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Nutritional and cardiovascular disease risk in older persons living in *Quilombola* communities

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Abstract *This article aims to assess nutritional and cardiovascular disease (CVD) risk based on anthropometric measures among older persons living in Quilombola communities in the state of Maranhão, Brazil. We conducted a cross-sectional study with 205 older persons living in 11 Quilombola communities in Bequimão, Maranhão. Nutritional and CVD risk were estimated according to sex and age group based on anthropometric indicators using Pearson's chi-square or Fisher's exact tests and analysis of variance, adopting a significance level of p<0.05. The study participants suffer precarious housing, basic sanitation and social conditions. Prevalence of nutritional and CDV risk was high across the sample, showing differences between sexes and age groups. Prevalence of excess weight was higher in women and the youngest age group, while prevalence of malnourishment and loss of muscle mass was higher in men and individuals aged 80 years and over. Prevalence of CVD risk was high across all age groups and higher in women than men. The older persons living in the Quilombola communities investigated by this study are socially vulnerable and showed high prevalence of low weight, loss of muscle mass and CDV risk. The prevalence of CVD risk was higher among women and the oldest age group.*

Key words *Older persons, Groups of African descent, Anthropometry, Nutrition, Cardiovascular*

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Introduction

Quilombola communities, or quilombos, are settlements founded by descendants of runaway slaves. They are predominantly located in remote rural areas and the poor living conditions in these communities make *Quilombolas* a socially vulnerable group. Although found throughout the whole of Brazil, these communities are largely located in the Northeast region, mainly in states of Bahia (30.0%) and Maranhão (27.7%)[1].

Quilombos are spaces of resistance and struggle for rights and the conservation of culture, religious beliefs, and traditional values and practices rooted in African ancestry. They represented an alternative for the survival of slaves who refused to accept the rules imposed by a racist colonial system. Today they are a symbol of resistance to the historical exclusion of black people who developed their own specific forms of social organization, relationship with the land and life and health habits[1,2].

Although the number of epidemiological studies on the health status of *Quilombolas* has increased in recent years, they still represent only a small fraction of studies of the black population. Available studies reveal poor health, quality of life, basic sanitation, and access to social and health services, especially among the extremes of age, such as older persons[1] and children[3]. The significant variability in health status between different groups within quilombos highlight the additional inequalities experienced by older persons living in these communities, which increase the risk of becoming ill[1,4].

Aging among *Quilombolas* is characterized by poverty, greater social and health needs, poor quality of life, nutrition insecurity and multiple chronic conditions[1]. The inequalities faced by *Quilombolas* result from the socioeconomic and material deprivation that they have been subjected to since the era of slavery. This accumulation of disadvantages and government neglect down the generations and throughout the lifecycle is reflected in the indicators commonly used to assess nutritional health and associated risks in older persons, which show differences between sex and age subgroups[5].

Research investigating nutritional status and cardiovascular disease (CVD) risk among *Quilombolas* are scarce and the few studies with older persons have reported high prevalence of nutritional risk[2,6-8]. Most of these studies analyzed specific indicators, rather than performing a combined analysis of anthropometric measurements and CVD risk, and did not examine differences in nutritional disorders and CVD risk between sexes and age groups, thus not clearly showing the real risk faced by these populations.

This study therefore assessed nutritional and CVD risk based on anthropometric measurements among older persons living in *Quilombolas* in the state of Maranhão.

Methods

Study area and population

This study is part of the *Population Survey of the Living Conditions and Health Status of Older Persons Living in Quilombola Communities in the Baixada Maranhense* project (the “IQUIBEQ” project), a cross-sectional household survey conducted in 11 communities in Bequimão, Maranhão. Although there are 18 *Quilombos* in Bequimão, only 11 have so far been officially recognized as *Quilombola* communities by the Palmares Cultural Foundation and Ministry of Culture. The study was therefore restricted to these 11 communities (Figure 1).

