

Coronary heart disease and associated risk factors in Qazvin: a population-based study

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مرض القلب التاجي وعوامل اختطاره في قزوین، بجمهورية إيران الإسلامية: دراسة سكانية
حسین فخرزاده، فاطمة بندریان، حسین أدیبی، طاهرة سماوات، حسین ملک أفضلی، إلیه حجت زاده، باقر لاریجانی

الخلاصة: في دراسة مستعرضة أجريت في قزوین، بجمهورية إيران الإسلامية، تم تقييم 846 شخصاً مقيماً (425 رجلاً و421 امرأة) تبلغ أعمارهم ≤ 30 عاماً، للكشف عن أي إصابة بمرض القلب التاجي وعوامل اختطاره، وذلك بمقارنة مجموعة مصابة بالأمراض الإقفارية ischaemic بمجموعات غير مصابة بها. وبلغت معدلات الانتشار المصححة بحسب العمر لاحتمال احتشاء العضلة القلبية 4.2٪، وللتغيرات الإقفارية في تخطيط كهربية القلب 36.8٪، وللذبحة الصدرية 2.2٪. ولم يلاحظ أي فرق في متوسط الضغط الانقباضي والانبساطي للدم، وفي منسب كتلة الجسم، بين المجموعة المصابة بالأمراض الإقفارية والمجموعة غير المصابة بها. وتبين وجود ترابط يُعتدُّ به إحصائياً بين احتمال الإصابة باحتشاء العضلة القلبية وبين فرط ضغط الدم، والنمط الثاني من السكري، والتدخين بين النساء. كما لوحظ ترابط يُعتدُّ به إحصائياً بين حدوث تغيرات إقفارية في تخطيط كهربية القلب وبين نسبة الخصر إلى الورك WRH في النساء، وكذلك بين التغيرات الإقفارية في تخطيط كهربية القلب وبين فرط ضغط الدم في الرجال.

ABSTRACT In a cross-sectional study in Qazvin, Islamic Republic of Iran, 846 residents (425 men and 421 women) aged ≥ 25 years were assessed for coronary heart disease and its associated risk factors comparing ischaemic and non-ischaemic groups. The age-adjusted prevalence of possible myocardial infarction, ischaemic ECG changes and angina pectoris were 4.2%, 36.8% and 2.2% respectively. There was no difference in the mean systolic and diastolic blood pressure and body mass index between ischaemic and non-ischaemic groups. There was a significant association between possible myocardial infarction and hypertension, type 2 diabetes, and smoking in women. There was also a significant association between ischaemic ECG changes and waist-hip ratio in women and between ischaemic ECG changes and hypertension in men.

Maladie coronarienne et facteurs de risque associés à Qazvin : étude en population générale
RÉSUMÉ Dans le cadre d'une étude transversale menée à Qazvin, en République islamique d'Iran, 846 habitants (425 hommes et 421 femmes) âgés de 25 ans et plus ont fait l'objet d'une évaluation de la maladie coronarienne et des facteurs de risque qui lui sont associés sur la base d'une comparaison entre événements ischémiques et non ischémiques. Les prévalences respectives, ajustées sur l'âge, de la possibilité d'infarctus du myocarde, des modifications ischémiques à l'ECG et de l'angor étaient de 4,2 %, 36,8 % et 2,2 %. En ce qui concerne la pression artérielle systolique et diastolique moyenne et l'indice de masse corporelle, il n'a été constaté aucune différence entre les groupes « événements ischémiques » et « événements non ischémiques ». Dans la population féminine, il est apparu une association significative entre, d'une part, la possibilité d'infarctus du myocarde et, d'autre part, l'hypertension, le diabète de type 2 et le tabagisme. L'association s'est également avérée significative entre les modifications ischémiques à l'ECG et le rapport taille/hanche chez la femme, de même qu'entre ces mêmes modifications ischémiques et l'hypertension chez l'homme.

