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Cardiovascular Disease Risk Assessment among Female Residents at the National Guard Residential City, Jeddah, Saudi Arabia

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Abstract

Objectives: Cardiovascular Disease (CVD) remains the major cause of global mortality. This community-based study assessed CVD risk among female's ≥30 years in Jeddah, Saudi Arabia.

Methods: All women living in the National Guard Residential City (n=616) received CVD screening and clinical and laboratory assessments from 1st of January to 30th of April 2015. The Framingham risk score was calculated for each individual and their readiness to make lifestyle changes was assessed. Logistic regression analysis was used to examine factors of CVD risk.

Results: Most participants (n=531; mean age, 42 ± 8 years) were in the low risk group (86%). The moderate (10%) and high (4%) risk groups (n=85) had a mean age of 49 ± 6.5 years. CVD risk was seven-fold (95% Confidence Interval [CI], 3.6%-16.3%), six-fold (95% CI, 3%-14%) five-fold (95% CI, 2.4%-10.6%), two-fold (95% CI, 1.2%-5%), and almost three-fold (95% CI, 1.3%-5.4%) in women with diabetes, hypertension, family history of heart disease, hypercholesterolemia, and those who were junk food consumers compared to other women. Thinking of changing lifestyle was a protective factor.

Conclusion: CVD risk factors, including co-morbid conditions, inactive lifestyle, family history of chronic conditions, and smoking were associated with moderate to high CVD risk among participants. The findings also highlight the need to provide comprehensive interdisciplinary programs according to individual risk and readiness to change.

Keywords: Cardiovascular disease; Framingham risk score; Readiness for change

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Introduction

Cardiovascular disease (CVD) includes conditions such as Hypertension (HTN), Coronary Heart Disease (CHD), myocardial infarction, angina pectoris, heart failure, and stroke [1]. Although incidence of and mortality from CVD has declined in recent decades [2], CVD remains the leading cause of death worldwide [3]; in 2008, CVD caused 7.3 million deaths (30% of all mortalities) [4]. According to the World Health Organization, the majority of mortalities in Saudi Arabia were due to non-communicable diseases which accounted for 73% of all deaths, 37% were due to CVDs [4]. According to the World Heart Federation, CVD is the most serious, neglected health problem affecting women worldwide [5]. Almost two-thirds (64%) of women who die suddenly of CHD have had no previous symptoms [6].

Modifiable risk factors clinically proven to influence cardiovascular health include diabetes, high blood pressure, hypercholesterolemia, overweight or obesity, insufficient physical activity, unhealthy diet, and smoking. Other non-modifiable risk factors include age, gender, family history, and race [7]. Previous studies have shown that tailoring messages on lifestyle counselling to an individual's readiness to change increases the likelihood of their success in adapting their modifiable risk factors for CVD. Therefore, this study aimed to evaluate cardiovascular disease risk among females ≥30 years and readiness to make

lifestyle changes. The findings of this study could be used to support the development of an effective, community-based lifestyle modification program for women with moderate to high risk CVD in Saudi Arabia.

Research Methodology

The protocol of this study followed the principles of the Helsinki Declaration and was approved by King Abdullah International Medical Research Center (Institutional Review Board approval number: RJ13/039/J). Women received detailed information of the study and provided informed written consent before.

This study was conducted in the National Guard Residential City, Jeddah, which consists of 1229 villas from 5 geographical sections. Women aged ≥30 years were screened from January to April 2015 and their Framingham Risk Scores (FRS) were calculated. Accordingly, participants with moderate to high CVD risk were included in another interventional study. Women aged <30 years, aged ≥30 years with low risk of CVD, who were pregnant, or who were diagnosed with CVD were excluded.

All households in the residential city were visited and informed of the study by a group of trained research assistants. Eligible women were asked to participate in the research. By using the Coronary Risk Profile (CRP) questionnaire from Wellsource Inc. (Portland, OR, USA) [8], data on health history, smoking habits, physical activity, eating practices, social factors, and readiness for behavioural change to reduce CVD risk were collected.

