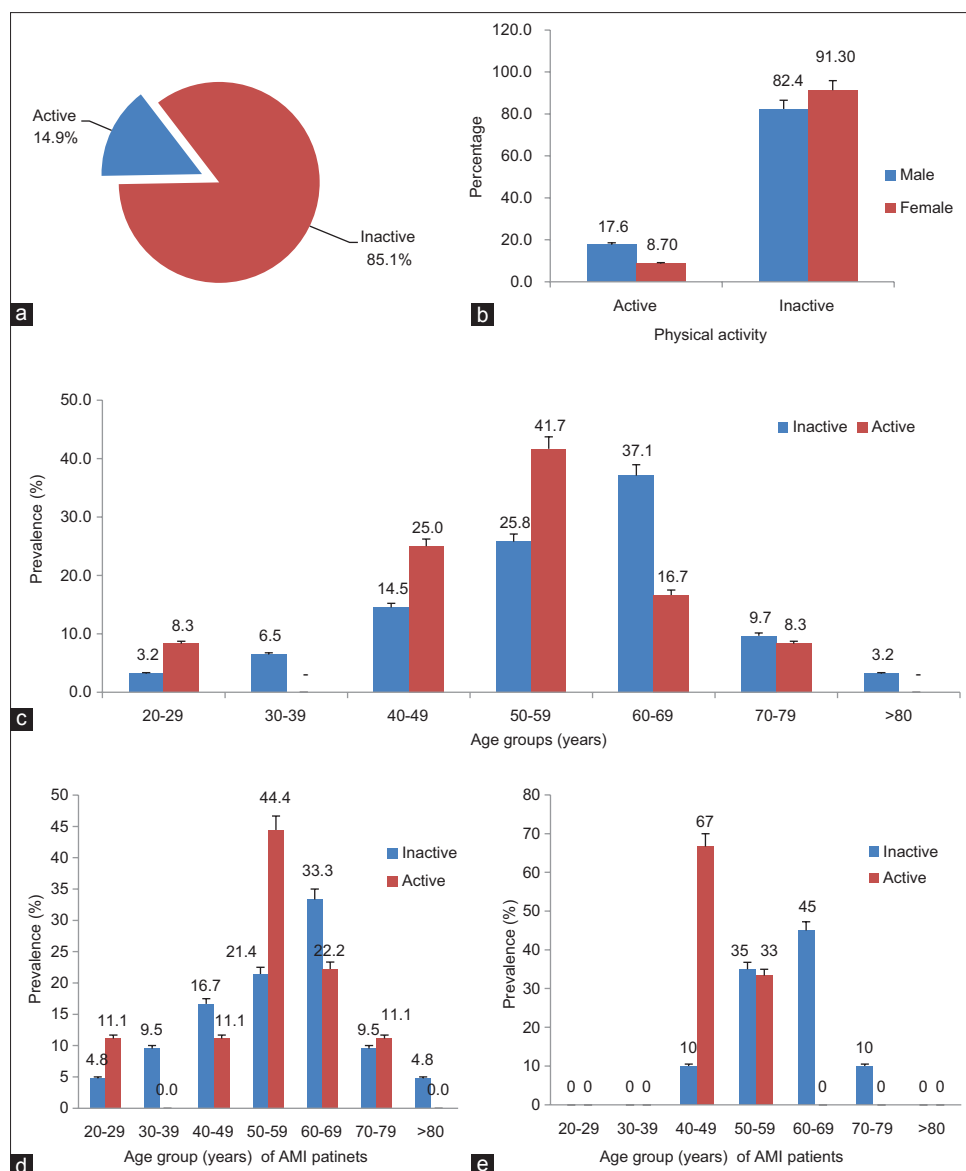


Figure 10: Correlation of physical inactivity risk factor in acute myocardial infarction patients. (a) Prevalence of physical activity in acute myocardial infarction patients. (b) Prevalence of physical activity in acute myocardial infarction patients in relation to gender. (c) Prevalence of physical activity in acute myocardial infarction patients in relation to age. (d) Prevalence of physical activity in male acute myocardial infarction patients. (e) Prevalence of physical activity in female acute myocardial infarction patients

According to the findings of this study, AMI in Iraq has higher prevalence rate in male compared to female patients as similar to findings in other countries around the world. The incidence of male-to-female ratio of AMI in Iran^[17] was 79/29 and 70/30 in Japan and Switzerland, respectively.^[18,19]

In this study, insufficient physical activity was considered the most common risk factor that was observed in AMI patients. Thus, this finding emphasizes that regular physical activity such as exercising is an important factor to improve and maintain cardiovascular health and fitness. Most epidemiological studies have shown a strong graded association between the levels of insufficient physical activity and increased risk of CAD death. It has been shown that physical activity contributes up to 30% reduced risk of CAD.^[20,21] Awareness of the benefits

of exercise, especially walking, should hopefully encourage people to improve their lifestyle.

