DOI: 10.1590/1413-812320212610.11252021

ARTICLE

Factors related to the physical capacity of upper and lower limbs in quilombola elderly people

Brenda Natally Soares Furtado (https://orcid.org/0000-0002-2570-8799) [1]
Ricardo Alves de Olinda(http://orcid.org/0000-0002-0509-8428) [2]
Gabriela Maria Cavalcanti Costa (https://orcid.org/0000-0003-4466-6886) [3]
Tarciana Nobre de Menezes (https://orcid.org/0000-0003-1784-3218) [4]

Abstract *This paper aimed to assess the factors related to the physical capacity of upper and lower limbs in quilombola older adults. This is a cross-sectional, analytic study performed with elderly residents in the quilombola community Caiana dos Crioulos, Alagoa Grande, Paraíba, Brazil. The researched dependent variables were the physical capacity of upper and lower limbs. It was performed the Spearman correlation and multiple and linear simple regression (95% CI; p<0.05). This work was performed per Resolution 466/2012 from National Health Council. Forty-three older adults were assessed. The bivariate analyses showed a positive correlation between handgrip strength (HGS) and physical activity (PA), between HGS and arm muscle circumference (AMC), and an inverse correlation between Short Physical Performance Battery (SPPB) and age. The multiple-model for HGS was significantly correlated with age, AMC, and years of study (R^2=0.374; p<0.05). Regarding the SPPB, it showed a significant correlation with age (R^2=0.2524; p=0.001). Therefore, the muscle mass reserve, years of study, and age were factors related to the physical capacity among quilombola older adults. The strict compliance of these aspects and the early intervention can preserve physical capacity and ensure the productive inclusion and economic autonomy so much sought in the communities' social agenda.*

Key words *Elderly health, Physical functional performance, Ethnic groups, African Continental Ancestry Group*

[1] Programa de Pós-Graduação em Saúde Pública, Universidade Estadual da Paraíba. Av. Baraúnas 351, Campus Universitário. 58109-753 Campina Grande PB Brasil. brenda.natally@gmail.com
[2] Departamento de Estatística, Universidade Estadual da Paraíba. Campina Grande PB Brasil.
[3] Departamento de Enfermagem, Universidade Estadual da Paraíba. Campina Grande PB Brasil.
[4] Departamento de Fisioterapia, Universidade Estadual da Paraíba. Campina Grande PB Brasil.

Introduction

The term capacity is related to the ability of an individual to perform a task or an action in a uniform and standard environment[1]. The assessment of physical capacity is an essential tool to gauge the health status of older adults, given its relationship with the functionality of this group[2]. Changes in the functionality of the lower limbs limit mobility, which commonly leads to physical disability and loss of functional independence[3,4]. Changes in the physical capacity of upper limbs can be important indicators of general strength, predictors of cardiometabolic diseases, disability, morbidity, and early mortality[4].

Elderly health promotion and health actions should consider global functionality, enabling individuals to manage their lives[5]. This perspective expands elderly health care, removing the focus from disease and the biological aspect and leading to sociocultural approaches, promoting active and healthy aging[6].

The quilombola population is included, given the importance of this approach. Its contextual factors contain conditions of vulnerability to diseases that include social aspects. The Brazilian government recognized this situation of vulnerability with the creation of the Special Secretariat of Policies for the Promotion of Racial Equality (SEPPIR) and the establishment of the National Policy for the Comprehensive Health of the Black Population (PNSIPN)[7].

Quilombola communities consist of African descent individuals, who stand out among the black population by being more susceptible because of socioeconomic differences and their mostly rural geographic location[8]. This population faces difficulties in the operationalization of public policies and interruption of the State's proposed actions, which favors increasing inequalities to the detriment of vulnerable groups[9].

Few studies in the scientific literature assess quilombolas' physical capacities[10,11]. A study carried out in two quilombola communities in Tocantins evaluated the handgrip strength, body composition, and gait speed of older women, and identified mean values of adequate physical capacities (21.79±5.57 Kg of HGS and 1.28 ±0.4 m/s of gait speed)[10].

Assessing the functionality of older adults through physical capacity can positively contribute to their health. Physical tests identify early the need for intervention, thus improving the clinical prognosis. Therefore, it is relevant to separately assess the factors associated with the physical capacity of upper and lower limbs, given their specificities and consequences for the lives of older adults, and identify early those at higher risk of developing a functional decline. This initiative translates as one of the goals of the National Elderly Health Policy (PNSPI) for achieving healthy aging[12]. Thus, this study aimed to assess the factors related to the physical capacity of lower and upper limbs in quilombola older adults.

Methods

This is a cross-sectional, quantitative study with primary data collection nested in a more extensive study entitled "Multidimensional assessment of the health of older adults in a quilombola community in the state of Paraíba" (*Free translation from the Portuguese*).

We included older adults (60 years or older) of both genders, living in the quilombola community of Caiana dos Crioulos, registered in the E-SUS. We excluded older adults with cognitive decline, who declared in person or through an informant to have uncorrected severe visual or hearing impairment, who were bedridden or whose physical condition prevented them from walking or performing physical capacity activities, and who were absent from the quilombo during data collection.

The Mini-Mental State Examination (MMSE)[13] was used to screen for cognitive decline, with the following cutoff points: illiterate (score < 13 indicates dementia, ≥ 13 without dementia); elementary and high school, < 8 years schooling (score < 18 indicates dementia, ≥ 18 without dementia); high schooling level, > 8 years schooling (< 26 indicates dementia, ≥ 26 without dementia).

