Tropical Journal of Pharmaceutical Research December 2022; 21 (12): 2659-2667
ISSN: 1596-5996 (print); 1596-9827 (electronic)

Available online at http://www.tjpr.org
http://dx.doi.org/10.4314/tjpr.v21i12.22

Original Research Article

Applying the Framingham Risk Score for cardiovascular diseases in Jordan: A cross-sectional study

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Sent for review: 15 July 2021 *Revised accepted: 1 December 2022*

Abstract

Purpose: *To assess the protective measures taken by Jordanians to decrease the risk of first cardiovascular event using the Framingham Risk Score classification.*
Methods: *A survey was created using Google forms and disseminated through social media platforms (WhatsApp and Facebook) in order to facilitate contact with multiple sections of the Jordanian population. The questions were designed to measure the objectives of this study and a scale was used to measure the level of application. Demographic parameters were documented. Framingham's risk score was calculated.*
Results: *Taking lipid-lowering medications decreased the Framingham Risk Score, and patients with significantly elevated high-density lipoprotein (HDL) values have lower Framingham Risk Scores. A significant difference in Framingham Risk Score was observed among patients with a diploma and those with high school or less education (p = 0.043). There was a significant difference in Framingham Risk Score between non-smokers and sometimes smokers.*
Conclusion: *The Framingham Risk Scores reveals that 90 % of individuals have a low risk of getting cardiovascular disease (CVD) in the Jordanian population, 5 % have an intermediate risk, and 5 % have a high risk. This is normal as the age range of participants in the survey was within the 20 to 30 years.*

Keywords: *Jordan, Framingham Risk Score, Cardiovascular disease (CVD), Risk factors, Secondary prevention*

Tropical Journal of Pharmaceutical Research is indexed by Science Citation Index (SciSearch), Scopus, Web of Science, Chemical Abstracts, Embase, Index Copernicus, EBSCO, African Index Medicus, JournalSeek, Journal Citation Reports/Science Edition, Directory of Open Access Journals (DOAJ), African Journal Online, Bioline International, Open-J-Gate and Pharmacy Abstracts

INTRODUCTION

In Jordan, as well as the rest of the globe, cardiovascular disease (CVD) is the main cause of morbidity and mortality among adults [1,2]. Cardiovascular diseases include peripheral arterial disease (like significant limb ischemia and intermittent claudication), heart failure (HF), coronary heart diseases (CHD) such as myocardial infarction (MI) and angina pectoris, cerebrovascular disease such as transient ischemic attack (TIA) and stroke, and aortic diseases such as aortic atherosclerosis, thoracic aortic aneurysm, and abdominal aortic aneurysm [3].

By making lifestyle changes and receiving preventive therapy, a patient can lower their risk

of future cardiovascular events. Quitting smoking, eating a healthy diet, and engaging in regular exercise are examples of lifestyle changes [4]. Low-dose aspirin, statins, or preventive treatment for hypertension can all be considered protective therapeutic measures [3,5]. It is crucial to be able to predict a patient's risk, decide when to start a lifestyle modification, and administer preventive, therapeutic measures [6]. Numerous risk models have been developed to predict the cardiovascular risk of certain patient groups. The Framingham Risk Score is a significant critical risk model developed using the results from the Framingham Heart Study [6-8]. The Framingham Risk Score is a gender-specific algorithm used to forecast an individual's 10-year risk of developing cardiovascular disease. Cerebrovascular events, peripheral artery disease, and heart failure were added as illness outcomes for the 2008 Framingham Risk Score in addition to cardiovascular disorders to assess the 10-year cardiovascular disease risk [8,9].

The purpose of this study was to evaluate the preventive measures taken by the Jordanian population to lower the risk of experiencing the first cardiovascular event. To do this, the Framingham Risk Score categorization was used to determine their risk of experiencing their first cardiac event. This is significant because recent research from Jordan has reported that risk variables were very common among the general population [10-12].

METHODS

Development of survey instrument

A Google Form was created to generate a survey. A closed-ended questionnaire was used to explore Jordanian participants. The questions were designed to assess the study goal, and the amount of application was assessed using a scale. A self-completed survey with pertinent suggestive questions was used to gather data. To verify the content validity of the questions, thorough literature research was done prior to questionnaire preparation. Next, there were conversations to make sure the questions were clear and resolve any ambiguity. Two clinical pharmacists and one statistician assessed the questionnaire's several drafts to confirm its validity. A few questions were accordingly added or removed.

Administration of survey instrument

A cross-sectional study was conducted, and adult Jordanians were recruited as the study models from a variety of national representations. Social media (WhatsApp and Facebook) was used to share the survey with the Jordanian community.