The second highest prevalence level of modifiable risk factor observed in this study was hypertension in AMI patients. The systolic and diastolic blood pressure increase the risk of AMI, and the higher the pressure, the greater the risk.^[17] Hypertension is a well-known predisposing factor of causing atherosclerosis in coronary blood vessels, leading to myocardial infarction. The prevalence of hypertension is considered the second highest in the Eastern Mediterranean countries. In old age, hypertension has a deleterious effect on the heart in older patients and responsible for about 70% of heart disease.^[22] The prevalence of hypertension in Iraqi patients with CAD was higher (74.3%) compared to that of recent studies conducted across different

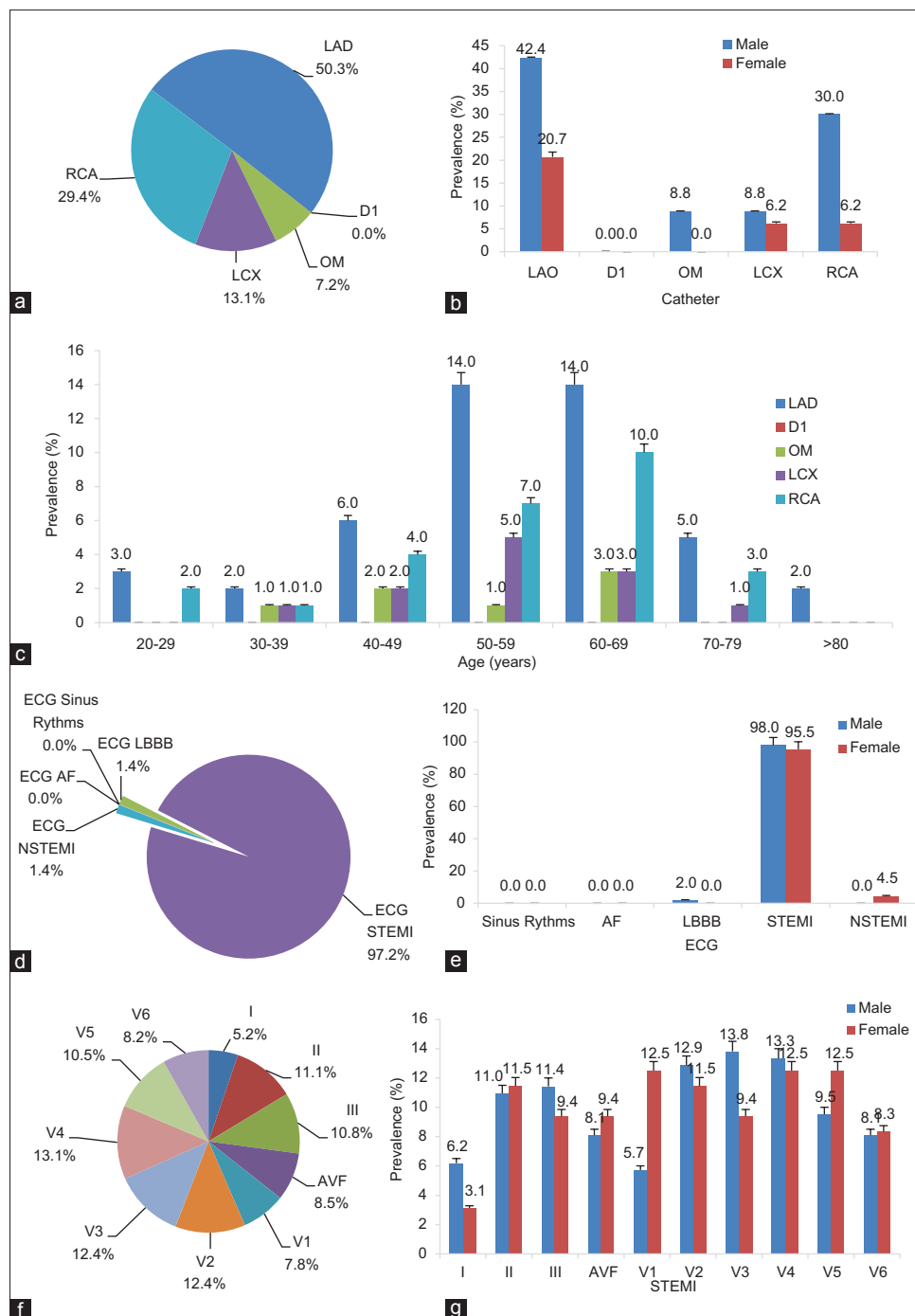


Figure 11: Abnormal coronary arteries. (a) Most common vessels affected during acute myocardial infarction. (b) Most common vessels affected during acute myocardial infarction in relation to gender. (c) Most common vessels affected during acute myocardial infarction in relation to age. (d) Most common electrocardiogram presented during acute myocardial infarction. (e) Most common Electrocardiogram (ECG) presented during acute myocardial infarction in relation to gender. (f) Most common STEMI presented during acute myocardial infarction. (g) Most common STEMI presented during acute myocardial infarction in relation to gender

