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What is the best anthropometric predictor for identifying higher risk for cardiovascular diseases in afro-descendant Brazilian women? A cross-sectional population-based study

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Abstract

Objectives: Excessive adiposity is associated with cardiovascular disease (CVD). Anthropometric indices are useful in screening individuals at higher risk for these diseases. However, there are no studies that show which of these indices has the best discriminatory power among Afro-descendant Brazilian women. The objective of this study was to assess the accuracy of anthropometric indices in identifying risk factors for CVD in Afro-descendant Brazilian women and define the one most suitable for use under the operating conditions prevailing in Quilombola communities.

Methods: A household random sample of 1661 women descendants of African slaves were analyzed. The anthropometric predictors analyzed were waist circumference (WC), body mass index, waist-to-height ratio, conicity index (C-index), body shape index, and percentage of body fat (%BF; estimated by bioimpedance). The assessed risk factors for CVD were arterial hypertension, diabetes mellitus, and dyslipidemias (hypertriglyceridemia; hypercholesterolemia; low high-density lipoprotein). To identify the statistical significance between the differences in the areas under the ROC curves (AUC) obtained with the different predictors and outcomes, was used the Bonferroni test adjusted for multiple analyses by the Sidak method.

Results: The AUC obtained with WC was higher ($p < .05$) or similar ($p > .05$) to those obtained with the other predictors 29 times out of 30 possibilities

(six predictors x five outcomes). Only the AUC obtained with C-index in identifying hypercholesterolemia was significantly higher than that with WC.
Conclusion: Due to its accuracy and greater operational simplicity, WC was the most adequate predictor for identifying Afro-descendant women at greatest risk for CVD.

1 | INTRODUCTION

The prevalence of chronic noncommunicable diseases (NCDs) has increased in recent decades. Three out of every five deaths that occur worldwide are due to one of the four most important NCDs, including cardiovascular disease (CVD) (Hajat & Stein, 2018). Among the various risk factors, obesity is considered as one of the main determinants of CVD (World Health Organization, 2020). Excess body fat is strongly associated with diabetes, hypertension, and dyslipidemia. Thus, the early identification of individuals at higher risk for CVD is very important for planning actions that contribute to the reduction of the incidence of these diseases (World Health Organization, 2000).

Excessive accumulation of body fat is reflected as an excess of body weight. However, not every overweight individual is obese, which is why the accurate diagnosis of obesity depends on the assessment of body composition, especially by determining the percentage of body fat (%BF). For this assessment, there are quite accurate methods, which are laboratory-based and very expensive (Lee & Gallagher, 2008), restricting their use in epidemiological studies and even in clinical practice, particularly in settings where healthcare resources are very limited. Given this limitation, anthropometry represents a good alternative due to its noninvasive and easy-to-perform nature, low cost, and good precision and accuracy (World Health Organization, 1995).

Among the anthropometric indices most used in epidemiological studies to identify obesity or the pattern of body fat distribution are the body mass index (BMI) and waist circumference (WC) (World Health Organization, 2000). Other indices were developed with a combination of anthropometric measures and include the conicity index (C-index), the waist-to-height ratio (WHtR), and the body shape index (ABSI) (Haun et al., 2009; Krakauer & Krakauer, 2012; Valdez, 1991).

Despite its high correlation with body fat, BMI does not discriminate body composition and does not define the pattern of fat distribution, whether visceral or subcutaneous (World Health Organization, 2000). This information is important because visceral fat is related to metabolic disorders such as insulin resistance, increased levels of blood pressure (BP) and dyslipidemia (World Health Organization, 2000; World Health Organization, 2008). To overcome this limitation, BMI has been used in association with WC. However, these measures are strongly correlated (He & Chen, 2013; Thomson et al., 2016; Tian et al., 2016). In the case of a disease predictor, the concomitant use of measures that have a high correlation among themselves may not present an additional advantage to their use individually (Vieira, 2008).

Specifically concerning ABSI, first proposed in 2012, its accuracy has never been tested in studies involving a representative sample of the Afro-descendant Brazilian population. ABSI was created using allometric analysis, aiming to assess the relationship that exists between changes in certain parts of the body. Thus, it consists of assessing the impact of central body volume in relation to body size, using height, mass, and WC measurements and optionally normalized for sex and age. In this sense, ABSI could overcome some of the above concerns by taking into account the distribution of body fat, since it incorporates WC in its definition, but has little or no correlation with BMI (Krakauer & Krakauer, 2012).

In Brazil, blacks are distinguished from the rest of the population because they are at the lowest socioeconomic levels. Within the black population, the Quilombola population is characterized by even greater social vulnerability. This is a large segment of the black population, formed by communities originated from the group of slaves of African origin who, at the time of slavery, fled the farms and took refuge in remote areas, forming the so-called Quilombola communities. These were organized to maintain their cultural traditions and resist the persecutions imposed by the State and established farmers. After the end of slavery, many individuals remained and still currently live in these locations (Cadernos de Estudos Desenvolvimento Social em Debate, 2014). Due to social exclusion and institutional racism, still in effect presently, and exposure to a greater number of risk factors, the Quilombola population is more susceptible to the development of NCDs when compared to the general population of the country (Ferreira et al., 2013).

However, although several studies have previously investigated all the above-mentioned anthropometric indices as predictors of health problems, only a few were conducted specifically in the Brazilian population segments of African ancestry. Thus, it is not known which of the anthropometric indices have the best discriminatory power among Afro-descendant Brazilian individuals.

This information is important because race/ethnic differences in body composition (Heymsfield et al., 2016). A study that compared Quilombola (n = 1631) and non-Quilombola (n = 1098) women from the state of Alagoas, Brazil, concluded that the former were at greater risk of abdominal obesity and hypertension, making them especially vulnerable to morbidity and mortality from CVDs, which justifies prioritizing them regarding the implementation of preventive measures (Ferreira et al., 2013).

This study aimed to compare the capacity of different anthropometric and body composition indicators as predictors of CVD risk factors, including arterial hypertension (SAH), diabetes mellitus (DM), hypertriglyceridemia, hypercholesterolemia, and low high-density lipoprotein (HDL), in Afro-descendant Brazilian women living in Quilombola communities. Considering the lesser access and the precarious infrastructure of the health services available, our goal was to define the most suitable measure for use under the operating conditions prevailing in the Quilombola communities.

2 | MATERIALS AND METHODS

This is a cross-sectional study, integrated with a broader project to assess the nutrition status and health of the maternal and child population of the remaining Quilombola communities in the state of Alagoas, Brazil. The study was approved by the Research Ethics Committee of the Federal University of Alagoas (CAAE: 33527214.9.0000.5013). Data collection was performed only when there was formal consent from the participant by signing the Informed Consent Form after all procedures were thoroughly explained to the participants.

