Assessment of the 10-year risk of coronary heart disease events for Qatar Petroleum's firefighters and non-firefighter staff in Qatar

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تقييم اختطار الأَحْداث القلبية التاجية على مدى عشر سنوات لدى رجال الإطفاء في شركة قطر للبترول ولدى غيرهم من العاملين فيها

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الخلاصة: يُعَدُّ مرض القلب التاجي من مشكلات الصحة العمومية الكبرى في جميع أرجاء العالم، وقد يكون رجال الإطفاء بحكم مهنتهم عُرضةً لاختطار إضافي. وقد أجرى الباحثان دراسة مستعرضة في المدينة الصناعية في راس لافان، في قطر، لتقييم اختطار الأَحْداث القلبية التاجية على مدى عشر سنوات لدى 369 من العاملين في شركة قَطَر للبترول وذلك خلال إجرائهم للفحوص الطبية الدورية. وقد قُسِّم المشاركون في الدراسة (وجميعهم من الرجال) إلى قسمين: رجال الإطفاء وغير رجال الإطفاء. ووجد الباحثان بعد إجراء الحسابات بناءً على حَرَز الاختطار فرامنغهام أن 69.9٪ من المشاركين في الدراسة يَقَعُون في صنف المنخفضي الاختطار، وأن 27.1٪ منهم يَقَعُون في صنف متوسطي الاختطار، وأن 2.9٪ منهم يَقَعُون في صنف مرتفعي الاختطار. ولم يكن أيٌّ من رجال الإطفاء في صنف مرتفعي الاختطار، بل كان 15.5٪ منهم في صنف ذوي الاختطار المتوسط، والباقي في صنف ذوي الاختطار المنخفض. وقد كان عامل الاختطار الأكثر شيوعاً في مجمل المجموعة، هو انخفاض مستوى الكولسترول المرتفع الكثافة (68.8٪)، يليه ارتفاع ضغط الدم (32.0٪)، والتدخين (15.4٪). وكان وسطي اختطار إصابة بمرض قلبي تاجي لدى رجال الإطفاء (3.7±6.5٪) وهو أقلُّ بقليل مما هو عليه لدى غير رجال الإطفاء (9.5±6.5٪).

ABSTRACT Coronary heart disease is a major public health problem worldwide and firefighters may be at particular occupational risk. In a cross-sectional study in Ras Laffan Industrial City, Qatar, we assessed the 10-year risk of coronary heart disease events for 369 Qatar Petroleum staff at their periodic medical examination. The subjects of the study (all males) were divided into firefighters and non-firefighters groups. Based on the Framingham risk score calculations, 69.9% of the subjects were categorized as low risk, 27.1% as intermediate risk and 2.9% as high risk. None of the firefighters was categorized as high risk, 15.5% were intermediate and the rest were low risk. In the whole group, low high-density lipoprotein cholesterol was the most prevalent risk factor (68.8%), followed by hypertension (32.0%) and smoking (15.4%). The mean risk of developing coronary heart disease in firefighters [6.5% (SD 3.7%)] was significantly lower than in non-firefighters [9.5% (SD 6.5%)].

Évaluation du risque d'événements cardiopathiques coronariens à 10 ans chez les pompiers et autres personnels de Qatar Petroleum au Qatar

RÉSUMÉ Les cardiopathies coronariennes représentent un problème de santé publique mondial et les pompiers, en raison de leur métier, pourraient être davantage exposés au risque. Lors d'une étude transversale menée dans la ville industrielle de Ras Laffan (Qatar), nous avons évalué le risque d'événements cardiopathiques coronariens à 10 ans chez 369 membres du personnel de Qatar Petroleum à l'occasion de leur visite médicale de routine. Les sujets de l'étude (tous de sexe masculin) ont été répartis soit dans un groupe composé de pompiers, soit dans un groupe d'autres professions. D'après les calculs basés sur le score de risque de Framingham, 69,9 % des sujets présentaient un risque faible, 27,1 % un risque intermédiaire et 2,9 % un risque élevé. Aucun pompier n'a été classé dans la catégorie à haut risque, 15,5 % ont été classés dans la catégorie à risque intermédiaire et le pourcentage restant appartenait à la catégorie à faible risque. Sur l'ensemble du groupe, le faible taux de cholestérol des lipoprotéines de haute densité était le facteur de risque le plus fréquent (68,8 %), suivi par l'hypertension (32,0 %) et le tabagisme (15,4 %). Le risque moyen de survenue d'une cardiopathie coronarienne chez les pompiers [6,5 % (E.T. 3,7 %)] était nettement inférieur à celui des autres professions [9,5 % (E.T. 6,5 %)].

