Original Article

Awareness of cardiovascular disease in eastern Saudi Arabia

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DOI: 10.4103/1319-1683.68784

ABSTRACT

Objective: To estimate the awareness of cardiovascular disease (CVD) and their determinants in a screening campaign in the eastern province of Saudi Arabia. **Materials and Methods:** All national residents in the eastern province of Saudi Arabia aged 30 years and above, were invited to participate in a screening campaign for the early detection of diabetes and hypertension at more than 300 examination posts throughout the eastern province. A pre-structured questionnaire was designed to collect data on age, gender, marital status, education level, occupation, lifestyle habits, and history of heart attack, angina, arterial disease, stroke, and transient ischemic attack. Weight, height, blood pressure, and glucose concentration were measured. **Results:** Out of 197,681 participants, 5372 (2.7%) were aware of a history of a CVD. The prevalence correlated well with age. It was higher in women, widows, and subjects with lower level of education. More than 75% of affected subjects had two or more risk factors. **Conclusion:** A substantial proportion of those with a history of CVD had multiple risk factors, necessitating an effective, focused policy for the prevention and treatment. Increased effort is required to promote an awareness of cardiac disease and also probably target primary care providers involved in the screening process.

Key words: Awareness, campaign, cardiovascular disease, Saudi Arabia, screening

INTRODUCTION

Cardiovascular diseases (CVD), including coronary heart disease, stroke, and peripheral vascular diseases constitute major public health problems worldwide.[1] They are the leading cause of global morbidity and mortality. The World Health Organization (WHO) estimated that 17.5 million people died from CVDs in 2005, representing 30% of all global fatalities.[2] An estimated 7.6 million were due to coronary heart disease and 5.7 million due to stroke. By 2015, almost 20 million people will die from CVDs, mainly from heart disease and stroke. These are projected to remain the single leading cause of death.

Cardiovascular risk factors, including hypertension (HPT), diabetes mellitus (DM), hypercholesterolemia (HyCh), cigarette smoking, excess body weight, and sedentary lifestyle play a major role in the occurrence of CVD.[3] They, in turn, are substantially influenced by behavioral, social, cultural, and economic factors.[4-6]

The burden of cardiovascular disease (CVD), especially ischemic heart disease and stroke, varies remarkably between the regions of the world, with declining rates in the developed countries,[7] whereas it is estimated that the corresponding mortality rate and risk prevalence would be the leading cause of death by 2020 in the developing countries.[8] This difference may be attributed to the decline of smoking,[9] and control of other modifiable risk factors,[10] besides the change to a healthy diet,[11] and improvement in medical care,[9] which may be lacking in the developing world.

This study aims to estimate the level of awareness of cardiovascular disease (CVD) in a screening campaign in the eastern province of Saudi Arabia, and examine its association with lifestyle and other cardiovascular risk factors.

MATERIALS AND METHODS

This study was part of a large screening campaign

conducted between August 2004 and February 2005 (interrupted by Ramadan and feast holidays). These methods have been described in detail, previously.[12] Briefly, all Saudi residents in the eastern province aged 30 years and above were invited to participate in the survey. Pregnant women and non-Saudis were excluded from the survey. For recruitment, a media campaign was organized in each sector using written material and audiovisual media. In addition, posters were put up on billboards along the streets and public places in the eastern province. The estimated target population of Saudi residents in the eastern province aged ≥30 years was 650,000. 197,681 Saudis responded to the invitation (30.4%).The survey was conducted by trained nurses and technicians in more than 300 examination posts throughout the eastern province, including all primary health care centres (PHCCs), governmental hospitals, several private health centres, and other venues, as well as mobile teams who visited the target population in any places of work that had more than 30 employees. A structured questionnaire was used by members of the health teams. Data was collected on age, gender, place of residence, marital status, occupation, level of education, and lifestyle patterns including physical activity and smoking. Physical activity was grouped into four categories. "No physical activity" meant complete sedentary lifestyle (reading, watching TV), "mild physical activity" included ordinary housework, walking less than 3 hours per week, "moderate physical activity" included at least three hours of exercise per week, engaging in sporting activity such as cycling, walking or other activities that needed effort, and "strenuous physical activity" such as exercise for at least five hours per week, involving sports like jogging or swimming.

Some additional information was also obtained: first, whether they had been previously diagnosed with a heart attack, stroke, angina, or transient ischemic attack which is known as mini-stroke. Second: if the response to the first question is affirmative then the follow-up question was if there had been treatment for it and where the treatment was given. A smoker was defined as someone who reported that they had smoked >100 cigarettes, in their life time, or smoked every day or some days or any time, used any tobacco products such as a pipe, or shesha for one month or more before the campaign, and was still smoking at the time of the campaign.