Each participant's weight, height, Body Mass Index (BMI), waist circumference, and blood pressure were measured. Fasting blood sample was obtained using the CardioChek PA System [Polymer Technology Systems, Inc. Indianapolis, IN, USA], to determine cholesterol, High-Density Lipoprotein (HDL), glucose, and triglyceride levels. The results met the accuracy guidelines established by the National Cholesterol Education Program of the National Institutes of Health [9]. FRS was calculated to estimate the 10-year risk of major cardiovascular events and was categorized into low (<10% FRS), moderate (10%-19% FRS), or high (≥20% FRS) risk. Those with moderate and high risk were evaluated for their Metabolic Syndrome (MS) status. They were classified as having MS if they satisfied 3 of the following 5 criteria (based on the criteria established by the National Heart, Lung, and Blood Institute for the diagnosis of MS): (1) abdominal obesity, determined by an increased waist circumference of >88 cm in women; (2) increased triglyceride levels of ≥1.7 mmol/L (150.6 mg/dL); (3) reduced HDL level of <1.3 mmol/L (50.2 mg/dL); (4) elevated blood pressure of ≥ 130/≥ 85 mmHg; and (5) increased fasting glucose level of ≥6.1 mmol/L (109.8 mg/dL). Individuals who were screened as positive were referred to the primary health-care centre for further assessment. Nevertheless, these participants were enrolled in the study.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences version 22 (IBM Corp., Armonk, NY, USA). Demographic and clinical data were analysed using descriptive statistics, including means, standard deviations, and frequencies as well as logistic regression analysis. This research used an alpha level of statistical significance of less than 0.05.

Results

Data from 616 female subjects who met the inclusion criteria were analysed in this study. The mean age of participants was 42.0 ± 7.9 years. Most were married (93.2%), had university education (36.7%), were housewives (68.0%), and were employed (31.7%). Overall, 29.0% were overweight (BMI, 25-29.9 kg/m^2), 54.2% were obese (BMI, ≥30 kg/m^2), and 78.0% were abdominally obese (>88 cm). Some of the participants had one or more CVD risk factors, 4 including hypertension (11.0%), diabetes (15.7%), and hypercholesterolemia (18%). Family history of diabetes, hypertension, hypercholesterolemia, and heart diseases in first-degree relatives were present in 65.6%, 52.8%, 25.3%, and 20.6% of the participants. Inactive lifestyle was commonly reported, with 54.0% having less than 30 min of exercise per day and 20% of women spending 2 hours daily in domestic work.

In the assessment of cardiovascular disease risk according to the Framingham 10-year CVD risk score, 86.0% (n=531) of the screened population showed low risk. Of the remaining participants, 10% were at moderate risk and 4% were in the high-risk category (n=85).

Statistically significant differences in CVD risk score were observed between the 2 groups in age (p=0.01), marital status (p=0.04), educational level (p=0.01), and income (p=0.01). Moderate- and high-risk groups were more likely to be older, illiterate, and have lower monthly income **(Table 1).**

Medical history was compared between the 2 groups, and a statistically significant difference in CVD risk score was found between the low-, moderate- and high-risk groups in diabetes (p=0.01), hypertension (p=0.01), and hypercholesterolemia (p=0.01). Overall, 58.0% in the moderate- and high-risk groups had diabetes, 48.0% had hypertension, and 52.0% had hypercholesterolemia.

There were statistically significant differences in CVD risk score between the low-risk group and moderate- and high-risk groups in family history of diabetes (p=0.01), heart diseases (p=0.01), and hypercholesterolemia (p=0.01). Moderate and high-risk groups were more likely to have family histories of diabetes, heart diseases, and hypercholesterolemia than the low-risk group.

A statistically significant difference in CVD risk score was observed between the low-risk, moderate-risk, and high-risk groups in smoking status (p=0.03). The percentage of smokers in the moderate- and high-risk group (5.0%) was higher than in the low-risk group (0.5%). No statistically significant difference in CVD risk score in relation to passive smoking was observed between the 2 groups.

Table 2 shows that the moderate- and high-risk groups tended to be less active during the week. This difference was statistically significant (p=0.03).

As shown in **Table 3**, both groups tended to skip breakfast and eat less than one serving of fruits and vegetables, although the

Table 1 Socio-demographic characteristics of women according to cardiovascular disease risk score (n = 616) at the National Guard Residential City in Jeddah, Saudi Arabia, 2015.

