

## The Emotional, Environmental, Physical and Chemical Triggers of Acute Myocardial Infarction: An Analytical Demographic Study

Akut Kalp Krizinin Duygusal, Çevresel, Fiziksel ve Kimyasal Tetikleyicileri: Analitik Bir Demografik Çalışma

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### ABSTRACT

**Objective:** Acute triggers are external stimuli that produce acute pathophysiologic changes directly leading to the onset of myocardial infarction (MI). Acute myocardial infarction (AMI) is one of the main causes of mortality. Recent studies have confirmed the impact of acute triggers on the occurrence of AMI, but have not evaluated their differences in terms of demographic characteristics. This study was conducted to investigate the impact of acute triggers on AMI in various demographic groups.

**Methods:** This is an analytical cross-sectional study on 269 patients affected by AMI in two hospitals in 2015 and 2016 in Iran. To attain the goals of the study, acute triggers were divided into four groups of emotional, environmental, physical, and chemical. A researcher-developed questionnaire and interview were used to collect data. The risk and control periods were also evaluated for each trigger. The data were analyzed by descriptive statistics and inferential statistics such as statistical logistic regression and McNemar's test using SPSS 21. The P-value was set at 0.05.

**Results:** The results showed that sudden exposure to hot/cold weather in men (P=0.03, OR=3.4), underlying diseases (P=0.03, OR=1.8), heavy activities (P=0.03, OR=1.6) and consuming tea/coffee in men (P=0.01, OR=1.8) increased the chance of AMI. It was also discovered that triggers such as pulmonary infections, overeating and/or eating high-fat foods that are not dependent on demographic variables promoted the chance of AMI (P<0.05).

**Conclusion:** All people - regardless of age, sex, and the presence/lack of underlying illness - are at risk of developing MI in the face of respiratory infections, overeating, and intake of high-fat foods. Also, sudden exposure to hot and / or cold weather, heavy activity and high consumption of coffee and/or tea, can increase the risk of MI in men.

**Key Words:** Demography, acute triggers, myocardial infarction

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### ÖZET

**Amaç:** Akut tetikleyiciler doğrudan kalp krizininin başlangıcına yol açan akut patofizyolojik değişiklikler üreten dış uyaranlardır. Akut kalp krizi mortalitenin başlıca nedenlerinden biridir. Son yıllarda yapılan çalışmalar, akut tetikleyicilerin akut kalp krizi oluşumundaki etkisini doğrulamaktadır ancak demografik özellikler açısından farklılıklarını değerlendirmemiştir. Bu çalışma, çeşitli demografik gruplarda akut tetikleyicilerin akut kalp krizi üzerindeki etkisini araştırmak için yürütülmüştür.

**Yöntemler:** Bu, 2015 ve 2016 yıllarında İran'da iki hastanede akut kalp krizinden etkilenen 269 hasta üzerinde yapılan analitik kesitsel bir çalışmadır. Çalışmanın amaçlarına ulaşmak için, akut tetikleyiciler duygusal, çevresel, fiziksel ve kimyasal olmak üzere dört gruba ayrıldı. Veri toplamak için araştırmacı tarafından geliştirilen bir anket ve mülakat kullanılmıştır. Her tetikleyici için risk ve kontrol periyotları da değerlendirildi. Veriler, betimsel istatistikler ve istatistiksel lojistik regresyon gibi çıkarımsal istatistikler ve SPSS 21'i kullanarak McNemar testi ile analiz edildi. P-değeri 0.05'e ayarlandı.

**Bulgular:** Sonuçlar, erkeklerde sıcak/soğuk havaya ani maruziyetin (P = 0.03, OR = 3.4), altta yatan hastalıkların (P = 0.03, OR = 1.8), ağır aktivitelerin (P = 0.03, OR = 1.6) ve erkeklerde tüketilen çay/kahve (P = 0.01, OR = 1.8) akut kalp krizi riskini artırdığını gösterdi. Pulmoner enfeksiyonlar, aşırı yeme ve/veya aşırı yağlı gıdalarla yeme gibi demografik değişkenlere bağımlı olmayan tetikleyicilerin akut kalp krizi riskini arttırdığı da keşfedildi (P < 0.05).

**Sonuç:** Yaş, cinsiyet ve altta yatan hastalığın varlığı/eksikliği ne olursa olsun tüm insanlar solunum yolu enfeksiyonları, aşırı yorulma ve yüksek yağlı gıdalar alımı karşısında kalp krizi gelişme riski altındadır. Ayrıca, ani sıcak ve/veya soğuk havaya maruz kalma, yoğun aktivite ve yüksek kahve ve/veya çay tüketimi erkeklerde lap krizi riskini artırabilir.

**Anahtar Sözcükler :** Demografi, akut tetikleyiciler, kalp krizi

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**INTRODUCTION**

The most prevalent cardiovascular disease in adults is coronary artery disease (CAD)(1). This disease has caused death in 16 million people, 82% of which is seen in developed countries(2). Despite rapid diagnostic and therapeutic advances, still, one-third of patients who get affected by heart stroke die. The incidence of CAD & MI in Iran are upward trend(3). These diseases impose excessive costs on health services. In spite of all these, cardiovascular diseases are considered as one of the most preventable non-contagious diseases of human(4). Cardiovascular diseases could happen suddenly and are mostly initiated by acute physical activities and mental stresses(5, 6). The effects caused by demographic and psychological properties are among the factors that are known to the incidence of ischemic and chronic cardiovascular diseases. It is assumed that several external triggers cause ACS, and these factors include heavy physical activities, emotional stresses, sexual activities, and overeating. Some of these triggers like physical activities are present in half of the initiation cases of acute coronary syndromes in men. Acute triggers include emotional, physical, environmental and chemical triggers(7-9). Triggers lead into the start of hemodynamic, prothrombotic, and vascular constrictive procedures which are accompanied by an increase in the risk of cardiovascular diseases and all occur in some hours(7, 10).

Interventional studies demonstrated that reducing the risk factors results in the diminished rate of CAD, brain stroke, and other cardiovascular issues (11). Triggers start the attack during a timeframe of some minutes or hours and this attack might differ based on the severity of trigger mechanism (7). Indeed, triggers start the action some minutes to 24 hours before ACS and this time period is called as risk period, and recently 1-2 hours before symptoms initiation has been emphasized(12). The presence of plaques susceptible to atherosclerosis, disturbance in the conductive system of the heart, and small arteries diseases along with physical and emotional trigger stressors, could transiently cause vasoconstriction and prothrombotic effects which all finally lead into plaque rupture and thrombosis. The trigger can cause ventricular fibrillation and sudden death by decreasing the cardiac electrical resistance threshold and increasing sympathetic activity through releasing central mediators such as catecholamine(7, 13).

Despite the high prevalence of AMI, few if any studies have been conducted the effects of all types of triggers on the incidence of AMI in terms of demographic conditions. Therefore, the current study was concluded to investigate the correlation between the emotional, environmental, physical, and chemical triggers and the incidence of AMI based on demographic indices.

**METHODS**

*Data*

This is a descriptive-analytical study which has been performed by a cross-sectional method on 269 patients affected by AMI and hospitalized in to the Dr Heshmat and Rasoul-e-Akram hospitals in the city of Rasht in north of Iran, from September 2015 to February 2016. Required sample size was determined based on results of Lanky et al. study (14). The study was conducted after the permission (No. 9624/19/145/3) of the Ethics Committee of Guilan University of Medical Sciences. The sampling was performed using the non-probability or convenient method, and the data were collected using researcher-designed questionnaires and interview after getting the written informed consent from the patients. The included criteria were age under 18, AMI diagnosis by a cardiologist based on the documents, and excluded criteria were angina pectoris and patient's reluctance to continue. Data collection instrument consisted of two sections and 28 questions. The first 11 questions were demographic and medical information including sex, age, marital status, diabetes underlying, blood pressure, overweight according to BMI > 25, smoking, alcohol drinking, using drugs, tea and coffee consumption and MI history. The second section consisted of 17 questions for identifying acute triggers (emotional, environmental, physical, and chemical). Emotional triggers were anger, insomnia, dispute, hearing the sudden news, losing a job, losing beloved people, the excitement of watching sports competitions and exciting serials. Environmental triggers included

exposure to long driving, jam traffic, driving accident for the person or others, pulmonary infections and sudden exposure to hot or cold weather. Heavy activities and sexual activities were the physical triggers and chemical ones included overeating and eating high-fat foods, alcohol, drugs, coffee or tea. Underlying diseases were overweight, diabetes, and high blood pressure and the patients were divided into two groups, with and without underlying disease.

Three risk periods and three control periods were considered in this study according to the type of trigger. In triggers like anger, insomnia, dispute, sudden news, excitement due to sport competitions and series, long driving, traffic, driving accident, hot or cold weather, high-fat foods, alcohol, drugs, and coffee or tea, the risk period <24 hours and control period >24-hour were considered for investigating the effects of trigger. In others triggers such as losing a job and pulmonary disease, the risk period was the first week and control period was considered as more than one month. In none of the cases, the control period was more than a year before AMI.

*Analysis*

To check scientific validity of the questionnaire, it was given to 10 members of the faculty members of the university and the content validity index was estimated at 98.6%. The test-retest method and kappa coefficient were utilized for calculating the tool's reliability, and agreement coefficient was obtained as 1. Demographic information was examined using descriptive statistics method (frequency, mean, and standard deviation). McNemar's test was also utilized to check whether there is a significant difference between the risk period and control period. To determine the chance of AMI occurrence, logistic regression GEE model was used. Data were analyzed by SPSS21 and p<0.05 was considered as statistically significant.

**RESULTS**

According to the results, 37.2% and 78.4% of the patients were women and men of whom 78.4% were married, and the mean of age was 60.3±12.2 years. Half of the patients consumed more than 3 cups of tea per day. In addition, about 36% of the patients had diabetes, 44% of them had high blood pressure and 60%, of them were overweight (Table 1).

**Table1.** Frequency of Demographic/Medical factors

	Variables	Number	%
Sex	Female	100	37.2
	Male	169	62.8
Marital status	Single	55	20.4
	Married	211	78.4
	Separated	3	1.1
Diabetes history		98	36.4
Hypertension history		118	43.9
Overweight: BMI>25		160	59.5
Smoking		101	37.5
Alcohol consumption		22	8.2
Narcotics consumption		52	19.3
Tea consumption >3cup.day		135	50.2
MI history		44	16.4

Regarding the frequency of occurrence of the acute triggers of AMI, in the emotional group, anger was observed in 57% of men and insomnia in 44.8% of the people under the age of 60, insomnia was also seen in 40% of the people with underlying diseases.

With regard to the environmental triggers, 32% and 35% of men had faced heavy/semi-heavy traffic and hot or cold weather, respectively. Moreover, exposure to pulmonary infections and the hot or cold weather were noticed in 36% of the people under the age of 60 and 34.3% of the people with underlying diseases.

About physical and chemical triggers, 74% of men and 51% of people <60 years age had heavy activities during risk period. Consuming fewer than three cups of tea per day was observed in 77.5% of men, and overeating was discovered in 40% of people <60 years age. Additionally, overeating was present in 37% of patients with the underlying disease during the risk period (Table 2).

**Table 2:** Frequency of exposure with trigger, based on risk and control period and Odds Ratio of AMI

Triggers	Exposure Number		Exposure based on underlying disease (%)		Exposure based on sex (%)		Exposure based on age (year) (%)		P value <sup>1</sup>	Odds Ratio
	Risk period	Control period	Without	With	Male	Female	>60	<60		
Anger	99	75	41	35.7	57	42	31.5	41.4	0.02	1.5
Insomnia	107	94	39	40	55	52	33.9	44.8	0.2	1.2
Quarrel	48	32	25	16	24	24	13	22	0.05	1.6
Sudden Bad News	60	44	25	21.6	34	26	18	26	0.08	1.4
losing job	0	4	5.4	-	-	-	-	-	-	-
Loss of loved one	26	37	3.6	11	16	10	10	9	0.1	1.1
Watching Sport Games	9	3	-	4.2	4.1	2	1.6	4.8	0.009	3
Exposure to Traffic Jam	35	31	10.7	13.6	18.9	3	3.2	21.4	0.5	1.1
Witness Car Accidents	4	4	-	1.9	2.4	-	-	2.8	0.9	1
Respiratory Infections	89	38	28.6	34.3	31.4	36	36.3	30	0.0001	3
Exposure to Hot/Cold Weather	45	26	14.3	17.4	20.7	10	12	20.7	0.01	1.8
Physical Activities	111	86	37.5	42.3	43.8	37	30	51	0.02	1.5
Sexual Activities	43	33	10.7	17.4	20	9	5	25.5	0.2	1.3
Overeating & High-fat Food Consumption	90	37	19.6	37	39.6	23	25.8	40	0.001	3
Alcohol Abuse	3	4	3.6	-	1.2	1	-	2	0.7	0.7
Drugs Abuse	44	44	16.1	16.4	21.3	8	13	18.6	0.9	1
Drinking Tea	172	142	66	63	77.5	41	59	63	0.008	1.6

<sup>1</sup> McNemar test

According to Table 3, anger increased the chance for AMI by 2.5 times in people without underlying disease that was statistically significant (P=0.03). Chance of AMI was significant in the case of exposure triggers such as pulmonary infections, overeating and consuming high-fat foods in people under 60 years (P=0.001) and increased 2.7 and 3.5 times, respectively. The exposure of pulmonary infections was predictive of AMI and increased its rate in people over 60 years, women, men, those with underlying diseases and without underlying diseases by 3.3, 2.5, 3.4, 3, and 2.8, respectively.

The exposure to hot or cold weather was just significant in men with underlying diseases (P=0.03) and increased the chance of AMI up to 3.4 times in men and to 1.8 in people with underlying diseases. Heavy activities (P=0.03) and consuming tea or coffee (P=0.01) increased the chance of AMI in men by 1.6 and 1.8 times, respectively in men.

**Table 3:** Frequency of significant triggers based on odds ratio of AMI and demographic variables

Trigger Type	Variables	Exposure/Hazard Period		Exposure/Risk Period		Odd ratio	Confidence Interval of 95%		P value <sup>1</sup>	
		No	%	No	%		Min	Max		
Anger	Underlying disease	Without	23	41.1	12	21.4	2.55	1.11	5.86	0.03
		<60	44	44	20	13.8	2.72	1.51	4.91	0.001
Severe Respiratory Infection	Age (years)	>60	45	36.3	18	14.5	3.35	1.81	6.23	0.001
		Female	36	36	18	18	2.5	1.33	4.92	0.01
	Sex	Male	53	31.4	20	11.8	3.4	1.93	6.01	0.001
		Underlying disease	With	73	34.3	31	14.6	3.06	1.9	4.92
Overeating & High-fat Food Consumption	Age (years)	Without	12	28.6	7	12.5	2.8	1.05	7.47	0.04
		<60	45	36.3	18	14.5	3.54	2.03	6.17	0.001
	Sex	>60	32	25.8	14	11.3	2.73	1.38	5.43	0.001
		Female	23	23	12	12	2.19	1.02	4.69	0.04
Exposure to Hot or Cold Weather	Underlying disease	Male	67	39.6	25	14.8	3.78	2.24	6.39	0.001
		Without	79	37.1	35	16.4	3	1.9	4.74	0.001
	Sex	Male	11	19.6	2	3.6	6.6	1.39	31.34	0.02
Heavy Activity Coffee/Tea drink	Sex	Male	35	20.7	20	11.8	3.4	1.93	6.01	0.03
		Underlying disease	Female	37	17.4	22	10.3	1.83	1.04	3.22
Heavy Activity Coffee/Tea drink	Sex	Male	74	43.8	55	32.5	1.61	1.04	2.51	0.03
		Male	131	77.5	110	65.1	1.85	1.14	2.99	0.01

<sup>2</sup>GEE

## DISCUSSION

This study was conducted in order to evaluate the relationship between the demographic characteristics of people and acute triggers contributing to the incidence of AMI. Among the 17 triggers which were investigated, pulmonary infections, overeating and high-fat food consumption, hot or cold weather, heavy activities, and drinking tea or coffee correlated with demographic properties and underlying diseases and increased the chance for AMI.

Considering the results of current study, among the environmental triggers, pulmonary infections elevated the chance of AMI in women and men by 2.5 and 4.3, respectively. Warren-Gash et al., have reported chance of AMI 4 times in women and 4.3 times in men, 1-3 days after facing the acute pulmonary infections (especially influenza)(15). In our study, the chance of AMI in people >60 years increased by 3.3 times by pulmonary infections and by 2.7 in people under 60 years age. Warren-Gash reported this percentage as 5.9 times in people over 80 years(15). It seems that pulmonary infections could elevate AMI chance older ages and the chance for the disease are close in both sexes. Hence, it is recommended to treat the respiratory infections rapidly. Sudden exposure to hot or cold weather increased the chance of AMI by 3.4 times in men and 1.8 in people with underlying diseases.

Moghadamnia et al. showed that the short-term effects of cold and heat exposure on the risk of cardiovascular mortality in males were 3.8% and 1.1% respectively. Moreover, the effects of cold and heat exposure on risk of cardiovascular mortality in females were 4.1% and 1.4% respectively(16). The cold seasons causes physiological changes including increases in blood sugar, levels of cholesterol, fibrinogen concentration and platelet aggregation. Fibrinogen plays an important role in the formation of clots in the coronary artery, the start of acute myocardial infarction and life-threatening arrhythmias(7). Exposure to high temperature could increase the viscosity of plasma and cholesterol levels in serum(17).

In the study of Massomi, no significant relationship was found between cold weather exposure and AMI occurrence(8). This contradiction might be due to the difference between the climates of Kerman and Guilan province. Bhaskaran et al. showed that a temperature increase of >20 C°, elevated the chance of AMI(18). One of the differences between current study and Bhaskaran's study is that the current one was performed in the three seasons of summer, autumn, and winter and the daily temperature was not recorded, but the study done by Bhaskaran was carried out in the temperature of >20 C along with temperature recording.

In the group of chemical triggers, this study showed that overeating and consumption of high-fat foods increased the chance for AMI by 3.5 times in the individuals under the age of 60 years, and by 2.7 in those over 60 years. Additionally, it increased this chance by 2 times in women and 3.7 in men, and also 6.6 in people who did not have underlying disease. Lipovetzky et al. reported the increased chance of AMI following overeating by 7 times (18). In their study, mean of age was 60 years, and they were overweight, with most of the men having diabetes and high blood pressure history. It appears that in lower ages, the chance for AMI is higher and this trigger is more effective in men compared to women because of more overeating. In addition, in people who do not have underlying diseases, the mentioned trigger has more profound effects due to lack of limitation in food consumption.

In the group of physical triggers, our study showed that heavy activities increased the chance of AMI by 1.6 in men. Mittleman et al. have addressed the chance for AMI occurrence as 2.4 times more with increased heavy physical activities (13). In a study by Massomi, heavy physical activities did not have any significant correlation with the trigger of angina related to AMI (8) and it seems that the reason for the contradiction between the current study and the Massomi's study might be the less exposure with this trigger in that study. The vigorous physical activity especially in who have nor regular exercise may be effect on atheroma and causes rupture of plaque and finally myocardial infarction.

Among the emotional triggers, the current study showed that anger in people who lacked any underlying disease increased the chance of AMI by 2.5 times. In three separate studies performed by Mostofsky (19), Edmondson (20), and Buckley (21) also the chance for AMI has been reported as 2.3, 3 and 8.5 times more with anger trigger. It seems that those men who do not have a history of another disease had more relative chance for AMI with anger as a trigger. Hence, the findings of this study were consistent with the mentioned studies.

The current study demonstrated that drinking tea or coffee increased the chance for AMI by 1.8 times and consuming much tea increased the AMI occurrence chance in men. Bylin et al. reported the chance for by AMI 1.1 folds with drinking coffee (22), and since the type of drink differs between this study and in the one by Bylin, no similarity could be mentioned between these two studies.

## CONCLUSION

Exposure to respiratory infections and eating high-fat foods could lead to AMI in both sexes and all age groups and people with or without underlying diseases. Heavy activities, sudden exposure to cold or hot weather, and anger, especially in men, would also result in AMI; all should be avoided. Anger could also cause AMI even in people without underlying diseases, and it is essential to recommend learning and employing calming techniques and anger management strategies to all people.

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## Conflict of interest

No conflict of interest was declared by the authors.

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