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Research Article

Physical Activity and Cardiovascular Risk Factors among Sellers at Congolenses Market in Luanda, Angola

Henrique Cotchi Simbo Muela[1]*, Dingameno Afonso Sebastião[2], Crislaine Catarina Ntonha Teixeira[2], Cristela Mayamba Domingos Isidor[2], Diana de Jesus do Amaral Gourgel Malamba[2], Divina Lemba Augusto[2], Daniela Segunda Sebastião[2], Cláudio Domingos Moniz[2], Daniela Capingana Cassoma[2], Dizolele Vilolo Sebastião[2], Dany Xavier Almeida[2], Capela António Dicazeco Pascoal[2], Carlos Mateus Lucamba[2], Dinis Suca Manda[2], Mujimbi José Viana[1] and Isaura da Conceição Almeida Lopes[1]

[1]*Department of Physiology, Faculty of Medicine, Agostinho Neto University, Luanda, Angola*

[2]*Medical Student, Faculty of Medicine, Agostinho Neto University, Luanda, Angola*

***Corresponding Author:** Henrique Cotchi Simbo Muela, Department of Physiology, Faculty of Medicine, Agostinho Neto University, (Américo Boa Vida Hospital Backyard), Luanda, Angola.

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Abstract

Introduction: At least two-thirds of cardiovascular deaths currently occur in low- and middle-income countries, bringing a double burden of disease to poor and developing world economies. Hypertension (HTN) is by far the commonest underlying risk factor for cardiovascular disease and increasing physical activity prevents hypertension.

Objective: To assess physical activity and blood pressure levels among sellers of the Congolenses market in Luanda, Angola.

Methodology: A cross-sectional study was carried out with a sample including 296 individuals (198 men and 98 women). Anthropometric and clinical data, clinical history of CVD, tobacco and alcohol consumption were collected. Physical activity was assessed by the International Physical Activity Questionnaire (IPAQ). The t-test for independent samples and Mann-Whitney test were used to compare variables between the groups. Bivariate correlation and multivariable analysis were performed to evaluate the association between the variables. Statistical significance was set at 5%.

Results: The two groups were similar for most variables, except for the age group in which group 1 (sedentary and irregularly active) had higher mean age compared to group 2 (37.2 ± 11.1 vs. 34.1 ± 10.2, $p = 0.018$). Among all hypertensive patients (95 out of 296 participants, 32.1%), only 43 (45.3%) were aware of their condition and of them 21 (48.8%) were taking medication and only 7 (33.3%) had their blood pressure under control. There was a negative correlation between physical activity and the blood pressure level with group 2 showing lower BP levels.

Conclusion: Lower levels of physical activity were associated with higher blood pressure levels among sellers at the market.

Keywords: *Physical Activity; Blood Pressure Levels; Risk Factors; Cardiovascular; Sellers; Market*

Introduction

Globally, hypertension is the leading risk factor for morbidity and mortality, causing an estimated 9.4 million deaths in 2010 [1]. Lifestyle factors, including physical inactivity, are important modifiable risk factors in the development of hypertension. In addition to standard anti-hypertensive therapy, the benefits of physical activity on hypertension and cardiovascular disease have been well established [2-4]. Accordingly, physical activity and other lifestyle modifications are important components of American, European, and World Health Organization guidelines for anti-hypertensive therapy [5-7].

Over the last years, it has become evident that lifestyle factors, such as physical activity, are related to development of noncommunicable diseases, particularly cardiovascular disease. Physical activity has been reported to be inversely associated with blood pressure [8], lipid profiles [9], obesity [10] and insulin sensitivity [11]. As noncommunicable diseases are rapidly emerging to replace communicable diseases in developing countries, few studies have described physical activity and its relationship to cardiovascular disease and its risk factors in these countries. Studies in Mauritius [12] reported that physical activity had a significant protective effect on risk factors for cardiovascular disease and diabetes in Asian Indian, Creole, and Chinese in Mauritius. Similar evidence of the association between physical activity and cardiovascular risk factors is currently scarce for black populations in Africa. In a study about the relationship of physical activity to cardiovascular risk factors, Oyeyemi AL., *et al*. [13], found that physical activity level of the working population of Nigerian adults was low and was related with adverse risk factors for CVD.