Data collection

Initially, a pilot study was carried out in the quilombola community of Pedra D'Água in Ingá, Paraíba, with eighteen older adults, equivalent to 32% of older adults residing in Caiana dos Crioulos. The collection of data of older adults from the quilombola community of Caiana dos Crioulos, in Alagoa Grande, Paraíba, Brazil, was conducted from October to December 2019. The city is located in the inland region of the state, 111 km from the capital João Pessoa. Initially, a meeting was held with the representative of the quilombola community and the community health worker (ACS) responsible for the area, in

Ciência & Saúde Coletiva, 26(10):4591-4602, 2021

which the methodology and objectives of the research were explained. Both were invited to be information multipliers, helping to communicate with the community.

We obtained a list of older adults from the community at the PHC Unit (UBS), which allowed for planning a schedule with days and times set to attend the research site. Thus, the older adults were invited to visit the headquarters of the quilombo residents' association on a pre-determined day and time. A new call was made for older adults who did not attend. Another absence would trigger a home visit to the older adults by the research team, with up to two visits. Older adults absent in the two visits were considered a loss.

The variables evaluated were upper and lower limb physical capacity (dependent variables), socioeconomic-demographic status, depressive symptoms, health status, physical activity, and sedentary behavior (independent variables).

The physical capacity of the upper limbs was verified through the handgrip strength. Initially, older adults were asked about the arm they considered to have the greatest strength. They were also asked about having undergone surgery on the arm or hand in the three months before data collection, and if so, they were excluded from the test. Handgrip strength was measured using a manual hydraulic dynamometer (Takei Kiki Kogyo® TK 1201 dynamometer, Japan) adjusted to the size of each older adult's hands. This procedure was performed three times, with a one-minute interval between executions, considering the mean as the final value. The higher the mean value, the better the physical capacity.

Lower limb capacity was assessed using the Brazilian version of the Short Physical Performance Battery (SPPB)[3], an effective instrument for assessing lower limb capacity in the elderly population. It consists of three tests that assess static balance while standing, gait speed, and lower limb muscle strength. The score for each test ranges from 0 (worst performer) to 4 points (best performer). The SPPB classification is given by the sum of the scores of the three tests, which can range from 0 to 12. The higher the value-added, the better the physical capacity of older adults.

Questions related to age, years of study, number of residents in the household (sum of people living in the same household, including older adults), per capita household income (sum of gross household income divided by the number of people living in the household) were verified. The socioeconomic level was obtained from the questionnaire of the Brazilian Association of Research Companies, generating a score for economic stratification: classes A/B (29 to 100 points), C (17 to 28 points), and D/E (0 to 16 points). Higher values are indicative of better socioeconomic status[14].

Depressive symptoms were analyzed using the Geriatric Depression Scale (GDS)[15], consisting of 15 questions, with a total score ranging from 0 to 15 points. Each question has two alternatives (yes, no) with assigned values from 0 to 1 point. A score above 5 points indicates depressive symptoms.

Physical activity and sedentary behavior were analyzed using the International Physical Activity Questionnaire (IPAQ) short version[16]. The questionnaire consists of questions regarding the frequency, duration, and intensity of physical activity: the longer the duration in minutes per week, the more active the individual is. The total physical activity in MET-min/week was obtained using the physical activity compendium. The metabolic equivalent of task (MET) intensity level is a measure that estimates energy expenditure with physical activity. The mean MET scores were used for each domain (Walk=3.3 METs; Moderate=4.0 METs; Vigorous=8.0 METs). Then, the following equation was used: mean MET x minutes of activity x frequency per week, thus obtaining continuous values in METs-minutes/week[17].

The domain time sitting during one day of the week and one day on the weekend was used to assess sedentary behavior. A weighted average calculation was performed, in which the sitting time indicated for the days of the week was multiplied by 5, then added to the time for the weekend days, and multiplied by 2. This result was divided by 7 to obtain the number average number of hours per day spent in the sitting position[18]. The cutoff point indicated for sedentary behavior "yes" is >180 minutes[19]. The longer the sitting time in minutes per week, the greater the indication of sedentary behavior.

The health situation was assessed through information on the number of reported morbidities, falls, nutritional status, and metabolic risk. The number of reported morbidities was obtained by asking older adults whether any doctor or other health professional informed them that they had any of the mentioned diseases: arterial hypertension; heart problem; osteoporosis; stroke or CVA; arthritis/arthrosis or rheumatism; diabetes mellitus; cancer; chronic lung disease; glaucoma; Parkinson's disease. Falls were evaluated through the answer to the following question: Did you fall in the last 12 months? If so, the number of times was asked.

Nutritional status was verified through the Body Mass Index (BMI) (weight (kg)/height (m)^2), the calf perimeter (CP), and the arm muscle circumference (AMC). Weight and height were measured using a portable digital electronic scale (TANITA UM080®) and a portable stadiometer (ALTUREXATA®), respectively[20]. According to the classification suggested by the Pan American Health Organization (PAHO)[21], BMI values ≤ 23 kg/m² are indicative of low weight, > 23 kg/m² and < 28 kg/m² indicate eutrophy, ≥ 28 kg/m² and < 30 kg/m² indicate overweight, and ≥ 30 kg/m² indicate obesity. The lower the BMI, the greater the risk of malnutrition, and the higher the BMI, the greater the risk of overweight/obesity.

