# **Research Paper:** Modifiable and Non-modifiable Risk Factors in Myocardial Infarction in the Iranian Population



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# **ABSTRACT**

**Background and Aim:** Cardiovascular disease, especially myocardial infarction, is one of the common causes of death, disability, and productivity reduction globally, which is also rising in Iran. This study evaluated the share of modifiable and non-modifiable risk factors in myocardial infarction in the Iranian population.

Materials and Methods: A descriptive-analytic and retrospective study was conducted on 361 patients with myocardial infarction in Alborz, Iran, in 2015-2019. Data collection was done by reviewing records of patients diagnosed with myocardial infarction with ECG changes or increased cardiac enzymes (CPK-MB, Troponin I). Then required information was extracted, and intended data were analyzed with descriptive and inferential statistics by the SPSS software.

**Results:** Among the subjects in the study, 71/1% were male, and 28/9% were female. The majority of samples were between the ages of 60 to 71(33/8%), and the least of them were under 30 years old (1/7%). 82.68% of the samples had a positive family history. The most common modifiable risk factors of myocardial infarction in this study were first Hypertension (42/4%), then Diabetes (31/6%), smoking (32/04%), and Hyperlipidemia (15%). Hypertension was significantly associated with gender, age, and diabetes, and Hyperlipidemia is also positively associated with diabetes and Hypertension.

**Conclusion:** Myocardial infarction is common in men and patients with Hypertension in the Iranian population. High blood pressure is also associated with gender, age, and diabetes. The prevalence of both modifiable and non-modifiable risk factors and coronary artery occlusion increases with increasing age. Therefore, training a healthy lifestyle and controlling modifiable risk factors from an early age can significantly prevent various cardiovascular diseases in the future.

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# 1. Introduction

ardiovascular diseases are a major cause of global mortality and reduced quality of life. Myocardial infarction is among the critical health problems increasing worldwide, including in Iran [1, 2]. The overall frequency of deaths induced by cardiovascular disease during the 20th century has risen from 10% to 30%. Besides, it is estimated that by 2030, >23.6 million deaths in various communities will be due to cardiovascular disease. In Iran, the complications of this disease (e.g., psychoeconomic problems, disability, the loss of ability to work, & heavy costs) are on the rise [3-5].

Coronary artery disease ranges from irreversible myocardial damage to acute myocardial infarction. Myocardial infarction occurs due to insufficient blood flow and the acute occlusion of the coronary artery due to thrombosis. If heart damage occurs in the whole thickness of the myocardium as necrosis, the Electrocardiogram (ECG) changes are in the form of ST-segment elevation; cardiac enzyme indices are used to differentiate it from other ischemic diseases [6, 7].

Advances in medical science over the past few decades have facilitated the diagnosis of risk factors that may accelerate coronary heart disease; however, but this knowledge is unable to significantly reduce the incidence of coronary heart disease. Effective risk factors are divided into two categories of modifiable and non-modifiable characteristics. Modifiable risk factors include diabetes, hypertension, smoking, Low-Density Lipoprotein (LDL), High-Density Lipoprotein (HDL), and a high-fat diet, Moreover, non-modifiable risk factors include the age of over 65, male gender, a family history of coronary artery disease, and race [7, 8].

The incidence of myocardial infarction and sudden death have been epidemiologically studied; the findings vary based on the mentioned factors in demographic levels and over time [9]. Baqaei et al. reported a higher incidence of acute myocardial infarction in smoking men with hypertension. The concurrent presence of several risk factors increases the risk of cardiovascular disease [10].

Faisal et al. examined individuals, aged <45 with myocardial infarction. They concluded that, in 94% of the study subjects,  $\geq$ 3 risk factors (e.g., smoking, diabetes, hypertension, dyslipidemia, lifestyle, obesity, & family history) were associated with myocardial infarction. Some racial-ethnic groups experience a greater disease burden. In the United States, various studies have identified racial differences in the treatment of patients with cardiovascular disease; such data could be attributed to financial barriers, clinical differences, and patient preferences, as well as the extent of patient contact with the healthcare system [11].