3 | STUDY AREA AND SAMPLE PLANNING

The target population of the study were women aged 19–59 years living in Quilombola communities in Alagoas, which is 1 of 27 Brazilian states (including the Federal District, where is located Brasilia, capital of the country). Brazil is a country of continental dimensions, with more than 200 million inhabitants, 80% of whom live in urban areas. The 27 states of Brazil are grouped into five regions: North, Northeast, Midwest, Southeast, and South. The Northeast region, in which the state of Alagoas is located, is considerably poorer in relation to the South and Southeast regions. The state has about 3 358 963 inhabitants distributed in 102 municipalities. Among these, in 35 there are quilombola communities. Figure 1 illustrates the distribution of these communities in the different municipalities of Alagoas.

For the calculation of the sample size, the prevalence of 50% was assumed for the outcome of interest, considering that this is the value that results in the largest possible sample size. This procedure is recommended when there are no estimates based on previous studies, as well as when working with multiple outcomes, as in the case of the present investigation. To define the universe of the study, it was considered that for each household of the target population there would be a woman. According to official data available at the time of the survey, there were 6465 households in the Quilombola communities of Alagoas (Alagoas, 2015). Assuming a margin of error of 2.5 and 1.3% for correction of the complex design effect, 1614 women would be required, according to calculations made in the StatCalc module of the Epi-info software, version 7.2.1.0. Additionally, 15% was added to this number to compensate for possible sample losses, making a total sample target of 1856 participants.

To obtain the planned sample, it was established to investigate women residing in 50% of Quilombola communities in the state. Using the systematic sampling strategy, 34 communities were drawn from the existing 68, which are distributed in 27 of the 102 municipalities in Alagoas, the majority located between the Agreste and the Sertão of Alagoas.

In the present study, women aged 19–59 years were considered eligible. When there was more than one woman in the household who met the inclusion criteria, the selection was made by a simple draw. Pregnant, postpartum and lactating women were not included, as well as those who had low stature (below 1.40 m) (Kliegman et al., 2016), and ones who had ingested alcoholic beverages in the previous 24 h or who had any physical condition that compromised the anthropometric assessment.

4 | DATA COLLECTION AND ANALYZED VARIABLES

Data collection took place from April 2017 to January 2018 and was carried out in the household of the participants by a properly trained and supervised team. Through home visits, interviews were conducted with the participants following a protocol established in previously tested forms in a pilot study.

During training, each anthropometrist obtained the measures of interest in at least 10 women, who were also

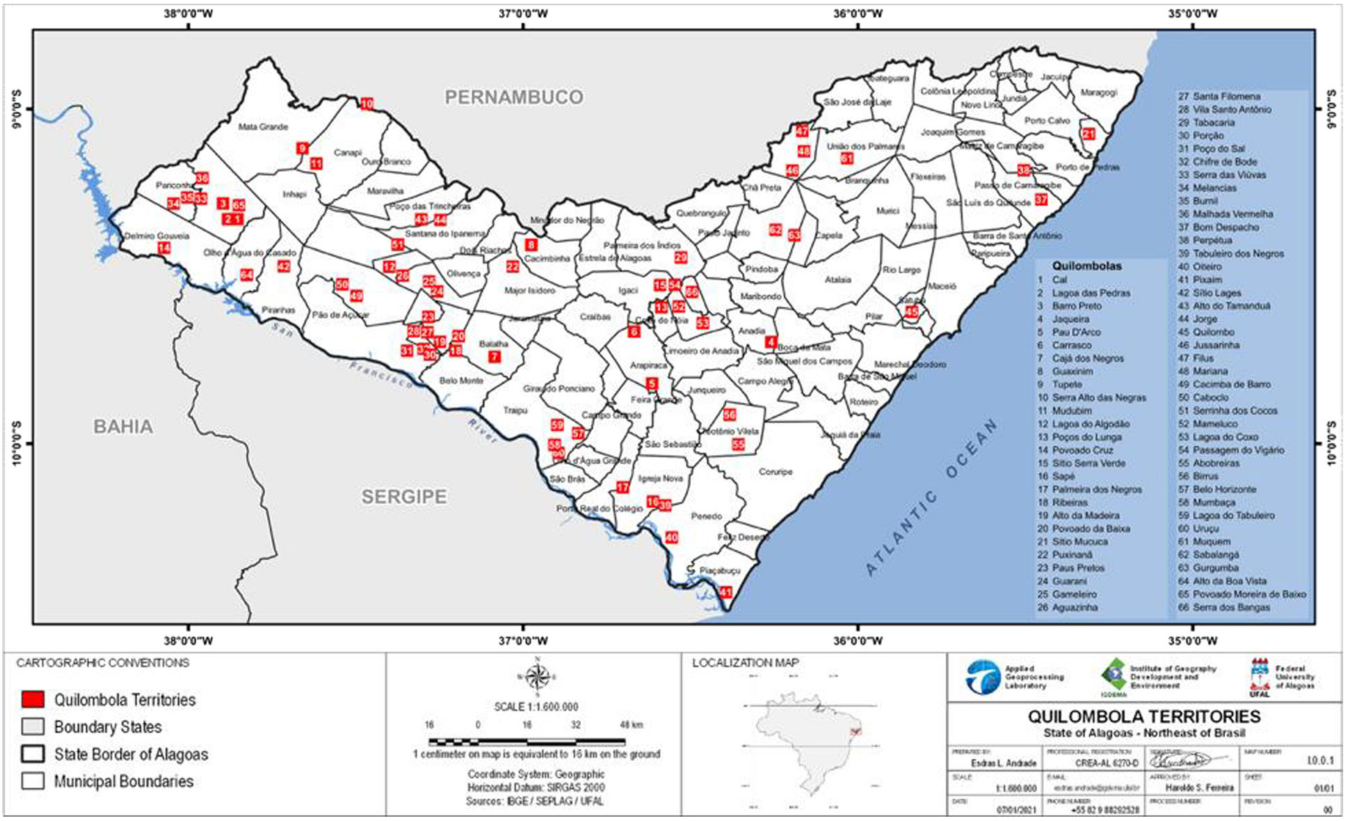

FIGURE 1 Locations of Quilombola communities in different municipalities in the state of Alagoas (Northeast Brazil). Numbered red squares indicate the location of Quilombola communities. *Source*: Department of Planning, Management and Heritage, Government of the State of Alagoas. Adapted by the Applied Geoprocessing Laboratory of the Institute of Geography Development and Environment, Federal University of Alagoas

examined by an experienced researcher (standard measure). If there was a discrepancy greater than the minimum scale unit of the equipment (100 g for body mass and 1 mm for height or perimeter measurements), the respective measurements were repeated and errors discussed. Each anthropometrist was considered trained and qualified for the work when he/she could reproduce the 10 measurements without exceeding the maximum admitted error. For quality control, during the survey, the supervisor reproduced about 10% of the measurements taken by the team, promoting the proper correction whenever necessary.

The economic classification was established according to the criteria proposed by the Brazilian Association of Research Companies (ABEP), which consists of a point system obtained by the sum of the presence of certain consumption items (bathroom, automobile, refrigerator and others), water availability (whether plumbing or not), type of street where the house was located (whether paved or not) and the level of education of the head of the family. In this system, families are classified in descending order of economic level, in classes A, B1, B2, C1, C2, and D + E (ABEP, 2016). The analysis was done in a dichotomous way, grouping the families according to two categories: B + C; D + E (no family fell into class A).