The CP was measured with an inelastic measuring tape[20]. The following values indicate decreased muscle mass: ≤ 34 cm for men and ≤ 33 cm for women[22]. The AMC was obtained from the following equation 23: AMC (cm) = [AP (cm) – (ϖ x TSF (cm))]. Arm perimeter (AP) and triceps skinfold (TSF) were measured using an inelastic measuring tape and the Lange® skinfold compass, respectively[20]. Lower AMC values are indicative of malnutrition.

The metabolic risk was verified through the waist circumference (WC), according to the techniques described in Lohman et al.[20]. The metabolic risk was verified using the following WC values: ≥ 102 cm for men and ≥ 88 cm for women[24].

Statistical procedures

Data were double-entered and validated using the "validate" tool (Epi Info 7.2). Descriptive data are shown as mean, median, interquartile ranges, standard deviation, and maximum and minimum values. Data distribution normality was analyzed using the Anderson-Darling test.

Spearman's correlation test was performed, and simple linear regression models were built, considering the independent variables vis-à-vis the dependent variables (5% significance level). An initial multiple linear regression model was built for each dependent variable to test the mutual relationship of the independent variables on the HGS and the SPPB score. Variables with a p-value below 0.20 in each initial model were included in a final multiple linear regression model. The variables with a significance level of p<0.05 remained in the final model. The Backward method was used for multiple linear regression. The variables that were most likely not related to the dependent variables (HGS and SPPB) were gradually removed by the stepwise method. Analyses were performed with statistical software R (R CORE TEAM, 2019).

Ethical aspects

This study's more extensive research was approved by the Research Ethics Committee (CEP) of the State University of Paraíba (Opinion No. 3.459.657). Upon accepting to participate, older adults were instructed to sign the Informed Consent Form, as recommended by Resolution no. 466/2012 of the National Health Council of the Ministry of Health.

Results

Forty-three quilombola older adults participated in this study, with a mean age of 70.74 years (±6.66), ranging from 60 to 83 years. Four of the older adults living in the quilombola community (55) refused to participate in the research, two were not found in their homes in the two visits carried out, two were excluded for not being able to answer the questionnaires, three were excluded according to the MMSE criteria, and one was excluded for not being able to perform the physical tests.

Table 1 shows the values referring to the mean, standard deviation, median, maximum value, minimum value, and first and third quartiles of the studied variables. The mean of the handgrip strength values was 22.44 kgf, and the Short Physical Performance Battery (SPPB) score was 8.47 (±2.09).

Table 2 shows the simple linear regression analysis results via the bivariate model, between handgrip strength and the independent variables evaluated. A statistically significant positive correlation was observed between HGS and PA (R^2=0.141; p=0.013), showing an increase of 0.000048 unit of the value of HGS (kgf) ($\beta 1$=0.000048) for each unit of increase in PA (METs-min/week). A statistically significant positive correlation was identified between HGS and AMC (R^2=0.237; p=0.0009); so, an increase of 1.199 units in the HGS (kgf) (β_1=1.199) value is observed or each unit of increase in the AMC (cm) value.

Table 3 presents the simple linear regression analysis results via the bivariate model between the Short Physical Performance Battery (SPPB) score and the independent variables. It is possible to observe an inverse correlation between the SPPB score and age (R^2=0.236; p=0.0009). Thus, according to the adjusted data model, a 0.152 decrease in the SPPB score unit ($\beta 1$= -0.152) is observed for each unit of age increase.

Table 4 presents the results of the multiple linear regression between the independent variables and the HGS and the SPPB. Age, AMC, and years of schooling showed a significant correlation with HGS ($p<0.05$), explaining 37% (R^2=0.374) of the variation in HGS among quilombola older adults. The AMC showed a significant directly proportional effect ($\beta 1$=1.305) with the HGS; that is, each unit of AMC increase corresponds to an increase of 1.305 in the unit of the HGS value. Age and years of study had a significant inversely proportional effect ($\beta 1$= -0.373 and $\beta 1$= -2.726, respectively) with HGS; each unit of increase in age and years of study corresponds to a decrease of 0.373 and 2.726, respectively, in the unit of the HGS value.

As for the SPPB score, age is the significant variable ($p<0.05$) that makes up the final model, which explains 25% (R^2=0.2524) of the SPPB variation among quilombola older adults. Age had a significant inversely proportional effect ($\beta 1$= - 0.15003) to SPPB. Each unit of age increase corresponds to a 0.15003 unit decrease in the SPPB score.

Discussion

Physical capacity portrays the individual's ability to develop an activity and reflects the state of functionality independently. Several factors are associated with physical capacity, such as flexibility, strength, balance, and aerobic conditioning[25]. Santos et al.[2] show that assessing these factors in older adults is essential for planning more appropriate interventions that meet the demands exposed by this group.

The implementation of actions aimed at older adults is provided for in the guidelines of the Ministry of Health. However, it is still incipient in primary care services, especially for activities aimed at healthy aging, which calls attention to the urgent need for improvements in the performance of services of the SUS[26].

This may be the first study that aimed to evaluate the factors associated with the physical ca-

Table 1. Mean, standard deviation, median, minimum value, maximum value, first and third quartiles of the variables related to the physical capacity of upper and lower limbs, socioeconomic-demographic situation, depressive symptoms, health status, physical activity, and sedentary behavior. Alagoa Grande, Paraíba, Brazil, 2019.