The participants underwent measurement of weight, height, blood pressure, and capillary blood glucose. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Those with a BMI of 25.0–29.9 kg/m^2 were classified as overweight, while those with a BMI ≥ 30.0 kg/m^2 were classified as obese, and the normal range was taken as (18.5-24.9 kg/m2). Blood pressure (BP) measurement was based on the recommendations of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VII).[13] The screening test was considered positive if the systolic blood pressure (SBP) was ≥ 140 mmHg or the diastolic blood pressure (DBP) was ≥ 90 mmHg. Participants were labeled hypertensive once a positive BP screening was confirmed on a second day, or if the subject had had a previous diagnosis.

Capillary glucometer blood testing was performed. Whole blood glucose concentration was measured using uniform portable glucometer with a Medisafe Reader (Terumo Co., Tokyo, Japan), based on the reflectance photometry. The screening test was considered positive if Capillary casual blood glucose (CCBG) was ≥140 mg/dl (7.8 mmol/l), or the Capillary fasting blood glucose (CFBG) ≥100 mg/dl (5.6 mmol/l). All subjects who had screened positive with undiagnosed diabetes were asked to come fasting for ≥ 8 hours on the following day for confirmation of the results by testing venous blood for sugar. Diagnosis of diabetes mellitus was made if the FBS was ≥ 126 mg/dl (7.0 mmol/l), or if there was a history of previous diagnosis of DM on diet or on lowering blood glucose agents. Impaired fasting glucose (IFG) was made if FBS=100-125 mg/dl. Dyslipidaemia was diagnosed from the history or from the results of the fasting venous blood sampling for cholesterol of ≥ 200 mg/dl.

Data analysis

Data was analyzed using SPSS version 16. Chi-square test to assess the relation between the history of CVD and socioeconomic status, in addition to cardiovascular risk factors. Those found to be significantly associated with CVD were tested by multiple logistic regressions. Age and sex were included in the model. Age was treated as continuous measurement, while other variables were analyzed as categorical variables.

The odds ratio and 95% confidence interval were calculated. P value < 0.05 was considered indicative of statistical significance.

RESULTS

The level of perception of having CVD among screened adults (≥30 years old) was 5,372 (2.7%) out of 197,681 who participated in the campaign. There were more women 2,745 (2.8%) than men 2,627 (2.6%; P<0.002). Of these, 2,571 (56.4%) were getting their treatment in the public Ministry of Health (MOH) institutions, 941 (20.6%) in other governmental non-MOH hospitals, 682 (15%) in

the private sector, while 154 (2.9%) in multiple health centers. However, for 209 (4.6%) the treatment center was not known.

Among those with a history of CVD, the mean ± SD SBP and DBP were 129.5 ± 19.9 mmHg and 80.44 ± 10.9 mmHg, respectively. The mean ± SD capillary blood glucose was 149.6 ± 76.9 mg/dl, and the mean ± SD capillary casual blood glucose was 165.8 ± 96.3 mg/dl. The mean ± SD cholesterol level was 196.7 ± 55.1 mg/dl, and the mean ± SD BMI was 31.0 ± 6.3kg/m^2.

Of all those who knew that they had CVD, 2,611 (48.6%) were diabetic; 150 (2.8%) were pre-diabetic; 3,128 (58.2%) were hypertensive; 129 (2.4%) were pre-hypertensive; 2,420 (45%) were dyslipidemic; 1,742 (32.4%) were overweight, and 2,774 (51.6%) were obese. Regarding cardiovascular risk factors among those with a history of CVD, it was found that 1,973 (36.7%) had combined DM and HPT, while 1494 (27.8%) had combined risk factors of DM, HPT, and dyslipidemia. One fifth (22%) had the triple disease in addition to abnormal BMI, while 145 (2.7%) had the combined previous factors plus smoking, and 67 (1.2%) had six risk factors including physical inactivity.

Figure 1 reveals the general relation of a number of risk factors to CVD, which shows that the total number of those who had two or more risk factors was 4,102 (76.4%). The prevalence of CVD among different age groups and their marital status is shown in Table 1. It was significantly higher in the older age group in both sexes. Furthermore, it was higher in women than in men in all age groups except in those over 70 years. Cardiovascular disease was significantly higher among the widowed and was lower among singles.