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Introduction

Cardiovascular disease is the most common cause of mortality in urban industrial and developing countries [1] and the most serious life-threatening disease in developed countries [1]. In the United States it is the underlying cause of 39.4% of all deaths. Coronary heart disease (CHD) comprises half of all cases of cardiovascular disease before the age of 75 years [2]. The incidence of CHD after 40 years of age is 40% for men and 32% for women and 1 out of 5 deaths are due to CHD [2]. Improvements in primary prevention and treatment during recent decades have successfully reduced the mortality due to CHD in North America and Western Europe; but in the same period it has increased in Asia and Eastern Europe [3]. Even in industrialized countries, despite technological advances and efforts at prevention, myocardial infarction (MI) is still a fatal event in approximately one-third of patients. In addition 25% of men and 38% of women who survive will die within 1 year of the first attack [2].

In the Islamic Republic of Iran, the burden of cardiovascular disorders, especially CHD is also high, and according to data from the Iranian Department of Health it is the leading cause of mortality in this country [4]. Nearly 317 out of every 750 daily deaths in 2003 were due to cardiovascular disease of which 166 cases were due to MI, and it was estimated that on each day 2726 years of life had been lost through cardiovascular disease [4]. Furthermore, the economic burden of CHD on urban communities is escalating. The cost of care for CHD patients in the United States was estimated at US\$ 129.9 billion in 2003 [1]. The total cost of CHD in the Iranian oil industry alone has been estimated at 26.77 billion rials in the year 2000 [5].

The classic risk factors such as positive family history, dyslipidaemia, hypertension,

smoking and diabetes have been diagnosed as the major underlying causes of CHD for many years, but in nearly 50% of cases coronary events occur in the absence of these known factors [6–9]. Notwithstanding, prevention and control of these risk factors and adoption of a healthy lifestyle has been shown to reduce the burden of CHD on many communities [10].

In countries of the Eastern Mediterranean Region increasing economic wealth along with rapid population growth has led to a rapidly increasing mortality rate from cardiovascular disease [11]. So primary and secondary prevention of CHD in this area have become an urgent public health issue [12]. The aim of this study was to determine the prevalence of ischaemic heart disease (IHD) and its related risk factors as a part of a World Health Organization (WHO) funded programme of noncommunicable disease prevention in Qazvin city, which is in the central north region of the Islamic Republic of Iran.

Methods

A cross-sectional study was conducted in Qazvin in the year 2000. The study protocol was approved by the ethics committee of the Vice-Chancellor for Research Affairs of the Iranian Ministry of Health.

Sample

Individuals aged 25 years and older who were registered at the medical health centres of Qazvin were sampled by random multi-stage cluster sampling and were invited to participate in this study. A total of 1000 residents took part in the study; 154 people with incomplete information or no biochemical blood assessment were excluded from the study. Informed consent was obtained from all participants before they were enrolled in the study.

Data collection

A structured questionnaire including demographic information and medical history and risk factors was completed for each subject.

Height was measured with the individual standing barefoot on the platform of the stadiometer with the upper back, buttock and heels pressed against the upright position of the instrument and any head covering removed. Weight was measured using a standard scale with the participants barefoot and wearing a thin cloth.

A blood sample was obtained after overnight fasting, for assessment of glucose and lipid profile. Blood pressure was measured twice in the sitting position after 5 minutes of resting using a standardized mercury sphygmomanometer according to the Joint National Committee (JNC-VII) criteria [13].

For participants who were 30 years and older a 12-lead electrocardiogram (ECG) was taken in the resting position.

Definitions

Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2) and was used as the criteria for diagnosis of overweight and obesity. Participants were divided into 3 groups: normal weight ($BMI < 25 \text{ kg}/m^2$), overweight ($25 \text{ kg}/m^2 \leq BMI < 30 \text{ kg}/m^2$) and obese ($BMI \geq 30 \text{ kg}/m^2$). Systolic blood pressure of $\geq 140 \text{ mmHg}$ and/or diastolic blood pressure $\geq 90 \text{ mmHg}$ was considered as hypertension.

