

Research Article

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Risk Factors Associated with Cardiovascular Diseases among Adults Attending the Primary Health Care Centers in Qatar, a Cross-Sectional Study

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Abstract

Introduction/Aim: In Qatar, prevalence of risk factors of cardiovascular diseases significantly higher compared to many other countries. It is therefore critical to understand the associations between selected risk factors and having cardiovascular diseases (Any cardiac disease including coronary, thrombotic/hemorrhagic and peripheral vascular diseases) as we aimed by this study.

Materials and Methods: Cross-sectional study design was used. Data for individuals aged ≥ 18 and who visited primary health care centers in Qatar during 2017 were extracted from electronic medical records and analysed.

Results: The adjusted model of analysis confirmed that the increase in age especially over the age of sixty (adjusted OR of 6.65) represents the most potent risk factor for cardiovascular diseases occurring among study's participants. Being male gender, Northern African, Western Asian, Southern Asian, Qatari increased the risk of cardiovascular disease unevenly with adjusted OR of 1.36, 1.45, 1.42, 1.31 and 1.15 respectively. Having a high blood pressure almost doubled the risk of cardiovascular disease developing (adjusted OR of 1.83). Unlike expected, the high triglycerides component failed to show any significant contribution to risk of having cardiovascular disease with adjusted OR of 0.86. For each one-factor increase in the count of metabolic syndrome components, the risk of having the outcome is multiplied by 21%.

Conclusion: The study provides essential epidemiological data required by decision makers. Although not nationally representative, this study is suggestive of a higher risk of cardiovascular diseases occurring among an older population, men and in Northern African, Western Asian and Southern Asian nationalities, as well as having high blood pressure, insulin resistance and low serum HDL. More studies are needed to establish which public health interventions are likely to be effective in Qatar. Currently, efforts should be contextualized and should target the key epidemiological features.

Keywords: Adult; Cardiovascular diseases; Primary health care; Qatar; Risk factor

Introduction

Cardiovascular Disease (CVD) are a group of major disorders of the heart and the arterial circulation supplying the heart, brain and the peripheral tissues. Accordingly, the main components of CVDs are ischemic heart disease, stroke, heart failure, peripheral arterial disease, and a number of other cardiac and vascular conditions, constitute the leading cause of global mortality and are a major contributor to reduced quality of life. They are common in the general population, affecting mainly adults past the age of 60 years [1-3].

Many risk factors for CVD are modifiable by specific preventive measures. In a study covered patients from 52 countries, nine potentially modifiable factors accounted for over 90 percent of the population-attributable risk of a first myocardial infarction (MI): smoking, dyslipidemia, hypertension, diabetes, abdominal obesity, psychosocial factors, lack of daily consumption of fruits and vegetables, regular alcohol consumption, and lack of regular physical activity [4]. In addition to age and gender, most patients with CVD have at least one established or borderline risk factor [5-7].

Coronary Heart Disease (CHD) represent about one-half of the total cases of CVD. Based on the Framingham Heart Study of 7733 participants aged 40 to 94 and were initially free of CHD, the

lifetime risk for individuals at age 40 was 49 percent in men and 32 percent in women [8].

Although many evidences showing that death rates from CVD, CHD, and stroke have declined in the United States since 1975, CVD and its related complications remain highly prevalent and expensive to treat [9]. CVD is the leading cause of death in most developed countries, as well as its prevalence is rapidly increasing in developing countries [10].

In 2017, CVD caused an estimated 17.8 million deaths worldwide, corresponding to 330 million years of life lost and another 35.6 million years lived with disability [2,3].

Unfortunately, information related to CVD in Qatar is limited, however many studies have tried to cover some important aspects related to these conditions relatively. A study on Non-Communicable Diseases (NCDs) in Qatar indicated that CVD is on the top of diseases burden economically. Same study demonstrated that the risk factors of CVD can be traced mainly to lifestyle-patterns such as tobacco use, fatty food and physical inactivity [11]. A cross-sectional study conducted on school children aged 6-11 years old concluded that overweight and obese children screened using International Obesity Task Force reference values are at increased risk of CVD in adulthood [12]. When the data registry of all patients admitted between 1982 and 1990 to the Coronary Care Unit at the main general in Qatar with the diagnosis of documented acute MI is reviewed, the results showed that 86.6% of cases were among men with a mean age of 51 years. Among the cases, 62% were smokers, 29% had diabetes, and 20% had hypertension. Being older age and female gender were associated with higher mortality [13].