The risk factors for CVD investigated were SAH, DM, hypertriglyceridemia, hypercholesterolemia, and low HDL. BP measurements were performed to identify SAH, while DM and dyslipidemia were identified by the biochemical determinations of glycated hemoglobin (HbA1c) and triglycerides, low-density lipoprotein (LDL) and HDL, respectively.

The BP measurement was performed twice, on the left arm, with the participant seated, after 15 min of rest and with cuffs of adequate size for the arm circumference, using an Omron® device, model HEM-7200. A minimum interval of 5 min was respected between measurements. In the event of a difference of more than 20 mmHg between the two measurements, a third one was performed. In this case, for the calculation of the average, the most discrepant measure was disregarded. Women who had mean systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (BPD) ≥90 mmHg or were using antihypertensive medication were classified as hypertensive (Associação Brasileira de Medicina Diagnóstica et al., 2016).

Biochemical analyses were conducted on a drop of blood obtained by puncture of the digital pulp, regardless of being in the fasting state or not (de Medicina Diagnóstica et al., 2016). These determinations were performed on Alere Cholestech LDX System devices except for HbA1C, which was performed in Alere NycoCard Reader II. DM was established by HbA1c level ≥ 6.5% or the use of hypoglycemic drugs (Oliveira et al., 2017). For dyslipidemia, the following criteria were adopted: hypertriglyceridemia (triglycerides ≥175 mg/dl), hypercholesterolemia (LDL≥160 mg/dl) and low-HDL (HDL < 50 mg/dl) (Faludi et al., 2017).

The %BF was estimated by bioelectrical impedance using a portable device (Omron, model HBF-306). The adopted procedures followed the recommendations indicated by the manufacturer. Obesity was defined when the participant had %BF ≥30 (Gallagher et al., 2000).

Anthropometric data were collected following internationally standardized protocols (World Health Organization, 1995). For the measurement of body mass, a Seca portable digital scale (model 813) with capacity of 200 kg and accuracy of 100 g was used. Stature was measured using a Seca stadiometer (model 213) with subdivisions of 0.1 cm and with the capacity to measure up to 205 cm.

WC measurement was obtained at the midpoint between the last rib and the upper border of the iliac crest. An inextensible measuring tape with subdivisions of 0.1 cm and a capacity of up to 150 cm was used. Abdominal obesity was defined by WC ≥80 cm, a cutoff point that characterizes the risk for metabolic complications associated with obesity (World Health Organization, 2000).

With the stature and WC measurements, WHtR was calculated dividing WC by the stature of the participants, both in centimeters. The cut-off point proposed to designate cardiometabolic risk due to abdominal obesity is 0.5 (Ashwell & Hsieh, 2005).

BMI was obtained by dividing body mass by squared stature. For classification of nutritional status, the following categories were adopted (kg/m^2): low weight (<18.5); eutrophy (18.5–24.9); overweight (25–29.9); and obesity (≥30) (World Health Organization, 2000). The term excess of weight was used to refer to the sum of cases of overweight and obesity.

The C-index (Valdez, 1991) and the ABSI (Krakauer & Krakauer, 2012) were calculated from the following equations, respectively:

$$Conicity \setminus ndex = \frac{Waist \setminus circumference}{0.109 \setminus x \setminus \sqrt{\frac{Body \setminus weight \setminus}{Stature}}}.$$

$$ABSI = \frac{Waist \setminus circumference}{\mathrm{BMI}^{\frac{2}{3}}\mathrm{Xstature}^{\frac{1}{2}}}.$$

For the ABSI, there is no single cutoff point to define the risk condition, as means and standard deviations vary according to the individual's gender and age (Krakauer & Krakauer, 2012). As for the C-Index, the cut-off point of 1.18 proposed by Pitanga and Lessa (2005) to discriminate high-coronary risk in adults was used.

5 | DATA ANALYSIS

The data were entered into an electronic form generated in the Epi-Info software, version 3.5.4 (CDC, Atlanta, GA). Descriptive analysis of demographic, socioeconomic, anthropometric, biochemical, and BP levels was performed.

The Pearson correlation (r) and age-adjusted partial correlation (a-pr) between the anthropometric indices (ABSI, BMI, WC, WHtR, C-index, and %BF) with each other and with the risk factors for NCDs (SBP, HbA1c, triglycerides, LDL. and HDL) was calculated. To estimate the total correlation strength of each predictor in relation to the total of the different outcomes analyzed, the mean of the respective a-pr obtained was calculated. For this, the values of HDL were considered in a modular way, in order to disregard their negative values.

The predictive ability of all indices to detect SAH, DM, hypertriglyceridemia, hypercholesterolemia, and low HDL was defined based on the area under the ROC curve (AUC). The results were classified as follows: excellent (AUC 0.9–1.0); very good (AUC 0.8–0.9); good (AUC 0.7–0.8); sufficient (AUC 0.6–0.7); and poor (AUC 0.5–0.6) (Borges, 2016). The 95% confidence interval (95% CI) of the AUC were calculated and compared for each of the predictor variables. To identify the statistical significance between the differences in the areas under the ROC curves obtained with the different predictors and outcomes, the Bonferroni test adjusted for multiple analyzes by the Sidak method was used. For this, Stata's rocgold and sidak commands were used. For comparisons, the WC was used as a reference predictor.

Sensitivity and specificity values were calculated for each indicator and respective outcome, and the Youden index (J) was subsequently calculated, as follows: J = (sensitivity + specificity) − 1. The best cutoff point was considered to be the one that obtained the highest J value. This cutoff point was referred to in the present study as the "ideal cutoff point" to differentiate from those originally proposed. The association between the predictors, defined according to the different cutoff points (original and ideal), and the respective outcomes was investigated based on the age-adjusted prevalence ratio (PR) and its 95%CI, calculated by Poisson regression with robust adjustment of variance. Accuracy tests were performed in an stratified manner according to two age groups: 19–40 and 41–59 years.

The level of significance considered for all statistical procedures was 5% ($p < .05$). All statistical analyzes were performed using the Stata 12.0 software (StataCorp, College Station, TX).

6 | RESULTS

A total of 1877 women were identified, of whom 119 (6.3%), were excluded because it was not possible to obtain anthropometric data, 87 (4.6%) for having drunk alcohol in the 24 h preceding the interview and 10 (0.5%) for presenting relevant height deficit. The final sample was composed of 1661 women (37 ± 10 years), mostly self-declared as black or brown (90.6%), belonging to the economic classes D + E (96.5%) and with low level of education (≤4 years of schooling) (47.4%). Socioeconomic, demographic, anthropometric, and health characteristics are shown in Tables 1 and 2.

The prevalence of SAH was 29.7%, while that of DM was 23.2%. Among the components of dyslipidemia, low HDL was the most prevalent, followed by hypertriglyceridemia and hypercholesterolemia. The BMI classification revealed that 1094 (65.9%) women had excess weight, a prevalence similar to that of abdominal obesity defined using WC as well as with obesity defined by %BF (Table 1).