regions in Iraq in 2014 (54.7%) in Basrah,^[23] in 2015 (46%) in Duhok,^[24] and in 2018 (45%–55%) in Karbala.^[25]

Hyperlipidemia is a well-established predisposing risk factor for coronary atherosclerosis, and intervention of lipid profile parameters can reduce the risk of cardiovascular risk. According to the present study, hyperlipidemia was present at

a high frequency in Iraqi patients with AMI. The prevalence of each of the elevated LDL (50.0%) and TG (41.9%) in these patients was higher when compared to that of the studies carried out in Iran and across the Middle Eastern countries.^[26,27]

Smoking has a harmful effect on cardiovascular health. It is considered the most frequent and strong risk factor of acute

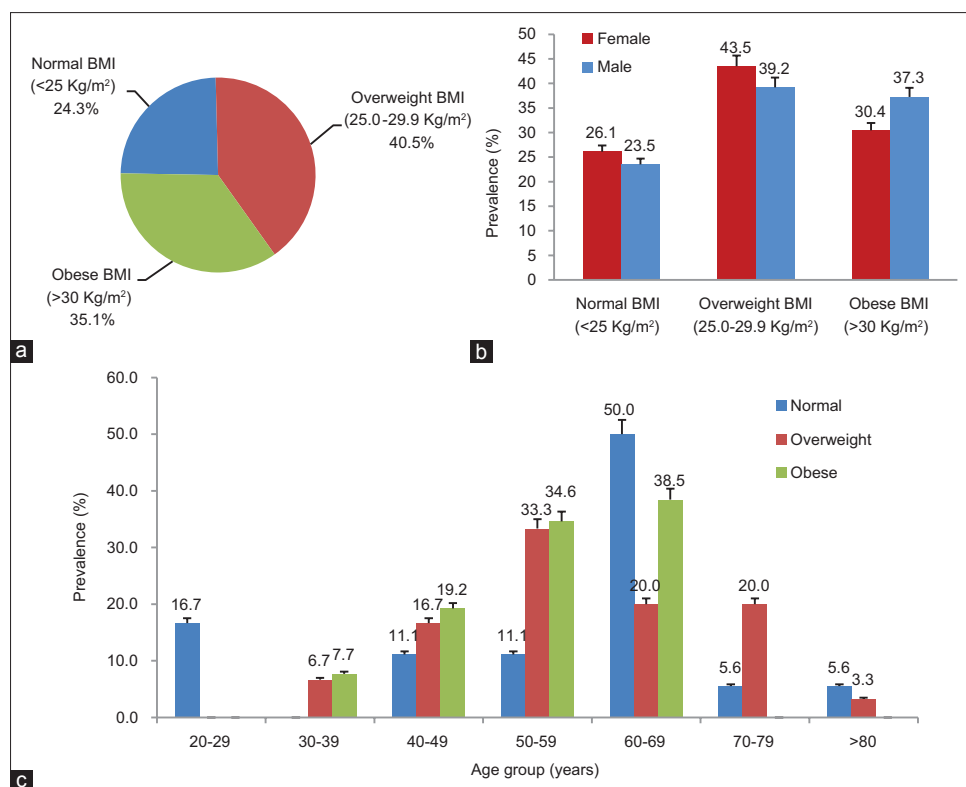


Figure 12: Prevalence of obesity in acute myocardial infarction patients in relation to both gender and age. (a) Prevalence of obesity in acute myocardial infarction patients. (b) Prevalence of obesity in acute myocardial infarction patients in relation to gender. (c) Prevalence of obesity in acute myocardial infarction patients in relation to age