Cardiovascular diseases are the most frequent cause of death in Iran; due to the change in the share of these factors in different races and populations, it is possible to identify, prioritize, and plan to adjust and modify risk factors to reduce the incidence and mortality rate of a heart attack. Accordingly, such measures result in maintaining the productive force of society and improving the lives of the Iranian population. The current study aimed to investigate the share of modifiable and non-modifiable risk factors as well as the relationship between these factors in patients with acute myocardial infarction.

# 2. Materials and Methods

This retrospective and the descriptive-analytical study were performed on 361 patients aged 20-82 years hospitalized with a diagnosis of acute myocardial infarction, in the Cardiac Intensive Care Unit of Ghaem Hospital in Karaj City, Alborz Province, Iran, in 2015-2019.

After obtaining permission from the relevant authorities, by referring to all records and considering the desired inclusion and exclusion criteria, the required data were collected by convenience sampling method and census technique.

The inclusion criteria of the study consisted of acute myocardial infarction with changes in the ECG (STsegment elevation in at least two leads) and a three-fold increase in cardiac enzymes (CPK-MB & TROPONIN). Furthermore, patients without ECG changes but elevated cardiac enzymes were included in this study. Major risk factors, such as hypertension, hyperlipidemia, diabetes, age, and gender were assessed. Moreover, patients with incomplete records were excluded from the study.

Data analysis was performed by SPSS. Descriptive statistics were performed using frequency distribution tables, as well as statistical indicators and graphs. Besides, inferential statistics were performed using correlation tests. The alpha error rate in all tests was calculated as 5%.

# 3. Results

Based on the descriptive data obtained from 361 available records and according to Table 1, the frequency of non-modifiable factors (gender & age groups) was ex-

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Variables		No. (%)	
Condor	Male	259 (71.1)	
Gender	Female	102 (28.9)	
	<30	6 (1.7)	
	31-40	9 (2.5)	
A == ( )	41-50	33 (9.1)	
Age (y)	51-60	74 (20.5)	
	61-70	122 (33.8)	
	≥70	117 (32.4)	
Desitive femily history	Male	97 (37.45)	
Positive family history	Female	32 (31.37)	
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Table 1. The demographic characteristics of patients with acute myocardial infarction by non-modifiable factors

amined. Eighteen cases were excluded due to incomplete medical records. Among the examined samples, 358 cases with ECG changes (ST Elv.) and 3 individuals without ECG alternations (Non-ST Elv.) were observed.

There were 192, 103, 46, and 20 study participants with lower myocardial infarction, anterior myocardial infarction, lateral myocardial infarction, and extensive myocardial infarction, respectively. The results of three test samples of cardiac enzyme troponin type I were also positive in all research samples. Furthermore, the incidence of male patients significantly increased, compared to females. In other words, 71.1% of the study subjects were men and 28.9% were women. The highest and lowest frequencies of the study samples belonged to the age range of 70-61 (33.8%) and <30 (1.7%) years, respectively. Additionally, 37.45% of men and 31.37% of women reported a positive family history.

Among the modifiable factors in the population with myocardial infarction, the highest and lowest frequencies were related to hypertension (42.4%) and hyperlipidemia (15%), respectively. The incidence of diabetes was measured as 31.6%.