Diabetes was diagnosed by the American Diabetes Association (ADA) criteria (fasting blood glucose $\geq 126 \text{ mg}/dL$ or treatment with oral hypoglycaemic agents or insulin). Criteria for dyslipidaemia were according to National Cholesterol Education Program adult treatment panel (NCEP:ATP III) guidelines [14] and total cholesterol $\geq 200 \text{ mg}/dL$ was considered as hypercho-

lesterolaemia. Patients with triglycerides $> 150 \text{ mg}/dL$, low-density lipoprotein cholesterol (LDL-C) $\geq 160 \text{ mg}/dL$ and high-density lipoprotein cholesterol (HDL-C) $\leq 40 \text{ mg}/dL$ were defined as having dyslipidaemia. Waist-hip ratio (WHR) ≥ 0.9 was defined as the cut-off for visceral obesity.

ECGs were interpreted according to the Minnesota code and Whitehall criteria in the WHO Multinational Programme for Diabetes and Coronary Heart Disease by 2 experienced cardiologists [15]. Diagnosis of angina pectoris was made by the Rose criteria [16]. CHD was defined as angina pectoris (grade I or II of Rose criteria), myocardial infarction [possible MI, i.e. major Q wave (Minnesota code 1.1)], or history of previous MI and ischaemic resting ECG abnormalities including probable and possible ischaemic heart diseases. Probable ischaemic heart disease included major Q or QS wave (Minnesota codes 1.1, 1.2) or complete left-bundle branch block (Minnesota code 7.1.1). Possible ischaemic heart disease included small Q or QS wave (Minnesota code 1.3), ST depression (Minnesota codes 4.1–4.3), or T-wave items (Minnesota codes 5.1–5.3). Total ischaemia was considered as any ischaemic changes in ECG. ECGs that did not fulfil any of these criteria were categorized as normal. Each individual with any of these criteria was included only once.

Participants were initially divided in to 4 categories of cigarette smoking according to WHO criteria (non-smoker, < 10 , 10 – 19 and > 20 cigarettes per day) and later analysed in 2 groups: smoker/nonsmoker [17].

Laboratory analysis

Blood glucose was measured by the glucose oxidase method. Triglycerides, LDL-C and HDL-C were measured by calorimetric methods (Pars Azmoon kit, Islamic Repub-

lic of Iran). LDL-C was calculated indirectly by Friedwald's formula [18].

Data analysis

Mean and standard deviation (SD) were calculated for simple frequencies. *SPSS*, version 10 was used for data analysis and descriptive tests, cross-tabulations and *t*-test were applied. Odds ratios (OR) and 95% confidence intervals (CI) are shown.

Results

The mean age of participants was 47.1 (SD 11.9) years with 425 (50.2%) men and 421 (49.8%) women. The mean BMI was 27.5 (SD 9.3) kg/m².

The prevalence of CHD risk factors in the study population is shown in Table 1. The age-adjusted prevalence of hyper-

cholesterolaemia, diabetes, hypertension and obesity were 30.9%, 12.8%, 9.6% and 23.2% respectively.

Crude and age-adjusted prevalence of possible MI, ischaemic ECG changes and angina are shown in Table 2. The prevalence of ischaemic heart disease in the total population according to ECG findings was 36.5% (Table 2) and prevalence of MI according to ECG findings and clinical evidence was 4.9% (Table 2). The age-adjusted rates were 36.8% and 4.2% respectively.

MI was more common among men than women (6.8% versus 2.9%, OR = 2.50%, 95% CI: 1.26%–4.97%) while ischaemic ECG changes were significantly lower in men than women (24.7% versus 48.5%, OR = 0.35%, 95% CI: 0.26%–0.47%). The mean (SD) age of patients with ischaemic ECG changes [48.7 (12.9) years] and MI

Table 1 Prevalence of coronary heart disease risk factors in males and females, Qazvin, Islamic Republic of Iran