Variables	Mean	Standard diviation	Mean	Maximum	Minimum	1st Quartile	3rd Quartile
HGS (kgf)	22,44	8,93	22,7	47,3	7,6	15,8	27,2
SPPB (points)	8,47	2,09	9	12	4	7	12
Age (years)	70,74	6,66	70	83	60	65,5	75
Socioeconomic level (points)	12,6	2,8	12	22	7	11	14
Per capita household income (R$)	868.899	520,21	748,5	1.996	166,3	487	998
Humber of household residents	2.84	1.56	2	7	1	2	4
Years of study	0.65	1	0	4	0	0	1
GDS15 (points)	3.42	2.34	3	11	1	2	4
PA (METs-min/week)	5.725,09	6.986,98	2.388	27.540	0	873	8.418,5
Sedentary behavior (min/week)	207,31	145,42	197,14	720	30	111,42	300
Number of reported morbidities	1,54	1,25	1	5	0	1	2
Number of falls	0,44	0,73	0	2	0	0	1
BMI (kg/m2)	26,92	4,87	26,98	37,38	17,17	23,38	30,41
AMC (cm)	22,39	3,63	21,98	31,13	15,68	19,23	25,62
CP (cm)	33,41	4,22	33,9	40,9	21,6	30,65	36,5
WC (cm)	92,71	12,73	93	121,8	62,46	85	101,9

HGS: Handgrip strength; SPPB: Short Physical Performance Battery; GDS: Geriatric Depression Scale; PA: Physical activity; BMI: Body Mass Index; AMC: Arm Muscle Circumference; CP: Calf Perimeter; WC: Waist Circumference.

Source: Survey data, 2019.

Table 2. Adjustment of the simple linear regression model via the bivariate model between HGS and independent variables in quilombola older adults. Alagoa Grande, Paraíba, Brazil. 2019.

Variables	Hand grip strength (HGS)					
	r (95% CI)	p-value	Estimated β0 (p-value)	Estimated β1	R²	p-value
Age	-0.179 (-0.452 – 0.136)	0.250	-40.600 (0.008) *	-0.256	0.036	0.218
Socioeconomic level (points)	0.154 (-0.136 – 0.439)	0.322	15.330 (0.019) *	0.564	0.031	0.256
Per capita household income (R$)	-0.192 (-0.500 –0.126)	0.216	25.468 (<0.0001)	-0.003	0.041	0.192
Years of study	-0.250 (-0.507 – 0.044)	0.104	23.621 (<0.0001)	-1.815	0.041	0.193
Humber of household residents	0.114 (-0.198 – 0.440)	0.465	20.482 (<0.0001)	0.689	0.014	0.442
GDS15 (points)	-0.285 (-0.551 – 0.017)	0.063	25.437 (<0.0001)	-0.877	0.052	0.138
PA (METs-min/week)	0.212 (-0.132 – 0.490)	0.170	19.69 (<0.0001)	0.0004	0.141	0.013*
Sedentary behavior (min/week)	0.071 (-0.284 – 0.384)	0.648	20.465 (<0.0001)	0.009	0.024	0.321
Number of reported morbidities	-0.087 (-0.394 – 0.232)	0.586	23.664 (<0.0001)	-0.765	0.010	0.516
Number of falls	-0.173 (-0.438 – 0.112)	0.265	23.572 (<0.0001)	-2.564	0.044	0.175
BMI (kg/m2)	0.099 (-0.214 – 0.371)	0.527	17.632 (0.029) *	0.178	0.009	0.534
AMC (cm)	0.478 (0.222 – 0.680)	0.001*	-4.400 (0.565)	1.199	0.237	0.0009*
PP (cm)	0.199 (-0.108 – 0.498)	0.198	4.259 (0.694)	0.544	0.065	0.096
WC (cm)	0.077 (-0.264 – 0.381)	0.620	12.592 (0.221)	0.106	0.022	0.333

HGS: Handgrip strength; SPPB: Short Physical Performance Battery; GDS: Geriatric Depression Scale; PA: Physical activity; BMI: Body Mass Index; AMC: Arm Muscle Circumference; PP: Calf Perimeter; WC: Waist Circumference; r: correlation coefficient; * Level of significance < 0.05; β0: intercept; β1: angular coefficient; R²: determination coefficient.

Source: Survey data, 2019.

pacity of upper and lower limbs in quilombola older adults. As they are a vulnerable population, quilombolas are often treated by public policies in a macro fashion, at the same level as other vulnerable groups. However, it is necessary to recognize the specificities of each group and this vulnerable population. Although policies for seniors[12] and blacks[27], and a social agenda for quilombolas[28] are in place, there is no public policy or specific agenda for quilombola older adults, making this group and, therefore, their needs invisible.

The findings of this study indicated a relationship between upper limb physical capacity and age, AMC and years of schooling, and between the physical capacity of lower limbs and age. Information such as these can help health professionals to adopt specific prevention measures for the population, contributing to health promotion by stimulating physical skills, positively favoring physical and functional capacity, affecting health protection and longevity, and reducing future expenses with more complex services.

A significant correlation was observed between HGS and AMC and between HGS and physical activity in the bivariate analysis of this study. The multiple regression model identified three factors (age, AMC, and years of study) which, together, explain 37% of the variability of upper limb physical capacity. The correlation between HGS and AMC corroborates results obtained in other studies carried out with older adults[29,30]. Evaluating 420 elderly of both genders, Silva et al.[29] found a positive and significant correlation between HGS and AMC. The authors argue that variations in anthropometric indicators can interfere with the HGS of these older adults. A study carried out in São Caetano do Sul, São Paulo, Brasil, observed an association between lower values of AMC and decreased HGS, which, according to the authors, confirms AMC as a sensitive indicator of muscle reduction[30].