Table 2 shows the prevalence of CVD in relation to socioeconomic status. It was significantly higher among the unemployed men and self -employed women. In addition, in both genders it was lower as the level of education and income rose (P<0.0001).

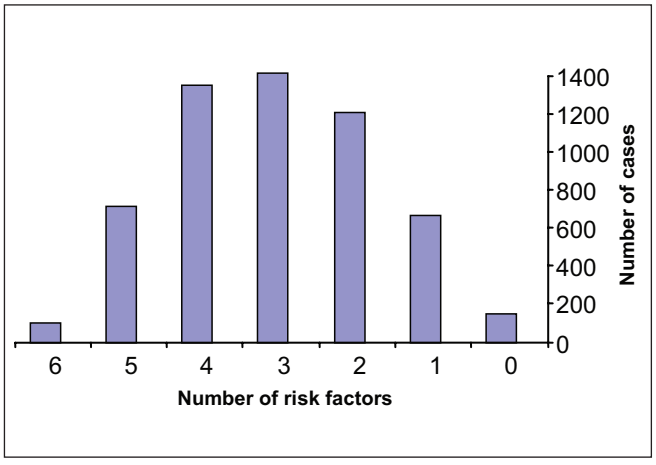

Figure 1: The relation of number of risk factors to cardiovascular diseases

Multiple logistic regressions of lifestyle and socio-economic factors used to predict cardiovascular disease showed that increasing age, widowhood, being self-employed and illiterate was proportionally related to CVD, while military personnel and those with higher education were inversely related to CVD [Table 3].

Cardiovascular disease was significantly more likely among those who were overweight, or obese, and had a positive family history of DM, and hypertension. It was higher among women who had a history of gestational diabetes (GDM) and had delivered a big baby. It was statistically higher among hypertensives, pre-hypertensives, diabetics, pre-diabetics, and those who had dyslipidaemia than in those without those risk factors. Cardiovascular disease was significantly less likely in those who undertook a higher level of exercise, or who were smokers [Table 4].

To assess the cardiovascular factors independently associated with cardiovascular disease, multiple logistic regression was performed with cardiovascular disease as a dependent variable. It was found that having a family history of HPT, being a diabetic, hypertensive, having dyslipidemia, performing mild to moderate physical activity had a higher occurrence of CVD, while smoking, having a family history of DM, rigorous exercise, and the level of BMI could not statistically predict CVD [Table 5].

DISCUSSION

Awareness of CVD among the population is crucial to early intervention programs. There is no published data about the prevalence of CVD in the eastern province. This study indicates that (2.7%) of the participants were aware of having cardiovascular disease. This is less than the report published by A-Nozha *et al*[14] on the prevalence of coronary artery disease in Saudi Arabia (5.5%), which revealed the lack of awareness of this killer disease.

Our analysis shows a significantly inverse relation of socioeconomic status and prevalence of CVD. This is consistent with the findings of other studies,[15,16] which also show this negative relationship.

Using regression analysis and taking socioeconomic factors as independent variables for CVD, it was found that the strongest association was related to education, regardless of income and occupation, which may not be as reliable and valid as education.[17]

Table 1: Perceived prevalence of cardiovascular diseases according to age and marital status

Factors	Total no. of men	CVD prevalence in men No. (%)	Total no. of women	CVD prevalence in women No. (%)	CVD prevalence in both sex	*P*-value
Age						<0.0001
30-40	49126	466 (0.9)	46757	506 (1.1)	972 (1.0)	
41-50	28573	599 (2.1)	28730	846 (2.9)	1445 (2.5)	
51-60	12169	659 (5.4)	12285	676 (5.5)	1335 (5.5)	
60-69	6466	511 (7.9)	5518	449 (8.1)	960 (8.0)	
70+	3775	373 (9.9)	2670	249 (9.3)	622 (9.7)	
Marital status						<0.0001
Single	5508	62 (1.1)	6175	71 (1.1)	133 (1.1)	
Married	93285	2519 (2.7)	79263	2007 (2.5)	4526 (2.6)	
Widowed	418	19 (4.5)	7893	578 (7.3)	597 (7.2)	
Divorced	261	8 (3.1)	2404	76 (3.2)	84 (3.2)	

Total varied for some missing data, All differences were statistically significant *P*<0.0001

Table 2: Perceived prevalence of cardiovascular diseases according to socioeconomic factors