The questionnaire was conducted in English. Participants' agreement to participate in the study was obtained before starting the survey, and confidentiality was highlighted. Anthropometric characteristics, as well as demographic information, were recorded. Framingham's risk score was calculated. Accordingly, cardiac event risk was determined.

Ethical approval

The World Medical Association Declaration of Helsinki guidance was followed in the study [9]. The study was approved by the Institutional Review Board (IRB) at Balqa applied university (approval no. 490/2020).

Sampling frame and procedure

Adults, aged 20 years and older who had not been given a CVD diagnosis of any kind were included in the trial. Patients with chronic stable angina, prior myocardial infarction (MI), coronary artery bypass graft (CABG), prior revascularization (percutaneous coronary intervention, or PCI), valvular heart diseases, and any other non-atherogenic causes of angina, as well as reliable non-invasive angiographical evidence of myocardial infarction, were excluded from the study.

Questionnaire components

The questionnaire was divided into two sections, with part A intended to obtain demographic data on the patient, such as age, education, place of residence, gender, marital status, and the occurrence of any prior CV events. People who had a prior CV event were not included in the study. Part B was created to gather patient medical data, such as their most recent lipid profile check with detailed results values for triglyceride (TG), High-Density Lipoprotein (HDL), and Low-Density Lipoprotein (LDL) and most recent blood pressure check with results values for systolic and diastolic blood pressure, that may affect their Framingham Risk Score.

Participants' smoking habits were questioned (including cigarettes and hubbly bubbly use). Furthermore, participants were questioned regarding their regular usage of aspirin for CVD prevention, diabetic medicines, lipid-lowering drugs, and antihypertensive therapy.

Risk factors

The definitions of risk factors are as follows: Dyslipidemia, as a prior diagnosis by a physician or the presence of one or more of the following: low-density lipoprotein, cholesterol > 100 mg/dL (2.59 mmol/L) [13,14], high-density lipoprotein, cholesterol < 40 mg/dL (1.04 mmol/L), or triglycerides > 150 mg/dL (3.89 mmol/L), measured after fasting for > 8 h. The use of lipid-lowering medications was not utilized to define dyslipidemia. Hypertension was defined as a prior diagnosis by a physician or known Blood Pressure (BP) values > 140/90 mmHg (nondiabetics) or > 130/80 mmHg (diabetics) [15] on more than two incidents. The BP-lowering medication used was not utilized to define hypertension (HTN). Diabetes was defined as a prior diagnosis by a physician, known Fasting Blood Glucose (FBG) values > 126 mg/dL (7 mmol/L), or the current use of hypoglycemic treatment [16,17]. Obesity was defined as body mass index (BMI) ≥ 30, but less than 40 kg/m^2, and overweight was defined as BMI ≥ 25 but less than 30 kg/m^2. Current smoking was defined as smoking at least one cigarette/day or water pipe up to one month before enrollment [17].

Data analysis

The Statistical Package for Social Sciences (SPSS), version 22.0 database, was used to code and enter the data for statistical analysis. Descriptive statistics were performed for data analysis and the related 95 % confidence intervals (CIs). The chi-square test for categorical data was used to assess the differences between the groups. Independent *t*-test and ANOVA for normally distributed continuous data were used. *P*-values less than 0.05 were considered statistically significant.

RESULTS

Patient characteristics

A total of 517 participants with no history of CVD participated in this study. Patients had an average age of 57.6 years and an average age range between 23 and 30 years (Table 1). The study revealed that 90 % of the participants had a low risk for developing CVD, 5 % were at intermediate risk, and 5 % were at high risk for developing CVD. The study also revealed that 35.6 % of the population were smokers. Some 60 % had never tested for lipid profile, and 23 % had never tested for blood pressure. The study showed that there was an unexplained use of aspirin among low-risk patients as 95.5 % of the population who use aspirin were at low risk for developing CV event. On the other hand, 10 % of the participants who were not taking aspirin were at medium or high risk to develop CV event, and they should use aspirin for prophylaxis (Table 2 and Table 3).

Lifestyle risk factors

The study revealed that 35.6 % of the population were smokers, and this is a high percentage. Significant differences occur between non-smokers and sometimes smokers ($p < 0.028$, Table 2), while 60 % of the study participants had never had their lipid profiles tested.