In this study, we have tried to explore the magnitude of participating of specific factors in the risk of developing any CVD as an outcome among adults using the governmental funded primary health care centers in Qatar.

Materials and Methods

Study design and settings

A cross-sectional study used ready raw data (secondary data from the electronic medical records “EMR”) in the data analysis to get the results. Essentially, data have been collected through the health centers affiliated with the Primary Health Care Corporation (PHCC) in the State of Qatar. PHCC is the largest primary care provider in the country publicly with 30 health centres (all accredited by Accreditation Canada International).

Study population and data collection

The study population includes both Qataris and non-Qataris registered at a PHCC health centre, aged ≥ 18 and who visited a health centre between 1 January 2017 and 31 December 2017. Required data were extracted from the EMR for the defined population.

Definitions and data analysis

The definition of having CVD was based on a list of SNOMED codes and its ICD-10 translated counterpart which is used in the PHCC-EMR (appendix 1). The National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) component definitions was adapted for the definition of the five components of Metabolic syndrome (MetS) used in this study based on the data available in the PHCC-EMR system (Table 1) [14]. All data were analyzed using the Statistical Package for the Social Sciences (SPSS) statistical software package.

Components	NCEP ATP III definition	Study definition	Rationale
Insulin resistance	Fasting blood sugar (FBS) over 100 mg/dl.	<ul style="list-style-type: none"> Insulin Resistance (Serum Fasting Glucose ≥ 100 mg/dl or HbA1c ≥ 5.56) or A diagnosis of T2DM 	<ul style="list-style-type: none"> HbA1c is an important marker and enhances the detection of hyperglycaemia for the diagnosis for MetS [15-18]
High Blood Pressure	Blood pressure over 130/85 mmHg	<ul style="list-style-type: none"> Blood pressure over 130/85 mmHg or A diagnosis of hypertension 	Same definition used
Obesity	Waist circumference over 40 inches (men) or 35 inches (women)	<ul style="list-style-type: none"> Waist circumference over 102 centimetres (men) and 94 centimetres (women) or Body Mass Index (BMI) ≥ 30 kg/m² 	<ul style="list-style-type: none"> Waist circumference are specific for each population therefore waist circumference for the Qatari population was used from a published study [19] BMI value was shown by International Diabetes Federation to be a specific enough criterion to represent central obesity without the need for waist circumference measurements

High serum triglycerides	Fasting triglyceride level over 150 mg/dl	Fasting triglyceride level over 150 mg/dl	Same definition used
Low serum HDL	Fasting high-density lipoprotein (HDL) cholesterol level less than 40 mg/dl (men) or 50 mg/dl (women)	Fasting high-density lipoprotein (HDL) cholesterol level less than 40 mg/dl (men) or 50 mg/dl (women)	Same definition used

Table 1: Metabolic Syndrome component definitions.

Ethical considerations

Study’s team have assured the privacy of subjects and the confidentiality of the data, as all the collected data for the study purpose were anonymised. None of the subjects’ personal information was available to the research team. Overall, the study was conducted with integrity according to generally accepted ethical principles and was approved by the PHCC’s independent ethics committee (PHCC/RS/18/02/003).

Results

In univariate modeling (Table 2), the older age, male gender and the Asian, North African and Qatari nationalities increased the risk of having CVD (Any cardiac disease including coronary, thrombotic/hemorrhagic and peripheral vascular diseases). The five selected risk factors (components of MetS) contributed towards the risk of having CVD with high blood pressure and insulin resistance being the largest contributors. Having metabolic syndrome increased the risk by 2.5 times while accumulating more risk factors accounting for metabolic syndrome significantly increased the risk of having CVD.