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Introduction

Coronary heart disease (CHD) is a major public health problem worldwide, including in Gulf countries such as Qatar. It has become the most frequent cause of death in both developed and developing countries and has been linked with significant social and economic burden. The lifetime risk of contracting CHD is considerable and the disease is frequently silent, emphasizing the importance of prevention. In Qatar, approximately 35% of overall deaths were attributable to cardiovascular disease, mostly due to CHD [1].

Assessing the risk of developing CHD plays a pivotal role in the prevention and management of the disease. Risk assessment can identify people at high risk of developing CHD events for whom earlier and intensive management are required [2]. Up until now, several tools have been developed to predict the occurrence of CHD [3]. The Framingham risk score, which has been described as the gold standard for measurement of CHD risk [4], utilizes risk factors such as age, blood pressure, smoking, obesity, diabetes and lipid profile in assessing the risk of developing general cardiovascular disease, CHD, stroke and other problems. The Framingham and other studies showed that assessment of CHD risk factors was universally applicable in all groups of the population [5,6]. Despite the availability of these well established prediction tools, their use has been limited in primary care [7]. This is unfortunate given the role of primary care as the main health care provider in the community.

Qatar Petroleum (QP) medical services department provides medical support to all QP staff, including firefighters working in Ras Laffan industrial city. From the perspective of an occupational health job risk assessment, firefighting and rescue operations are stressful and arduous physical duties that require optimal physical and mental fitness. Poor fitness places individual firefighters, their colleagues and those whom they are rescuing at increased risk of harm. As such, firefighters in QP are required to attend annual health assessment in order to review their continued physical (especially cardiovascular) and mental fitness. The aim of this study was to use the Framingham risk score to investigate the CHD risk of QP firefighters and to compare the risk with that of non-firefighter employees.

Methods

Study design and setting

Using cross-sectional methods, this study utilized periodic medical examination data, extracted from the electronic medical records and periodic medical examination reports available in QP health centre (occupational health section) in Ras Laffan industrial city. Under the health surveillance and prevention programme in QP, all QP staff should undergo periodic medical examination. The frequency of medical examination depends on staff age: once in 3 years for those aged < 40 years, once in 2 years for those aged 40–50 years and once a year for those aged > 50 years.

Sample

In 2009, 410 QP staff (out of roughly 1200 QP staff working in Ras Laffan industrial city) underwent their periodic medical examination. The data of these staff were utilized as subjects of our study. The inclusion criteria were data from individuals aged 30–74 years without CHD at the baseline examination whose records contained complete information for the CHD event calculation. Based on the subjects' jobs, the data was categorized into firefighters and non-firefighters groups. Since all subjects in the firefighters group were men, data for female staff from the non-firefighters group were excluded.

Data collection

Data on the following risk factors were extracted from the files for each individual: age, sex, lipid and sugar profiles, smoking status, hypertension and diabetes mellitus. A subject was labelled as a smoker if he reported ever smoking (cigarettes or waterpipe) in the month before his periodic medical examination, regardless of the frequency or duration of smoking. A subject was defined as diabetic if he had been diagnosed by physician as diabetic, regardless of the type of diabetes or management. The levels of blood pressure, total cholesterol and high-density lipoprotein (HDL) cholesterol were based on the latest measurements. Hypertension cut-offs were defined based on JNC-7 criteria, i.e. systolic blood pressure > 140 mmHg and/or diastolic blood pressure > 90 mmHg [8]. Total cholesterol and HDL cut-off values were based on the National Cholesterol Education Program criteria: i.e. total cholesterol level > 240 mg/dL (6.2 mmol/L) and HDL < 40 mg/dL (1.0 mmol/L) [9].

Analysis

All of these risk factors were tabulated, calculated and entered into the Framingham risk score to facilitate the assessment of CHD risks (angina, myocardial infarction and death) within the next 10 years. This scoring system predicts 10-year absolute risk of CHD in an individual who has no established cardiovascular disease. This tool scores the risk factors and converts them into percentage values that reflect the likelihood of getting CHD within the next 10 years. Individual risk values can subsequently be categorized as high risk of CHD (> 20%), intermediate risk (10%–20%) and low risk (< 10%) [10,11].

The risk factors and risk scores were expressed as proportions and mean and standard deviation (SD). A statistical analysis was performed to test observed differences between firefighters and non-firefighters groups. Independent

t-test was used for continuous data while *z*-test was used for proportions. *P*-value < 0.05 was used to determine the significance of differences.

Results

Of the total of 410 employees who underwent the periodic medical review, only 369 met the inclusion criteria. The remaining 41 were excluded due to incomplete data (7 subjects), outside the age criteria (18 subjects) or female sex (16 subjects). Of the included subjects, 142 were firefighters and 227 were non-firefighters. Their mean ages were 38.5 (SD 5.5) years and 44.8 (SD 7.6) years respectively.

The prevalence of cardiovascular risk factors is shown in Figure 1. Low HDL was the most prevalent risk factor in the whole group of subjects (68.8%), followed by hypertension (32.0%), smoking (15.4%), diabetes mellitus (11.1%) and high total cholesterol (10.8%). Roughly 3.6% of the total subjects had 4 risk factors, 17.4% had 3 risk factors and 35% had 2 risk factors. The rest of them had a single risk factor. In general, the pattern of prevalence figures were similar comparing the study groups of firefighters and non-firefighters.

Based on Framingham risk score calculations, 69.9% of subjects were categorized as low risk, 27.1% as intermediate risk and 2.9% as high risk (Figure 2). While 4.8% of the non-firefighters subjects were in the high-risk category, none of the firefighters fell into this category. Two-thirds of non-firefighters (34.2%) were in the intermediate risk category compared with only 15.5% of firefighters. The remainder (60.8% of non-firefighters and 84.5% of firefighters) were at low risk.

Observed differences between firefighters and non-firefighters groups were analysed (Table 1). In terms of risk of developing CHD, firefighters had significantly lower mean risk percentage score 6.5% (SD 3.7%), than
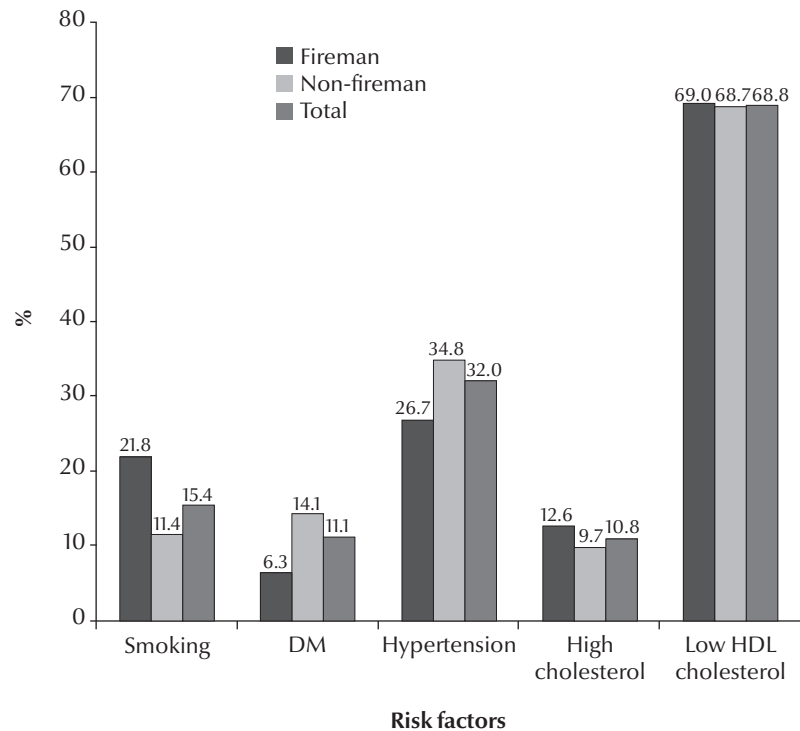
Figure 1 **Prevalence of risk factors for coronary heart disease in the study groups of firefighters (*n* = 142) and non-firefighters (*n* = 227) in Qatar (DM = diabetes mellitus, HDL = high-density lipoprotein)**
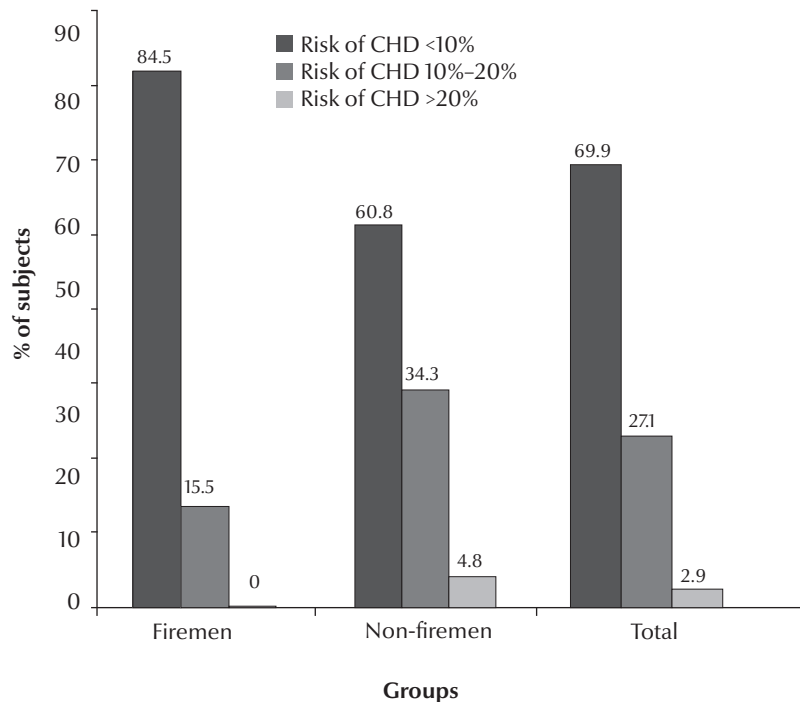
Figure 2 **Risk of coronary heart disease (CHD) events in study groups of firefighters (*n* = 142) and non-firefighters (*n* = 227) in Qatar**

Table 1 Difference of coronary heart disease risks between firefighters and non-firefighters in Qatar

Risk factors	Firefighters (n = 142)	Non-firefighters (n = 227)	Statistics	P-value
	Mean (SD)	Mean (SD)		
Age (years)	38.5 (5.5)	44.8 (7.6)	$t = 9.3$	< 0.001
Total cholesterol (mmol/dL)	5.06 (0.96)	5.06 (0.86)	$t = -0.17$	0.413
HDL cholesterol (mmol/dL)	0.91 (0.20)	0.91 (0.20)	$t = 0.22$	0.913
CHD risk score (%)	6.5 (3.7)	9.5 (6.5)	$t = 5.5$	< 0.001
	%	%		
Smoking	21.8	11.4	$z = 2.53$	0.011
Diabetes mellitus	6.3	14.1	$z = 2.14$	0.032
Hypertension	26.7	34.8	$z = 1.50$	0.134
Hypercholesterolaemia	12.6	9.7	$z = 0.72$	0.471
Low HDL cholesterol	69.0	68.7	$z = -0.05$	0.960

HDL = high-density lipoprotein cholesterol; CHD = coronary heart disease; SD = standard deviation.

non-firefighters 9.5% (SD 6.5%) ($P < 0.001$). The prevalence of smoking was higher in the firefighters group (21.8% versus 11.4%) ($P = 0.011$), while the prevalence of diabetes was higher in the non-firefighters group (14.1% versus 6.3%) ($P = 0.032$).

Discussion

Cardiovascular events, mostly CHD, have been reported to cause 45% of deaths among firefighters while they are on duty, particularly when extinguishing fires, responding to alarms and returning from alarms [12]. This mortality rate was considerably higher than that in on-duty police officers and emergency health workers (22% and 11% respectively). This high rate of CHD death among firefighters was linked with lack of physical fitness, the presence of cardiovascular risk factors and the existence of subclinical or clinical CHD among firefighters. Among firefighters who had fatal and non-fatal cardiovascular events during their duty, 26% and 18% of them respectively had documented CHD [12].