Socio-demographic characteristics	Low risk (n = 531)	Moderate and high risk (n = 85)	Chi-square test p-value
Age			
Mean ± SD	40 ± 5.6	54 ± 9.1	0.01*
30-39	246 (46.0%)	1 (1.0%)	
40-49	251 (47.0%)	27 (32.0%)	
50-59	30 (6.0%)	31 (36.0%)	
60-69	4 (1.0%)	17 (20.0%)	
70+	0 (0.0%)	9 (11.0%)	
Marital status			
Single	4 (1.0%)	0 (0.0%)	0.04*
Married	500 (94.0%)	75 (88.0%)	
Separated	4 (1.0%)	1 (1.0%)	
Divorced	9 (1.6%)	1 (1.0%)	
Widow	14 (2.4%)	8 (10.0%)	
Education			
Illiterate	54 (10.0%)	35 (41.0%)	0.01*
Read and write	35 (6.5%)	6 (7.0%)	
Primary	83 (15.5%)	11 (13.0%)	
Intermediate	68 (13.0%)	8 (9.0%)	
High school	76 (15.0%)	12 (14.0%)	
University	213 (40.0%)	13 (16.0%)	
Occupation			
Housewife	352 (66.3%)	67 (76.0%)	0.13
Employee	177 (33.3%)	18 (21.0%)	
Student	2 (0.4%)	0 (0.0%)	
Income/month (SR)			
<5000	37 (7.0%)	18 (21.0%)	0.01*
5000-10000	264 (50.0%)	44 (52.0%)	
>10000	230 (43.0%)	23 (27.0%)	
Data are presented as number and percentage (%). * Statistically significant at $p < 0.05$.			
SD: Standard Deviation			

Table 2 Physical activity according to cardiovascular risk score (n = 616) at the National Guard Residential City in Jeddah, Saudi Arabia, 2015.

Physical activity	Low risk (n = 531)	Moderate and high risk (n = 85)	Chi-square test p-value
Regular exercise			
None	295 (56.0%)	53 (62.0%)	0.53
Once	77 (14.0%)	13 (15.0%)	
Twice	52 (10.0%)	7 (8.0%)	
3-4 times	62 (12.0%)	9 (11.0%)	
5 or more times	45 (8.0%)	3 (4.0%)	
Moderate exercise			
None	290 (55.0%)	51 (60.0%)	0.03*
Half an hour	84 (16.0%)	10 (12.0%)	
1 hour	60 (12.0%)	4 (5.0%)	
2 hours	35 (7.0%)	6 (7.0%)	
3-4 hours	28 (5.0%)	7 (8.0%)	
5+ hours	34 (6.0%)	7 (8.0%)	
Vigorous exercise			
None	485 (91.0%)	79 (93.0%)	0. 28
Half an hour	23 (4.0%)	3 (4.0%)	
1 hour	17 (3.0%)	1 (1.0%)	
2 hours	2 (1.0%)	2 (2.0%)	
3- ≥4 hours	3 (1.0%)	0 (0.0%)	
Data are presented as number and percentage (%). * Statistically significant at $p < 0.05$			

Table 3 Nutritional habits according to cardiovascular disease risk score (n = 616) at the National Guard Residential City in Jeddah, Saudi Arabia, 2015.

Nutritional habits	Low risk (n = 531)	Moderate and high risk (n = 85)	Chi-square test p-value
Skipping breakfast			
No	331 (62.0%)	53 (62.0%)	0.55
Yes	200 (38.0%)	32 (38.0%)	
Bread (servings/day)			
<1	86 (18.0%)	3 (4.0%)	0.01*
1	170 (35.0%)	28 (33.0%)	
2	100 (21.0%)	30 (36.0%)	
3	40 (8.0%)	6 (7.0%)	
3	57 (12.0%)	16 (19.0%)	
≥5	27 (6.0%)	1 (1.0%)	
Fruit (servings/day)			
<1	242 (49.0%)	32 (38.0%)	0.14
1	157 (32.0%)	36 (42.0%)	
2	61 (13.0%)	15 (18.0%)	
3	16 (3.0%)	1 (1.0%)	
3	7 (2.0%)	1 (1.0%)	
≥5	7 (1.0%)	0 (0.0%)	
Vegetables (servings/day)			
<1	141 (29.0%)	22 (26.0%)	0.71
1	197 (40.0%)	36 (46.0%)	
2	80 (16.0%)	10 (12.0%)	
3	37 (8.0%)	6 (7.0%)	
3	15 (3.0%)	3 (3.0%)	
≥5	17 (4.0%)	5 (6.0%)	

Data are presented as number and percentage (%). * Statistically significant at p < 0.05.

difference was not statistically significant. The moderate-and high-risk groups tended to consume more servings of bread; this difference was statistically significant (p=0.01).