Table 1: Socio-demographic details of participants who responded to the questionnaire, (N = 500*)

PARAMETER	N (%)
Age in years	
23 – 30	280 (56.0)
31 – 40	85 (17.0)
41 – 50	71 (14.2)
51 – 60	49 (9.8)
61 – 70	9 (1.8)
> 70	6 (1.2)
Gender	
Female	306 (61.2)
Male	194 (38.8)
Education level	
High school or less	36 (7.2)
Middle Diploma	247 (49.4)
Bachelor	142 (28.4)
Higher education	75 (15.0)
Residence	
Capital City	192 (38.4)
Middle area	263 (52.6)
North area	35 (7.0)
South area	10 (2.0)
Marital Status	
Single	248 (49.6)
Married	232 (46.4)
Divorced	13 (2.6)
Widow	5 (1.0)
Smoking Status	
Smoker	178 (35.6)
Non-smoker	273 (54.6)
Occasionally smokes	46 (9.2)
The average family income per month (in JD)	
< 600	258 (51.6)
600 – 1200	100 (20.0)
> 1200	130 (26.0)
Number of dependents	
1	222 (44.4)
2	122 (24.4)
≥ 3	**142 (28.4)**

*Some data were missing, subsequently totals do not always add to 500, JD: Jordan dinar

Table 2: Participants' health characteristics, (N = 500*)

PARAMETER	N (%)
Weight (Kg)	
< 60	145 (29.0)
60-80	225 (45.0)
80-100	104 (20.8)
> 100	24 (4.8)
Height (cm)	
≥ 160	155 (31.0)
161 – 170	217 (43.4)
> 171	128 (25.6)
Presence of previous cardiovascular diseases	
Yes	20 (4.0)
No	465 (93.0)
Maybe (I 'don't know)	15 (3.0)
Last fasting lipid profile testing	
Never been tested	300 (60.0)
Within one month	32 (6.4)
Within six months	61 (12.2)
Within 12 months	56 (11.2)
> 12 months	51 (10.2)
High-density lipoprotein (HDL) value (mg/dL)	
Female	
Never been tested	222 (72.5)
< 35	10 (3.3)
35-59	51 (16.7)
≥ 60	15 (4.9)
Male	
Never been tested	118 (60.8)
< 35	13 (6.7)
35-59	51 (26.3)
≥ 60	7 (3.6)
Low-density lipoprotein (LDL) value (mg/dL)	
Never been tested	337 (67.4)
< 100	55 (11.0)
100-129	39 (7.8)
130-159	26 (5.2)
160-190	10 (2.0)
> 190	19 (3.8)
Total cholesterol (TC) value (mg/dL)	
Never been tested	354 (70.8)
< 160	53 (10.6)
160-199	43 (8.6)
200-239	32 (6.4)
240-279	14 (2.8)
> 280	4 (0.8)
Using lipid control medications	
Yes	39 (7.8)
No	452 (90.4)
MAYBE	**6 (1.2)**

Table 3 show the Framingham Risk Score frequency while Table 4 show the association between Framingham risk score and participants' characteristics. As shown, participants with significantly elevated HDL values had lower Framingham Risk Scores (p = 0.01), which have been significantly lowered by the use of lipid-lowering medicines (p = 0.003). A significant difference was observed in the Framingham Risk Score between patients with diplomas and those with only a high school education or less (p = 0.043). The difference in Framingham Risk Scores between occasional smokers and nonsmokers was also significant (p = 0.028).

Table 2 *(Continued)*: Participants' health characteristics, (N = 500*)

PARAMETER	N (%)
Last Blood Pressure (BP) testing	
Never been tested	117 (23.4)
Within one month	211 (42.2)
Within six months	86 (17.2)
Within 12 months	46 (9.2)
> 12 months	36 (7.2)
Systolic Blood Pressure (SBP) value (mmHg)	
Never been tested	134 (26.8)
< 120	136 (27.2)
120-129	159 (31.8)
130-139	39 (7.8)
140-159	18 (3.6)
≥ 160	2 (0.4)
Diastolic Blood Pressure (DBP) value (mmHg)	
Never been tested	142 (28.4)
< 80	139 (27.8)
80-84	143 (28.6)
85-89	39 (7.8)
90-99	22 (4.4)
≥ 100	5 (1.0)
Using Antihypertensive medications	
Yes	65 (13.0)
No	420 (84.0)
Maybe	10 (2.0)
Using aspirin (in prophylaxis dose)	
Yes	45 (9.0)
No	425 (85.0)
Maybe	25 (5.0)
Using Hypoglycemic medications	
Yes	55 (11.0)
No	436 (87.2)
MAYBE	**7 (1.4)**

*Some data was missing, subsequently totals do not always add to 500

Table 3: Framingham Risk Score frequency and mean value, (N = 500)

PARAMETER	N (%)
Framingham Risk Score	
≤ Zero	336 (67.2)
≥ 1	164 (32.8)
Framingham Risk Score (±SD)	
Minimum	- 12.0
Mean (±SD)	- 2.04 (±6.48)
Maximum	+14.0
Framingham Risk Score	
Low (<10%)	453 (90.6)
Intermediate (10-19%)	25 (5.0)
HIGH (>20%)	**22 (4.4)**

Table 4: Association between participants' characteristics and their Framingham Risk Score, (N = 500*)

PARAMETER	DEPENDENT VARIABLE: FRAMINGHAM RISK SCORE			
Independent variable	***Framingham Risk Score Magnitude***	***Framingham Risk Score***	***P- Value***	***Comments***
Age			NS	
20-30	-1.16	4.53		
31-40	-2.18	3.88		
41-50	-2.29	5.28		
51-60	-2.88	4.43		
61-70	-4.78	3.88		
>70	-5.67	3.17		
Gender			NS	
Male	-2.25	4.29		
Female	-1.91	4.61		
Smoking			0.028	The difference between non-smokers and sometimes smokes
Yes	-1.63	4.51		
No	-2.47	4.16		
Sometimes	-0.717	6.56		
Education			0.043	Difference between diploma participants and those with high school or less level
High school or less	-0.81	7.06		
Middle Diploma	-1.90	4.26		
Bachelor	-2.46	4.39		
Higher education	-2.28	4.19		
Residence			NS	
Capital City	-2.45	4.53		
Middle area	-2.01	4.36		
North area	-0.91	4.97		
South area	+1.30	5.50		
Marital status			NS	
Single	+2.40	4.42		
Married	-1.94	4.54		
Divorced	-2.18	3.00		
Widow	-2.62	10.40		
Previous CVD			NS	
Yes	-2.35	5.25		
No	-2.05	4.43		
Maybe (I don't know)	-1.13	5.20		
HDL value			0.01	Patients with HDL value of more than 60 mg/dL have lower Framingham risk score levels than the patients who never measure the HDL value
Never been tested	-1.69	4.56		
<35	-2.17	3.78		
35-59	-2.25	4.52		
≥60	**-5.82**	**3.32**		

*Some data was missing, subsequently totals do not always add to 500. Independent *t*-test and ANOVA were used. NS: not significant

Table 4 (continued): Association between participants' characteristics and their Framingham Risk Score, (N = 500*)

PARAMETER	DEPENDENT VARIABLE: FRAMINGHAM RISK SCORE			
Independent variable	***Framingham Risk Score Magnitude***	***Framingham Risk Score***	***P- Value***	***Comments***
LDL value			NS	
Never been tested	-1.60	4.60		
< 100	-2.82	3.95		
100-129	-2.74	5.26		
130-159	-3.58	3.35		
160-190	-2.90	2.50		
>190	-3.21	4.58		
Total cholesterol value			NS	
Never been tested	-1.66	4.60		
<160	-2.58	4.13		
160-199	-3.02	4.23		
200-239	-2.66	4.66		
240-279	-4.71	3.85		
>280	-3.00	3.00		
Systolic BP value			NS	
Never been tested	-1.82	4.52		
<120	-1.82	4.65		
120-129	-2.26	4.54		
130-139	-2.08	4.15		
140-159	-4.11	2.72		
≥ 160	+4.50	7.50		
Diastolic BP value			NS	
Never been tested	-1.64	4.60		
<80	-2.35	4.73		
80-84	-1.83	4.63		
85-89	-2.64	3.41		
90-99	-1.77	4.23		
≥100	-2.60	3.60		
Taking HTN medication			NS	
Yes	-2.78	3.92		
No	-1.93	4.56		
Maybe	+0.50	6.40		
Taking DM medication			NS	
Yes	-1.33	5.78		
No	-2.12	4.36		
Maybe	-1.29	2.86		
Taking aspirin			NS	
Yes	-3.77	3.93		
No	-1.82	4.60		
Maybe	-1.84	4.08		
Using lipid control medications			0.003	Patients taking lipid-lowering agents have lower Framingham risk score levels than the patients who may be taking the lipid-lowering agents
Yes	-3.13	3.72		
No	-2.01	4.47		
MAYBE	**+4.00**	**12.2**		

*Some data was missing, subsequently totals do not always add to 500. Independent *t*-test and ANOVA were used. NS: not significant

DISCUSSION

A government study conducted in 2019 in collaboration with the World Health Organization, revealed that more than eight out of ten Jordanian men smoke or regularly use nicotine products, including e-cigarettes, as smoking rates in the Middle Eastern kingdom of Jordan have risen to the highest in the world [14]. The poll further reported that everyday smokers in

Jordan smoke an average of 23 cigarettes per day [14]. Obesity, smoking, and physical inactivity are three important negative life patterns. Rapid economic development, significant lifestyle changes, and societal differences may all be contributing factors [15]. The low levels of physical activity among the sexes point to the need to increase opportunities for nutrition and exercise guidance. Such guidance from medical professionals will help to lessen the burden of mortality and morbidity. Patients should also be urged to engage in more physical activity and make it a regular part of their daily routine [16,17]. The benefits of reducing weight on blood pressure, lipid profiles, and the propensity for hyperglycemia should be made clear by doctors [17]. The high incidence of dyslipidemia and DM in Jordanians, as well as their use of lipid-lowering drugs and antidiabetic agents, were other studies carried out among people who appeared to be in good health [15]. All smokers should have their need for smoking cessation emphasized by their doctors. The most crucial intervention for the primary and secondary prevention of CAD is quitting smoking [16,17].

Analysis of risk variables and treatment gaps in relation to the age and gender of the patients indicated a generally homogenous trend. The social norms forbid women from leaving their homes or exercising in public, and they promote taking care of their husbands and children at the expense of their own needs. Women reported smoking less frequently, on the other hand. The low smoking frequency among Jordanian women is likely due to cultural norms that forbid women from smoking. The results of this study should increase the standards of preventive cardiology by stimulating the formation of national recommendations, their dissemination, and their applications, even though no previous study has specifically sought to demonstrate the advantages of risk reduction among Jordanians in particular.

Women must receive special attention since they are more likely to have uncontrolled BP and FPG than men. The study also found that 23 and 60 % of participants had never had their blood pressure and lipid profiles, respectively checked, which can affect the risk category and the suggested prophylactic or lifestyle adjustments to prevent the development of a first cardiovascular event. The National Heart, Lung, and Blood Institute (NHLBI) Expert Panel updated the recommendations to lower CVD risk and improve cardiovascular health in children and adolescents in 2011 [14]. They recommended a universal lipid screening for individuals between the ages of 9 and 11 years and a second universal screening between the ages of 17 and 21 years as one of the primary points of these guidelines [14]. These ideas are the first to support cholesterol screening in children outside those with clear family histories of CVD, and they are evaluated as grade B evidence and strongly recommended [15]. To take preventive steps and correct their lipid profiles earlier in life, Jordanians should begin screening their lipid profiles earlier.

Unexplained aspirin use was detected among low-risk patients, 95.5 % of the population who use aspirin were at low risk for developing a CV event, whereas 10 % of participants who do not take aspirin were at medium or high risk of developing CV event and should take aspirin for prophylaxis. When used as directed, aspirin can help people avoid acquiring cardiovascular disease in the first place. Still, current research and recommendations show that only a small number of individuals benefit from this use of aspirin. It is therefore advised that patients should continue to use aspirin if they have experienced a heart attack, stroke, coronary stent, or coronary artery bypass graft surgery. However, aspirin should not be taken for the primary prevention of heart disease if the patient have not experienced any of the aforementioned surgeries or diseases, are younger than 40 years old, are older than 70 years old, or are at an increased risk of bleeding due to an illness or medicine. Furthermore, taking aspirin may be beneficial if a patient is between 40 and 70 years old, have a low risk of bleeding, and are deemed to have a high risk of developing heart disease.

Limitations of the study

The results of this survey need to be interpreted considering the following potential limitations.

1. Due to time restrictions, a wider range of the Jordanian population could not be reached.

2. The survey relied on participants' reports of laboratory measurements, but no attempts were made to measure BP, FPG, or lipid profile directly. Some participants reported old values because of limitations associated with the coronavirus 2019 pandemic.

CONCLUSION

The Framingham Risk Scores reveals that 90 % of individuals have a low risk of getting cardiovascular disease (CVD), 5 % have an intermediate risk, and 5 % have a high risk. This is normal as the age range of participants in the survey is within 20 to 30 years. Guidelines

recommend that people with a history of heart attack, stent, stroke, or coronary artery bypass graft surgery should use aspirin as part of their medications. But people who are older than 70 years and younger than 40 years with no history of heart disease should not use aspirin for primary prevention of heart disease. Jordanians should commit to those recommendations.

DECLARATIONS

Acknowledgements

This study was supported by the Deanship of Academic Research, Al-Balqa Applied University.

Funding

None provided.

Ethical approval

The study was approved by the Institutional Review Board (IRB) at Balqa Applied University (approval no. 490/2020).

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

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