The AMC is an indicator of muscle reserve, which is often reduced during aging. Less muscle reserve translates as less muscle strength[29]. This declining muscle mass can result in a deficit in physical capacity and influence the onset of dis-

Table 3. Adjustment of the simple linear regression model via the bivariate model between SPPB and independent variables in quilombola older adults. Alagoa Grande, Paraíba, Brazil. 2019.

Variables	Short Physical Performance Battery (SPPB)					
	r (95% CI)	p-value	Estimated β0 (p-value)	Estimated β1	R²	p-value
Age	-0.467 (-0.675 – 0.209)	0.001*	19.238 (<0.0001)	-0.152	0.236	0.0009*
Socioeconomic level (points)	-0.144 (-0.427 – 0.167)	0.354	10.262 (<0.0001)	-0.142	0.036	0.218
Per capita household income (R$)	-0.302 (-0.562 – 0.014)	0.048*	9.132 (<0.0001)	-0.000	0.036	0.218
Years of study	0.119 (-0.191 – 0.379)	0.445	8.169 (<0.0001)	0.454	0.047	0.162
Humber of household residents	0.207 (-0.098 – 0.469)	0.180	7.817 (<0.0001)	0.228	0.029	0.274
GDS15 (points)	-0.142 (0.424 – 0.158)	0.360	8.737 (<0.0001)	-0.079	0.008	0.568
PA (METs-min/week)	0.318 (-0.0364 – 0.589)	0.037*	7.962 (<0.0001)	0.000	0.086	0.055
Sedentary behavior (min/week)	-0.195 (-0.5006 – 0.123)	0.208	8.901 (<0.0001)	-0.002	0.021	0.348
Number of reported morbidities	-0.172 (-0.4906 – 0.184)	0.281	9.098 (<0.0001)	-0.397	0.054	0.142
Number of falls	-0.076 (-0.3702 – 0.213)	0.626	8.461 (<0.0001)	0.007	0.000	0.987
BMI (kg/m2)	0.066 (-0.235 – 0.3604)	0.670	7.349 (0.0002) *	0.041	0.009	0.536
AMC (cm)	0.085 (-0.205 – 0.378)	0.584	7.890 (0.0003) *	0.025	0.002	0.775
PP (cm)	0.128 (-0.2102 – 0.419)	0.412	5.178 (0.048) *	0.098	0.039	0.201
WC (cm)	-0.010 (-0.303 – 0.294)	0.947	8.402 (0.001) *	0.0006	0.00001	0.979

HGS: Handgrip strength; SPPB: Short Physical Performance Battery; GDS: Geriatric Depression Scale; PA: Physical activity; BMI: Body Mass Index; AMC: Arm Muscle Circumference; PP: Calf Perimeter; WC: Waist Circumference; r: correlation coefficient; * Level of significance <0,05; β0: intercept; β1: angular coefficient; R²: determination coefficient.

Source: Survey data, 2019.

Table 4. Adjustment of multiple linear regression via bivariate model to estimate the prediction of independent variables on the HGS and SPPB score in quilombola older adults. Alagoa Grande, Paraíba, Brazil, 2019.

	Variables	R²	β1	Standard error	T-Statistic	p-value
Handgrip strength (HGS)		0.374				
	Intercept		21.376	13.8408	1.544	0.1305
	Age		-0.373	0.173	-2.15	0.037*
	AMC (cm)		1.305	0.313	4.163	0.0001*
	Years of study		-2.726	1.162	-2.346	0.024*
Short Physical Performance Battery (SPPB)		0.2524				
	Intercept		19.918	3.176	6.270	<0.0001
	Age		-0.15003	0.044	-3.354	0.00178*
	Socioeconomic level (points)		-0.074	0.104	-0.706	0.484
	Number of falls		0.213	0.398	0.536	0.595

HGS: Handgrip strength; SPPB: Short Physical Performance Battery; AMC: Arm Muscle Circumference; * Level of significance <0,05; β0: intercept; β1: angular coefficient; R²: determination coefficient.

Source: Survey data, 2019.

abilities and frailty. Thus, it is crucial to assess the behavior of this important indicator on different measures of physical abilities, an aspect mainly addressed by this study.

As for the inverse correlation between HGS and age found in this study, a similar result was found by Lima et al.[31] in a study carried out with adults and older adults, which identified age as a factor associated with lower HGS values. The authors argue that this relationship can be explained by weaker muscles over the years, declining muscle mass and because the oldest older adults in this study are more inactive. Marques et al.[30] found an association between decreased HGS and older age. The literature shows a clear inverse relationship between age and HGS. This loss is mainly associated with muscle atrophy resulting from sarcopenia and low physical activity levels among older adults, contributing to muscle disuse and consequent dynapenia in this population.

The inverse relationship between HGS and years of education observed in this study shows that the smaller the number of years of education, the higher the HGS value; therefore, the better the physical capacity. This inverse relationship may be related to the fact that less-educated individuals would be more likely to engage in works that require more effort, which, consequently, would improve strength. According to Miranda et al.[9], the convergence of ethnicity, gender, region, class, and schooling contributes to exploiting the workforce, precariousness, and maintenance of social inequalities. Quilombolas mainly develop work related to agriculture and civil construction. Informality does not guarantee labor rights, payment of contributions, or benefits for workers. In this sense, public policies focused on quilombolas are offshoots and require articulation with the State, besides the participation of all those involved.