In the present study we aim to evaluate the physical activity and blood pressure levels and associated cardiovascular risk factors among sellers at the Congolenses market in Luanda, Angola.

Methods

Study sample: This cross-sectional study was carried out among sellers from the informal market at Luanda (Congolense's Market), in August 2019. Invitation was addressed to all sellers through the market administration and all those who accepted to participate were included. The protocol and consent form were approved by the institutional review board of the Department of Physiology, Faculty of Medicine, Agostinho Neto University and all participants gave written, informed consent. Participants with the following conditions were excluded: aged <18 years, pregnant women and not being a regular seller in the market.

Procedures: Data were collected during two morning visits at the work place provided by the market administration. All participant gave their written informed consent; demographic and physical activity interviews were conducted, and clinical measurements were taken. Clinical data included weight, height, blood pressure levels, waist circumference and hip circumference, history of diabetes, previous stroke and myocardial infarction, dyslipidemia, smoking and alcohol consumption.

Measures

Physical activity levels were estimated by the short form International Physical Activity Questionnaire (IPAQ-SF). The IPAQ-SF has been recommended for population prevalence studies, where time is limited, because it is easier and more feasible to complete than the long form. The IPAQ questionnaire is an internationally used instrument to classify individuals according to the level of physical activity practice considering the last week in relation to the evaluation date [14]. For this purpose, vigorous physical activities are considered to be those that require a great deal of physical effort and that make breathing much more than normal; moderate physical activities are those that need some physical effort and that make breathing a little stronger than normal. According to the level of physical activity classification, participant were grouped into: 1) Very active - those who fulfilled recommendations of ≥ 5 days/week of vigorous activities and ≥ 30 minutes per session or ≥ 3 days/week of rigorous activities and ≥ 20 minutes per session + Moderate and/or Walk ≥ 5 days/week and ≥ 30 minutes per session; 2) Active - those who fulfilled recommendations of ≥ 3 days/week of vigorous activities and ≥ 20 minutes per session or moderate or walk ≥ 5 days/week and ≥ 30 minutes per session or any added activity ≥ 5 days per week and ≥ 150 min per week (walking + moderate + vigorous); 3) Irregularly active - those who perform physical activity but insufficient to be evaluated as active as it does not comply with the recommendations regarding frequency or duration. In order to carry out this classification, the frequency and duration of the different types of activities are added (walking + moderate + vigorous) and 4) sedentary - those with no physical activity occurring for at least 10 minutes. For the purposes of statistical analysis, the irregularly active and sedentary groups were joined as group 1 and the very active and active as group 2.

Both height and weight were measured with an electronic balance (SECA Medical 769 column scale, Germany). Waist circumference was measured at the narrowest point or at the umbilicus if no narrowest point existed with an inextensible measuring tape. Hip circumference was measured at the widest part of the buttocks. All measurements were made with light clothes on and shoes off. Body mass index (BMI) was calculated by the following formula: weight (kg)/height (m^2); the waist-hip ratio (WHR) was expressed as the ratio of waist circumference to hip circumference.

BP measurement

Brachial systolic blood pressure (SBP) and diastolic blood pressure (DBP) was assessed with an Omron automatic device (HEM-7131-E model) on the right upper arm, with the subject seated, after resting for 5 minutes following the recommendations of the 2018 European HTN guidelines [6]. A mean of 3 measurements with a 1-minute interval between was calculated and used to determine SBP and DBP in each patient and the average of the three blood pressure readings was used for this study analysis. Hypertension was defined as SBP and/or DBP ≥ 140/90 mmHg or current use of antihypertensive drugs. Controlled hypertension was defined as blood pressure < 140/90 mmHg under antihypertensive drugs.

Statistical analysis

Data were analyzed with SPSS for Windows 21.0 (IBM Corporation). Data distribution was determined using the Kolmogorov-Smirnov test. Continuous variables are presented as mean and standard deviation or as median and range if they were not normally distributed and they were analyzed by the independent samples *t* test and Mann-Whitney test when suitable. Categorical data are presented as percentages. Pearson's coefficient was used for bivariate correlations between anthropometric variables, physical activity and arterial blood pressure and multivariate step-wise analysis was performed to determine the variables associated with blood pressure. Statistical significance was set at 5%.