Unhappiness, anger, and exhaustion were more prevalent in the low-risk group than in the moderate- and high-risk groups; the difference was statistically significant (p<0.05).

As shown in **Table 4**, metabolic syndrome was more common in moderate- and high-risk groups. This difference was statistically significant (p=0.01).

The results of the logistic regression model indicated that medical history of hypercholesterolemia, hypertension, diabetes, family history of heart disease in a first-degree relative, and eating junk food were positive predictors (risk factors) of developing CVD. Thinking of changing lifestyle was a negative predictor (protective factor) of CVD (p<0.05).

CVD risk was seven-fold (95% CI, 3.6%-16.3%), six-fold (95% CI, 2.9%-13.9%) five-fold (95% CI, 2.3%-10.6%), two-fold (95% CI, 1.2%-5.1%), and almost three-fold (95% CI, 1.3%-5.3%) in women with diabetes, hypertension, family history of heart disease, hypercholesterolemia, and women who were junk food consumers, as shown in **Figure 1**.

Regarding readiness to make lifestyle changes, 61.0% of women

Table 4 Metabolic syndrome according to cardiovascular disease risk (n = 616) at the National Guard Residential City in Jeddah, Saudi Arabia, 2015.

Metabolic Syndrome	Low risk (n=531)	Moderate and high risk (n=85)	Chi-square test p-value
No	375 (71.0%)	24 (28.0%)	0.01*
Yes	156 (29.0%)	61 (72.0%)	

Data are presented as number and percentage (%). *Statistically significant at p<0.05.

were thinking of eating healthy meals daily and 46.0% were thinking of adopting 30 minutes or more of physical activity 3-4 days or more per week. Additionally, 51.0% were thinking of achieving a healthy weight **(Figure 2)**.

Discussion

The objective of this study was to assess the CVD risk in all National Guard female residents aged 30 and older. After screening for eligibility, the majority (86.0%; n = 531) were in the low-risk group, 10.0% were in the moderate-risk group, and 4.0% (n = 85) were in the high-risk group. These proportions were expected, since most of the participants were young and non-smokers. Most previous international studies were conducted in primary health-care centers where the participants had co-morbid conditions and most involved both genders; thus, the percentage of moderate- and high-risk participants in those studies were higher [2,3].

The results of this study showed that half (54.2%) of the screened population was obese and 78.0% had abdominal obesity. The prevalence rates of diabetes, hypertension, and hypercholesterolemia were high and close to the national figures [9]. These high rates could be explained by the high rates of positive family history of chronic and cardiac diseases. More than half (65.6%) had a family history of diabetes, while 52.8%, 25%, and 20.6% had family histories of hypertension, hypercholesterolemia, and heart disease.

This study shows the relationship between socio-demographics and CVD risk. Older and illiterate females with low income were more likely to be in the moderate and high-risk group. Socio-economic status appears to be a consistent inverse relationship between these indicators and CVD risk factors [10,11], and a study in Saudi Arabia by Al Baghli et al. [12] showed similar results to our findings.

A significant relationship was observed between smoking and CVD risk: the moderate and high-risk groups both consisted of a higher percentage of smokers. However, passive smoking did not show a significant relationship with CVD risk in our study. Conversely, another study revealed that passive smoking was associated with a 25%-30% increased risk of CVD [13].

Another finding of our study was a significant relationship between physical activity and CVD risk. Less active women were more likely to be in the moderate and high-risk groups. A meta-analysis showed that individuals below the 25th percentile of fitness distribution are at higher risk [14]. Being unfit is a risk factor of CVD and is thus worthy of screening and intervention [15].