Despite this inverse relationship, the importance of education as a means to promote health must be considered. Ribeiro et al.[32] verified in a study the influence of education on health, showing a positive impact on the socioeconomic condition, which provided lifestyle changes. Thus, schooling promoted health, adopting healthy habits, engaging in physical activity, improving the understanding of health guidelines. Therefore, considering that education promotes health, it must be provided and encouraged for the entire population.

The SPPB mean value found in this study was similar to the early days of a two-year longitudinal study on older adults, which found a mean score of 8.46 (±2.68) points[33]. This mean value points to a moderate physical capacity of lower limbs, which may be related to high sedentary behavior despite older adults' engagement in adequate physical activity.

Therefore, in a systematic review and meta-analysis, Pavasini et al.[34] found that an SPPB score lower than 10 points is indicative of all-cause mortality. Thus, it is vital to consider the decline in the score of this instrument since it consists of a decline in physical capacity, indicating the need for intervention in this population. Even if the mean value presented in this study is suggestive of moderate capacity, older adults should be monitored, given the importance of this variable to their functionality.

In this study, age was inversely related to SPPB in the bivariate and multiple analyses. In the multiple model only age was correlated with SPPB, explaining a 25% lower limb physical capacity variability. A similar result was found in other studies[35,36]. Ikegami et al.[33] observed a relationship between the age group and the SPPB, in which older adults have worse scores. The authors argue that although chronological age is not a precise marker for aging changes, the passing of years entails a declining physical function, an aspect harming mobility, balance, and strength.

Broadly, advancing age affects different individual aspects. Silva et al.[37] argue that older adults show declining motor units, muscle fibers, and neurological system efficiency, an increase in muscle weakness and fatigue, slow movement, which contribute to the limitations in walking, standing up, and performing activities.

These age-related changes justify the findings of this study, in which age was inversely related to both HGS and SPPB in the multiple model. Thus, the older the age, the worse the physical capacity of both upper and lower limbs. We should consider that healthy aging requires health promotion strategies at all ages, from birth to old age. Therefore, prevention actions must be directed to all groups. Thus, the PNSPI provides for investment in health promotion at all ages, disseminating adequate information about aging to the entire population, including in school curricula subjects that address the aging process and promotion and prevention measures[12].

Concerning the assessment of physical capabilities, the tests used in this research have different characteristics related to muscle recruitment. HGS is assessed by dynamometry and requires more type I muscle fibers. Included in the SPPB, the sit-and-stand test recruits mostly type II fibers, which are more prevalent in the lower limbs and suffer greater hypotrophy[2]. As a result, we emphasize the need for specific assessment of different body segments, thus seeking a more careful assessment of physical capacity during the aging process to prevent outcomes arising from this period of life.

In this study, physical activity was related to HGS in the bivariate analysis. However, it lost statistical significance in the multiple model, showing that, together, other variables were more closely related to HGS. Notwithstanding this, physical activity is an important measure to be encouraged due to its positive impact on strength and muscle mass.

Multicomponent exercises can help gain other skills such as coordination, balance, and mobility, contributing to older adults' independence. Lenardt et al.[38] suggest that physical activity is a preventive strategy against problems that generate physical frailty, thus providing direct and indirect benefits to older adults, such as improving muscle strength levels.

It is relevant to observe an aspect considered by Bezerra et al.[39], who identified in a study that quilombola older adults had a physical activity profile similar to that of rural groups and that they are more active at work and less active at leisure. According to the authors, this finding may be related to schooling, as better education can provide better access to health resources and opportunities to adopt healthy habits. Thus, we suggest that establishing partnerships for implementing programs of physical and recreational activities for older adults, provided for in the urban development item of the PNSPI[12], must also reach the quilombola populations.

This work has some limitations regarding the number of participants. While limited, we can make valid inferences from the detailed description of the scenario and the consistency of the data, considering that the transferability of results under similar conditions is feasible in quilombola populations. We suggest recognizing and standardizing cultural differences and that social public policies identifying the remaining subjects of this vulnerable group recognize traditional practices/customs and demands and effectively ensure the implementation and monitoring of preventive and clinical care actions. After all, we identified gaps in the objective description of actions in the social agenda of the *Brasil Quilombola* Program and, in national policies of health promotion, Comprehensive Health of the Black Population, and elderly health.

This study is among the few carried out in rural quilombola groups, despite the complex logistics of collection and home visits. The information generated may help developing actions to prevent and maintain the functionality of quilombola older adults and providing this population with autonomy and independence. The results may support actions in other rural quilombola communities, given the representativeness of the Caiana dos Crioulos quilombola community in the region.

Conclusion

This study showed that muscle mass reserve, years of schooling, and age were factors related to physical capacity among quilombola older adults. The higher the AMC, the better the capacity of the upper limbs, the longer the years of study, the worse the capacity of the upper limbs, and the older the age, the worse the capacity of the upper and lower limbs.

Knowledge of factors related to physical capacity can contribute to formulating health promotion strategies to improve physical capacities and enable better functionality and independence for older adults. Thus, periodic assessments of AMC are suggested as an early indicator of malnutrition, compromising physical capacity and involvement in functional activities. Also, it is essential to adopt prevention and health promotion measures for all ages, strengthening educational actions on healthy aging for the entire population and assertively in school curricula. Careful observance of these aspects and early intervention can preserve physical capacity and ensure productive inclusion and economic autonomy coveted in the communities' social agenda.

The instruments employed in this study can be used in health services to identify older adults with reduced physical capacity and related factors. Tests can provide important information about functionality. They are simple to perform so that they can be included in assessments in PHC. However, the hydraulic dynamometer is not an instrument available at UBS, which hinders the use of this test, specifically in PHC. Thus, studies are suggested to validate other more accessible instruments for the assessment of upper limbs. In contrast, the SPPB is a viable tool for implementation in this context. Given the possibility of this assessment, older adults with inadequate physical capacity should be monitored.