Risk factor ^a	Females (n = 421)		Males (n = 425)		Total		Age-adjusted prevalence %
	No.	%	No.	%	No.	%	
Triglycerides ≥ 150 mg/dL	219	52.4	255	61.3	474	56.8	53.5
Total cholesterol ≥ 200 mg/dL	143	34.2	141	34.0	284	34.1	30.9
HDL-cholesterol < 40 mg/dL	198	47.4	256	62.0	454	54.6	54.0
LDL-cholesterol > 160 mg/dL	54	13.6	34	8.9	88	11.3	21.1
LDL-cholesterol > 130 mg/dL	110	27.8	96	25.2	206	26.5	24.1
Diabetes	59	14.6	66	16.4	125	15.5	12.8
Impaired glucose tolerance	46	11.4	28	6.9	74	9.2	7.8
Hypertension	65	15.4	32	8.7	102	12.1	9.6
Obesity	158	37.5	59	13.9	217	25.7	23.2
Overweight	169	40.1	179	42.1	348	41.1	41.1
Waist-hip ratio > 0.9	205	48.7	248	54.8	453	53.5	47.0
Smoking	8	1.9	128	30.5	136	16.2	16.1

^aSee the Methods for definitions of risk factors.

HDL = high-density lipoprotein; LDL = low-density lipoprotein;

n = total number of participants (data were missing for some variables).

Table 2 Prevalence of ischaemic electroencephalography changes in males and females

Ischaemic changes	Females (n = 421)		Males (n = 425)		Total		Age- adjusted prevalence %
	No.	%	No.	%	No.	%	
Myocardial infarction	12	2.9	29	6.8	41	4.9	4.2
Probable ischaemia	15	3.6	30	7.1	45	5.3	4.7
Possible ischaemia	178	42.3	95	22.4	273	32.3	32.9
Total ischaemia	204	48.5	105	24.7	309	36.5	36.8
Angina pectoris	12	2.9	7	1.6	19	2.2	2.2

n = total number of participants.

[56 (11.1) years] were significantly higher than normal participants [46.8 (11.9) years] ($P < 0.001$).

The mean systolic and diastolic blood pressures and BMI were not significantly different in those with ischaemic ECG and normal ECG. Also no difference was found in the mean BMI between these groups (Table 3).

The prevalence of ischaemic ECG changes was significantly higher in patients with hypertension than in normotensive patients (51% versus 40%).

MI was slightly more common in patients with diabetes than those without diabetes (2.4% versus 0.7%, $P = 0.1$). Possible MI was also slightly more common in smokers than non-smokers but the differences were

Table 3 Means values of coronary artery risk factors in participants with normal and ischaemic electroencephalographic (ECG) changes

Risk factor	Ischaemic ECG group ^a		Normal ECG group		P-value
	Mean	SD	Mean	SD	
Triglycerides (mg/dL)	207.2	163.7	216.5	168.2	≥ 0.05
Total cholesterol (mg/dL)	195.8	93.5	201.7	163.7	≥ 0.05
LDL-cholesterol (mg/dL)	174.4	232.8	186.7	254.6	≥ 0.05
HDL-cholesterol (mg/dL)	49.5	95.0	60.7	142.4	≥ 0.05
BMI (kg/m ²)	27.5	4.7	27.0	(4.7)	≥ 0.05
Diastolic blood pressure (mmHg)	75.3	9.2	75.8	8.5	≥ 0.05
Systolic blood pressure (mmHg)	119.8	15.5	118.2	12.4	≥ 0.05

^aIncludes participants with any ischaemic changes in the ECG.

LDL = low-density lipoprotein; HDL = high-density lipoprotein; BMI = body mass index; SD = standard deviation.

not significant (3.7% versus 0.6%, $P = 0.06$).

Discussion

In this survey we found a high prevalence of CHD among the Qazvin population. Similar to most of the previous studies, ischaemic ECG changes were more common in women and MI was more common in men [19,20]. In a study in Bushehr port in the south of the Islamic Republic of Iran the prevalence of CHD was 17.4% in men and 19.8% in women; possible MI was present in 3.5% of men and 1.3% of women and its crude rate was 2.5%; a total of 4.9% of people suffered from angina [19,20].