Results

In August 2019, a cross-sectional study was carried out including 296 individuals (men: 198 and women: 98) at the informal Market of Congolenses in Luanda, Angola.

The general characteristics of the sample according to the physical activity level are presented in the table 1. The groups were similar to the majority of variables, except the age, where the group 1 (sedentary and irregularly active) had a higher age mean in comparison to the group 2 (active and very active). Significantly statistical differences were also registered in the variable having his own place at the Market, with the group 1 being composed mostly with people who owned a place in the Market.

The correlations between anthropometric, physical activity and blood pressure are presented in table 2. The data showed that age,

Characteristic	Group 1 (n = 112)	Group 2 (n = 184)	P value
Age (years), mean ± SD	37.18 ± 11.11	34.11 ± 10.16	0.018
Weight (Kg), mean ± SD	70.76 ± 14.42	70.29 ± 14.28	0.784
Height (m), mean ± SD	1.68 ± 0.09	1.68 ± 0.10	0.607
BMI (kg/m^2), mean ± SD	24.97 ± 4.80	25.01 ± 4.85	0.950
Gender			
Male, n (%)	75 (67.0)	123 (66.8)	0.984
Female, n (%)	37 (33.0)	61 (33.2)	
Race			
White, n (%)	1 (0.9)	1 (0.5)	0.722
Black, n (%)	111 (99.1)	183 (99.5)	
WC (cm), mean ± SD	85.55 ± 14.77	85.10 ± 13.53	0.791
HC (cm), mean ± SD	98.42 ± 11.11	96.15 ± 15.01	0.139
Waist-to-Hip ratio, mean ± SD	0.87 ± 0.11	0.92 ± 0.71	0.186

Schooling (education level)			
Illiterate, n (%)	2 (1.8)	7 (3.8)	0.752
Primary school, n (%)	36 (32.1)	57 (31.0)	
High school, n (%)	49 (43.8)	83 (45.1)	
Univertisy, n (%)	25 (23.3)	37 (20.1)	
Schooling (completed years)	9.86 ± 4.20	9.53 ± 4.11	0.778
Marital status			
Married, n (%)	37 (33.0)	63 (34.2)	0.620
Single, n (%)	67 (59.8)	113 (61.4)	
Divorced, n (%)	5 (4.5)	4 (2.2)	
Widow, n (%)	3 (2.7)	4 (2.2)	
SBP (mmHg), mean ± SD	127.36 ± 18.85	126.49 ± 19.29	0.701
DBP (mmHg), mean ± SD	80.16 ± 12.11	79.30 ± 13.97	0.578
PP (mmHg), mean ± SD	47.20 ± 11.21	47.18 ± 10.49	0.989
HR (bpm), mean ± SD	75.79 ± 10.38	76.00 ± 10.96	0.867
HTN (aware), n (%)	14 (12.5)	29 (15.8)	0.441
Diabetes (aware), n (%)	4 (3.6)	3 (1.6)	0.287
Dyslipidemia (aware), n (%)	2 (1.8)	6 (3.3)	0.449
Smoking, n (%)	20 (17.9)	33 (17.9)	0.987
Alcohool consumption, n (%)	59 (52.7)	77 (41.8)	0.070
Previous stroke, n (%)	1 (0.9)	6 (3.3)	0.194
Previous MI, n (%)	1 (0.9)	7 (3.8)	0.135
Has his(her) own place in the market			
Yes, n (%)	84 (75.0)	111 (60.4)	0.010
No, n (%)	8 (7.1)	19 (10.3)	
Hawker, n (%)	20 (17.9)	54 (29.3)	

Table 1: *General characteristics of the sample according to the group of physical activity level.*
Abbreviations*: WC: Waist Circumference; HC: Hip Circumference; HR: Heart Rate; HTN: Hypertension; MI: Myocardial Infarction; BMI: Body Mass Index; IPAQ: International Physical Activity Questionnaire; DBP: Diastolic Blood Pressure; SBP: Systolic Blood Pressure; PP: Pulse Pressure; WHR: Waist-to-Hip Ratio. P values refer to mean or proportions comparisons between the groups by independent t-test or Mann-Whitney test.*

weight, BMI, waist circumference, hip circumference and waist-to-hip ratio positively correlated with blood pressure. Conversely, physical activity level had negative correlation with blood pressure levels.

	Age		Weigh		Height		BMI		WC		HC		WHR		IPAQ	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
SBP	0.36	<0.001	0.35	<0.001	0.09	0.104	0.32	<0.001	0.41	<0.001	0.29	<0.001	0.28	<0.001	-0.03	0.671
DBP	0.46	<0.001	0.33	<0.001	-0.07	0.245	0.42	<0.001	0.48	<0.001	0.38	<0.001	0.31	<0.001	-0.06	0.307
PP	0.14	0.017	0.18	0.002	0.20	0.001	0.06	0.348	0.13	0.025	0.04	0.480	0.11	0.056	0.01	0.832
HR	0.09	0.110	0.08	0.161	-0.13	0.030	0.19	0.001	0.17	0.005	0.12	0.037	0.19	0.001	0.01	0.837

Table 2: *Correlations between anthropometrics variables, physical activity level and blood pressure.*
Abbreviation: *BMI: Body Mass Index; DBP: Diastolic Blood Pressure; HC: Hip Circumference; HR: Heart Rate; IPAQ: International Physical Activity Questionnaire; SBP: Systolic Blood Pressure; PP: Pulse Pressure; WC: Waist Circumference; WHR: Waist-to-Hip Ratio.*

In the multivariable analysis (Table 3), age, weight, height and waist circumference were the main predictors for higher levels of blood pressure.

Variable		Parameter	
	B	CI of 95% for B	p
		SBP	
Age	0.622	0.431 - 0.812	< 0.001
Weight	0.292	0.151 - 0.434	< 0.001
		DBP	
Age	0.330	0.188 - 0.472	< 0.001
WC	0.276	0.168 - 0.384	< 0.001
		PP	
Age	0.283	0.167 - 0.398	< 0.001
Height	24.955	12.424 - 37.486	< 0.001

Table 3: *Multivariable linear regression analysis with anthropometric, physical activity and eating habits as independents variables and blood pressure levels as dependent variables.*
Note: *B - Indicates unstandardized model coefficients to indicate how much the dependent variable varies with an independent variable when all other independent variables are held constant. Consider the effect of age in this example. The unstandardized coefficient, B1, for age is equal to 0.622. This means that for each 1-year increase in age, there is an increase on 0.622 mmHg in systolic blood pressure; DBP: Diastolic Blood Pressure; HC: Hip Circumference; PP: Pulse Pressure; SBP: Systolic Blood Pressure; WC: Waist Circumference.*

Among all hypertensive patients (95 out of 296 participants, 32.1%), only 43 (45.3%) were aware of their condition and of them 21 (48.8%) were taking medication and only 7 (33.3%) had their blood pressure under control defined as blood pressure < 140/90 mmHg (Figure 1).

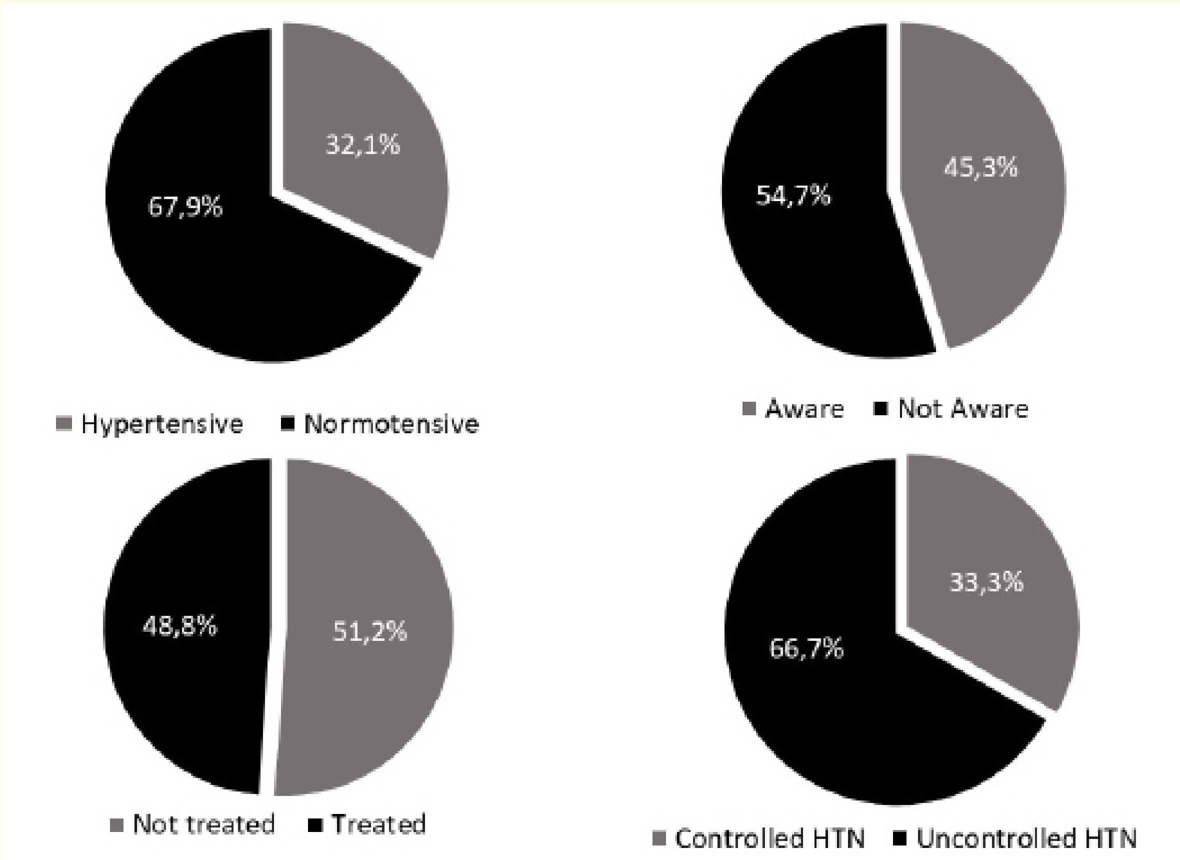

Figure 1: *Prevalence, awareness, treatment and control of hypertension.*

Discussion

The most important findings of the present study are: a) about one third of patients (32.1%), that is, about 1 in 3 people evaluated was hypertensive; b) the increase in age, weight, BMI, waist circumference, hip circumference and waist-to-hip ratio were associated with higher blood pressure levels; c) there was a negative correlation between the physical activity and blood pressure levels and d) the alcoholic beverages consumption was high.

The data from our study indicate a high prevalence of some risk factors such as hypertension, overweight/obesity and alcohol consumption. The hypertension awareness was low and most patients being treated did not have their blood pressure under control.

The prevalence of hypertension registered in our study (32.1%) is slightly above those reported in similar studies carried out in different regions of the country, although it is closer to the prevalence found in the largest study ever made in the country [15-17]. In their study carried out in the province of Bengo, Pires., *et al*. [15], reported a prevalence of hypertension (SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg) of 23% (95% CI: 21% - 25.2%). Among hypertensive individuals, 21.6% were aware of their condition and only 13.9% of them were taking antihypertensive drugs, and approximately one third had blood pressure under control. On the other hand, Simão., *et al*. [16], found a hypertension prevalence of 23.5% in a sample of 667 mostly young people. Victória-Pereira., *et al*. [17], in their study involving

17,481 individuals evaluated in six provinces of Angola, the prevalence of hypertension was 34.5%. In this study, among the individuals who did not take any medication, 26.3% were hypertensive and of those receiving antihypertensive treatment, 59.7% did not have their blood pressure under control.

In developing countries, evidence suggest that the impact of hypertension today is very high and is exacerbated in black people mainly due to low levels of awareness and control of hypertension, onset of the disease at an ever younger age, and a course of the disease potentially more aggressive [18,19]. A rapid and pragmatic measure to deal with this reality is to increase the screening campaigns for diseases such as hypertension, diabetes and dyslipidemia.

Our data also indicated that the prevalence of overweight/obesity was high (41.6%), with the variables related to obesity showing a great correlation with the increase of blood pressure levels. Obesity coexists with a wide variety of cardiovascular risk factors and has been linked to increased cardiovascular risk in a wide range of observational studies [20].

Data from the Framingham study have shown that both overweight and obesity are strongly related to the risk of hypertension in both men and women. The relative risk (RR) ranged from 1.5 to 1.7 for overweight and 2.2 to 2.6 for obese people [20]. The corresponding joined estimates of the population-attributable risk (PAR) were greatly increased, and the BMI of 25 kg/m^2 or more accounted for approximately 34% of hypertension risk in men and 62% of hypertension in women. Other factors, especially excessive of alcoholic beverages consumption and estrogens in women, have been shown to increase the risk of hypertension, but the impact on the population is less because the prevalence of each factor is low [21,22].

The consumption of alcoholic beverages in our study was high, being higher in men compared to women. Evidence indicate that alcohol abuse is a powerful cardiovascular risk factor, one of the strongest risk for atrial fibrillation and at least equivalent to the established risk factors for AMI and heart failure [23].

The possible effects of alcohol consumption on blood pressure continue to raise interesting debates. A study of New York residents [24] found no consistent association between alcohol consumption and risk of hypertension in North American consumers of beer, wine or spirits. In a cross-sectional study of Chinese men that examined the association between alcohol consumption and isolated systolic hypertension, isolated diastolic hypertension and the combination of systolic and diastolic hypertension, found that in those with higher consumption (≥ 30 drinks/week) had twice as high risk of having hypertension than non-consumers, with the population-attributable risks of 13.8%, 12% and 13.4% respectively [25]. Another study that grouped Japanese men based on total consumption of beer, sake, shochu (traditional Japanese drink), whisky or wine [26] showed that blood pressure was higher in the shochu group, but once adjusted analysis for the total alcohol consumed the difference disappeared.

However, some studies suggest that the effects of alcohol on lipids and insulin sensitivity may account for a large proportion of the lower risk of CVD/mortality seen with moderate alcohol consumption under the assumption that the alcohol-CVD association is causal. Djoussé., *et al*. [27], found a J curve in the relationship between alcohol consumption and the incidence of CV disease, total and cardiovascular mortality in multivariate models.

Our data also showed a negative correlation between the level of physical activity and blood pressure levels, with lower levels of blood pressure being registered in the most active group, although there was no statistical significant difference between groups and the correlations were weak.

The WHO has developed a series of recommendations based on risk factors to prevent and control disease [28]. Increased physical activity is one of those recommendations because it is considered to be a highly accessible, inexpensive and effective intervention. Data from large prospective studies in American population including the Nurses' Health Study II, the Aerobics Center Longitudinal Study (ACLS), and the Coronary Artery Risk Development in Young Adults (CARDIA) study showed that self-reported physical activity is inversely associated with the development of hypertension [29-31]. Similarly, data from the CARDIA and ACLS studies showed that cardiorespiratory fitness is inversely associated with the development of hypertension [30,31]. Inverse associations between physical activity and/or cardiorespiratory fitness and incidence of hypertension have also been reported among several international population studies in Britain, China, Denmark, France, Italy, Korea, Saudi Arabia and Thailand in recent years [32-39].

Limitations of the Study

This study is not exempt from the limitations of cross-sectional studies. The prevalence of some risk factors, such as diabetes and dyslipidemia, cannot be measured properly since it was not possible to measure the glucose and lipid profile of the participants. The consumption of alcoholic beverages, although it was high, it was not possible to quantify the consumption and have a more accurate measure. The association between the different variables does not imply any cause-effect relationship and the data must be confirmed by longitudinal studies.

Conclusion

Lower levels of physical activity were associated with higher blood pressure levels among sellers at Congolenses market in Luanda, Angola.

The prevalence hypertension and associated risk factors such as overweight/obesity and alcohol consumption was high; there was a positive correlation between blood pressure levels with age, weight, height, BMI, waist circumference, hip circumference and negative correlation with the level of physical activity; the variables that were most associated with elevated blood pressure were: age, weight, waist circumference and height.

Conflict of Interest

The authors declare no conflicts of interest and that no funds were received for the preparation of this article.

Author Contributions

Muela HCS: Designed and performed research, analyzed data and wrote the manuscript; Sebastião DA, Teixeira CCN, Isidoro CMD, Malamba DAG, Augusto DL, Sebastião DS, Moniz CD: Performed research and analyzed data; Cassoma DC, Sebastião DV, Almeida DX, Pascoal CAD, Lucamba CM, Manda SM: Performed research; Viana MJ, Lopes ICA: Reviewed and contributed with comments.

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