Except for ABSI, there was a statistically significant correlation between all the predictors. It was found that the BMI did not correlate with ABSI and showed a weak correlation with the C-index. However, there was a strong correlation of BMI with WC, with WHtR and with % BF (data not shown). According to Table 3, there were weak but significant correlations (r values ranging from −0.12 to 0.41) between all predictors and outcomes. However, in most situations, there was a reduction in values when the age-adjusted partial correlations were calculated (a-pr ranging from −0.23 to 0.32). Nevertheless, all a-pr remained statistically significant, except for ABSI in relation to SBP and LDL-cholesterol. After adjusting for age, WC and WHtR were the predictors that had the highest aggregated value of a-pr (0.19).

Analyzing the ability of predictors to correctly identify the risk factors for CVD, considering all age groups, it was found that, for SAH, the %BF had the greatest discriminatory power. For DM, WHtR had the best performance, while for hypertriglyceridemia the C-Index was the one with the highest AUC. ABSI and C-Index had the best performance to distinguish hypercholesterolemia and WC showed greater discriminatory power for low-HDL (Table 4). However, the AUC obtained with WC

TABLE 1 Demographic, socioeconomic, nutritional, and health characteristics of women (n = 1661) living in Quilombola communities in the state of Alagoas, Northeast Brazil, 2018

Variables	n[f]	(%)
Age group (years)		
19–40	1040	62.6
41–59	621	37.4
Race/skin color (self-reported)		
Black + Brown	1.502	90.6
Others[a]	155	9.4
Economic class[b]		
B + C	58	3.5
D + E	1.603	96.5
Schooling (years of study)		
Never studied	178	10.7
1–4	609	36.7
5–8	435	26.2
≥9	433	26.4
Arterial hypertension[c]		
Yes	486	29.7
Diabetes mellitus[d]		
Yes	305	23.2
Hypercholesterolemia (LDL ≥160 mg/dl)		
Yes	102	10.2
Hypertriglyceridemia (Triglycerides ≥175 mg/dl)		
Yes	333	30.8
HDL-low (HDL <50 mg/dl)		
Yes	795	73.5
Nutritional classification[e]		
Low weight	40	2.4
Eutrophy	527	31.7
Overweight	576	34.7
Obesity	518	31.2
Obesity defined by the percentage of body fat (≥30%)		
Yes	1076	64.8
Abdominal obesity (waist circumference ≥80 cm)		
Yes	1.086	65.4

[a]For the variable race/skin color, women who declared themselves as white, yellow or indigenous were grouped in the "others" category due to the low frequency of these conditions.
[b]According to ABEP criteria (ABEP, 2016).
[c]Systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg or use of antihypertensive drugs.
[d]HbA1c (glycated hemoglobin) ≥6.5% or the use of hypoglycemic agents.
[e]According to the body mass index (BMI; kg/m^2) (World Health Organization, 2000).
[f]Different sample values between variables due to missing data.

TABLE 2 Physical, clinical, and biochemical characteristics of women living in Quilombola communities in the state of Alagoas, Northeast Brazil, 2018. (n = 1661)

Variable	Mean	SD	95% CI
Body mass (kg)	67.2	14.6	66.5–67.9
Stature (m)	1.56	0.06	1.556–1.561
Body mass index (BMI; kg/m^2)	27.7	5.8	27.4–28.0
Waist-to-height ratio (WHtR)	0.55	0.08	0.55–0.56
Conicity index (C-index)	1.20	0.08	1.20–1.2
Body fat percentage	31.9	7.7	31.5–32.3
Waist circumference (WC; cm)	86.1	12.8	85.5–86.7
ABSI (body shape index)	0.075	0.004	0.075–0.076
Systolic blood pressure (mm/Hg)	124.5	18.5	123.6–125.4
Diastolic blood pressure (mm/Hg)	78.4	10.9	77.8–78.9
Glycated hemoglobin (HbA1c; %)	6.10	1.32	6.02–6.18
Low-density lipoprotein (LDL; mg/dl)	111.2	36.2	108.9–113.4
High-density lipoprotein (HDL; mg/dl)	43.4	12.2	42.6–44.1
Triglycerides (mg/dl)	157.4	99.2	151.5–163.3

TABLE 3 Pearson's correlation (r)[a] age-adjusted partial correlation (a-pr)[a] coefficient between anthropometric predictors and systolic blood pressure (SBP), glycated hemoglobin (HbA1c), blood triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Study with women from the Quilombola communities in Alagoas, Northeast Brazil (2018). (n = 1.661)

	SBP		HbA1c		TG		LDL		HDL		TOTAL (mean)[b]	
Predictors	r	a-pr	r	a-pr	r	a-pr	r	a-pr	r	a-pr	r	a-pr
Waist circumference (WC)	0.26	0.15	0.21	0.16	0.40	0.32	0.18	0.10	−0.22	−0.23	0.25	0.19
Body shape index (ABSI)	0.21	0.02[ns]	0.17	0.07	0.31	0.17	0.17	0.04[ns]	−0.12	−0.13	0.20	0.09
Body mass index (BMI)	0.20	0.14	0.16	0.14	0.30	0.26	0.13	0.10	−0.19	−0.19	0.20	0.17
Waist-to-height ratio (WHtR)	0.28	0.14	0.22	0.16	0.40	0.31	0.21	0.12	−0.23	−0.23	0.27	0.19
Conicity index (C-index)	0.28	0.09	0.23	0.14	0.41	0.29	0.22	0.09	−0.20	−0.22	0.27	0.17
Body fat percentage (%BF)	0.28	0.11	0.17	0.08	0.35	0.22	0.24	0.13	−0.16	−0.17	0.24	0.14
Mean	0.25	0.11	0.19	0.13	0.36	0.26	0.19	0.10	−0.19	−0.20	0.24	0.16

[a]Statistically significant correlation for all situations, except when marked ns (non-significant).
[b]For calculation of the means, the HDL values were considered in a modular way, in order to disregard their negative values and, thus, show only the strengths of the correlations.

was higher ($p < .05$) or similar ($p > .05$) to those obtained with all other predictors 29 times out of 30 possibilities (six predictors x five outcomes). Only the AUC obtained with C-index in identifying hypercholesterolemia was higher than that with WC. The results stratified by age group were even more consistent in this respect, as in no other situation there was supremacy in relation to the AUC achieved with the WC as a predictor.

Most of the predictors were classified as having sufficient predictive capacity (AUC between 0.6 and 0.7). However, %BF for SAH and WHtR, C-Index and WC for hypertriglyceridemia were classified as having good performance (AUC between 0.7 and 0.8). Despite this, independently of age group, considering the occurrence of overlap between the 95% CI of the AUCs, they all showed similar performance, except ABSI, which were inferior to the other parameters regarding the prediction of SAH.