The study sample comprised people aged 60 years and over, selected with the help of the local social services and community health workers (CHWs). The CHWs conducted a preliminary survey and produced a list of 220 older persons with information on sex and date of birth. All the older persons on the list were invited to participate in the study. After excluding refusals and individuals who were not located after two attempts on separate dates, the final sample comprised 205 older persons.

Data were collected during the day on weekdays between July and October 2018. A pilot study was conducted prior to the main study to adjust the instruments and for the purposes of interviewer training. The interviewers used an instruction manual and were supervised by the researchers responsible by for the study.

Questionnaires and study variables

The following socioeconomic variables were used for the purposes of this study: sex; age; race/skin color; marital status; literacy; family income in Brazilian reals; socioeconomic status (based on the social classes adopted by the Brazilian Market Research Association’s economic classification criteria[9]); receipt of government benefits; number of rooms per household; use of appro-

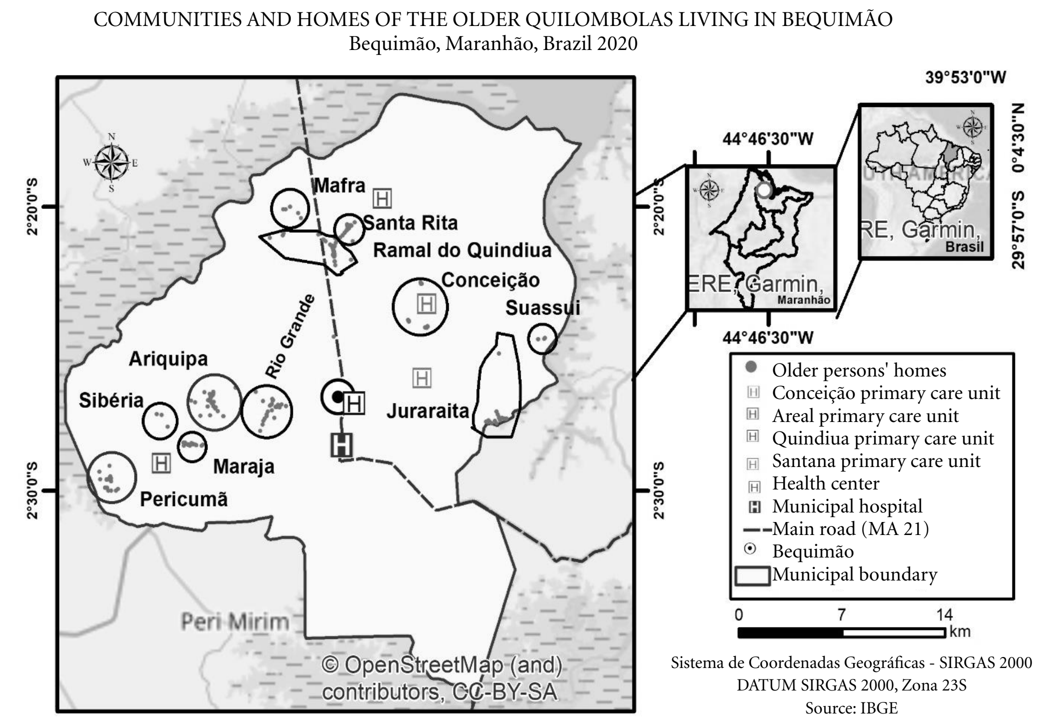

Figure 1. Location of the 11 *Quilombola* communities in Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2018.

Source: Authors.

priate building materials for walls, roof and floor; water supply and treatment; sewage disposal; and household waste management.

The following anthropometric measurements were taken: Weight, Height, Waist Circumference (WC), Hip Circumference (HC), Arm Circumference (AC) and Left Calf Circumference (LCC).

Individuals were weighed without shoes and instructed to remove items that could result in an inaccurate reading of actual body weight. They were asked to stand upright on the scale with feet together and arms at their sides[10]. We used an Omron® weighing scale with 440 lb/200 kg capacity and 100 g/0.2 lb precision.