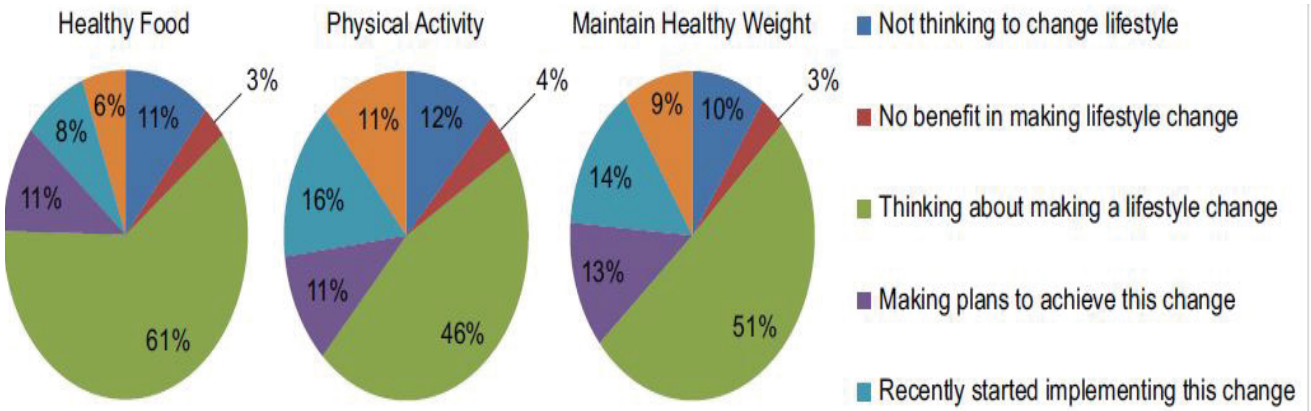

Figure 1 Predictors of cardiovascular disease risk among females (n=616) at the National Guard Residential City in Jeddah, Saudi Arabia, 2015.

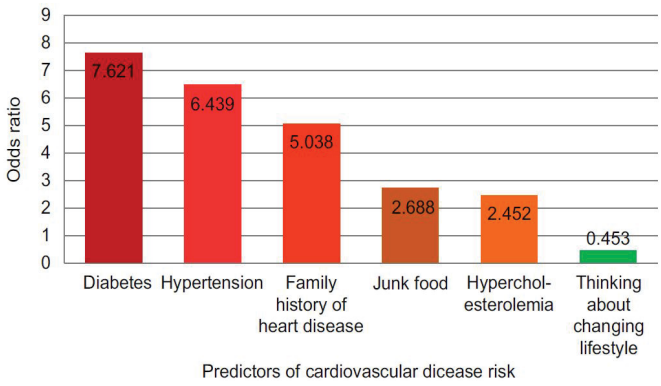

Figure 2 Participants' readiness for behavioural change to reduce cardiovascular disease risk (n=616) at the National Guard Residential City in Jeddah, Saudi Arabia, 2015.

Consumption of fruits and vegetables did not show a significant difference in our study population. This is inconsistent with the results of a previously published meta-analysis that indicated that fruit and vegetable consumption is inversely associated with the occurrence of CVD; the risk of CVD decreased by 4% for each additional portion per day and by 7% for fruit consumption alone [14].

Psychological factors were more common in the low-risk group, and the difference was significant. This could be because women in the low-risk group tended to be younger, employed, and have a higher education, resulting in a more stressful life. Conversely, a review suggested that anger is associated with CVD outcomes both in healthy and CVD populations [16]. Another study revealed that depressed patients are at higher risk of cardiac morbidity and mortality [17].

Concerning readiness to make lifestyle changes, most women in the present study were thinking of change but taking no action. Evidence suggests that health-promotion interventions based on social and behavioural science theories are more effective than those lacking a theoretical basis. Participants should be evaluated for their stage of readiness before being counselled to change a specific behaviour [18].

Limitations of the Study

The results may not be generalizable because the study was conducted in single community setting in Jeddah, KSA.

Conclusion

CVD risk factors, including co-morbid conditions, inactive lifestyle, selected socio-demographic factors (older age, illiteracy, and low socio-economic status), family history of chronic conditions, and smoking were associated with moderate to high CVD risk among participants. Readiness to make lifestyle changes could help in facilitating effective intervention upon lifestyle counselling. The findings also highlight the need to provide comprehensive interdisciplinary programs according to individual's risk and readiness to change. Future studies, using a prospective design, could examine the effectiveness of such intervention programs.

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