The ideal cutoff points for the study's Quilombola women in the prediction of the different outcomes analyzed are shown in Table 5. These cutoff points provided greater discriminatory power than those traditionally used. However, the improvement in performance was due to the increase in specificity at the expense of sensitivity, except in 4 out of 25 possible combinations (ABSI was not examined for original cut-off). In this case, there was an increase in sensitivity for hypercholesterolemia prediction with the BMI (0.70–0.92) and with the C-index (0.75–0.92) and for the low-HDL when the predictor was the WC (0.71–0.78) and the C-index (0.65–0.71). In all other situations, there was a reduction in sensitivity and an increase in specificity.

TABLE 4 Area under the ROC curve (AUC) for anthropometric predictors for risk factors for chronic noncommunicable diseases (NCD), according to age groups. Study with women from Quilombola communities in the state of Alagoas, Northeast Brazil, 2018. (n = 1661)

	Age groups (years) AUC (95% CI)		
Risk factors for NCD	**Total**	**19–40**	**41–59**
Waist circumference (WC)			
Arterial hypertension	0.69 [ref] (0.66–0.71)	0.69 [ref] (0.65–0.74)	0.61 [ref] (0.57–0.65)
Diabetes mellitus	0.64 [ref] (0.60–0.67)	0.63 [ref] (0.58–0.68)	0.60 [ref] (0.55–0.65)
Hypertriglyceridemia	0.72 [ref] (0.69–0.75)	0.73 [ref] (0.69–0.77)	0.67 [ref] (0.62–0.71)
Hypercholesterolemia	0.59 [ref] (0.53–0.65)	0.61 [ref] (0.53–0.70)	0.53 [ref] (0.45–0.60)
Low HDL	0.63 [ref] (0.59–0.67)	0.62 [ref] (0.57–0.67)	0.67 [ref] (0.61–0.72)
Body shape index (ABSI)			
Arterial hypertension	*0.63 [L] (0.60–0.66)*	*0.55 [L] (0.50–060)*	*0.51 [L] (0.46–0.55)*
Diabetes mellitus	0.60 [NS] (0.56–0.64)	*0.53 [L] (0.48–0.58)*	0.58 [NS] (0.52–0.63)
Hypertriglyceridemia	0.67 [NS] (0.63–0.71)	*0.62 [L] (0.57–0.67)*	0.63 [NS] (0.57–0.68)
Hypercholesterolemia	0.64 [NS] (0.59–0.70)	0.61 [NS] (0.52–0.70)	*0.59 [L] (0.52–0.66)*
Low HDL	*0.56 [L] (0.53–0.60)*	0.55 [NS] (0.50–0.60)	0.61 [NS] (0.55–0.67)
Body mass index (BMI)			
Arterial hypertension	*0.66 [L] (0.63–0.69)*	0.69 [NS] (0.65–0.74)	0.62 [NS] (0.57–0.66)
Diabetes mellitus	*0.60 [L] (0.57–0.64)*	0.63 [NS] (0.58–0.68)	*0.57 [L] (0.52–0.62)*
Hypertriglyceridemia	*0.66 [L] (0.63–0.70)*	*0.70 [L] (0.65–0.75)*	*0.62 [L] (0.56–0.67)*
Hypercholesterolemia	*0.54 [L] (0.48–0.59)*	0.58 [NS] (0.50–0.67)	0.48 [NS] (0.40–0.56)
Low HDL	0.62 [NS] (0.58–0.65)	0.60 [NS] (0.55–0.65)	0.64 [NS] (0.58–0.70)
Waist-to-height ratio (WHtR)			
Arterial hypertension	0.70 [NS] (0.67–0.72)	0.70 [NS] (0.66–0.75)	0.60 [NS] (0.55–0.64)
Diabetes mellitus	0.64 [NS] (0.61–0.68)	0.64 [NS] (0.58–0.69)	0.60 [NS] (0.55–0.65)
Hypertriglyceridemia	0.72 [NS] (0.69–0.75)	0.73 [NS] (0.69–0.77)	0.66 [NS] (0.61–0.71)
Hypercholesterolemia	0.60 [NS] (0.55–0.66)	0.63 [NS] (0.55–0.71)	0.53 [NS] (0.45–0.61)
Low HDL	0.63 [NS] (0.59–0.66)	0.61 [NS] (0.56–0.66)	0.66 [NS] (0.61–0.72)
Conicity index (C-index)			
Arterial hypertension	0.69 [NS] (0.66–0.71)	*0.65 [L] (0.60–0.70)*	*0.55 [L] (0.51–0.60)*
Diabetes mellitus	0.64 [NS] (0.60–0.67)	0.60 [NS] (0.55–0.65)	0.61 [NS] (0.55–0.66)
Hypertriglyceridemia	0.73 [NS] (0.70–0.77)	0.72 [NS] (0.68–0.76)	0.68 [NS] (0.63–0.73)
Hypercholesterolemia	*0.65 [H] (0.59–0.70)*	0.64 [NS] (0.55–0.72)	0.58 [NS] (0.51–0.66)
Low HDL	0.61 [NS] (0.57–0.65)	0.60 [NS] (0.55–0.65)	0.65 [NS] (0.59–0.71)
Percentage of body fat (%BF)			
Arterial hypertension	0.71 [NS] (0.68–0.73)	0.69 [NS] (0.65–0.74)	0.59 [NS] (0.55–0.64)
Diabetes mellitus	0.62 [NS] (0.58–0.65)	0.61 [NS] (0.56–0.66)	0.55 [NS] (0.50–0.60)
Hypertriglyceridemia	*0.68 [L] (0.65–0.72)*	*0.70 [L] (0.65–0.75)*	*0.60 [L] (0.54–0.65)*
Hypercholesterolemia	0.60 [NS] (0.55–0.66)	0.61 [NS] (0.53–0.69)	0.54 [NS] (0.46–0.62)
Low HDL	*0.59 [L] (0.55–0.62)*	0.58 [NS] (0.53–0.63)	*0.62 [L] (0.56–0.68)*

Note: The analyzes were carried out in relation to the data located in the columns and according to the Bonferroni test adjusted by the Sidak method for multiple comparisons. [L] significantly lower or [H] higher than the AUC obtained with WC [ref] as a predictor ($p \leq .05$; highlighted in italics).

Abbreviations: HDL, high-density lipoprotein; NS, no statistical significance.