Explanatory variables	Total No.	Cardiovascular diseases		Odds ratio	95% CI OR	P
		No.	%			
Age group (years)						
18-39	44576	509	1.1	Ref		
40-59	60598	2313	3.8	3.4	(3.12 - 3.78)	<0.001
60+	22767	2635	11.6	11.3	(10.29 - 12.47)	<0.001
Total	127941	5457	4.3			
Gender						
Female	70853	2289	3.2	Ref		
Male	57088	3168	5.5	1.8	(1.67 - 1.86)	<0.001
Nationality category						
Others	9054	253	2.8	Ref		
Qatar	45854	1722	3.8	1.4	(1.19 - 1.55)	<0.001
Northern Africa	21397	956	4.5	1.6	(1.41 - 1.87)	<0.001
Southern Asia	32205	1607	5	1.8	(1.6 - 2.09)	<0.001
Western Asia (excluding Qatar)	19431	919	4.7	1.7	(1.5 - 1.99)	<0.001
Obesity (BMI>=30 kg/m² or central obesity)						
Negative	64400	2406	3.7	Ref		

Explanatory variables	Total No.	Cardiovascular diseases		Odds ratio	95% CI OR	P
		No.	%			
Positive	63541	3051	4.8	1.3	(1.23 - 1.37)	<0.001
High Blood Pressure (Systolic or Diastolic) or hypertensive						
Negative	60183	1058	1.8	Ref		
Positive	67758	4399	6.5	3.9	(3.62 - 4.16)	<0.001
Low serum HDL (<1.04 mmol/L in male and <1.3 mm in female)						
Negative	65899	2355	3.6	Ref		
Positive	62042	3102	5	1.4	(1.34 - 1.5)	<0.001
High serum Triglycerides (>=1.7 mmol/L)						
Negative	89568	3660	4.1	Ref		
Positive	38373	1797	4.7	1.2	(1.09 - 1.22)	<0.001
Insulin Resistance (Serum Fasting Glucose>=100 mg/dl or HbA1c>=5.56) or DM						
Negative	50841	986	1.9	Ref		
Positive	77100	4471	5.8	3.1	(2.9 - 3.34)	<0.001
Metabolic Syndrome						
Negative	65379	1644	2.5	Ref		
Positive	62562	3813	6.1	2.5	(2.37 - 2.67)	<0.001
Count of positive criteria for Metabolic Syndrome						
0	13471	179	1.3	Ref		
1	22030	436	2	1.5	(1.26 - 1.78)	<0.001
2	29878	1029	3.4	2.6	(2.25 - 3.11)	<0.001
3	31830	1628	5.1	4.0	(3.43 - 4.67)	<0.001
4	22122	1483	6.7	5.3	(4.56 - 6.24)	<0.001
5	8610	702	8.2	6.6	(5.58 - 7.79)	<0.001

Table 2: The risk of having cardiovascular disease (Any cardiac disease including coronary, thrombotic/hemorrhagic and peripheral vascular diseases) by selected explanatory variables.

The multivariate modelling (Table 3) showed a similar pattern of association between increasing age, male gender, Asian, Qatari and North African nationalities, risk factors and count of MetS components and increased risk of having CVD. The magnitude of risk estimates for each explanatory variable included in the model after adjustment is lower than its counterparts in unadjusted model. In addition, the high triglycerides component failed to show any significant contribution to risk of having CVD after adjusting for other factors. For each one factor increase in the count of MetS components the risk of having the outcome is multiplied by 21%.

Explanatory variables	Adjusted OR	P
Age group (years)		
40-59 years of age compared to '18-39 years of age'	2.42	<0.001
60+ years of age compared to '18-39 years of age'	6.65	<0.001
Male gender compared to female	1.36	<0.001
Nationality category		
Qatar compared to 'Others'	1.15	0.045
Northern Africa compared to 'Others'	1.45	<0.001
Southern Asia compared to 'Others'	1.31	<0.001
Western Asia (excluding Qatar) compared to 'Others'	1.42	<0.001
Risk factors (Metabolic Syndrome elements)		
Insulin Resistance (Serum Fasting Glucose \geq 100 mg/dl or HbA1c \geq 5.56) compared to those with no insulin resistance	1.31	<0.001
Being obese (BMI \geq 30 kg/m ² or central obesity) compared to non-obese	1.13	<0.001
Having a high Blood Pressure (Systolic or Diastolic) or hypertensive compared to those with normal Blood Pressure	1.83	<0.001
Having a low serum HDL (<1.04 mmol/L in male and <1.3 mm in female) compared to those with normal HDL	1.28	<0.001
Having a high serum Triglycerides (\geq 1.7 mmol/L) compared to those with normal triglycerides	0.86	<0.001
Constant	0.005	
Count of positive criteria for Metabolic Syndrome	1.21	<0.001

Table 3: Multiple logistic regression model evaluating the independent association of selected risk factors with having cardiovascular diseases (Any cardiac disease including coronary, thrombotic / hemorrhagic and peripheral vascular diseases) as an outcome.