In our study the prevalence of risk factors in both firefighters and non-firefighters groups were somewhat comparable. In firefighters, non-firefighters and total subjects, the prevalence of low HDL was nearly 70%, which was considerably higher than the prevalence of hypertension, smoking, diabetes and hypercholesterolaemia, which accounted for 32.0%, 15.4%, 11.1% and 10.8% respectively. In general, the figures from this study are comparable with that elsewhere in the region. The prevalence of hypertension in the Qatari population, for instance, was reported to be 32.1% [13]. A systematic review of studies on cardiovascular risk factors in the Middle East region revealed the following prevalence of risk factors: obesity 24.5% (95% CI: 21.8%–27.5%), diabetes 10.5% (95% CI: 8.6%–12.7%), hypertension 21.7% (95% CI: 18.7%–24.9%) and smoking 15.6% (95% CI: 12.3%–19.6%) [14].

The 10-year risk of CHD events showed that 30.0% of our subjects had intermediate or high risk scores (> 10%). All of the high-risk subjects were in the non-firefighters group. The mean risk of developing CHD events in the firefighters group (6.5%) was significantly lower than that in the non-firefighters group (9.5%). This risk difference might be attributed to the different ages, smoking and diabetes status between the 2 groups. Although the prevalence of smoking in the firefighters group was higher than that in the non-firefighters group ($P = 0.011$), the firefighters were significantly younger ($P < 0.001$) and were significantly less likely to have diabetes ($P = 0.032$), making their risk of developing CHD lower than that in the non-firefighters.

An important finding from this study was that low HDL was the most prevalent risk factor in both firefighters and non-firefighters. In many risk factor studies, the prevalence of low HDL has been rarely documented. In fact, HDL is thought to play an important role in CHD events. Every 1 mg/dL increase of HDL is associated with a decline of 2%–3% of CHD events [15]. To reduce the risk of CHD in our population, appropriate management of risk factors, particularly low HDL level, is required. This may include the introduction of a mass CHD prevention campaign to Ras Laffan industrial city staff regarding lifestyle modifications. Smoking cessation, weight loss, regular exercise and other lifestyle modifications (such as increased fish consumption and a diet rich in fruit and vegetables) have been shown to be associated with lower rates of hypertension, diabetes and hypercholesterolaemia but also with raised HDL level and lower risk of CHD events [15,16]. In addition, the establishment of diabetic and hypertension clinics in

Ras Laffan Medical Center is recommended as this will centralize the management of risk factors, particularly hypertension and diabetes [17].

In our study, none of the firefighters had a risk of CHD more than 20% and therefore none of them was categorized as high risk. However, a substantial number of firefighters had a risk level of 20% and if the threshold of high risk were lowered to include 20% then they would fall into the high-risk category. Since firefighting is considered as high-stress job and therefore high risk fro CHD, it is suggested to lower the risk category threshold to include those with risk of 20% as this would improve the management of CHD risk in this group.

One limitation of this study is that it the risk factor identification and calculations were based on the assumption that the subject had no underlying cardiovascular diseases. To obtain more accurate data on the population risk, therefore, the results of this study should be complemented with data from other sources such as medical and insurance reports.

Conclusion

The 10-year risk of CHD events in QP staff in Ras Laffan industrial city was high, given that almost one-third of them had intermediate or high risk scores (risk of CHD events > 10%). Added to this was the finding that around one-fifth of them had 3 or more risk factors, making intervention management challenging. While all these risk factors should be addressed by health promotion interventions, a specific programme to promote increased levels of HDL in the population may be required. The risk of CHD among firefighters was lower than that among non-firefighters, but the prevalence of smoking in this group was higher than in the non-firefighters group. On the other hand, the prevalence of diabetes in the non-firefighters group was higher than in the firefighters group. Given the dissimilarity of risk factors and risk of CHD between the 2 groups, it is recommended to target specific issues of health promotion on each particular group, such as intensive smoking cessation for the firefighters group and diabetes management for the non-firefighters group.

Acknowledgements

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