Collaborations

BNS Furtado participated in data collection, literature review, interpretation and discussion of data, writing, review, and paper approval. RA Olinda participated in the statistical analysis, data interpretation, and writing of the paper. GMC Costa participated in the literature review, interpretation, and discussion of data, writing, and review.

References

1. Machado FN, Machado AN, Soares SM. Comparação entre a capacidade e desempenho: um estudo sobre a funcionalidade de idosos dependentes. *Rev Lat Am de Enfermagem* 2013;21(6):1321-1329.
2. Santos FC , Boggio EB, Souza CM, Rosa PV, Silva MF, Rosa LHT. A associação entre capacidade física e probabilidade de internação hospitalar em idosos que vivem na comunidade. *Fisioter Pesqui* 2017;24(3):238-244.
3. Nakano MM. *Versão brasileira da Short Physical Performance Battery SPPB : adaptação cultural e estudo da confiabilidade* [dissertação]. Campinas (SP): Universidade Estadual de Campinas; 2007
4. Alonso AC, Ribeiro SM, Luna NMS, Peterson MD, Bocalini DS, Serra MM, Brech GC, Greve JM, Garcez-Leme LE. Association between handgrip strength, balance, and knee flexion/extension strength in older adults. Sergi G, organizador. *PLoS One* 2018; 13(6):e0198185.
5. Moraes EN de, Marino MC de A, Santos RR. Principais Síndromes Geriátricas. *Rev Med Minas Gerais* 2009; 20(1):1-11.
6. Santos GLA, Santana RF, Broca PV. Execution capacity of instrumental activities of daily living in elderly: Ethnonursing. Escola Anna Nery *Rev Enfermagem* 2016; 20(3):1-7.
7. Santos VC, Boery EN, Pereira R, Rosa DOS, Vilela ABA, Anjos KF, Boery RNSO. Condições Socioeconômicas e de Saúde associadas à Qualidade de vida de idosos quilombolas. *Texto Context Enferm* 2016; 25(2):1-9.
8. Oliveira SKM, Pereira MM, Guimarães ALS, Caldeira AP. Autopercepção de saúde em quilombolas do norte de Minas Gerais, Brasil. *Cien Saude Colet* 2015; 20(9):2879-90.
9. Miranda S, Oliveira J, Sampaio C, Rodrigues Neto J. Artigos Cartografia das condições de trabalho de a informalidade e a saúde mental. *Interface (Botucatu)* 2021; 25(e200478):1-20.
10. Cunha BS, Souza CRG, Prudente LOB, Osório NB, Neto LSS. Sarcopenia em idosas quilombolas : Análise das variáveis antropométricas e de força de preensão manual. *Rev Patol do Tocantins* 2017; 4(3):9.
11. Silva Neto LS, Rezende FAC, Nunes DP, Maciel EDS, Travassos A, Osório NB. Associação de força de preensão palmar e osteoporose avaliada por densitometria óssea (DXA) em idosos quilombolas. *Acta Fisiátrica* 2018; 25(4).
12. Brasil. Ministério da Saúde (MS). *Portaria n° 2528 de 19 de outubro de 2006.* Aprova a Política Nacional de Saúde da Pessoa Idosa. Brasília: MS; 2006.
13. Bertolucci PHF, Brucki SMD, Campacci SR, Juliano Y. O Mini-Exame do Estado Mental em uma população geral: impacto da escolaridade. *Arquivos de Neuro-Psiquiatria* 1994; 52(1):1-7
14. Associação Brasileira de Empresas de Pesquisa (ABEP). *Critério de Classificação Econômica Brasil* [Internet]. São Paulo: ABEP; 2019 [acessado em 2020 Fev 10]. Disponível em: http://www.abep.org/criterio-brasil
15. Almeida OP, Almeida SA. Short versions of the Geriatric Depression Scale: A study of their validity for the diagnosis of a major depressive episode according to ICD-10 and DSM-IV. *Int J Geriatr Psychiatry* 1999; 14:858-865.
16. Matsudo SM, Matdsudo VR, Araújo T, Andrade D, Andrade E, Oliveira L, Braggion G. Nível de atividade física da população do Estado de São Paulo: análise de acordo com o gênero, idade, nível socioeconômico, distribuição geográfica e de conhecimento. *Rev Bras Cienc Mov* 2002; 10(4):41-50.
17. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, O'Brien WL, Basset DR, Shimitz KH, Emplaincourt PO, Jocobs DR, Lenon AS. Compendium of Physical Activities: an update of activity codes and MET intensities. *Med Sci Sport Exerc* 2000 Set; 32(9):498-516.
18. Martins MO, Cavalcante VLF, Holanda GS, Oliveira CG, Maia FES, Meneses Júnior JR. Associação entre comportamento sedentário e fatores psicossociais e ambientais em adolescentes da Região Nordeste do Brasil. *Rev Bras Ativ Fis Saude* 2012; 17(2):143-150.
19. Rezende LFM, Sá TH, Mielke GI, Viscondi JYK, Rey-López JP, Garcia LMT. All-Cause Mortality Attributable to Sitting Time. *Am J Prev Med* 2016; 51(2):253-263.
20. Lohman T, Roche A, Martorell R. *Anthropometric standardization reference manual.* 1ª ed. Champaign, Illionois: Human Kinetics Books; 1988.
21. Organización Panamericana de la Salud (OPAS). *Encuesta Multicéntrica. Salud Bienestar y envejecimento (SABE) en América Latina y el Caribe.* Screening. Kingston, Jamaica: OPAS; 2001. 22 p.
22. Pagotto V, Santos KF, Malaquias SG, Bachion MM, Silveira EA. Calf circumference: clinical validation for evaluation of muscle mass in the elderly. *Rev Bras Enferm* 2018; 71(2):322-328.
23. Gurney MJ, Jelliffe DB. Arm anthropometry in nutritional assessment: nomogram for rapid calculation of muscle circumference and cross-sectional muscle and fat areas. *Am J Clin Nutr* 1973; 26:912-915.
24. World Health Organization (WHO). *Obesity: preventing and managing the global epidemic* . Report of a WHO Consultation [Internet]. Geneva: WHO; 2000 [cited 2020 Fev 23]. Available from: https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/
25. Preto LSR, Gomes JRL, Novo AFMP, Mendes ER, Granero-Molina J. Efeitos de um Programa de Enfermagem de Reabilitação na Aptidão Funcional de Idosos Institucionalizados. *Rev de Enfermagem Referência* 2016; Série IV (8):55-63.
26. Placideli N, Castanheira ERL, Dias A, Silva PA, Carrapato JLF, Sanine PR, Machado DF, Medonça CS, Zarili TFT, Nunes LO, Monti JFC, Hartz ZMA, Nemes MIB.
27. Avaliação da atenção integral ao idoso em serviços de atenção primária. *Rev Saude Publica* 2020; 54(6):1-14.
28. Brasil. Ministério da Saúde (MS), Secretaria de Gestão Estratégica e Participativa, Departamento de Apoio à Gestão Participativa. *Política Nacional de Saúde Integral da População Negra : uma política para o SUS.* 2ª ed. Brasília: MS; 2013.