Factors	Total no. of men	CVD prevalence in men No. (%)	Total no. of women	CVD prevalence in women No. (%)	CVD prevalence in both sex	*P*-value
Occupation						<0.0001
Self-employed	13837	566 (4.1)	489	24 (4.9)	590 (4.1)	
Housewife			71941	2273 (3.2)	2273 (3.2)	
Military	21932	247 (1.1)			247 (1.1)	
Professional	12396	213 (1.7)	9254	117 (1.3)	330 (1.5)	
Technical	6100	119 (2.0)	2228	48 (2.2)	167 (2.0)	
Non-technical	5187	133 (2.6)	1195	36 (3.0)	169 (2.6)	
Administration	28005	507 (1.8)	6290	115 (1.8)	622 (1.8)	
Unemployed	9973	759 (7.6)	2852	81 (2.8)	840 (6.5)	
Education						<0.0001
Illiterate	11214	667 (5.9)	33760	1610 (4.8)	2277 (5.1)	
Read and write	5054	244 (4.8)	8760	251 (2.9)	495 (3.6)	
Primary	14968	479 (3.2)	13424	317 (2.4)	796 (2.8)	
Intermediate	17794	376 (2.1)	9098	143 (1.6)	519 (1.9)	
Secondary	27210	470 (1.7)	13977	214 (1.5)	684 (1.7)	
University	20226	298 (1.5)	15104	161 (1.1)	459 (1.3)	
Higher degree	1425	25 (1.8)	471	8 (1.7)	33 (1.7)	
Income						<0.0001
<2000	12928	598 (4.6)	23047	875 (3.8)	1473 (4.1)	
2000 - <5000	28237	667 (2.4)	22228	586 (2.6)	1253 (2.5)	
5000 - <7000	22524	428 (1.9)	13495	289 (2.1)	717 (2.0)	

Our results indicated that there were substantial geographic variations in the prevalence of CVD. The reasons for these differences may guide the design of the prevention programs for public health. The differences may be the result of rapid urbanization leading to increasing risk factors of CVD,[3] and may reflect the disparity of diagnosis, the quality of health care, or cultural norms in each region.

Data on gender differences reveals a significantly higher awareness in women having CVD than men, which is similar to the results of other studies that found a higher rate of angina in women,[18] but contradicted the findings of other studies.[14,19] The cause for this variation could be explained by the fact that the rate at which women sought medical care /advice was higher than men. The women also had a higher risk of metabolic syndrome compared to the men,[20-22] but without a confirmatory test, this is difficult to generalize.

It is suggested that coronary artery disease can be predicted by establishing risk factors in up to 75% of the

Table 3: Multiple logistic regression models of variables associated with history

Factors	LRC	Odds ratio	Confidence interval	*P*-value
Age	0.047	1.048	1.045-1.051	<0.0001
Gender				0.617
Men	-0.133	0.970	0.859-1.094	
Women		1		
Marital status				
Single		1		<0.0001
Married	0.213	1.237	1.016-1.506	0.034
Widowed	0.470	1.600	1.276-2.008	0.007
Divorced	0.425	1.529	1.124-2.080	<0.0001
Occupation				
Self-employed		1		<0.0001
Housewife	-0.189	0.828	0.709-0.966	0.017
Military	-0.700	0.497	0.421-0.586	<0.0001
Professional	-0.309	0.734	0.624-0.863	<0.0001
Technical	-0.201	0.818	0.680-0.983	0.032
Non-technical	-0.319	0.727	-.604-0.867	0.001
Administration	-0.273	0.761	0.667-0.867	<0.0001
Unemployed	0.093	1.098	0.973-1.238	0.129
Education				
Illiterate		1		<0.0001
Read and write	0.018	1.018	0.906-1.143	0.766
Primary	0.050	1.052	0.947-1.168	0.346
Intermediate	-0.164	0.849	0.748-0.963	0.011
Secondary	-0.308	0.735	0.647-0.835	<0.0001
University	-0.547	0.579	0.496-0.676	<0.0001
Higher degree	-0.454	0.635	0.434-0.931	0.020

LRC=Logistic regression coefficient

population.[23] The majority of the millions of individuals who develop heart attack and strokes every year have one or more of cardiovascular risk factors.[24] Our analysis examined six risk factors for CVD: high blood pressure, high cholesterol, diabetes, current smoking, physical inactivity, and BMI≥25 kg/m^2. A substantial proportion of the population had multiple risk factors, thus increasing their likelihood of cardiovascular disease. It reveals also that most of the patients with CVD had three risk factors while just 2.2% of them had no risk factors compared with those without (92.5%) P<0.0001. In the USA, a comparable study which examined the association of CVD with the six risk factors, revealed that 37.2% of respondents reported that they had been examined for two or more of the six risk factors for heart disease and stroke, compared with 76.4% in our study.[24] This is an alarming trend in the profile of the cardiovascular risk factors of the study participants and represents the onset of pandemic of cardiovascular disease. This necessitates an enforcement of both policy and research efforts in treatment and prevention, since many modifiable risk factors for heart disease and stroke can be addressed through prevention.[25] Also, there is an increasing interest to optimize traditional risk factors and thereby substantially lower risks for CVD, cardiovascular death, and mortality.[26]

Daviglus *et al*[27] concluded from 26 years of cohort study that favorable cardiovascular risk profile in middle-aged adults is associated with better quality of life and lower risk of diseases in older age.

Although the major causes of cardiovascular disease are tobacco use, physical inactivity, and an unhealthy diet,[28] the prevalence of smokers in our participant was significantly lower among those with CVD. This may be related to greater concern for health among them, but this was not the case among the physically inactive individuals. Smoking as a risk factor may have been overplayed by the health team, and physical activity down played as a modifiable risk factor.

On other risk factors,[29-31] it was revealed that there is a huge gap between the study of the effectiveness of modifying risk factors and the actual state in life.[32] Hence, a new strategy should be adopted to enhance the role of the healthcare providers in order to support and reinforce these public health recommendations for all patients, and to focus on strategies that aim at reducing the adverse social gradient in CVD risk factors among the deprived groups.

The major limitation in this study is its dependence on self-reporting of CVD, socioeconomic status, smoking,

Table 4: Risk factor profile of the population with no history of cardiovascular diseases

Variables	Total No.	Prevalence of CVD	*P*-value
Family history of Diabetes Mellitus (DM)	100132	2883 (2.9)	<0.0001
No family history of DM	86447	2013 (2.3)	
Family history of hypertension	89443	2713 (3.0)	<0.0001
No family history of hypertension	95376	2124 (2.2)	
History of delivering big baby	8069	313 (3.9)	<0.0001
No history of delivering big baby	68179	1612 (2.4)	
History of gestational DM	14220	480 (3.4)	<0.0001
No history of gestational DM	62070	1444 (2.3)	
DM	34054	2611 (7.7)	<0.0001
Pre-diabetes	5298	150 (2.8)	
No DM	158097	2611 (1.7)	
Hypertension	30706	3128 (10.2)	
Pre-hypertension	7323	129 (1.8)	
No hypertension	159388	211 (1.3)	
Dyslipidemia	16008	2302 (14.4)	
No dyslipidemia	180632	3059 (1.7)	
History of smoking	33084	808 (2.4)	0.001
Normal body mass index (BMI)	38671	789 (2.0)	
Non-smoker	163184	4526 (2.8)	
Overweight	68763	1742 (2.5)	
BMI			
Obesity	85253	2774 (3.2)	
Underweight	2617	44 (1.7)	<0.0001
Physical activity			
Sedentary life style	50543	1843 (3.6)	<0.0001
Mild	104394	2683 (2.6)	
Moderate	35851	688 (1.9)	
Strenous	4626	99 (2.1)	

Table 5: Multiple logistic regression models of variables associated with cardiovascular diseases

Variables	Factors			
	Logistic regression coefficient	Odds ratio	CI	*P*-value
Family history of DM	-0.014	0.986	0.876-1.110	0.814
Family history of hypertension	0.344	1.411	1.254-1.587	<0.0001
DM	0.557	1.745	1.558-1.954	<0.0001
Hypertension	1.340	3.820	3.413-4.276	<0.0001
Dyslipidemia	1.221	3.391	3.042-3.780	<0.0001
History of smoking	-0.172	0.842	0.658-1.076	0.169
BMI				
Underweight				0.154
Normal BMI	-0.070	0.932	0.515-1.687	0.817
Overweight	-0.212	0.809	0.451-1.453	0.478
Obesity	-0.245	0.783	0.437-1.401	0.410
Physical Activity				
Sedentary life style		1		<0.0001
Mild	-0.218	0.804	0.724-0.892	<0.0001
Moderate	-0.325	0.722	0.615-0.892	<0.0001
Strenuous	0.054	1.055	0.733-1.518	0.773

and the desire drive of the participants, The sample was a convenience non-random sample. However, it is fairly representative of the target population. The sub-classification of respondents with the latest census done in the eastern province regarding age and sex, was fairly comparable.[33] The strength of this study lies in the large

number of subjects and also the fact that measurements (weight, height, and BP, blood glucose, and cholesterol) were taken by previously trained health team, and not collected from the charts.

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Source of Support: Nil, **Conflict of Interest:** Nil