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RESEARCH ARTICLE

IDENTIFYING CARDIOVASCULAR RISK IN ADULTS AND ELDERLY USING THE *FRAMINGHAM* RISK SCORE

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ABSTRACT

Cardiovascular diseases are generally considered a public health problem, with high morbidity and mortality rates. Objective: The objective of this study was to evaluate the cardiovascular evolution and the use of the time scale in order to develop the risk of developing CVD in the next 10 years. METHODS: a quantitative, observational and cross-sectional study in a municipality in the interior of Bahia, consisting of 250 adult and elderly individuals from ages 30 to 74 years and without cardiovascular disease (CVD) without a baseline examination, following the Framingham Heart Study protocols. Only the CVD of the Framingham Study was published. Results: Statistical analysis of the variables between the significance level of $p < 0.00$ and $p < 0.01$, respectively. The association between age and diabetes was borderline $p = 0.06$ in relation to the framing risk score and the majority of the population was classified as below risk. Final Considerations: The positive and significant association between HDL and PAs brings a different approach to the performance of HDL-C in relation to PA levels.

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INTRODUCTION

According to the updated information from the World Health Organization – WHO (2017), cardiovascular disease (CVD) kills about 17.7 million people annually, representing 31% of all deaths (WHO, 2017), the main categories of CVD include diseases of blood vessels and the myocardium (Ding *et al*., 2017), with arterial hypertension being the main worldwide risk factor for negative outcomes for cardiovascular health (Zhou, 1975).

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Being one of the main representatives of chronic non-communicable diseases (DNCs), CVD has been associated with several negative health outcomes and a high number of deaths (D'Agostino *et al*., 2013), which reach 28 million deaths annually in Brazil (Siqueira *et al*., 2017). CVD has been the cause of approximately 38% of the total deaths in Brazil in a population with a productive age (18-65 Years), in which, in addition to deaths, they lead to work inactivity, decrease in family income and productivity, increasing annual health costs (Mansur *et al*., 2016). Being a multifactorial disease is one of the main causes of death among men and women in the five major regions of Brazil (Mansur *et al*., 2016) and in the world (Roth, 2017).

The epidemiological transition from a profile of infectious diseases to non-communicable diseases (D'Agostino *et al*., 2013; Ribeiro *et al*., 2016), as well as the change in the Brazilian's age profile and increase in life expectancy has led to an increase in the number of chronic diseases, mainly being CVD (Siqueira *et al*., 2017; Ribeiro, 2016; Corella, 2015). It is understood that people above 65 years of age have a greater predisposition to DNCs when associated with cardiovascular risk factors such as type 2 diabetes mellitus, hypercholesterolemia, hypertension, and have a lower life expectancy than the general population (Corella, 2015). The Framingham Heart Study (FHS), a US study aimed at identifying the common risk factors for the development of CVD, such as type 2 diabetes mellitus, hypertension, age, dyslipidemia, smoking habits. It can predict the risk of having cardiovascular events in the next 10 (men and women aged 30-74 years) or 30 years (male gender only 20-59 years old) (Lotufo, 2008; Galvão, 2013). Framingham Risk Score (FRS) has been commonly and globally used to predict cardiovascular risk in men and women of varying ages (D'Agostino *et al*., 2013; Santana *et al*., 2015; Barroso, 2010). In Brazil, its risk scale has been successfully used, through some risk variables prevalent in the Brazilian territory (Galvão, 2013; Santana, 2015; Pimenta *et al*., 2014; Oliveira *et al*., 2016). It can predict risk of cardiovascular problems in a projection of 10 to 30 years. The present study aimed to determine the cardiovascular risk in adults and the elderly using the Framingham score, in order to predict the risks of developing CVD in the next 10 years, to develop health intervention programs and to promote healthy habits, reducing risks of cardiovascular events.