29. Brasil. Decreto n°6.261, de 20 de novembro de 2007. Dispõe sobre a gestão integrada para o desenvolvimento da Agenda Social Quilombola no âmbito do Programa Brasil Quilombola, e dá outras providências. *Decreto n° 6.261.* 2007, 20 nov.
30. Silva NDA, Menezes TN, Melo RLP, Pedraza DF. Força de preensão manual e flexibilidade e suas relações com variáveis antropométricas em idosos. *Rev Assoc Med Bras* 2013; 59(2):128-135.
31. Marques KM, Ferreira MPN, Freitas TI, Goulart RMM, Aquino RC, Previdelli ÁN. Evaluation of dynapenia in the elderly in São Caetano do Sul, São Paulo, Brazil. *Fisioterapia em Movimento* 2019; 32(E003218): 1-10.
32. Lima TR, Silva DAS, Kovaleski DF, González-Chica DA. Associação da força muscular com fatores sociodemográficos e estilo de vida em adultos e idosos jovens no Sul do Brasil. *Cien Saude Colet* 2018; 23(11):3811-3820.
33. Ribeiro KG, Andrade LOM, Aguiar JB, Moreira AEMM, Frota AC. Education and health in a region under social vulnerability situation: Breakthroughs and challenges for public policies. *Interface* 2018; 22:1387-1398.
34. Ikegami ÉM, Souza LA, Tavares DMDS, Rodrigues LR. Capacidade funcional e desempenho físico de idosos comunitários: um estudo longitudinal. *Cien Saude Colet* 2020; 25(3):1083-1090.
35. Pavasini R, Guralnik J, Brown JC, di Bari M, Cesari M, Landi F, Vaes B, Legrand D, Verghese J, Wang C, Stenholm S, Ferrucci L, Lai JC, Bartes AA, Espaulella J, Ferrer M, Lim JY, Ensrud KE, Cawthon P, Turusheva A, Frolova E, Rolland Y, Lauwers V, Corsonello A, Kirk GD, Ferrari R, Volpato S, Campo G. Short Physical Performance Battery and all-cause mortality: Systematic review and meta-analysis. *BMC Med* 2016; 14(215):1-9.
36. Lenardt MH, Carneiro NHK, Betiolli SE, Binotto MA, Ribeiro DK de MN, Teixeira FFR. Factors associated with decreased hand grip strength in the elderly. *Esc Anna Nery - Rev Enferm* [periódico na Internet]. 2016 [acessado 2020 jan 12]; 20(4):e20160082 [cerca de 10p.]. Disponível em:https://doi.org/10.5935/1414-8145.20160082.
37. Garbaccio JL, Tonaco LAB, Estevão WG, Barcelos BJ. Envelhecimento e qualidade de vida de idosos residentes da zona rural. *Rev Bras Enferm* 2018;71(Supl. 2):776-784.
38. Silva N de A, Pedraza DF, Menezes TN de. Desempenho funcional e sua associação com variáveis antropométricas e de composição corporal em idosos. *Cien Saude Colet* 2015; 20(12):3723-3732.
39. Lenardt MH, Binotto MA, Carneiro NHK, Cechinel C, Betiolli SE, Lourenço TM. Handgrip strength and physical activity in frail elderly. *Rev Esc de Enfermagem da USP* 2016; 50(1):86-92.
40. Bezerra V, Andrade A, César C, Caiaffa W. Domínios de atividade física em comunidades quilombolas do sudoeste da Bahia , Brasil : estudo de base populacional. *Cad Saude Publica* 2015; 31(6):1213-1224.

Article submitted 20/11/2020
Approved 23/05/2021
Final version submitted 25/05/2021

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva