https://dx.doi.org/10.22161/ijaers.612.28 ISSN: 2349-6495(P) | 2456-1908(O)

Prevalence of cardiovascular risk factors in two Brazilian quilombola communities in Southwest Bahia State

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Abstract*— *Cardiovascular diseases represent one of the leading causes of morbidity and mortality in the world, accounting for approximately 17 million deaths per year. Despite the severity of these diseases, the risk factors are well established. They include systemic arterial hypertension, diabetes mellitus, dyslipidemia, smoking, black ethnicity and low socioeconomic conditions. Quilombola communities are predominantly composed of black individuals and generally present low socioeconomic indicators, with strong indications of a high stratification of risk factors, although still poorly studied.* ***Thus, the present *cross-sectional study was conducted in 2017 with 116 residents of the Maria Clemência and Oiteiro quilombola communities, aged 20 or older. The following indicators were considered: serum triglyceride (TG), total cholesterol (TC) and cholesterol fractions (LDL and HDL) levels; Castelli Index I (CT/HDL-c) and Castelli Index II (LDL-c/HDL-c); TG/HDL-C ratio; Framingham score, Body Mass Index (BMI); waist circumference (WC); fasting glucose (FG); glycated hemoglobin (HbA1c); and blood pressure (BP), which was subdivided into systolic (SBP) and diastolic (DBP) blood pressure. Statistical analyses consisted of the Student's t-test and Chi-square (χ^2) test. A significance level of 5% and confidence interval of 95% were adopted. In general, the Framingham risk score, WC, FG, TC, LDL, TG, FG, Castelli indices I and II indicated moderate to high cardiovascular risk in the population, especially in individuals older than 50 years. Regarding the sex of the individuals, the men's averages were higher than those of the women only in the Framingham Score; in the other indicators (DBP, SBP, BMI, WC, TC, LDL, HDL, TG, TG/HDL-C ratio, Castelli indices I and II, FG and HbA1c), women were statistically more susceptible to cardiovascular diseases. The study established that the Quilombola community studied presents moderate to high cardiovascular risk factors, especially among females. The results may guide actions aimed at reducing risks as well as treating individuals with already installed diseases, in order to minimize or neutralize the damage caused by cardiovascular diseases.*
***Keywords*— cardiovascular diseases; epidemiology; risk factors; quilombo; African descent population.**

I. INTRODUCTION

Cardiovascular diseases (CVDs) represent the leading cause of death worldwide, accounting for about 17.13 million deaths per year (Mendis, 2011). In Brazil, about one third of deaths are caused by cardiovascular problems. In addition to the morbidity and mortality of CVDs, there is also a socioeconomic impact that includes decreased

https://dx.doi.org/10.22161/ijaers.612.28 ISSN: 2349-6495(P) | 2456-1908(O)

productivity at work and decreased family income (BRASIL, 2011).

Cardiovascular diseases include coronary artery diseases such as angina and acute myocardial infarction, stroke, hypertensive heart disease, rheumatic fever, cardiomyopathy, cardiac arrhythmia, congenital heart disease, valvulopathies, carditis, aortic aneurysm, and peripheral artery disease, and venous thrombosis (MALACHIAS, 2016). The underlying mechanisms vary according to the disease in question. For example, coronary artery disease, stroke, and peripheral artery disease involve atherosclerosis, which can be caused by high blood pressure, smoking, diabetes, lack of exercise, obesity, high cholesterol, improper diet, and excessive alcohol consumption.

Among the deaths from cardiovascular disease, 13% are caused by hypertension, 9% by tobacco, 6% by diabetes, 6% by lack of exercise, and 5% by obesity (BRASIL, 2014). Thus, lifestyle (modifiable factors) is essential to predict the present and future risks of CVD. Access to health, physical inactivity, smoking, obesity, lipid profile, systemic arterial hypertension (SAH) and diabetes mellitus (DM) are the main modifiable factors related to these risks. Age, race and family history are also important but not modifiable (XAVIER, 2013); (SIMÃO, 2014; BONOW, 2017).

The extension of these concepts to the context of Quilombola communities is more serious because these communities have a history of social vulnerability. They are normally far from large urban centers, living in rural areas, and their access to health and education is precarious (FREITAS, 2011). Furthermore, because they are a mostly black community (BRASIL, 2001), individuals have greater genetic susceptibility to certain health problems, including hypertension (XAVIER, 2013).

Quilombola communities are still poorly studied and there is hardly any specific data on the risks of CVD, despite these recognized aggravating factors. Consequently, there are no statistics on the extent to which these diseases affect these communities, as for example in terms of quality of life, economic situation, disability or premature death. Thus, it is difficult to propose prevention and risk reduction actions in this community, with a view to improving the quality of life and well-being of individuals.

In this context, the aim of this study was to identify the prevalence of cardiovascular risks in adults living in the Quilombola communities of Lagoa de Maria Clemencia and Oiteiro in southwestern Bahia. It has been found that these communities had a moderate to high risk for cardiovascular diseases.

II. MATERIAL AND METHODS

This is an experimental cross-sectional study conducted with residents of the Quilombola communities of Lagoa de Maria Clemencia and Oiteiro. This article is part of a larger project entitled: Genetic counseling for patients with sickle cell trait and identification of chronic diseases and their risk factors in Quilombola dwellers in southwestern Bahia. This project was submitted and approved by the Research Ethics Committee of the Southwest Bahia State University, under number CAAE 73479917.6.0000.0055.

All residents were invited and spontaneously accepted to participate in the project. People who wished to participate in the research and signed the Informed Consent Form were included in the study (in the case of those who could not write, fingerprints were collected). The exclusion criteria in this study were: individuals under the age of 20 or those who, during the project, gave up participating. After applying these criteria, the residents of these communities were listed in this study. The volunteers were interviewed to collect information about their socioeconomic conditions, educational level, previous medical history, smoking, and usual consumption of alcohol, according to an adapted questionnaire (SILVA, 2016).

Subjects were also assessed for systolic blood pressure (SBP) and diastolic blood pressure (DBP) and were measured twice in the left arm after a 10-minute rest in the supine position with sphygmomanometer and stethoscope. Individuals with high blood pressure (SBP $\geq$ 140 and/or DBP $\geq$ 90) had their blood pressure measured once again after 1 week. The nutritional status was estimated based on Body Mass Index (BMI) and Waist Circumference (WC) according to recommendations of the World Health Organization, as they are simple indicators, easy to apply in population studies (WHO, 2000).

Body mass index is a ratio of weight to height obtained from the calculation of weight in kilograms divided by height in meters squared. A digital scale with capacity of one hundred and fifty kilograms with scale of 100 grams, properly calibrated was used to measure weight, and a mobile stadiometer measuring up to 210 cm and with 0.1 cm accuracy was used to measure height. Waist circumference was measured with a 150 cm inextensible measuring tape with precision of 0.1 cm, and the measurement occurred at the midpoint between the last rib and the iliac crest (MELLER, 2014).

Blood samples (about 20 mL) were collected from patients after 10 - 12 hour fast by venipuncture through a vacuum collection system using a needle (venipuncture) to obtain the blood to be used for laboratory tests, which was put in 2 dry tubes and 1 tube with EDTA, both with separating gel. Serum was used for laboratory determination of fasting glucose (FG), glycated hemoglobin, total cholesterol (TC) and fractions - high density lipoprotein (HDL) and low density lipoprotein (LDL) -, and triglycerides (TG) (BURTIS, 2008). Lipids were dosed by enzymatic methods with an automatic multichannel chemical analyzer (AU680 Clinical Chemistry Analyzer) at the Central Laboratory of Vitória da Conquista, Bahia, Brazil. Glycated hemoglobin (HbA1c) was determined by the National Glycohemoglobin Standardization Program (NGSP) certified immunoturbidimetric method using the Flex kit. Fasting glucose was measured by the glucose oxidase method using the Dimension RXL system (Siemens Healthcare, Newark, NJ, USA) under standard laboratory techniques.

Existing risks for cardiovascular disease were also calculated by the Castelli Index I (CT/HDL-c ratio), Castelli Index II (LDL-c/HDL-c ratio), and Framingham risk score (CASTELLI, 1983; D`AGOSTINO, 2008).

Table I below lists the indicators selected for this study and their respective parameters for cardiovascular risk analysis.

Table 1 – List of cardiovascular risk analysis indicators and parameters

Cardiovascular risk indicators	*Benchmarks assigned to risks*
BMI (kg/m2)7,15	≥ 25.0 kg/m^2 for adults
WC (cm)	≥ 94 cm in men and ≥ 80 cm in women
Index of Castelli I	> 4,4 in women and > 5,1 in men
Index of Castelli II	> 2,9 in women and > 3,3 in men
Risk escore of Framingham:	Low risk - probability < 10%
	Medium risk - probability in between 10% and 20%
	High risk - probability > 20%
	≥ 27.0 kg/m^2 for seniors
Blood pressure (mm/Hg)	Systolic blood pressure ≥ 140 mmHg and/or
	Diastolic blood pressure ≥ 90 mmHg and/or
	Use of antihypertensive medication
Total cholesterol (mg/dl)	≥ 200 mg/dl
HDL-cholesterol (mg/dl)	< 50 mg/dl in women and < 40 mg/dl in men
LDL-cholesterol (mg/dl)	≥ 130 mg/dl
Triglycerides (mg/dl)	≥ 150 mg/dl

HDL: High density lipoprotein; LDL: Low density lipoprotein; TG: Triglycerides; BMI: Body mass index.

The Kolmogorov-Smirnov test was used to check the normality of distribution of the variables. Differences between means of numerical variables of males and females were tested with the unpaired Student's t test. The Chi-square test ($\chi 2$) was used to compare categorical variables, for comparisons of age groups, which were divided into <50 years and ≥ 50 years. The significance level of $p < 0.05$ and 95% confidence intervals were adopted. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) in its twentieth edition.

III. RESULTS AND DISCUSSION

The total population studied in the Quilombola communities was 116 individuals, distributed in 69 (59.5%) women and 47 (40.5%) men. The median age of the population was 49.5 years. Means and standard deviations of risk indicators are presented in Table 2, where comparisons between men and women are also presented.

The means found for men were higher than those of women only in the Framingham Score; the other indicators (DBP, SBP, BMI, WC, TC, LDL, HDL, TG, TG/HDL-C ratio, Castelli indices I and II, FG and HbA1c) had higher means among. Of these, the difference in BMI, TC, LDL, Castelli I Index, FG and HbA1c means were statistically significant. In the comparisons between age groups under 50 and over 50, there was a high prevalence of cardiovascular risk in the older group. As to the indicators described in Table 3, the Framingham score, BP, WC, FG, TC, LDL, FG, Castelli Index I and Castelli Index II presented statistically significant difference between age groups.

The Framingham score showed that moderate risk was present in 25% of the individuals, and females corresponded to about 80% of the findings. Among those with moderate cardiovascular risk, 20.8% were men and 79.2% women. Moderate risk was present in 25.9% of the total population, and of these 46.7% were men and 53.3% women. Comparatively, men presented higher means, specifically 10.5 in contrast with 8.7 in women. It is worth noting that in the study, no one participant under the age of 50 presented high risk. Also, individuals under age 30 received a score of zero for age.

A mean BMI of 25.6 was found in the study. Most of the population (54.3%) was above the appropriate level. Regarding WC, the prevalence of people at risk was 54.3%, with a higher ratio in individuals over 50 years, 67% of those at risk. The present study revealed that the Quilombola communities of Lagoa de Maria Clemencia and Oiteiro present a moderate to high risk of developing CVDs. The indicators supporting this finding were the Framingham risk score, WC, FG, TC, LDL, TG, FG, Castelli Index I and Castelli Index II. Specifically regarding the Framingham score, approximately 48% of the study population had a moderate to high risk of developing a CVD within the next 10 years, which would lead to increased morbidity and mortality resulting from these diseases (MENDIS, 2011; D`AGOSTINO, 2008).

Table 2 – Average and standard deviation of general of cardiovascular risk indicators and according to sex.

	Average ± SD			
	General	Feminine	Male	p*
Age (years)	49.5 ± 16.4	49.6 ± 17.1	49.3 ± 15.5	0.912
Systolic blood pressure (mm/Hg)	126.6 ± 19.3	128.7 ± 20.6	123.5 ± 17.0	0.157
Diastolic blood pressure (mm/Hg)	79.8 ± 10.5	80.3 ± 11.0	79.0 ± 9.8	0.534
Risk score of Framingham	9.4 ± 8.3	8.7 ± 8.4	10.5 ± 8.2	0.247
BMI (kg/m2)	25.6 ± 4.1	26.6 ± 4.1	24.0 ± 3.6	0.001
Waisting circumference (cm)	85.2 ± 9.68	86.0 ± 9.6	84.0 ± 9.7	0.263
Total cholesterol (mg/dl)	181.2 ± 42.1	189.9 ± 43.6	168.5 ± 36.6	0.007
LDL-cholesterol (mg/dl)	118.9 ± 65.6	133.4 ± 71.6	97.5 ± 49.0	0.002
HDL-cholesterol (mg/dl)	50.6 ± 14.6	50.6 ± 12.0	50.53 ± 18.1	0.98
Reason TG/HDL-C	2.2 ± 0.86	2.3 ± 0.9	2.1 ± 0.8	0.108
Triglycerides (mg/dl)	106.9 ± 33.8	112.6 ± 35.2	98.5 ± 30.1	0.027
Index of Castelli I (CT/HDL-c)	2.6 ± 1.74	2.9 ± 1.9	2.15 ± 1.4	0.021
Index of Castelli II (LDL-c/HDL-c)	3.8 ± 1.11	3.9 ± 1.2	3.5 ± 1.0	0.052
Fasting blood glucose (mg/dL)	91.9 ± 31.1	95.7 ± 38.2	86.3 ± 14.1	0.064
HA1C	5.8 ± 1.2	6.0 ± 1.4	5.4 ± 0.6	0.006

* Student's T test comparing mean between sexes. BMI:body mass index; LDL: Low density lipoprotein, HDL: High density lipoprotein; CT: total cholesterol; TG: triglycerides

Serum lipid concentration is a major determinant of cardiovascular risk. High LDL and TC as well as low HDL serum concentrations predispose individuals to atherosclerotic disease (LIPSCHITZ, 1994). The risks inherent in changes in HDL, TC and LDL concentrations were present in 58.6, 31 and 31.9% of the total Quilombola population. Furthermore, the risk related to LDL and TC increased when individuals were stratified by age group, affecting the individuals aged 50 years or older. This may be related both to physical inactivity, because people in this age group tend to practice less physical exercise, and to the higher chance of hypertension and DM, which are closely linked to dyslipidemia, in this age group (SPOSITO, 2007). In the stratification by sex, the mean risks associated with TC and LDL were higher in women than in men. The prevalence of hypertension in women and men is known to differ significantly; in the former, hypertension gradually increases with age due to menopause. In this phase, there is also a decrease in estrogen, and this is an important factor for lipid metabolism and has a protective effect in cardiovascular function. Another important aspect is that women tend to

https://dx.doi.org/10.22161/ijaers.612.28 ISSN: 2349-6495(P) | 2456-1908(O)

exercise less than men. They are more sedentary, and this constitutes another risk factor for dyslipidemia (SILVA, 2002).

Other indices may add to the lipid analysis, including the Castelli Index I and Castelli Index II, which are useful in assessing the combined influence between risk factors. High values indicate that the individuals are more likely to have future CVDs (CASTELLI, 1983). In the study, both indices obtained values with $p < 0.005$ and CI > 95%.

The World Health Organization states that the BMI and WC are important predictors of CVD risk, either directly or indirectly, leading to the development of chronic diseases (WHO, 2000). When associated with dyslipidemia, SAH, DM, BMI and WC may increase the risk of acute myocardial infarction, stroke, among other CVDs (Lipshitz, 1994). More than half of the Quilombola population presented increased BMI and WC, especially individuals over 50 years old. Thus, these risks can be changed through encouraging these people to perform some physical activity, aiming to reduce physical inactivity and consequent high BMI and WC (WHO, 2000).

The Framingham criteria are a worldwide recognized means for stratifying cardiovascular risk. They allow predicting the likelihood of an individual acquiring a CVD within the following 10 years (D`AGOSTINO, 2008). According to these criteria, 20.7% of the population in this study had high cardiovascular risk and 25.9% moderate risk, among which women represented 80% of cases. In a cross-sectional study on the African continent in southwestern Nigeria, the rates of medium and high cardiovascular risk were 22.9%, and women represented 70.6% of the cases (OLUYOMBO, 2014). Thus, in this study, approximately 1 in 2-3 people had between 10 and 20% of chance of presenting a CVD in the next 10 years.

Table 3 – Frequency of cardiovascular risk indicators by second age range.

		Average ± SD			
		20-49 years	≥ 50 years	Total	p*
Blood pressure (mm/Hg)					<0.001
	High risk	41 (77.4%)	28 (44.4%)	69 (59.5%)	
	Low risk	12 (22.6%)	35 (55.6%)	47 (40.5%)	
Risk score of Framingham					<0.001
	Low risk	49 (92.5%)	13 (20.6%)	62 (53.4%)	
	Medium risk	4 (7.5%)	26 (41.3%)	30 (25.9%)	
	High risk	0 (0%)	24 (38.1%)	24 (20.7%)	
BMI (kg/m2)					0.769
	Normal	25 (47.2%)	28 (44.4%)	53 (45.7%)	
	Risk	28 (52.8%)	35 (55.6%)	63 (54.3%)	
Waist circumference (cm)					0.004
	Normal	32 (69.4%)	21 (33.3%)	53 (45.7%)	
	Risk	21 (39.6%)	42 (66.7%)	63 (54.3%)	
Blood glucose (mg/dL)					0.001
	High risk	49 (92.5%)	42 (66.7%)	91 (78.4%)	
	Low risk	4 (7.5%)	21 (33.3%)	25 (21.6%)	
Total cholesterol (mg/dl)					0.009
	Normal	43 (81.1%)	37 (58.7%)	80 (69.0%)	
	Risk	10 (18.9%)	26 (41.3%)	36 (31.0%)	
HDL-cholesterol (mg/dl)					0.267
	Normal	19 (35.8%)	29 (46.0%)	48 (41.4%)	
	Risk	34 (64.2%)	34 (54.0%)	68 (58.6%)	
LDL-cholesterol (mg/dl)					0.006
	Normal	43 (81.1%)	36 (57.1%)	79 (68.1%)	
	Risk	10 (18.9%)	27 (42.9%)	37 (31.9%)	
Triglycerides (mg/dl)					0.514

	Normal	49 (92.5%)	56 (88.9%)	105 (90.5%)	
	Risk	4 (7.5%)	7 (11.1%)	11 (9.5%)	
Index of Castelli I					0.032
	Normal	50 (94.3%)	51 (81.0%)	101 (87.1%)	
	Risk	3 (5.7%)	12 (19.0%)	15 (12.9%)	
Index of Castelli I					0.014
	Normal	21 (39.6%)	12 (19.0%)	33 (28.4%)	
	Risk	32 (60.4%)	51 (81.0%)	83 (71.6%)	

* Chi square test ($\chi2$). TG: triglycerídes; CT: total cholesterol; HDL: high density lipoprotein; LDL: low density lipoprotein; BMI: body mass index.

Another important aspect of CVD control is hypertension. This parameter alone is the main risk for CVDs. In the Brazilian population, the prevalence is 20 to 25% of the general population (BRASIL, 2014). However, in the study the prevalence was almost double (39.7%). A similar study was conducted to diagnose the prevalence of hypertension in Quilombola communities in the state of Sergipe. The result showed that 26% had hypertension (SANTOS, 2019). Thus, even in relation to other Quilombola communities, Lagoa de Maria Clemencia and Oiteiro have high rates of SAH cases. This may be directly related to the residents' lifestyle, low socioeconomic conditions, poor access to health, and also the black ethnicity (LEAL, 2011). The black ethnicity has a prevalence of hypertension approximately twice as higher as that found in the white population (LESSA, 2006).

Diabetes mellitus is a disease that increases by 3 times the risk of an individual to develop CVDs, mainly due to macro and microvascular complications and metabolic changes, typical of diabetic patients (MALERBI, 1992). Of all participants, 11.2% had DM. In comparison with Quilombola communities of Sergipe, whose prevalence was 9.23%, the percentage found in this study was higher (SANTOS, 2019). The FG measured in the study also had a higher correlation with older individuals (84%), and 21.6% of the participants had high glycemic levels. In contrast with other Quilombola community, this time from Maranhão, where there was a rate of 17.33% of hyperglycemia (> 100mg/dL), the indices shown in southwestern communities of Bahia (21.6%) were 4.27% higher (BARBOSA, 2015).

The present study has some limitations, including the moderate adherence of the community. Only approximately 30% of the community underwent examinations. Thus, there is a chance of selection bias because it is more common that unhealthy individuals seek to participate in the study with the objective of finding a diagnosis. The distance of collection sites, where samples were collected for the exams, in the case of some more distant residences, despite the fact that there were two collection points, was also an important factor leading to low adherence. A low socioeconomic level was identified in the study and this may have also interfered with the collection of exams, because, although informed about the ideal time of collection, some individuals did not have enough food and spent 10 hours fasting. Despite these variables, very few studies have evaluated cardiovascular risk indices in Quilombola communities.

ACKNOWLEDGMENT

This work was supported by grants from the Fundação deAmparo a Pesquisa do Estado da Bahia (FAPESB) and Conselho Nacional de Desenvolvimento Científico Tecnológico (CNPq).

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