Discussion

The prevalence of identified risk factors of CVD has changed over time because of increased awareness and changes in kind of diet and lifestyle. It can be said that the results of this study partly support the fact that the leading modifiable risk factors which estimated to be responsible for more than half of cardiovascular mortality are hypercholesterolemia, diabetes, hypertension, obesity, and smoking [20,21]. On the other hand, this study support that the absence of major risk factors predicts a much lower risk of CVD [22].

Our study has shown that CVD increased with increasing in age, in a multiple regression analysis of our data the adjusted odd ratio was 2.42 among age group of 40-59 increased to 6.65 among people aged 60 and above compared to age group of 18-39. When a study analyzed the situation of cardiovascular mortality in industrialized countries, the results showed a tendency for

mortality change, either positively or negatively, it was quicker in younger age groups than in older ones. These varying levels and trends in CVD mortality have been caused by differences in risk factors prevalence and operating in each country, affecting the incidence of CVDs and their prognosis [23]. Age alone contribute to the development of CVD as have shown in a cohort of more than 3.6 million individuals aged 40 years or older who had screened for CVD, the prevalence of any vascular disease increased significantly with each decade of life (2% in 40-50 years old, 3.5% in 51- 60, 7.1% in 61-70, 13% in 71-80, 22.3% in 81-90, 32.5% in 91-100 years old). After adjusting for traditional risk factors, each additional decade of life was associated with an approximate doubling of the risk of vascular disease, exactly as ours [24]. Systolic blood pressure and isolated systolic hypertension are major CHD risk factors at all ages and in both genders [25]. In the Framingham study, patients <50 years of age, diastolic blood pressure was the strongest predictor of CHD risk; in those 50 to 59

years of age, all three blood pressure indices (systolic, diastolic, and pulse pressure) were comparable predictors of CHD risk, while in those ≥ 60 years of age, pulse pressure was the strongest predictor [26].

This study indicated that CVD more prevalent among male compared to female with adjusted odd ratio of 1.36. Several population studies have identified male gender as a risk factor for higher rates of CVD and CVD-related mortality [27-29]. This fact has been supported by a study included 7733 participants where lifetime risk of CHD at age 40 years was 48.6% for men and 31.7% for women. At age 70 years, lifetime risk was 34.9% for men and 24.2% for women [8]. Similar findings have been reported in a meta-analysis of 18 cohorts involving over 250,000 men and women [30]. Contrary to the results of this research, the trends of cardiovascular mortality were much more promising in females than in males as shown in a different study [23].

In this study, we discussed the relation between the five elements of metabolic syndrome and having CVDs, these five elements were previously defined within the study.

When we conducted a multiple logistic regression model to evaluate the independent association of insulin resistance as a risk factor for having CVD, the results showed an adjusted odd ratio of 1.31 for having such cases. This outcome was reinforced by findings of many international researches. Results of 20 years of surveillance of the Framingham cohort relating CVD to diabetes, showed increase in some CVD by two to three times. The relative impact was greatest for intermittent claudication (IC) and congestive heart failure (CHF) compares to CHD [31]. Another study has shown that presence of DM was highly related ($P < 0.01$) to the development of first CHD events [21].

Obesity is associated with several risk factors for cardiovascular morbidity and mortality, including hypertension, insulin resistance and glucose intolerance, hypertriglyceridemia, and reduced HDL cholesterol [32-34]. In our study being obese increased the risk of CVD relatively with adjusted odd ratio of 1.13 compared to non-obese individuals. This result supported by an analysis of data from 4780 adults in the Framingham Offspring Study, where obesity significantly and independently predicted the occurrence of CHD and cerebrovascular disease after adjusting for traditional risk factors [21].