CAD, leading to myocardial infarction. An epidemiological observation had demonstrated that in 2015, the prevalence of cigarette smoking in the Eastern Mediterranean countries was higher than the global prevalence, but lower than in Europe.^[28] Our analysis revealed that the rate of smoking among patients with AMI was higher (39.2%) in this study compared to that of Mohammad *et al.* (26%).^[24] Furthermore, current smoking status was less prevalent among female patients compared to male patients. It is noteworthy that the smoker AMI patients were more likely to have increased rate of hypertension, hyperlipidemia, and diabetes compared to nonsmoking AMI patients. This finding is consistent with previous studies among patients with acute coronary events.^[27,29]

DM is a well-recognized risk factor for CAD. Acute CAD accounts for more than 80% of mortality and 75% hospitalized diabetic patients, and it is reported that atherosclerotic plaques are more prone to rupture among patients with diabetes.^[30] DM increases the risk of AMI through increasing atherosclerosis and adversely affects the lipid profile and promotes the formation of atherosclerotic plaque in the coronary artery vessels. Hence, it has been previously shown that AMI is more fatal and severe in diabetic patients as compared to AMI in patients without diabetes disease.^[29] The prevalence of DM in Iraqi patients with AMI in this study seems higher than the rates observed in Israel, Jordan, Qatar, and Saudi Arabia.^[31] Recent studies

had shown that female patients with diabetes are at higher risk to develop AMI than male patients.^[32,33] These data are similar to those found in our study, in which female patients with AMI more frequently had hypertension compared to male patients.

A positive family history of ischemic heart disease is a well-known risk factor that has been associated with an excess risk AMI, and this has been explained in light of hereditary predisposition to AMI.^[34] Several genetic factors are positively correlated with an increased risk of AMI, and family history with CAD in a first-degree relative doubles AMI risk.^[35] This study showed a significantly high rate of positive family history among patients with AMI.

In addition, among important findings of this study are that insufficient physical activity and overweight are important contributing factors for increasing the risk of the development of AMI affecting all ages and in both genders.^[36] Excess obesity may affect health, and it is necessary to control one's BMI to prevent AMI. It has been shown that overweight is considered an independent risk factor for AMI.

While this study has let to novel findings concerning the prevalence of most frequent cardiovascular risk factors for AMI, exploration of more new risk factors in larger population would further improve our understanding of the key roles of conventional and new risk factors in the pathogenesis of CAD and AMI.