TABLE 5 Sensitivity (S), specificity (E), and Youden index (J) according to the original and to the ideal cutoff points (CP) proposed for anthropometric indicators and the percentage of body fat as predictors of risk factors for chronic noncommunicable diseases. Study with women from quilombola communities in the state of Alagoas, Northeast Brazil, 2018. (n = 1661)

		Arterial hypertension					Diabetes mellitus					Hypertriglyceridemia					Hypercholesterolemia					Low HDL				
			Ideal CP		Original CP			Ideal CP		Original CP			Ideal CP		Original CP			Ideal CP		Original CP			Ideal CP		Original CP	
Predictor	Original CP	Ideal CP	S	E	S	E	Ideal CP	S	E	S	E	Ideal CP	S	E	S	E	Ideal CP	S	E	S	E	Ideal CP	S	E	S	E
WC (cm)	≥80[a]	83.8	0.74	0.55	0.83	0.43	86.6	0.65	0.57	0.81	0.37	84.8	0.77	0.58	0.88	0.44	92.4	0.44	0.71	0.78	0.34	77.0	0.78	0.43	0.71	0.48
J			0.29		0.26			0.22		0.18			0.35		0.32			0.15		0.12			0.21		0.19	
ABSI	–[b]	0.077	0.49	0.72	–	–	0.077	0.44	0.71	–	–	0.076	0.59	0.68	–	–	0.074	0.74	0.50	–	–	0.073	0.67	0.45	–	–
J			0.21		–			0.15		–			0.27		–			0.24		–			0.12		–	
BMI (kg/m^2)	≥25[c]	27.0	0.67	0.58	0.82	0.41	26.6	0.70	0.49	0.80	0.36	25.9	0.78	0.48	0.83	0.40	22.2	0.92	0.17	0.70	0.33	27.4	0.53	0.66	0.71	0.45
J			0.25		0.23			0.19		0.16			0.26		0.23			0.09		0.03			0.19		0.16	
WHtR	≥0.50[d]	0.53	0.80	0.50	0.88	0.36	0.6	0.61	0.61	0.88	0.31	0.5	0.83	0.52	0.91	0.37	0.6	0.63	0.56	0.84	0.29	0.50	0.75	0.45	0.76	0.42
J			0.30		0.24			0.22		0.19			0.35		0.28			0.19		0.13			0.20		0.18	
C index	≥1.18[e]	1.20	0.74	0.54	0.78	0.49	1.2	0.58	0.64	0.75	0.43	1.2	0.71	0.65	0.83	0.50	1.2	0.60	0.64	0.76	0.41	1.16	0.71	0.48	0.65	0.52
J			0.28		0.27			0.22		0.18			0.36		0.33			0.24		0.17			0.19		0.17	
%BF	≥30[f]	31.2	0.81	0.50	0.84	0.44	33.4	0.62	0.55	0.78	0.37	30.8	0.80	0.47	0.83	0.43	25.9	0.92	0.23	0.75	0.36	33.75	0.49	0.65	0.68	0.44
J			0.31		0.28			0.17		0.15			0.27		0.26			0.15		0.11			0.14		0.12	

Abbreviations: ABSI, A body shape index; BMI, body mass index; C-index, conicity index; HDL, high-density lipoprotein; WC, waist circumference; WHtR, waist-to-height ratio; %BF, percentage of body fat.

[a]Cutoff point for risk for the development of cardiovascular diseases (World Health Organization, 2000).

[b]There is no single cutoff point, as the health risk classification is different according to the individual's age and sex (Krakauer & Krakauer, 2012).

[c]Cutoff point that defines excess body weight (World Health Organization, 2000).

[d]Indicator of health risk associated with central obesity (Ashwell & Hsieh, 2005).

[e]Discriminating cut-off point for discriminate high-coronary risk in adults (Pitanga & Lessa, 2005).

[f]Obesity indicator due to excess body fat (Gallagher et al., 2000).

TABLE 6 Crude and age-adjusted prevalence ratios (PR and aPR) for risk factors for cardiovascular disease, according to anthropometric predictors defined according to the different cutoff points: Original and ideal, respectively. Study with women from Quilombola communities in the state of Alagoas, Northeast Brazil, 2018. (n = 1661)

Predictor Original CP Ideal CP	Arterial hypertension[a] PR (95% CI)	Arterial hypertension[a] aPR 95% CI	Diabetes mellitus[b] PR (95% CI)	Diabetes mellitus[b] aPR 95% CI	Hypertriglyceridemia (triglycerides ≥175 mg/dl) PR (95% CI)	Hypertriglyceridemia (triglycerides ≥175 mg/dl) aPR 95% CI	Hypercholesterolemia (LDL ≥160 mg/dl) PR (95% CI)	Hypercholesterolemia (LDL ≥160 mg/dl) aPR 95% CI	Low HDL (HDL <50 mg/dl) PR (95% CI)	Low HDL (HDL <50 mg/dl) aPR 95% CI
WC (cm)										
≥80.0	2.67 2.16–3.32)	1.82 (1.49–2.22)	2.06 (1.59–2.68)	1.68 (1.29–2.18)	3.88 (2.8–5.29)	3.21 (2.34–4.40)	1.80 (1.15–2.84)	*1.42 (0.89–2.26)*	1.25 (1.15–1.36)	1.28 (1.17–1.40)
≥83.8	2.48 (2.07–2.97)	1.74 (1.476–2.05)	2.01 (1.61–2.52)	1.67 (1.32–2.10)	3.06 (2.42–3.87)	2.57 (2.02–3.67)	*1.41 (0.96–2.06)*	*1.10 (0.74–1.65)*	1.23 (1.14–1.33)	1.26 (1.17–1.7)
ABSI										
0.077	1.77 (1.53–2.05)	*0.99 (0.86–1.15)*	1.48 (1.22–1.80)	*1.08 (0.87–1.3)*	2.02 (1.69–2.41)	1.51 (1.25–1.84)	*1.40 (0.96–2.06)*	*1.52 (0.99–2.32)*	1.24 (1.15–1.33)	1.26 (1.17–1.37)
BMI										
≥25.0	2.13 (1.74–2.60)	1.73 (1.46–2.06)	1.84 (1.43–2.36)	1.62 (1.26–2.08)	2.33 (1.81–3.00)	2.04 (1.60–2.62)	*1.10 (0.73–1.64)*	*0.95 (0.64–1.42)*	1.23 (1.13–1.34)	1.24 (1.14–1.36)
≥27.0	2.08 (1.76–2.45)	1.78 (1.53–2.06)	1.69 (1.37–2.08)	1.53 (1.25–1.88)	1.90 (1.57–2.30)	1.71 (1.42–2.07)	*1.23 (0.85–1.78)*	*1.10 (0.76–1.60)*	1.22 (1.13–1.31)	1.23 (1.14–1.32)
WHtR										
≥0.50	2.96 (2.31–3.81)	1.82 (1.44–2.30)	2.73 (1.97–3.79)	2.14 (1.53–2.99)	4.17 (2.91–5.96)	3.31 (2.30–4.77)	2.06 (1.23–3.44)	*1.51 (0.88–2.59)*	1.30 (1.18–1.43)	1.34 (1.21–1.49)
≥0.53	2.56 (2.11–3.10)	1.71 (1.42–2.05)	2.01 (1.59–2.55)	1.62 (1.27–2.07)	3.38 (2.60–4.40)	2.79 (2.13–3.66)	1.81 (1.19–2.76)	*1.40 (0.89–2.20)*	1.22 (1.13–1.32)	1.25 (1.15–1.36)
C-index										
≥1.18	2.41 (2.00–2.92)	1.39 (1.16–1.67)	1.91 (1.51–2.41)	1.44 (1.12–1.85)	3.26 (2.51–4.23)	2.60 (1.98–3.41)	2.00 (1.30–3.08)	*1.43 (0.89–2.29)*	1.21 (1.12–1.31)	1.26 (1.16–1.38)
≥1.20	2.23 (1.89–2.63)	1.28 (1.09–1.51)	1.79 (1.45–2.21)	1.34 (1.07–1.69)	2.84 (2.30–3.52)	2.28 (1.81–2.87)	2.09 (1.40–3.10)	*1.53 (0.98–2.36)*	1.18 (1.10–1.27)	1.23 (1.13–1.34)
%BF										
≥30	2.92 (2.34–3.65)	1.72 (1.39–2.14)	1.82 (1.42–2.33)	1.36 (1.05–1.76)	2.55 (1.98–3.28)	1.96 (1.50–2.56)	1.68 (1.09–2.58)	*1.17 (0.73–1.87)*	1.15 (1.06–1.25)	1.19 (1.09–1.29)
≥31.2	2.89 (2.34–3.54)	1.77 (1.45–2.16)	1.75 (1.40–2.20)	1.34 (1.05–1.70)	2.47 (1.96–3.11)	1.94 (1.52–2.47)	1.77 (1.17–2.69)	*1.30 (0.83–2.03)*	1.13 (1.05–1.22)	1.16 (1.07–1.26)

Note: Results in italics indicate association without statistical significance.

Abbreviations: ABSI, body shape index; BMI, body mass index; C-index, conicity index; HDL, high-density lipoprotein; WC, waist circumference; WHtR, waist-to-height ratio; %BF, percentage of body fat; 95% CI, 95% confidence interval.

[a] Systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg or use of antihypertensive drugs.

[b] HbA1c (glycated hemoglobin) ≥6.5% or the use of hypoglycemic agents.

Consequently, the application of these cutoff points (original and ideal) in defining the respective outcomes resulted in different age-adjusted PRs, which can be observed in Table 6. In most cases, there was a reduction in the strength of association (lower PR) when the ideal cutoff point was used. Except for hypercholesterolemia, crude PR remained statistically significant after adjusting for age.

7 | DISCUSSION

The remaining Quilombo communities (RQC) are located in geographically isolated areas and with precarious sanitary conditions. They are characterized by a high degree of social vulnerability, low levels of education and are mostly dependent on subsistence agriculture and social income transfer programs (Melo & Silva, 2015). This profile, quite common in many RQC in Brazil, is even more concerning in the present sample of investigated women because these RQC are located in the state (Alagoas), which has the highest poverty rates and stands out with the worst social indicators in the country (Ferreira et al., 2013).

A previous Quilombola Survey carried out in Alagoas, in 2008, found that the majority of women (91.9%) belonged to the lower economic classes (D + E). Low-education level (≤3 years of formal education) was also very common among these women (52.7%) (Ferreira et al., 2013). In 2015, a survey carried out by the Government of Alagoas (2015) indicated that 75% of Quilombolas had a per capita household income of up to R$ 77.00 (≅ 20.53 dollars/month; 1 dollar = 3.75 reais on July 31, 2018) and illiteracy of approximately 26%, conditions that designate the situation as extreme poverty, which explains the fact that the majority (86%) of families in this population are users of governmental income transfer programs (Bolsa Família Program). The results of the present study, carried out 10 years after the first Quilombola Survey, corroborate this panorama by indicating that a high degree of poverty and social vulnerability still prevails among the families of the RQC.

The prevalence of excess of weight in the sample now analyzed was quite high, and higher than that found in the 2008 Quilombola Survey (65.9 vs. 48.5%), constituting a continuous and growing health problem for these women. This finding is consistent with the worldwide and Brazilian trend of increase in the prevalence of overweight and obesity over the past few years (Nakano et al., 2018). The equally high occurrence of abdominal obesity is also of concern, given the relevance of fat deposition in the visceral region as a cardiometabolic risk factor (Mathew et al., 2013).

These results are consistent with the nutritional transition process that has occurred worldwide and that is due, among other factors, to the change in the dietary pattern of the population, which, combined with a sedentary lifestyle, determines a positive energy balance and the consequent increase in the proportion of body fat (Popkin et al., 2012). In the case of the Quilombola population, some studies demonstrate that changes in eating habits have been occurring due to the "urbanization" process that these communities are undergoing, with the incorporation of ultra-processed foods with high-energy density, high-sodium content, and reduced supply of vitamins and minerals (Navas et al., 2015; Silva et al., 2015). The reduced access to healthy food characterizes the situation of food insecurity, which is associated with a higher occurrence of risk factors for CVDs (Park & Strauss, 2020).

Given the scenario that characterizes the Quilombola population and considering that obesity is one of the main risk factors for CVDs, it is important to have simple and accurate measures that allow the monitoring of this condition and, thus, enable the planning and implementation of appropriate public health measures.

We verified in the present work a significant correlation between all predictors among themselves (except for analyses involving ABSI) and between these (including ABSI) and all risk factors, demonstrating that as body proportions increase, SBP, HbA1c, triglycerides, and cholesterol also increase, whereas there is a reduction in HDL. Correlation between body adiposity and risk factors for CVDs has also been found by other authors (Chang et al., 2016; Wei et al., 2019). Adjustment for age (partial correlation) reduced the magnitude of most correlations, demonstrating the strong association of age with risk factors for CVDs. Thus, regardless of the predictor used, age should always be a factor to be considered when establishing priority for intervention. In this regard, WC and WHtR were the predictors that added the most predictive value, regardless of age.

In this study was tested the ability of six anthropometric and body composition indicators (BMI, WC, WHtR, C-index, ABSI, and %BF) as predictors of five risk factors for CVDs (SAH, diabetes, hypertriglyceridemia, hypercholesterolemia, and low-HDL). None of the indicators achieved the best performance simultaneously for all outcomes, with alternation according to the condition analyzed.

The literature data are divergent in the sense of establishing a single parameter that better discriminates cardiovascular risk factors. Liu et al. (2019) when analyzing a sample of 46 285 men and women (aged 35–70 years) from 115 urban and rural communities in China, concluded that WHtR was the best predictor of dyslipidemia and hyperglycemia, while WC surpassed the other indicators on the identification of abnormal BP. ABSI did not show a better predictive capacity than any traditional anthropometric indicator related to obesity. Another study also conducted in China (Tian et al., 2016) (8126 adults of both sexes) found that, in women, the body roundness index (BRI) and WHtR had the best predictive capacity for all risk factors for CVDs analyzed (hypertension, diabetes, dyslipidemia, hyperuricemia, and metabolic syndrome).

An investigation carried out on the African continent involving 535 adults of both sexes, residing in Southwest Nigeria, compared the ability of 11 anthropometric parameters (WC, BMI, WHtR, ABSI, BRI, visceral adiposity index, abdominal volume index, C-Index, body adiposity index, lipid accumulation product and WC-triglyceride index) to predict metabolic syndrome (MetS) (Adejumo et al., 2019). It was concluded that the WC was the best for predicting MetS in both men and women.

In the present study, all analyzed parameters presented at least sufficient predictive capacity, when taking into account the interval estimation, which leads to the interpretation that, for the investigated population, these indicators have similar predictive capacity, except for ABSI in the prediction of hypertension and BMI in the case of hypertriglyceridemia. Specifically for these two situations, these two parameters were inferior to the others.

In a Korean longitudinal study, Choi et al. (2018) compared the predictive ability of body mass, WC, WHtR, waist-hip ratio, BMI, BRI, and ABSI to identify hypertension. It was observed that, although WC had reached a higher AUC, compared to body mass and BMI, there was also an overlap of 95% CI.

In a rural population in northeastern China, Chang et al. (2016) found a significant association between anthropometric predictors (ABSI, BMI, WC, waist-hip ratio and BRI) and SAH and that all indices were able to identify this outcome satisfactorily. The study showed BRI to be the best predictor in comparison to the other indices. In our study, this index was not considered. The differences in studies, both in predictors and in outcomes, make comparisons between the different studies difficult. Despite this, the results observed from the various studies compared here show that, in general, abdominal obesity indicators are better predictors of risk factors for CVDs, particularly WC and WHtR (Adejumo et al., 2019; Choi et al., 2018; Liu et al., 2019; Pitanga & Lessa, 2005; Tian et al., 2016).

Given this, we consider that WC is the most appropriate alternative to be adopted as a screening tool to identify Quilombola women with greatest risk for CVD. This conclusion is based on the facts that: (a) the assessed Quilombola population face a prevailing context of health services with little infrastructure, including lack of specialized human resources, making the use of parameters that are easier to obtain and interpret more appropriate to the reality of these communities and (b) the AUC obtained with WC was higher or similar to those obtained with all other predictors 29 times out of 30 possibilities. To this end, we propose that the WC be used for screening purposes in women from Quilombola communities. This proposal is consistent with the conclusions given by van Dijk et al. (2012) after performing a meta-analysis of 20 articles including 45 757 Caucasian individuals (21 618 men and 24 139 women). In their analyses, WC had the strongest correlation with the majority of the risk factors for CVDs.

As to the cutoff point to use, despite the fact that the ideal values were found to be different from those originally proposed, it does not seem to be advantageous to use a different cutoff point from that already traditionally established (≥80 cm), since the ideal cutoff points were different between conditions and since, except for low HDL, the use of a lower cutoff point will give greater sensitivity to the indicator, reducing the number of false negatives, which is desirable as a screening tool.

8 | STUDY STRENGTHS

The present study investigated a large sample, representative of an ethnically homogeneous people, so that its results can be extrapolated to other population groups of women of African origin. The information presented was derived from data obtained in a standardized manner, by highly qualified personnel and after a rigorous training process, ensuring high quality of the analyzed database. Detailed information is presented regarding the accuracy of different anthropometric measurements. We recommend WC as the indicator of risk factors for CVDs to be used in contexts such as Quilombola communities. This decision is based on the good accuracy demonstrated by this measure, in addition to its operational simplicity (only one measure) and ease of interpretation (direct observation about the 80 cm cutoff point).

9 | STUDY LIMITATIONS

Some limitations of the present study should be considered. First, the cross-sectional character of the design does not allow the establishment of a cause and effect relationship, with the available information being subject to temporal limitation. The predictive abilities of the anthropometric indicators were analyzed about the simultaneous prevalence of CVD risk factor outcomes. Follow-up studies could better clarify the relationship between risk factors and the incidence of CVD. Second, the universe investigated was restricted to women. The exclusion of individuals under 19 years of age is not a problem because they are much less affected by CVD in comparison to older individuals, but the absence of men in the sample recommends further studies covering this population segment, as there are important differences regarding the incidence of risk factors and CVDs according to sex, which also affects the predictive capacity of the indicators according to each situation.

An additional limitation is that this study did not consider some of the other anthropometric indices proposed and compared in the literature for CVD risk factor prediction. Besides, especially when anthropometric indicators are statistically independent, as is the case for BMI and ABSI, we would expect that suitable combinations of these indicators should be able to capture risk better than either indicator by itself (Krakauer & Krakauer, 2016).

10 | KEY RESULTS AND CONCLUSIONS

a. The Quilombola population is subject to great social vulnerability;
b. The prevalence of risk factors for CVDs in this population is very high;
c. There is a significant correlation between all anthropometric predictors among themselves (except for ABSI) and between these predictors (including ABSI) and all risk factors, demonstrating that as body weight and WC increase, SBP, HbA1c, triglycerides, and cholesterol also increase, but there is a reduction in HDL;
d. After adjusting for age, WC and WHtR were the predictors that had the highest value of partial correlation, when considering the mean obtained in relation to the set of outcomes examined;
e. Most of the predictors analyzed have sufficient predictive capacity (AUC between 0.6 and 0.7), with good performance (AUC between 0.7 and 0.8) being verified only about hypertriglyceridemia when predicted by WHtR, CI, and WC and SAH when investigated based on the %BF;
f. None of the predictors analyzed presents the best performance simultaneously for all outcomes, with alternation according to the condition analyzed;
g. About the ability of the predictors to correctly identify the risk factors for CVDs, considering the point estimation instead of interval estimation, there is supremacy (higher AUC) of the following indicators in identifying the following outcomes, respectively: %BF for SAH; WHtR for diabetes; C-Index for hypertriglyceridemia; ABSI and index-C for hypercholesterolemia and; WC for Low-HDL;
h. Taking into account the interval estimation, the occurrence of overlap between the 95% CI of the AUCs was verified for most indicators, so that these indicators have similar predictive capacity, except for ABSI in the prediction of hypertension and BMI concerning hypertriglyceridemia, which were lower than the other parameters specifically for these two situations.
i. The AUC obtained with WC was higher or similar to those obtained with all other predictors for 29 out of 30 possibilities.

Based on these findings, it is recommended that, due to its accuracy and greater operational simplicity, WC, associated with a cut point ≥80 cm, should be integrated into basic health actions developed in Quilombola communities to identify women at increased cardiovascular risk to receive adequate care for the prevention of these diseases.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

AUTHOR CONTRIBUTIONS

Haroldo Da Ferreira: Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; supervision; writing-review & editing. **Mariana Soares:** Conceptualization; data curation; formal analysis; investigation; methodology; writing - original draft; writing-review & editing. **Nir Krakauer:** Conceptualization; formal analysis; methodology; writing-review & editing. **Ewerton Santos:** Conceptualization; formal analysis; investigation; methodology; writing - original draft; writing-review & editing. **Jesse Krakauer:** Conceptualization; formal analysis; methodology; writing - original draft; writing-review & editing. **Tainá Uchôa:** Conceptualization; formal analysis; methodology; writing - original draft; writing-review & editing. **Tamara Santos:** Conceptualization; data curation; formal analysis; investigation; methodology; writing - original draft; writing-review & editing. **Luiz Anjos:** Conceptualization; formal analysis; methodology; writing - original draft; writing-review & editing.

DATA AVAILABILITY STATEMENT

Authors may provide the database used in the study upon specific request with justification academic.

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