This work has explored that increasing in blood pressure has almost doubled the prevalence of CVD compared to people with normal blood pressure. This was supported by a study where people with blood pressure $\geq 140/90$ mm Hg or those receiving blood pressure-lowering drugs had 63.3% lifetime risk of overall CVD at age of 30 years compared with 46.1% for those with normal blood pressure, as well as the group of high blood pressure developed CVD five years earlier [35]. Another study has

showed that decreasing in systolic blood pressure by 10 mmHg was associated with specific level of decreasing in risk of stroke and ischemic heart disease [36]. In this context, many studies have confirmed that high blood pressure act as a well-established risk factor for adverse cardiovascular outcomes, including mortality from Coronary Heart Disease (CHD) and stroke [4,35,37,38]. Furthermore, higher systolic blood pressure act as predictors for first CHD and cerebrovascular events [21].

When we have discussed the relation between lipid profile as risk factor and occurring of CVD, we found inconsistent or conflicted results. As having of a high serum triglyceride acted as a protective factor from CVDs occurring (adjusted odd ratio of 0.86). On the other hand, having a low serum HDL associated with higher CVDs (adjusted odd ratio of 1.28). These findings were supported in many studies, but there are also many others that opposed those results.

In some studies, the prevalence of dyslipidemia has been increased in patients with premature CHD, being as high as 75 to 85 percent compared with approximately 40 to 48 percent in age-matched controls without CHD [39,40]. In a study, dyslipidemia accounted for 49 percent of the population-attributable risk of a first Myocardial Infarction (MI) [4]. Using statins has reduced in total and LDL cholesterol levels which in turn have reduced coronary events and mortality when given for primary and secondary prevention as indicated in different studies [41-43].

Low serum HDL cholesterol can occur as sole lipid abnormality or, more often, in association with hypertriglyceridemia or elevated LDL particles or Apo lipoprotein B levels [40]. Isolated low HDL cholesterol, a condition that occurs when HDL cholesterol is < 50 mg/dL in women and < 40 mg/dL in men, and triglycerides and LDL cholesterol are < 100 mg/dL, predicts an increased risk for cardiovascular events in population studies [44,45]. Based on data from the Framingham Heart Study, the risk for MI increases by about 25 percent for every 5 mg/dL (0.13 mmol/L) decrement in serum HDL cholesterol below median values for men and women [46]. The rate of MI death was 33% lower in the highest HDL cholesterol quartile as compared with the lowest one [47]. Not all studies have found that HDL cholesterol is predictive of future events in patients with established CVD treated with statin therapy. In a cohort study of 6111 patients with CVD treated with intensive lipid lowering, HDL cholesterol was not associated with recurrent vascular events irrespective of LDL cholesterol level [48]. Despite the substantial body of evidence of an inverse relationship between HDL cholesterol and cardiovascular event risk, low levels of HDL cholesterol have not been established as causative of this relationship or with the development of atherosclerosis [49].

Elevated triglyceride levels are associated with and appear to be implicated in the pathogenesis of atherosclerosis and CVD.

Several studies have shown a positive relationship between hypertriglyceridemia and atherosclerotic cases in contrast to our finding [50-53]. So, elevated triglyceride levels are independently associated with increased risk of CVD events [54,55]. In two large prospective studies, the combined adjusted odds ratio was 1.7 for CHD comparing individuals in the top third of serum triglyceride levels with those in the bottom third [56]. In a study of 14,000 untreated males, aged 26 to 45 years who had serum triglycerides measured five years ago, triglycerides at first measurement were strongly and independently associated with CHD risk when comparing those in the highest level with those in the lowest [57]. Hypertriglyceridemia is associated with increased mortality in patients with known CHD as indicated in two different studies [58,59]. Other two large studies found that increased non-fasting triglyceride levels are associated with an increased risk for ischemic stroke [60,61].

From the above, we find that the risk factors associated with CVDs are many and vary between societies, origins and different nationalities, as the results of our research showed, in addition to many previous international researches.

Conclusion

The study provides essential epidemiological data required by decision makers. Although not nationally representative, this study is suggestive of a higher risk of cardiovascular diseases occurring among an older population, men and in Northern African, Western Asian and Southern Asian nationalities, as well as having high blood pressure, insulin resistance and low serum HDL. More studies are needed to establish which public health interventions are likely to be effective in Qatar. Currently, efforts should be contextualized and should target the key epidemiological features.

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