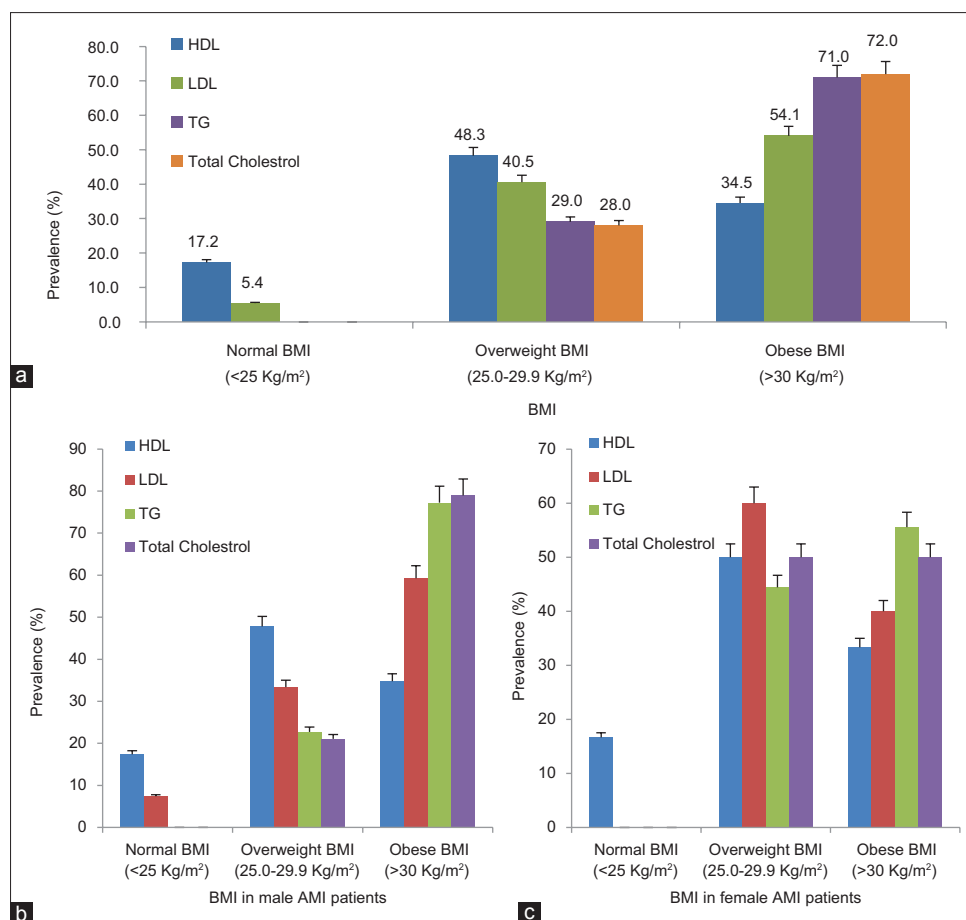


Figure 13: Correlation of obesity risk factor with hyperlipidemia in acute myocardial infarction patients. (a) Correlation of obesity with hyperlipidemia in acute myocardial infarction patients. (b) Correlation of obesity with hyperlipidemia in male acute myocardial infarction patients. (c) Correlation of obesity with hyperlipidemia in female acute myocardial infarction patients

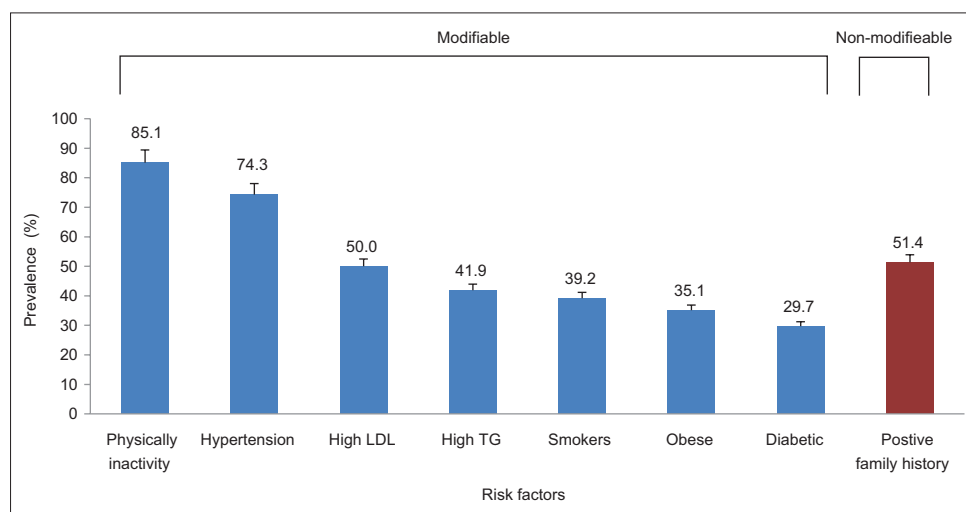


Figure 14: Summary of prevalence of modifiable and nonmodifiable risk factors in acute myocardial infarction patients

CONCLUSIONS

In light of these findings, this study showed that insufficient physical activity, hypertension, hyperlipidemia, and smoking were the major and most frequent risk factors for CAD,

especially AMI. Lower prevalence level of diabetes was observed among AMI patients. Another important independent risk factor for AMI is family history. Moreover, this study provides the first lines of evidence in demonstrating that

AMI has a multifactorial etiology in Iraqi population as the prevalence of CAD is likely rapidly rising due to urbanization and its accompanying transition in lifestyle.

Alarming, the most prevalent risk factors in AMI are hyperlipidemia, smoking, obesity, and hypertension with the higher incidence in older age and in male patients. Consequently, this study shed light on the primary prevention and control of these cardiovascular risk factors for CAD through healthy lifestyle, increased physical activity, and healthy dietary choices, which can reduce the prevalence of CAD.

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Conflicts of interest

There are no conflicts of interest.

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