METHODOLOGY

This is a quantitative, observational and cross-sectional study in a municipality in the interior of Bahia (latitude: 14º 51 '58 "S; longitude: 40º 50' 22" W). The study is a subproject entitled "Epidemiological Profile of Chronic Diseases in the Municipality of Vitória da Conquista / BA". Data was collected between August 2016 and November 2017, using the stratified random approach method. The sample consisted of 250 adult and elderly individuals, ages 30 to 74 years and without cardiovascular disease (CVD) at the baseline examination, following the Framingham Heart Study protocols. Only 38 subjects were within the recommendations needed to predict the CVD risk of the Framingham Study. For the data collection, questionnaires were given to the participants of the study, as well as biochemical blood analysis in order to obtain the necessary predictors of the study to calculate the risk for CVD (coronary death, myocardial infarction, coronary insufficiency, angina, cerebral ischemic stroke, hemorrhagic stroke, transient ischemic attack, peripheral arterial disease, heart failure) according to the Framingham Heart Study. The following variables were used: age, gender, diabetes, smoking habits, HDL cholesterol, total cholesterol (TC), treated and untreated systolic blood pressure (BP). We performed association tests adjusted to the variables for analysis of the prediction of incidence of cardiovascular diseases with a maximum follow-up duration of 12 years and a risk prediction of 10 years by the score of Framingham risk functions. The statistical analysis was performed with a multivariate linear regression. The adjusted variables were estimated using stepwise logistic regression to allow the potential imbalance between the gender, we considered the level of significance to be $p < 0.05$, the statistical program used was the SPSS® 24.4. The participants were clarified on the methods to be used for collection, according to Resolution 466/12 (National Health Council), which constitutes international documents of research involving human beings. It is noteworthy that the project was approved by the Research Ethics Committee of the Independent College of the Northeast (Opinion No. 1,859,545).

RESULTADOS

A sample of 38 individuals of both genders, 26 male and 12 female, with an average age of approximately 47 years, most of whom reported not smoking and did not have diabetes at the beginning of the study, as shown in table 1, there was also information on the cardiovascular risk factors the average BPs, CT and c-HDL. In statistical analysis of the variables, there was a positive association between HDL-C, CT and the increase of BPs with a significant value of $p < 0.00$ and $p < 0.01$, respectively. Association between age and diabetes was borderline with a p value = 0.06. These important associations suggest that both HDL-C and TC have an influence on blood pressure levels, as well as aging, may suggest an increased risk of diabetes. Table 2 presents the data on the Framingham risk score values to predict the risk of developing cardiovascular disease in the next 10 years between genders, most of which were classified as below risk (< 10%). Table 3 presents the average and standard deviation values of systolic blood pressure, total cholesterol, and HDL-cholesterol between genders.

DISCUSSION

In this study, the FHS of the study population was analyzed, in which it was verified that the male gender had the highest score in the FHS, >10%, when compared to the female gender. On the other hand, TC levels were higher in females. There was also a positive association between CT, HDL-C and the increase in systolic blood pressure levels, with significance $p < 0,01$ and $p < 0,00$, respectively. A large number of studies have used FRS as a model for predicting cardiovascular risk (Pimenta, 2014; Sousa, 2016; Lyngbæk, 2013; Larré, 2014). In our FHS analysis, we obtained 55.26% of the sample classified as low risk (<10%) of developing cardiovascular diseases in the next 10 years. Soares *et al*., (2013), in his article one can find the opposite of our study, with 24.3% of the sample being classified as low risk. Another study obtained results similar to ours, with the highest number of people classified as low risk (Sousa, 2016). FHS is still considered one of the best models for predicting the risk of developing cardiovascular diseases when compared to other models (Garg, 2017; Selvarajah, 2014), which justifies our choice. On average, the HDL-C of our sample was higher than the desirable levels, being above 40mg/dl, with an average of 46mg/dl, and is well known for its cardiovascular protective effects, protecting the vascular bed with the removal of oxidized-LDL, free lipids and their transport to the liver, inhibits the attachment of adhesion cells, monocytes, macrophages in the vascular endothelium and the stimulation of the release of nitric oxide (NO), a potent vasodilator (Aluko, 2018), whose function decreases the pressure in the arteries (SBC, 2017; Ganjali, 2018). However, in our statistical analysis we found a positive and significant association between elevated HDL-C and increased BP, suggesting that the higher the amount of HDL-C, the higher the systolic blood

Tabela 1. Characteristics of the sample and variables for the evaluation of the Framingham Risk Score

			Gender	
			Male	Female
Variables	Average	DP±	n (%)	n (%)
			26 (68)	12 (32)
Age (years)	47 anos	±10,06		
30-39			9 (24)	3 (8)
40-49			9 (24)	3 (8)
50-59			5 (13)	5 (13)
60-69			3 (8)	1 (2)
Diabetes				
Yes			1 (2)	1 (2)
No			25 (66)	11 (30)
Smoke				
Yes			9 (24)	4 (10)
No			17 (45)	8 (21)
Systolic Blood Pressure	129 mmHg	±18,217		
Total Cholesterol	197 mg/dl	±45,727		
HDL Cholesterol	46 mg/dl	±12,851		

Sources of research NEPE dc, 2018.

Tabela 2. Calculation of the Framingham Risk Score for the development of Cardiovascular Diseases between genders

Cardiovascular Risk	Gender	
	Male n=26 n (%)	Female n=12 n (%)
Below Risk (< 10%)	13 (34,21)	8 (21,05)
Medium Risk (10 a 20%)	6 (15,78)	3 (7,90)
Elevated Risk (>20%)	7 (18,42)	1 (2,64)
Average of the DP± of the Framingham Score	14,32% - ±9,143	8,86% - ±6,363

Sources of research NEPE dc, 2018.

Tabela 3. Average and standard deviation of BPs, CT and HDL-C between genders

	Gender			
Variables	Male		Female	
	Average	DP±	Average	DP±
Systolic Blood Pressure	129mmHg	±19	129mmHg	±18
Total Cholesterol	193mg/dl	±42	206mg/dl	±54
HDL Cholesterol	43mg/dl	±8,056	54mg/dl	±17,795

Sources of research NEPE dc, 2018.

pressure levels, which goes together with the positive effects described in the literature, in which low levels of HDL-C is a predictor of CVD (SBC, 2017). The overall sample had, on average, HDL-C levels above desirable levels, however, the protective and depressant effect of BPs, suggesting a new rationalizing/thinking perspective regarding the effects of HDL-C in different populations, was not observed in the whole sample. Regarding the TC, women had the highest values (206mg/dl), however, HDL-C was also higher when compared to males, which suggests a protective factor. In our results, the TC was positively and significantly associated with an increase in BP, in which its accumulation in the vascular bed can lead to vascular injury, accumulation of lipids and also the formation of atherosclerotic plaques, due to a decrease in the bioavailability of NO (26). Some studies have shown that changes in the lipid profile, such as increased TC, LDL-cholesterol and decreased HDL-C, increase the risk for progression and development of CVD (29,30). Another study found an inverse association between increased CT and triglyceride levels with the incidence of atrial fibrillation (31).

Final considerations: Our research presented results of the Framingham risk score that was able to predict the onset of cardiovascular disease over a 10-year period, classifying most of the sample at low risk for cardiovascular events. A very important and new result on HDL and BPs takes a different approach on the association of these two variables, in which there was a positive and significant association between the increase of HDL and PAs, deducing that the greater amount of HDL-cholesterol available in the current blood pressure the higher the systolic blood pressure levels would be. It is suggested that further research is conducted to better clarify HDL-cholesterol interference in the increase of systolic blood pressure.

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LIST OF ABBREVIATIONS

BP - Blood Pressure
CVD - Cardiovascular Disease
DCNTs - Chronic Non-Communicable Diseases
FHS - Framingham Heart Study

FRS - Framingham Risk Score
HDL - High Density Lipoprotein
TC - Total Cholesterol
WHO - World Health Organization

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