Table 2 outlines the frequency of modifiable factors by gender. The prevalence of modifiable characteristics, including hypertension (91.89%), diabetes (90.73%),

Table 2. The frequency of modifiable factors in patients with acute myocardial infarction

Variable		No. (%)		
Hypertension	Male	238 (91.89)		
	Female	76 (74.50)		
Diabetes	Male	235 (90.73)		
	Female	50 (49.01)		
Hyperlipidemia	Male	169 (65.25)		
	Female	52 (50.98)		
Smoking	Male	83 (32.04)		
	Female	12 (11.76)		
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Variable/ Age, y		No. (%)		
	Diabetes	Hypertension	Hyperlipidemia	
<30	1 (0.9)	1 (0.7)	1 (1.9)	
31-40	2 (1.8)	2 (1.3)	2 (3.7)	
41-50	7 (6.1)	7 (4.6)	3 (5.6)	
51-60	25 (21.9)	25 (16.3)	11 (20.4)	
61-70	35 (30.7)	52 (34)	15 (27.8)	
≥70	44 (38.6)	66 (43.1)	22 (40.7)	
Total	361 (100)	361 (100)	361 (100)	
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Table 3. The frequency of modifiable factors in individuals with myocardial infarction by age groups

hyperlipidemia (65.25%), and smoking (32.04%) was higher in men than women. Table 3 manifests the frequency of modifiable factors by age groups. The highest frequencies concerned hypertension (42.1%), diabetes (38.6%), and hyperlipidemia (40.7%) in individuals aged  $\geq$ 71 years old. Besides, the lowest frequency of the above-mentioned variables were 0.7 %, 0.9%, and 1.9%, respectively, i.e., reported in individuals aged <30 years.

Based on Table 4 and using inferential statistical methods with 95% confidence level and 5% error coefficient, there was a significant reverse relationship between

Table 4. Spearman correlation coefficient of diabetes, hypertension, hyperlipidemia, age, and gender

Varia	bles	Gender	Age	Diabetes	Hypertension	Hyperlipidemia
Gender	Correlation	1				
	Sig.	0.0				
	Number	361				
Age	Correlation	0.175				
	Sig.	0.001	0.0			
	Number	361	36			
Diabetes	Correlation	-0.081	-0.090			
	Sig.	0.124	0.088	0.0		
	Number	361	361	361		
Hypertension	Correlation	-0.197	-0.238	0.310		
	Sig.	0.000	0.000	0.000	0.0	
	Number	361	361	361	361	
Hyperlipidemia	Correlation	-0.059	-0.055	0.300	0.636	
	Sig.	0.263	0.298	0.000	0.000	0.0
	Number	361	361	361	361	361

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hypertension and gender (r=-0.19), age (r=-0.23), and diabetes (r=-0.31) (P<0.05); there was also a significant linear relationship between high blood fats and diabetes, as well as between hypertension (r=0.36) and diabetes (r=0.30) (P<0.05). According to these results, hypertension was significantly associated with gender, age, and diabetes; hyperlipidemia was also associated with diabetes and hypertension.

#### 4. Discussion

Myocardial infarction is among the complications of obstructive coronary artery disease. Besides, this condition is caused by a complete blockage of the coronary artery by atherosclerotic plaque [11]. Given the significant increase in myocardial infarction among the male and female populations, it is essential to identify modifiable and non-modifiable risk factors in reducing the incidence of heart attack and its subsequent complications. In this population, the study variables were divided into two categories of modifiable and non-modifiable characteristics, the age of individuals was divided into 6 groups. By examining different age groups, the highest frequency of acute myocardial infarction was reported in the age groups of 61-70 years (33.8%), followed by  $\geq$ 70 years (32.4%).

In the study of Asgari et al. [12], most study subjects were in the age group of 46-60 years; the highest frequency (39.2%) then belonged to the age group of 61-75 years as well as the age group  $\geq$ 75 years (20.8%). Kim et al. [13] reported the highest incidence of myocardial infarction in 10 years (2007-2016) in subjects aged 70-79 years (26.3%) with a higher proportion in men (57.9%). Thus, their findings were to some extent consistent with those of this study. In terms of gender, a significant increase was observed in the incidence of men (71.1%), compared to women (28.9%).

Various studies have supported the significant prevalence of cardiovascular disease in men [14, 15]. Therefore, male gender and aging are effective in the incidence of cardiovascular disease. Additionally, in both genders, <50% of the individuals presented a positive family history. In line with this study, Salehi et al. reported that the incidence of cardiovascular disease was equal to 23.8% [16].

In the category of modifiable factors, the highest prevalence was first related to hypertension, then diabetes and hyperlipidemia, and finally, a history of smoking. In a similar study, hypertension was reported more than any other underlying disease [17]. In the male population, the prevalence of hypertension and diabetes was >90%; the prevalence of hyperlipidemia was >50%. In the female population, more than half presented hyperlipidemia and hypertension.

In the study of Dan et al. [18], the prevalence of all 3 modifiable factors was higher in males, compared to females. Less than half of individuals with myocardial infarction reported a history of smoking, i.e., higher among men. Leifheit-Limson et al. [19] reported a history of smoking of >50% in both genders.

This study stated that with the increasing age of patients, the prevalence of all factors significantly elevated in different age groups. Thus, by aging, individuals become less physically active and gain weight. Such weight gain and fat storage around the abdomen reduce insulin activity and insulin resistance. Blood pressure is also an early sign of insulin resistance due to central obesity, which aggravates the risk of developing diabetes [20].

The correlation coefficient method was used to evaluate the relationship between age, gender, diabetes, hypertension, and hyperlipidemia. Diabetes was not significantly related to age and gender. Hypertension was significantly related with gender (r=-0.197), age (r=-0.23), and diabetes (r=-0.31). Bidel et al. [21], signified a significant relationship between hypertension, diabetes, and the gender of patients; however, no significant relationship was observed between hyperlipidemia and gender.

According to Petrie et al. [22], the positive association between diabetes and hypertension can be attributed to similar risk factors, such as vascular inflammation, atherosclerosis, dyslipidemia, and obesity. In this study, hyperlipidemia was not significantly associated with age and gender; however, it was significantly associated with diabetes (r=0.300) and hypertension (r=0.636). Fan et al [23] detected a positive association between changes in blood glucose and lipid levels. Furthermore, they found that the treatment of diabetes and hyperlipidemia was effective in reducing heart disease.

In the study of Shah et al. [24], there was a significant relationship between a history of hypertension, age, and gender, i.e., consistent with the results of our study. Furthermore, in the above-mentioned study, there was a significant gender-wise difference in different age groups respecting diabetes and hyperlipidemia, i.e., inconsistent with this study.

Baghaei et al. [25] assessed the prevalence of myocardial infarction without ST-segment elevation. Accordingly, they stated no significant relationship between the incidence of myocardial infarction and diabetes and hypertension. This difference seems to be due to differences in age groups. According to the present research results, diabetes and hyperlipidemia increased numerically with age, i.e., in line with previous studies. However, this increase was not statistically significant, which could be due to reasons, such as low sample size and improper sample selection.

A limitation of our study was the incompleteness of the medical records of several patients and the failure to review and record all the modifiable and non-modifiable variables in the medical records of the patients.

# 5. Conclusion

The obtained results concerning non-modifiable and modifiable factors in the incidence of myocardial infarction in the Iranian population revealed that the incidence of myocardial infarction was higher in men than women and the age group of >60 years. With age, the incidence of underlying diseases such as hypertension, diabetes, hyperlipidemia, and subsequent coronary artery occlusion increases. Therefore, teaching a healthy lifestyle and controlling modifiable factors from an early age can significantly prevent the occurrence of various cardiovascular diseases in the future.

### **Ethical Considerations**

#### Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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#### Authors' contributions

Conceptualization, methodology, writing-original draft preparation, and editing, conceptualization, data curation, validation, and editing: Mina Abolfazli, Bahman Aghaie; Methodology, supervision, data curation, visualization, investigation, validation: Mohammad Abbasinia, Mahshid Akbari and Mina Gaeeni.

#### Conflict of interest

The authors declared no conflicts of interest.

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