In recent decades the prevalence of CHD has increased in Eastern Mediterranean Region countries, alongside the increases in wealth and the market economy [21]. However, we are also faced with an increasing burden of CHD in other parts of Asia. Onat et al. in their survey in Turkey found the prevalence of CHD to be 3.7% [22]. In Sri Lanka the prevalence of CHD based on history alone was 54 per 1000 population and based on symptoms and ischaemic ECG was 16 per 1000, and in New Delhi the prevalence of CHD on based clinical history was 25.1 per 1000 and based on clinical manifestations and ECG findings was 66.8 per 1000 [23,24]. Possible MI was reported in 1.5% of Japanese people, while the prevalence of ischaemic ECG changes was 10% in men and 11.3% in women, respectively [25]. The results of our study are similar to results from other Middle East and Asian countries [21–25].

In industrialized countries improvements in primary prevention and treatment have been the underlying causes of declining rates of CHD; however cardiovascular disorders are still the most common cause of death. In Belgium apparent CHD was re-

ported in 8.3% of men and 7.6% of women by De Bacquer et al., while possible MI was seen in 3.2% of men and 2.3% of women [26]. There was no significant difference between men and women in the prevalence of ischaemic ECG changes. They found that obesity increased the risk of ischaemic ECG changes [26]. These results were similar to a previous survey in Georgia [27].

Possible MI had a significant association with smoking and hypertension in women of our study. Nabipour et al. in a study in Bushehr port (south of Islamic Republic of Iran) found that possible MI was related to hypertension in men and diabetes in women and there was a significant direct association between ischaemic ECG changes and hypertension [20]. In Belgium researchers showed a significant association between ischaemic ECG changes and diabetes [26]. This was similar to the results of the Charleston Heart Study in the United States [28]; while in our study this relation was significant only in women.

The association between ischaemic ECG changes and smoking in this study was not significant, which is in accordance to findings of De Baquer et al., Strogatz et al. and Sutherland et al. [26–28].

Ischaemic ECG changes are associated with a 2-fold increase in the risk of death due to CHD [29]. Like many previous studies, the prevalence of ischaemic ECG changes was high in our survey [26,30,31]. The pooling project researchers in the United States reported prevalences of 9% and 38% for minor and major ischaemic ECG changes respectively [32]. The International Collaborative Group in Europe reported prevalences of 9% in France and Italy, 7.3% in Denmark and 8.3% in Finland for major ischaemic ECG changes in adults [33].

Jones et al. found that the prevalence of CHD in African–American patients with hypertension and low HDL was higher than

people without these co-morbid conditions in both sexes and all races. CHD was also more prevalent in diabetics and smokers than non-diabetics and non-smokers in all races and both sexes [34]. Diabetes in white women and hypertension in black women were stronger prognostic factors for CHD.

Although the prevalence of ischaemic ECG changes in this sample of the Iranian population is lower than in industrialized countries, it is similar to results from other Eastern Mediterranean countries and Asian countries. As the Islamic Republic of Iran is a country with a developing market economy and increasing sedentary lifestyle, strict attention should be paid to prevention of the major risk factors of CHD in this

region. Based on the study findings, we can recommend that primary and secondary prevention of CHD is an important health priority. This is already occurring in the context of a collaborative programme of noncommunicable disease prevention in Qazvin assisted by WHO.

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Guidelines for assessment and management of cardiovascular risk

Guidelines for assessment and management of cardiovascular risk provides guidance on reducing disability and premature deaths from coronary heart disease, cerebrovascular disease and peripheral vascular disease in people at high risk, who have not yet experienced a cardiovascular event. People with established cardiovascular disease are at very high risk of recurrent events and are not the subject of these guidelines. They have been addressed in previous WHO guidelines. The risk prediction charts that accompany these guidelines allow treatment to be targeted according to simple predictions of absolute cardiovascular risk.

Recommendations are made for management of major cardiovascular risk factors through changes in lifestyle and prophylactic drug therapies. The guidelines provide a framework for the development of national guidance on prevention of cardiovascular disease that takes into account the particular political, economic, social and medical circumstances.

As a companion volume, *Pocket guidelines for assessment and management of cardiovascular risk. Middle East* will shortly be available in Arabic, which provides a cardiovascular risk prediction chart for the Eastern Mediterranean Region.

Further information about this and other WHO publications is available at <http://www.who.int/bookorders/anglais/home1.jsp?sesslan=1>