https://doi.org/10.3329/jicc.v5i2.75806

ORIGINAL ARTICLE

Association of Risk Factors of Acute Myocardial Infarction and Heart Blockage Among non-diabetic Patients in a Tertiary Care Hospital – An Observational Study

Md. Golam Mahfuz Rabbani[1], Md. Monirul Islam [2], Md. Shawqat Ali [3], Khondker Rafiquzzaman[3], Muhammad Fazlul Haque Khalid[4]

Abstract

Introduction: Cardiovascular diseases (CVDs) are a leading cause of death in the world. In 2015, an estimated 442.7 million prevalent cases of CVD were present worldwide. Cardiovascular diseases account for more than 17 million deaths globally each year. Previous studies identified diabetes mellitus, hypertension, hypercholesterolemia, smoking, alcohol consumption, obesity and sedentary lifestyle as risk factors.

Aim of the study: The aim of this study was to determine the risk factors for acute myocardial infarction associated with heart blockage among non-diabetic patients.

Methods: This was an observational study conducted in the Department of Cardiology of Jashore Medical College Sadar Hospital, Jashore, Bangladesh during the period from April, 2021 to March, 2022. In this study, we included 120 non-diabetic patients who were diagnosed with myocardial infarction.

Result: Mean age was 53.03±11.3 years & most of our patients were male. Among all patients, majority (65%) patients had >60% blockage, followed by 30(25%) patients had 40%-60% artery blockage, and <40% blockage was found in 10% patients. Hypertension, dyslipidemia & dyslipidemia with hypertension, age ≥60 years, family history of CHD, smoking, diabetes & obesity were individual risk factors of CHD among non-diabetic patients. The most common risk factors for heart blockage were age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life.

Conclusion: In our study, we found hypertension, history of CHD, dyslipidemia, dyslipidemia with hypertension, stress, age ≥60 years, and obesity were individual risk factors for CHD. These elements work as crucial risk factors for myocardial infarction in non-diabetic patients. Risk factors like age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life were responsible for the highest heart blockage in myocardial infarction patients.

Keywords: Myocardial infarction, Non-diabetic, Risk factor

J Inv Clin Cardiol 2023; 5(2): 38-44

Introduction

Cardiovascular diseases (CVDs) are a leading cause of death in the world. In 2015, an estimated 442.7 million prevalent cases of CVD were present worldwide.[1] Cardiovascular diseases account for more than 17 million deaths globally each year. This figure is expected to grow to 23.6 million by the year 2030. Ischemic heart disease alone caused 7 million deaths worldwide in 2010, an increase of 35% since 1990.[2] CVD accounted for 27% of all deaths in South Asia in 2013. This has been a substantial rise since 1990 when CVD accounted for only 15% of deaths.[3] The prevalence of coronary artery disease (CAD) in Bangladesh is about 4-6% and CVD is responsible for 17% of total deaths.[4] Coronary artery disease may manifest clinically as either chronic stable angina or

1. Assistant Professor, Department of Cardiology, Jashore Medical College, Jashore, Bangladesh
2. Medical Officer, Department of Cardiology, Sadar Hospital, Jashore, Bangladesh
3. Assistant Professor, Department of Cardiology, Jashore Medical College, Jashore, Bangladesh
4. Junior Consultant, Department of Cardiology, 250 Bedded District Hospital, Jashore, Bangladesh

Address of Correspondence: Dr. Md. Golam Mahfuz Rabbani; Assistant Professor, Department of Cardiology, Jashore Medical College, Jashore, Bangladesh, E-mail: mahfuz123098@gmail.com

acute coronary syndrome.[5] ACS encompasses unstable angina (UA), ST-segment elevation MI (STEMI), or acute non-ST-segment elevation MI (NSTEMI). ACS without myocardial necrosis is defined as UA, whereas myocardial necrosis is a necessary component of either STEMI or NSTEMI.[6] STEMI is a clinical syndrome defined by characteristic symptoms of myocardial ischemia in association with ST elevation in the ECG and release of biomarkers of myocardial necrosis.[7]

At present, STEMI comprises approximately 25% to 40% of all MI presentations. Although subjects with STEMI or NSTEMI share the same cardiovascular risk factors, patients with STEMI have worse short-term mortality compared with patients with NSTEMI.[8] As there is considerable variability in short-term mortality risk, therefore, in patients with STEMI, early risk stratification is crucial for successful initial management.[9] The pathogenesis of coronary artery disease remains incompletely understood. Interplay between environmental and genetic factors likely to the pathophysiology of coronary artery disease. The classic risk factors such as hypertension, dyslipidemia, diabetes mellitus and smoking undoubtedly play a vital role; in addition some emerging risk factors and as-yet-unrecognized factors may be important.[10] However, they do not entirely explain the variation in cardiovascular disease incidence and mortality between individuals and among population.[11] Therefore, additional risk factors have been proposed to better identify patients potentially at risk for CAD.[12] Many individual new biomarkers have been related to cardiovascular risk, including levels of CRP (C-reactive protein), B-type natriuretic peptide (BNP), fibrinogen, D-dimer and homocysteine. Among these new biomarkers is microalbuminuria (MAU), which is gaining recognition as a marker of an atherogenesis, owing to its association with several atherosclerotic risk factors and early systemic vascular (endothelial) damage.[13] Microalbuminuria (MAU) as a biomarker now a day is also considered a risk marker for CHD in diabetics and non-diabetics.[14]

The prevalence of coronary artery disease (CAD), a major contributor to CVD, is related to the increasing prevalence of modifiable risk factors.[15] Previous studies identified diabetes mellitus, hypertension, hypercholesterolemia, smoking, alcohol consumption, obesity and sedentary lifestyle as risk factors.[16,17] Other risk factors identified were waist-to-hip ratio, dietary patterns, physical inactivity, blood apolipoproteins, psychosocial factors, loneliness and social isolation and C-reactive protein, uric acid and homocysteine levels.[18-22] Therefore, in this study we aimed to determine the risk factors for acute myocardial infarction associated with heart blockage among non-diabetic patients.

Methodology & Materials

This was an observational study and conducted in the Department of Cardiology of Jashore Medical College Sadar Hospital, Jashore, Bangladesh during the period from April, 2021 to March, 2022. In this study, we included 120 non-diabetic patients who were diagnosed with myocardial infarction.

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged above 20 years old; b)Patients with ST-elevation myocardial infarction; c) Patients with non ST-elevation myocardial infarction; d) Patients with acute myocardial infarction; e) Patients who were willing to participate were included in the study And a) Patients with Diabetes mellitus; b) Patients with Coagulopathy; c) Patients with previous H/O of myocardial infarction ; d) Patients with cardiomyopathy; e) Patients with any history acute illness (e.g., renal or pancreatic diseases etc.) were excluded from our study.

After admission of a patient with chest pain suggestive of acute coronary syndrome, a detailed history and physical examination was performed. Patients were asked about the major modifiable risk factors profile of coronary artery disease such as hypertension, diabetes mellitus, smoking status, dyslipidemia and family history of CVD. Previous medical records were also checked for these risk factors.

A 12-lead resting ECG was done at a paper speed of 25 mm and 10 mm standardization at admission by placing the leads in proper position. Under aseptic precaution blood sample for highly sensitive troponin I was drawn on first assessment (designated as 0 hour). sample was then sent to same standard laboratory for estimation of highly sensitive cardiac troponin-I level. Another sample was sent 3 to 6 hours after first sample.

The diagnosis of acute STEMI was made with electrocardiographic (ECG) changes i.e., ST-segment elevation at the J point in 2 contiguous leads with the cut-point: 21 mm in all leads other than V2-V3 where the following cut-points apply. ≥2 mm in men 240

years: ≥2.5 mm in men <40 years, or ≥1.5 mm in women regardless of age. Plus, clinical evidence of acute myocardial ischemia and detection of a rise and /or fall of Tn I values with at least 1 value above the 99th percentile of upper reference limit.

Statistical Analysis: All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of Jashore Medical College Sadar Hospital , Jashore, Bangladesh.

Results

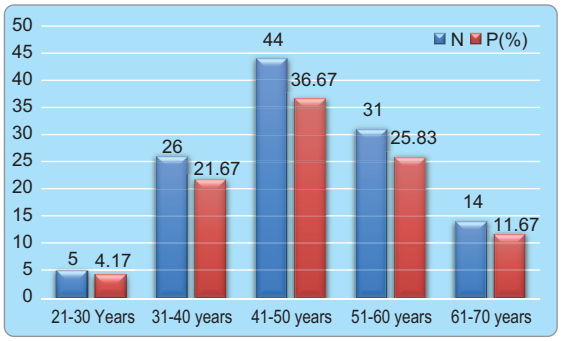

Figure 1: *Age distribution of our study patients*

Figure 1 shows that majority (36.67%) of participants belonged to the age group 41-50 years, followed by 25.83% of participants were 51-60 years and 21.67% belonged to the age group 31-40 years. Only 11.67% & 4.17% patients were found in 61-70 years & 21-30 years age group respectively.

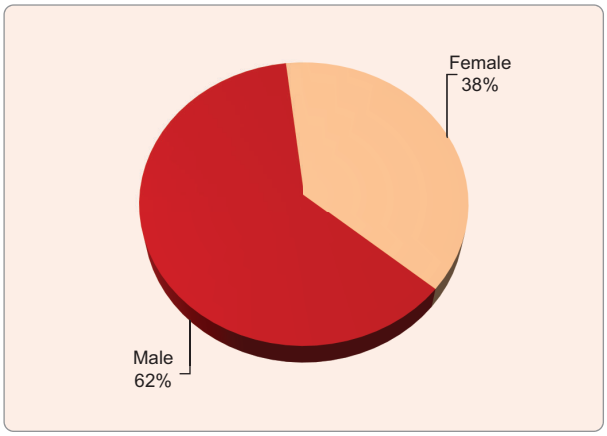

Figure 2: *Gender distribution of our study patients*

Figure 2 shows that most of the participants were male (62%) compared to female (38%).

Table-I

Baseline characteristics of our study subjects

Baseline characteristics	N	P(%)
Mean age (years)	53.03±11.3	
History of hypertension	44	36.67
Family History of CHD	43	35.83
History of dyslipidemia	38	31.67
BMI (kg/m^2)	28.97±4.24	
Heart Rate (per minute)	86 ± 17	
Systolic blood pressure (mm Hg)	135.24 ± 20.78	
Diastolic blood pressure (mm Hg)	83.94 ± 10.69	
Mean FBG (mg/dL)	119.45 ± 63.10	
Triglycerides (mg/dL)	187.85±55.04	
Total cholesterol (mg/dL)	199.83 ± 42.16	
HDL (mg/dL)	40.21 ± 9.05	
LDL (mg/dL)	122.35 ± 35.59	
CAG findings		
<40%	12	10.00
40% - 60%	30	25.00
>60%	78	65.00

CVD= cardiovascular disease, BMI = body mass index, FBS = fasting blood glucose, HDL=high-density lipoprotein, LDL=low-density lipoprotein

Table 1 shows the baseline characteristics of our study participants. We found the mean age was 53.03±11.3 years. Among all patients, 36.67% had family history of hypertension, 35.83% & 31.67% had history of CVD & dyslipidemia respectively. Among all patients, BMI was 28.97±4.24 kg/m^2. Heart rate was 86 ± 17 per mins. Both systolic & diastolic bp were 135.24 ± 20.78 & 83.94 ± 10.69 respectively. Cholesterol was found 199.83 ± 42.16 mg/dL, and HDL & LDL were found 40.21 ± 9.05 & 122.35 ± 35.59 mg/dL respectively. Among all patients, majority (65%) patients had >60% blockage, followed by 30(25%) patients had 40-60% artery blockage , and <40% blockage was found in 10% patients.