Height was measured in centimeters using an Alturexata® portable stadiometer. Individuals were positioned with their feet together and at least three of the following touching the stadiometer: heels, calves, buttocks, back, and back of the head[10].

WC was measured using a soft measuring tape at the midpoint between the last rib and iliac crest with individuals standing upright with their arms at their sides. HC was measured around the widest portion of the buttocks using and inelastic measuring tape[10].

LCC was measured using an inelastic measuring tape at the calf's widest point with individuals sitting with the knee at an angle of 90 degrees. To measure AC, individuals were asked to bend their arm with the elbow at an angle of 90 degrees to locate the midpoint of the upper arm. The arm was then relaxed at the side of the body and the measurement was taken at the point marked without applying any pressure[11].

Body mass index (BMI) was classified using the Lipschitz[10] cutoff points as follows: Low Weight (BMI<22 kg/m²); Normal Weight (BMI between 22 kg/m² and 27 kg/m²); and Excess Weight, representing overweight and obese (BMI>27 kg/m²).

AC was classified based on data from the Third National Health and Nutrition Examination Survey (NHANES III), using the 50th percentile for the Brazilian population as a reference and the following equation: *AC (%) = Obtained*

AC (cm) x 100/50th AC percentile. Nutritional status was classified as follows: Mild undernourishment <80%; Normal 90-110%; Excess weight 110-120%; Obese >120%[12].

CVD risk was assessed using the WC and HC values. The waist-to-hip ratio (WHR) was calculated using the following formula: WHR=WC (cm)/HC (cm). Risk was classified based on the recommendations of Lohman *et al.*[13] for people aged over 60: men - Low (<0.91), Medium (between 0.91 and 0.99) and High (1.00 to 1.03); women - Low (<0.76), Medium (between 0.76 and 0.84) and High (between 0.85 and 0.90)[13]. WC was classified using the WHO recommended cutoff points for risk in adults[11]: WC>94 cm for men and >80 cm for women.

For LCC, we used the WHO classification[11], where values below 31cm indicate loss of muscle mass. LCC is widely used to assess physical function and muscle mass in older persons, where the higher the values the higher the level of physical functioning and lower the frailty[14].

Data analysis

We calculated the relative and absolute frequencies of the socioeconomic and demographic characteristics. The quantitative variables (anthropometric measurements) were also described using means, standard deviations, medians and interquartile range: 25th percentile and 75th percentile. The Shapiro-Wilk test was used to determine if the variables were normally distributed. Height, WC and AC showed a normal distribution, while weight, HC and LCC did not have a normal distribution. We also tested for statistically significant differences in the means and medians of the body measures by sex and age group (60 to 69, 70 to 79, and ≥80 years). For the comparison between sexes, we used the Mann-Whitney test (for differences between medians) and equal-variance t-test (for differences between means). For the comparison of age groups, we used the Kruskal Wallis test with multiple comparisons (for differences between medians) and ANOVA with Bonferroni comparison (for differences between means). Pearson's and Spearman's correlation coefficients were also used to test the relationship between height, WC and AC, and weight, HC and LCC, respectively.

Nutritional and CVD risk were estimated for sex (male or female) and the three age groups using the following indicators: BMI, AC, LCC, WC and WHR. Pearson's chi-Squared test or Fisher's exact test were used to compare proportions.

A significance level of p<0.05 was adopted for all the analyses. The data were analyzed using Stata® version 14 (StataCorp LP, College Station, Texas, United States).

Ethical considerations

The study protocol was approved by the research ethics committee of the University Hospital of Maranhão Federal University (UFMA) (approval number: 2.476.488, 28/01/2018) and all participants signed an informed consent form before data collection.

Results

The median age of the study sample was 70 years (64-77 years) and almost half of the sample (49.3%) were aged between 60 and 69 years. Most were women (54.6%), black (58.5%), separated/divorced/widowed (64.4%) and illiterate (54.6%). Although 91.7% received a pension and 63.9% had a family income of more than one minimum wage, 98.1% of the sample belonged to economic class D/E. With regard to housing conditions, 68.8% lived in houses with four to seven rooms and only 27.8% lived in houses with walls, roofs and floors built with appropriate building materials. The majority did not have running water in their homes, 81.0% obtained their drinking water from a well or spring inside or outside the property, and 31.2% did not have adequate home water treatment. In 43.9% of homes, wastewater was disposed of in rudimentary cesspits or open-air, and none of the respondents reported regular waste collection services (Table 1).

There was little variation in body measurements across the sample. However, differences appeared between sexes and age groups. There were statistically significant differences in weight, height, WC, HC and LCC between men and women. Men showed higher values for weight (p=0.001), height (p=0.001) and LCC (p=0.002), while women showed higher values for WC (p=0.049) and HC (p=0.006). Statistically significant differences were observed between the age groups for weight (p=0.002), AC (p=0.026) and LCC (p=0.001). Individuals aged 80 years and over showed worse values for all the measurements. This group showed statistically significant lower values than the 60 to 69 years group for weight, AC and LCC (p=0.001, p=0.007 and p=0.001, respectively). When compared to the 70 to 79 years groups, the older group showed lower

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Table 1. Older *Quilombolas'* (≥60 years) socioeconomic, demographic and basic sanitation characteristics, Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2018.

Variables	(N=205)	%
Sex		
Male	93	45.4
Female	112	54.6
Age group (years)		
60 to 69	101	49.3
70 to 79	65	31.7
≥80	39	19.0
Color/race		
Black	120	58.5
Brown	60	29.3
Other	25	12.2
Marital status		
Married/stable relationship	73	35.6
Separated/divorced/widowed	132	64.4
Literate		
Yes	93	45.4
No	112	54.6
Family income in minimum wage (R$954.00)		
<1 minimum wage	74	36.1
1 to 2 minimum wages	131	63.9
Socioeconomic status*		
C	4	1.9
D/E	201	98.1
Benefits		
Pension	188	91.7
Bolsa Família	14	8.3
Number of rooms per household		
≤3	4	2.0
4 to 7	141	68.8
≥8	60	29.3
Use of appropriate building material for walls, roof and floor		
Yes	57	27.8
No	148	72.2
Water supply		
Mains	37	18.0
Well or spring on property	123	60.0
Well or spring off property	43	21.0
Other	2	1.0
Home water treatment		
Adequate	141	68.8
Inadequate	64	31.2
Bathroom wastewater disposal		
Septic tank	115	56.1
Rudimentary cesspit/open-air	90	43.9
Disposal of household waste		
Open-air	22	10.7
Burnt/buried	183	89.3

*None of the individuals belonged to class A and B.

Source: Authors.

values for weight (p=0.009) and LCC (p=0.023) (Table 2).

There was a statistically significant correlation (p=0.001) between the following measures: weight and HC (r=0.74), weight and LCC (r=0.74), HC and LCC (r=0.59), and WC and AC (r=0.68) (data not shown).

With regard to BMI, 52.7% of the sample were normal weight, 25.9% low weight and 21.4% excess weight. Women showed a higher prevalence of excess weight and lower prevalence of low weight; however, these differences were not statistically significant (p=0.188). Based on the AC values, 51.7% of the sample were malnourished. Prevalence of malnourishment was higher among men and prevalence of excess weight was higher in women; however, these differences were not statistically significant (p=0.174). Based on the LCC values, more than a third (34.0%) of the older persons were undernourished. Preva-

Table 2. Anthropometric variables by sex and age in older Quilombolas (≥60 years), Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2018.

Variables		Measures	Weight	Estatura (cm)	PC (cm)	PQ (cm)	PB (cm)	PPE (cm)
Total		Mean	57.9	1.53	87.5	94.5	28.2	31.6
		SD	9.8	0.08	9.7	7.4	3.2	3.4
		25thP	51.2	1.48	80.0	90.0	26.0	30.0
		Median	56.7	1.53	87.0	93.0	28.0	32.0
		75thP	63.3	1.6	94.0	99.0	30.0	33.5
Sex	Male	Mean	60.5	1.59[1]	86.1[1]	92.6	28.2[1]	32.1
		SD	9.5	0.07	9.3	6.3	3.2	3.5
		25thP	53.6	1.54	79.0	89.0	26.5	31.0
		Median	60.0[2]	1.60	85.3	93.0[2]	28.0	32.5[2]
		75thP	65.8	1.64	93.5	96.0	30.0	34.0
	Female	Mean	55.9	1.49[1]	88.8[1]	96.1	28.2[1]	31.1
		SD	9.6	0.06	9.9	8.0	3.2	3.2
		25thP	49.1	1.45	83.0	91.0	26.0	29.0
		Median	54.4[2]	1.49	89.0	94.0[2]	28.0	31.0[2]
		75thP	60.6	1.53	96.0	101.0	30.0	32.0
p-value			0.001[2]	0.001[1]	0.049[1]	0.006[2]	0.971[1]	0.002[2]
Age group (years)	60 to 69	Mean	59.3	1.54[3]	87.0[3]	94.5	28.6	32.1
		SD	9.9	0.08	9.4	7.2	2.9	3.6
		25thP	53.5	1.49	80.0	91.0	27.0	31.0
		Median	57.94*	1.55	86.0	93.5[4]	28.8[4**]	32.0[4***]
		75thP	65.0	1.61	93.0	97.0	30.0	34.0
	70 to 79	Mean	58.3	1.53[3]	89.1[3]	95.8	28.2	31.5
		SD	9.7	0.07	9.5	7.3	3.4	2.9
		25thP	50.8	1.48	81.0	90.0	26.0	29.5
		Median	57.54[$]	1.53	88.0	95.0[4]	28.0[4]	32.0[4$$]
		75thP	63.1	1.59	96.5	100.0	31.0	33.0
	80 and over	Mean	53.7	1.52[3]	86.4[3]	92.6	27.0	30.2
		SD	8.7	0.09	10.7	8.0	3.3	3.1
		25thP	47.7	1.47	79.0	87.0	25.0	28.0
		Median	51.64*$	1.52	86.0	91.0[4]	26.0[4**]	30.0[4***$$]
		75thP	57.3	1.57	95.0	98.0	30.0	32.5
p-value			0.002[4]	0.117[3]	0.291[3]	0.052[4]	0.026[4]	0.001[4]

SD: Standard deviation; 25thP: 25th percentile; 75thP: 75th percentile; WC: waist circumference; HC: hip circumference; AC: arm circumference; LCC: left calf circumference; [1] Equal variance t-test; [2] Mann-Whitney Test; [3] ANOVA with Bonferroni; [4] Kruskal Wallis (0.001*; 0.009[$]; 0.007**; 0.001***; 0.023[$$]).

Source: Authors.

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lence was significantly higher (p=0.01) in women (41.8%) than men (24.4%) (Table 3).

Over half of the sample (54.1%) showed CVD risk based on WC. Prevalence was significantly higher among women (p=0.001; 79.3%). Based on WHR, only 19.2% of participants were low risk and 52.7% were high risk. Prevalence of high risk based on WHR was higher in women (p=0.001) (Table 3).

Prevalence of low weight was higher among individuals aged 80 years and over (43.6%) and prevalence of excess weight was higher among the 60 to 69 years and 70 to 79 years groups (22.8% and 24.6%, respectively); however, these differences were not statistically significant. The AC values indicated that the greater the age, the lower the prevalence of malnourishment (59.0% for up to 69 years and 43.6% for ≥80 years) and the higher the prevalence of excess weight (8.0% and 28.2% in the age extremes; p=0.031). The LCC values indicated that prevalence of malnourishment was higher in individuals aged 80 years and over (59.0%) than among those aged 60 to 69 years (24.5%) (p=0.001). There were no statistically significant differences for the other indicators (Table 4).

Discussion

Our findings show that the older persons living in the *Quilombolas* investigated by this study suffer precarious housing, basic sanitation and social conditions. The results also reveal a high prevalence of nutritional and CVD risk, with important differences between the sexes and age groups.

The poor socioeconomic and basic sanitation conditions found by the present study are consistent with the findings of other studies with *Quilombola* communities[15,16]. Historical processes of racial segregation and discrimination have meant that these communities have accumulated disadvantages down generations, exposing black people to exclusion and marginalization. This has resulted in multiple practical barriers to health and social services, adversely affecting the health and well-being of *Quilombolas*. These long-term inequalities continue to be captured by the social and health indicators of older *Quilombolas*, especially in poorer regions like the State of Maranhão[1]. The historic inequalities faced by *Quilombola* communities also leave a mark on the health of older persons[17], given that

Table 3. Anthropometric pattern by sex in older Quilombolas (≥60 years), Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2018.

Measures	Total		Male		Female		p-value[1]
	n	%	n	%	n	%	
BMI							
Low weight	53	25.9	29	31.2	24	21.4	0.188
Normal	108	52.7	48	51.6	60	53.6	
Excess weight	44	21.4	16	17.2	28	25.0	
Arm circumference (AC)							
Undernourishment	105	51.7	55	59.8	50	45.1	0.174
Normal	61	30.1	23	25.0	38	34.2	
Excess weight	36	17.7	14	15.2	22	19.8	
Obese	1	0.5	0	0	1	0.9	
Left calf circumference (LCC)							
Malnutrition	68	34.0	22	24.4	46	41.8	0.010
Normal	132	66.0	68	75.6	64	58.2	
Waist circumference (WC)							
No risk	92	44.9	69	75.0	23	20.7	0.001
Risk	111	54.1	23	25.0	88	79.3	
Waist-hip-ratio (WHR: WC/HC)							
Low risk	39	19.2	38	41.3	1	0.9	0.001
Medium risk	57	28.1	42	45.7	15	13.5	
High risk	107	52.7	12	13.0	95	75.6	

[1] Pearson's chi-squared test or Pearson's exact test.

Source: Authors.

Table 4. Anthropometric pattern by age group (years) among older Quilombolas (≥60 years), Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2018.

Measures	Total		60 to 69		70 to 79		80 and over		p-value[1]
	n	%	n	%	n	%	n	%	
BMI									
Low weight	53	25.9	22	21.8	14	21.5	17	43.6	0.079
Normal	108	52.7	56	55.4	35	53.9	17	43.6	
Excess weight	44	21.4	23	22.8	16	24.6	5	12.8	
Arm circumference (AC)									
Undernourishment	105	51.7	59	59.0	29	45.3	17	43.6	0.031
Normal	61	30.1	32	32.0	19	28.1	11	28.2	
Excess weight	36	17.7	8	8.0	17	26.6	11	28.2	
Obese	1	0.5	1	1.0	0	0.0	0	0.0	
Left calf circumference (LCC)									
Normal	132	66.0	74	75.5	42	66.7	16	41.0	0.001
Undernourishment	68	34.0	24	24.5	21	33.3	23	59.0	
Waist circumference (WC)									
No risk	92	44.9	54	53.5	24	38.1	14	35.9	0.066
Risk	111	54.1	47	46.5	39	61.9	25	61.1	
Waist-hip-ratio (WHR: WC/HC)									
Low risk	39	19.2	23	22.8	11	17.5	5	12.8	0.239
Medium risk	57	28.1	32	31.7	13	20.6	12	30.8	
High risk	107	52.7	46	45.5	39	61.9	22	56.4	

[1] Pearson's chi-squared test or Pearson's exact test.

Source: Authors.

the growing population of older *Quilombolas* in Brazil is characterized by greater health needs and overlapping socioeconomic, health, nutritional and CVD risks[1,18].

The majority of the older persons in our study had an adequate BMI. However, women showed a higher prevalence of excess de weight than men, which is consistent with the findings of studies in a municipality in the state of Paraná[7] and Vitória da Conquista, Bahia[6]. However, other studies have shown that prevalence of overweight/obesity was higher in older men than in older women[19]. These discrepancies may suggest that malnutrition is associated with individual characteristics and therefore depends on the specific characteristics of each study population[20].

With regard to weight, means and medians decreased with increasing age and was associated with being female. These findings are corroborated by studies with older persons in seven Brazilian cities. The studies reported that prevalence of low weight was 12.0% and higher in individuals aged 80 years and over[21], and that being female, self-reported poor health and increased mean blood pressure were associated with high BMI[22]. According to Venturini *et al.*[23], prevalence of excess weight was higher among women due to greater visceral and subcutaneous fat accumulation. In addition, another study showed that menopause-related hormone disorders can lead to weight gain and adiposity[23].

Another possible explanation are differences in energy expenditure between sexes associated with the higher frequency of manual labor among men[24]. Men living in rural *Quilombola* communities are more likely to engage in manual agricultural work, while women devote themselves more to domestic tasks, rearing small animals and growing vegetables[25]. These differences can result in excess body fat among women.

With regard to the potential relation between food consumption and nutritional status, it is possible that the results observed in this study may have been influenced by poor quality diet; however, the latter was not assessed by the present study. Other studies with *Quilombola* com-

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munities have reported low consumption of fruits and vegetables, contributing to increased weight and CVD risk[2,26]. A study in a *Quilombola* community in Belém, Pará observed that, despite the variety of fruit and vegetables grown in the community, consumption was low because most of the produce was sold. In addition, fruit and vegetables were replaced by industrialized foods, which are linked to excess weight due to their high calorific value[27].

In the present study, despite the fact that there was no difference in Mean PB between men and women, as observed by Silva *et al.*[19], the PB values revealed higher prevalence of undernourishment among the older persons. Similar results were found by Silva *et al.*[28] in a study in a university hospital in the state of Pará, which showed lower mean AC in older persons with undernourishment (22.26 cm) than those with risk of undernourishment (25.98 cm)[28]. A study conducted in a university hospital in Recife, Pernambuco found that the most effective body measure for identifying nutritional deficiencies was AC[29].

The LCC values showed that 34% of the older persons in our study were undernourished and prevalence of undernourishment was higher in the 80 years and over age group and among women. Other studies investigating the nutritional status of older persons found lower prevalence rates, ranging from 2.2% to 7.9%[30]. These discrepancies may be due to differences in the socioeconomic characteristics of the study populations. Similar results were found by Miranda *et al.*[31] in a study with older persons in Benevides, Pará, which observed that undernourishment rose with increasing age. As did Almeida *et al.*[32], who found that prevalence of undernourishment based on LCC was 19.1% in a study with *Quilombolas* in Salvaterra, Pará. Since LCC is also an indicator of sarcopenia[33] (the progressive loss of skeletal muscle strength and mass with aging[34]), it is important to monitor this measure because muscle loss can adversely affect physical function and, consequently, quality of life and well-being.

The WHR values in the current study show that women were at greater risk of cardiovascular disease, especially in the over 70 age group, as shown by previous studies[35,36]. Women also showed higher mean values of WC and the prevalence of CVD risk was three time greater in women than in men. These findings are similar to those of a study with *Quilombolas* in the state of Amazonas, which showed that WC was significantly higher in women than in men[19]. In another study with older persons in Estrela, Rio Grande do Sul, mean WC was 98.43±11.64 cm[37], while Cordovil and Almeida[38] did not find any differences in mean WC between men and women in *Quilombola* communities in Salvaterra, Pará. However, they did find a strong correlation between this variable and BMI, demonstrating that the study population were at nutritional risk. Despite reporting high prevalence of hypertension and dyslipidemia in a *Quilombola* community in Maranhão, Barbosa *et al.*[39] also observed low prevalence of other independent risk factors for cardiovascular events[39].

The cardiovascular and nutritional health data of studies with Afro-descendant ethnic minorities in other countries also show well-established health inequalities[40-42]. Afro-Americans have a higher burden of cardiovascular diseases and events. They also show a higher prevalence of risk factors that are not recognized and therefore go without treatment, putting this group at greater risk of suffering adverse outcomes and, therefore, potentially higher morbidity and mortality. In addition, the prevalence of CVD risk factors is even higher in older persons[40]. CVD caused almost one million deaths in sub-Saharan Africa in 2013, constituting 38.3% of non-communicable disease deaths[41]. A study of CVD risk factors among South Asian ethnic groups showed a predominance of stroke events in black patients[42].

CVD is the leading cause of mortality in Brazil and a study showed that aged-adjusted rates in the country's main cities were higher than in some other countries, especially among women[43]. The higher the level of abdominal fat accumulation, the greater the risk of total mortality, since higher levels of fat accumulation are associated with increased risk of hypertension, diabetes, insulin resistance, dyslipidemia, atherosclerosis, and non-alcoholic fatty liver disease[43,44]. A previous study in *Quilombola* communities in Maranhão showed that these types of CVD morbidities were more common in older persons and that prevalence was higher among women[1].

Although the current study did no observe high levels of undernourishment and CVD, the anthropometric indicators examined highlight that undernourishment in individuals with CVD influences clinical outcomes, in-hospital complications and infection, thus increasing the risk of morbidity and mortality[14]. Therefore, understanding the nutritional profile of a population is important for the early detection of associated risk factors. In this regard, it is important to develop new anthropometric equations that take into account the coexistence of overlapping risk factors[45], especially in more vulnerable populations such as older persons and *Quilombolas*.

Study limitations include the fact that cross-sectional studies only provide a snapshot of a population at a single point in time. The interviews were conducted by a previously trained team and therefore any possible differences in anthropometric measurements are residual. Furthermore, some of the anthropometric measurements used fail to distinguish body composition. However, these measures are essential for the assessment of the nutritional status of older persons and are low cost and easy to apply. The measures used in this study showed a strong association with health status and disease and the nutritional and CVD risk observed in our findings may also be the result of deteriorating health conditions among the older persons.

The aging process is therefore related to the risk of developing CVD, and socioeconomic status, dietary patterns, metabolism and physical condition are some of the characteristics that should be assessed in this process[46].

The use of different indicators of nutritional status helped provide a complete assessment of nutritional status and some statistically significant correlations were found between some of the variables. AC is used to assess undernourishment and excess de weight, and is particularly useful in situations where it is not possible to measure weight and height to calculate BMI, in bedridden older persons for example[47]. LCC is one of the most sensitive measures of changes in muscle mass in older persons[14]. This measure was therefore useful both for diagnosing undernourishment and as an indicator of sarcopenia[33].

Finally, the findings reveal that the older persons living in the *Quilombola* communities investigated by this study are socially vulnerable, experience precarious housing conditions and basic sanitation and have a high prevalence of low weight, loss of muscle mass and high risk of CVD. Prevalence of poor nutritional status and CVD risk was higher in women. Prevalence of undernourishment with loss of muscle mass was higher in individuals from the oldest age group, while the youngest age group showed higher prevalence of undernourishment based on AC. It is therefore important to implement interventions that improve nutritional status in these groups, prevent current and future complications and promote health and quality of life in older *Quilombolas*.

Collaborations

TC Silva participated in data collection, writing the article and its final version. C Martins Neto participated in the writing of the article and its final version. CA Carvalho, PCAF Viola, LS Rodrigues and BLCA Oliveira worked in all stages from study design to review of the final version of the article.

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