Table-II

Risk factors for myocardial infarction among non-diabetic patients

Risk Factors	N	P(%)	P-value
Dyslipidemia	67	55.83	0.02
Hypertension	82	68.33	0.04
Dyslipidemia with hypertension	58	48.33	0.03
Stress	26	23.33	0.01
Age e" 60 years	12	10.00	0.01
Family history of CHD	35	29.17	0.02
History of CHD	43	35.83	0.03
Smoking	49	40.83	0.01
Obesity	38	31.67	0.01

Table 2 shows the risk factors for myocardial infarction. Among 120 cases, majority (68.33%) patients had hypertension. We found dyslipidemia was 55.83%. Dyslipidemia with hypertension was found in 48.33% cases. Stress, age ≥60 years, family history of CHD, history of CHD, smoking, diabetes & obesity were also individual risk factors of CHD among non-diabetic patients.

Table-III

Association of risk factors for heart blockage in myocardial infarction patients

Risk Factors	N	P(%)	P-value
Age > 45 years	75	62.50	0.01
High blood pressure	82	68.33	0.01
High low-density lipoprotein (LDL) cholesterol	72	60.00	0.01
Overweight or obesity	28	23.33	0.01
Unhealthy diet	94	78.33	0.02
Smoking	43	35.83	0.01
Rheumatoid arthritis	27	22.50	0.04
Stressful life	89	74.17	0.01
Physical inactivity	45	37.50	0.02

Table 3 shows the association of risk factors for heart blockage in myocardial infarction patients. The most common risk factors were age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life. There were some other individual risk factors that were found in our patients like smoking, being overweight, rheumatoid arthritis, and physical inactivity.

Discussion

In our study majority (36.67%) of participants belonged to the age group 41-50 years. A study conducted by Bahall et al found the majority of patients were in 60-69 years age group.[23] In this study we found female were 38% and male were 62%. Bahall et al found male 55% & female 45% in their study similar to our study.[23] We found the mean age was 53.03±11.3 years. In the study by Haffner et al., with 7 years of follow-up, the mean age of the study population at baseline was less than 60 years,[24] whereas in many other studies the mean age of the study population was 60–65 years at baseline.[25-27] Bahall et al found the overall mean age of all patients was 59.9 ± 12.07 years.[23]

In our study, hypertension was the most common risk factor for AMI in non -diabetic patients. Dyslipidemia, dyslipidemia with hypertension, stress, age ≥60 years, family history of CHD, CAD, smoking, diabetes & obesity were also individual risk factors of CHD among non-diabetic patients. Traditional risk factors such as hypertension, diabetes mellitus, history of IHD, family history of IHD, smoking and alcohol consumption, but not stress and hypercholesterolemia, were associated with AMI. These risk factors were also identified in the Framingham Heart study and the INTERHEART study.[28,29] Stress and hypercholesterolemia have been identified as risk factors in other studies.[30,31] This may have been related to the patients' unclear understanding and lack of uniformity among patients' understanding of hypercholesterolemia confirmation. The lack of an association, though, has also been noted in other studies.[23] Quintana et al. found that hyperlipidemia was not associated with myocardial infarction-related fatality.[32] In a study conducted by Goldfeld et al., patients with cardiac symptoms without overt CAD showed similar depression and/or stress levels as post-myocardial infarction patients.[33] Hypercholesterolemia is still a cause of concern since it is related to dietary patterns and type of food consumption.[34] Clusters of risk factors for CAD have been identified in numerous studies in Trinidad.[23] Thomas et al. revealed that diabetes mellitus, hypertension, hyperlipidemia and cigarette smoking were prevalent among patients presenting with AMI.[35] Mungrue et al. identified smoking and BMI as predictors of AMI-related death or survival.[36] Smoking was associated with a 1.6-times higher risk for AMI and BMI with a 1.3-times higher risk.[36] Alfred et al. found the most common risks associated with AMI in Tobago to be dyslipidemia, hypertension and diabetes mellitus.[37] Smoking, diabetes, hypertension and history of CAD were found to be the most common

cardiovascular risk factors in Libya,[38] and smoking and a family history of CAD were the common ones in Pakistan.[39] In a study on the epidemiology of myocardial infarction, associated risk factors for AMI mortality included age of > 84 years, female sex, educational level and smoking.[40]

In the Nurses' Health Study the excess risk of CHD mortality associated with prior CHD was higher than that associated with diabetes in all age groups studied (<55 years, 55–64 years and ≥65 years). This was, however, dependent on the duration of diabetes so that in women with a diabetes duration of more than 15 years the risk of CHD death was similar to that in women with prior CHD but no diabetes.[41] It is well-documented that diabetes raises the risk of CHD to a greater extent in women than in men.[42,43] It is as yet unknown what generates this increased risk in diabetic women that already exists in the prediabetic stages as it is only partly explained by an excess of the classic risk factors.[44,45] However, in the study by Mukamal et al. the results were sensitive to the duration of diabetes; when newly detected cases of diabetes were added to the analysis, CHD conferred a higher risk than diabetes.[42] Bahall et al found that diabetes, hypertension, smoking and alcohol consumption were significantly associated with AMI cases. However, stressful life, hypertension, hypercholesterolemia and smoking showed significant associations among controls.[23] This is in contrast to the findings of Kawano et al. who found that hypercholesterolemia is an independent risk factor for AMI in men but not in women.[46]

Limitations of the study

Our study was a single-centre study. We took a small sample size due to our short study period. There are more risk factors of myocardial infarction that needs to be evaluated. After evaluating once those patients we did not follow-up them for a long term and have not known other possible interference that may happen in the long term with these patients.

Conclusion and recommendations

In our study, we found hypertension, history of CHD, family history of CHD, smoking is associated with CHD. Dyslipidemia, dyslipidemia with hypertension, stress, age ≥60 years, and obesity were also individual risk factors for CHD. These elements work as crucial risk factors for myocardial infarction in non-diabetic patients. Risk factors like age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life were responsible for the highest heart blockage in myocardial infarction patients. Early identification of modifiable risk factors is important to set the strategy for prevention.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to identify more risk factors to prevent mortality among non-diabetic patients.

References

1. Roth GA, Johnson C, Abajobir A, Abd-Allah F, Abera SF, Abyu G, Ahmed M, Aksut B, Alam T, Alam K, Alla F. Global, regional, and national burden of cardiovascular diseases for 10 causes, 1990 to 2015. Journal of the American college of cardiology. 2017 Jul 4;70(1):1-25.
2. Wong ND. Epidemiological studies of CHD and the evolution of preventive cardiology. Nature Reviews Cardiology. 2014 May;11(5):276-89.
3. Roth GA, Huffman MD, Moran AE, Feigin V, Mensah GA, Naghavi M, Murray CJ. Global and regional patterns in cardiovascular mortality from 1990 to 2013. Circulation. 2015 Oct 27;132(17):1667-78.
4. Islam AM, Mohibullah AK, Paul T. Cardiovascular disease in Bangladesh: a review. Bangladesh Heart Journal. 2016;31(2):80-99.
5. Giugliano RP , Braunwald E. Non-ST elevation acute coronary syndromes, In: Zipes DP, Libby P, Bonow RO, Mann DL, Tomaselli GF. Braunwald's Heart Disease: A textbook of cardiovascular medicine. 11th ed. Philadelphia, Elsevier.2019;1:1181-208.
6. Baber U, Holmes D, Halperin J, Fuster V. Definitions of acute coronary syndromes. Hurst's The Heart. 2017;1:946-95.
7. O'gara PT, Kushner FG, Ascheim DD, Casey DE, Chung MK, De Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Journal of the American college of cardiology. 2013 Jan 29;61(4):e78-140.
8. Ishihara M, Fujino M, Ogawa H, Yasuda S, Noguchi T, Nakao K, Ozaki Y, Kimura K, Suwa S, Fujimoto K, Nakama Y. Clinical Presentation, Management and Outcome of Japanese Patients With Acute Myocardial Infarction in the Troponin Era–Japanese Registry of Acute Myocardial Infarction Diagnosed by Universal Definition (J-MINUET)–. Circulation Journal. 2015 May 25;79(6):1255-62.
9. Chung SR, Yang TH, Shin HC, Jin HY, Seo JS, Jang JS, Kim DK, Kim DS, Seo GW, Song PS, Kim DK. Initial total bilirubin and clinical outcome in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention with drug-eluting stents. Circulation Journal. 2016 May 25;80(6):1437-44.

10. Islam AM, Majumder AA. Coronary artery disease in Bangladesh: A review. Indian heart journal. 2013 Jul 1;65(4):424-35.
11. Kuulasmaa K, Tunstall-Pedoe H, Dobson A, Fortmann S, Sans S, Tolonen H, Evans A, Ferrario M. Estimation of contribution of changes in classic risk factors to trends in coronary-event rates across the WHO MONICA Project populations. The lancet. 2000 Feb 26;355(9205):675-87.
12. Hoseini VN, Rasouli M. Microalbuminuria correlates with the prevalence and severity of coronary artery disease in non-diabetic patients. Cardiology journal. 2009;16(2): 142-5.
13. Sadaka M, Elhadedy A, Abdelhalim S, Elashmawy H. Albumin to creatinine ratio as a predictor to the severity of coronary artery disease. Alexandria Journal of Medicine. 2013 Dec 1;49(4):323-8.
14. Memon AG, Kolachi M. Relationship of Microalbuminurea in Non-Diabetic and Non-Hypertensive Patients with Acute Myocardial Infarction. J Clin Exp Cardiolog. 2015;6(9):403-9.
15. Kreatsoulas C, Anand SS. The impact of social determinants on cardiovascular disease. Can J Cardiol. 2010;26(Suppl C):8C–13C.
16. Mahmood SS, Levy D, Vasan RS, Wang TJ. The Framingham heart study and the epidemiology of cardiovascular diseases: a historical perspective. Lancet. 2014;383(9921):999–1008.
17. Ryoo JH, Cho SH, Kim SW. Prediction of risk factors for coronary heart disease using Framingham risk score in Korean men. PLoS One. 2012;7(9): e45030.
18. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): a case-control study. Lancet. 2004; 364(9438):937–52.
19. Valtorta NK, Kanaan M, Gilbody S, Ronzi S, Hanratty B. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. Heart. 2016; 102(13):1009–16.
20. Auer J, Berent R, Lassnig E, Eber B. C-reactive protein and coronary artery disease. Jpn Heart J. 2002;43(6):607–19.
21. Sinan Deveci O, Kabakci G, Okutucu S, Tulumen E, Aksoy H, Baris Kaya E, et al. The association between serum uric acid level and coronary artery disease. Int J Clin Pract. 2010;64(7):900–7.
22. Kazemi MB, Eshraghian K, Omrani GR, Lankarani KB, Hosseini E. Homocysteine level and coronary artery disease. Angiology. 2006;57(1):9–14
23. Bahall M, Seemungal T, Legall G. Risk factors for first-time acute myocardial infarction patients in Trinidad. BMC Public Health. 2018 Jan 19;18(1):161.
24. Haffner SM, Lehto S, Rönnemaa T et al. (1998) Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. N Engl J Med 339:229–234
25. Lotufo PA, Gaziano JM, Chae CU et al. (2001) Diabetes and all-cause and coronary heart disease mortality among US male physicians. Arch Intern Med 161:242–247
26. Mukamal KJ, Nesto RW, Cohen MC et al. (2001) Impact of diabetes on long-term survival after acute myocardial infarction: comparability of risk with prior myocardial infarction. Diabetes Care 24:1422–1427
27. Cho E, Rimm EB, Stampfer MJ et al. (2002) The impact of diabetes mellitus and prior myocardial infarction on mortality from all causes and from coronary heart disease in men. J Am Coll Cardiol 40:954–960
28. Mahmood SS, Levy D, Vasan RS, Wang TJ. The Framingham heart study and the epidemiology of cardiovascular diseases: a historical perspective. Lancet. 2014;383(9921):999–1008
29. Anand SS, Islam S, Rosengren A, Franzosi G, Steyn K, Yusufali AH, et al. Risk factors for myocardial infarction in women and men: insights from the INTERHEART study. Eur Heart J. 2008;29:932–40.
30. Vujcic I, Vlajinac H, Dubljanin E, Vasiljevic Z, Matanovic D, Maksimovic J, et al. Psychosocial stress and risk of myocardial infarction: a case-control study in Belgrade (Serbia). Acta Cardiol Sin. 2016;32:281–9. 10.6515/ ACS20150424K.
31. The Fukuoka Heart Study Group. Medication for hypercholesterolemia and the risk of nonfatal acute myocardial infarction: a case-control study in Japan. Circ J. 2002;66:463–8.
32. Quintana HK, Janszky I, Gigante B, Druid H, Ahlbom A, Hallqvist J, et al. Diabetes, hypertension, overweight and hyperlipidaemia and 7-day casefatality in first myocardial infarction. IJC Metab Endocr. 2016;12:30–5. 10.
33. Goldfeld PRM, Soares LS, Manfroi WC. Association of depression and stress in acute myocardial infarction: a case-control study. Rev Fac Med. 2015; 63(3):439–48.
34. Na L, Han T, Zhang W, Wu X, Na G, Du S, et al. A snack dietary pattern increases the risk of hypercholesterolemia in northern Chinese adults: a prospective cohort study. PLoS One. 2015;10(8):e0134294.
35. Thomas CN, Titus G, Williams D, Simeon D, Pitt-Miller P. Two-year mortality and its determinants following acute myocardial infarction in Trinidad and Tobago. West Indian Med J. 2000;49(2):112–4.
36. Mungrue K, Mootoosingh C, Ramsingh S. Epidemiology, risk analysis and clinical outcomes of acute myocardial infarction in Trinidad. Anadolu Kardiyol Derg. 2011;11(3):267–70.
37. Alfred R, Okeke O, Moronu C, Elliot V, Frankson A, Barton EN. Descriptive epidemiology of cases of acute myocardial infarction in Tobago. West Indian Med J. 2009;58(3): 257–60.
38. Abduelkarem AR, El-Shareif HJ, Sharif SI. Evaluation of risk factors in acute myocardial infarction patients admitted to

the coronary care unit, Tripoli Medical Centre. Libya East Mediterr Health J. 2012;18(4):332–6.

39. Safdar MHK, Fazal I, Ejaz A, Awan ZI. Risk profile in young patients with acute myocardial infarction. PAFMJ. 2010;60(2):212–6.
40. +-Ahmadi A, Soori H, Mehrabi Y, Etemad K, Khaledifar A. Epidemiological pattern of myocardial infarction and modelling risk factors relevant to in-hospital mortality: the first results from the Iranian myocardial infarction registry. Kardiol Pol. 2015;73(6):451–7
41. Hu FB, Stampfer MJ, Solomon CG et al. (2001) The impact of diabetes mellitus on mortality from all causes and coronary heart disease in women: 20 years of follow-up. Arch Intern Med 161:1717–1723
42. Mukamal KJ, Nesto RW, Cohen MC et al. (2001) Impact of diabetes on long-term survival after acute myocardial infarction: comparability of risk with prior myocardial infarction. Diabetes Care 24:1422–1427
43. Becker A, Bos G, de Vegt F et al. (2003) Cardiovascular events in type 2 diabetes: comparison with nondiabetic individuals without and with prior cardiovascular disease. 10-year followup of the Hoorn Study. Eur Heart J 24:1406–1413
44. The DECODE Study Group (2003) Gender difference in all-cause and cardiovascular mortality related to hyperglycaemia and newly diagnosed diabetes. Diabetologia 46:608–617
45. Hu FB, Stampfer MJ, Haffner SM, Solomon CG, Willett WC, Manson JE (2002) Elevated risk of cardiovascular disease prior to clinical diagnosis of type 2 diabetes. Diabetes Care 25:1129– 1134
46. Kawano H, Soejima H, Kojima S, Kitagawa A, Ogawa H. Japanese Acute Coronary Syndrome Study (JACSS) investigators. Sex differences of risk factors for acute myocardial infarction in Japanese patients. Circ J. 2006; 70(5):513–7.