Metabolic syndrome and associated factors in quilombolas (inhabitants of black communities) from Bahia, Brazil

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Abstract *This study aimed to analyze the prevalence of this condition and associated factors in adult quilombolas (inhabitants of black communities). In a population-based study with a sample of 850 adults of both sexes, MS was determined using the Joint Interim Statement criteria. Hierarchical Poisson regression modeling was used to test the associations. The prevalence of MS was 25.8% (95%CI: 22.8:28.7). In multiple analysis, gender, age group, sleep quality, body mass index and fat percentage remained significantly associated (p < 0.05). In this respect, the presence of SM in adult quilombolas is associated with female gender, age ≥ 40 years, poor sleep quality, overweight, and obesity.*

Key words *Health survey, Group with African Continental Ancestry, Metabolic syndrome X*

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Introduction

Urbanization, technological transition and economic development impact on sociocultural patterns and promote changes in the risk factors for illness. Within this context, metabolic syndrome (MS) emerges as a condition of complex etiology. In view of the existence of questionable aspects of the definition of MS, the Joint Interim Statement[1] was agreed upon by important world health institutions, which classified this condition based on the simultaneous presence of at least three of the following components: high triglycerides, low high-density lipoprotein (HDL), increased blood glucose, high blood pressure, and central obesity.

High population prevalences of MS have been reported. Systematic reviews indicate a prevalence close to 25% in Latin America[2], while this rate ranges from 28.9% to 29.6% in Brazil[3]. However, studies investigating the prevalence of MS in specific population groups are necessary. Within this context, an ethnic-racial influence on the prevalence of MS has been identified[4,5]. However, knowledge about the impact of MS in black populations is still limited[6], especially for populations living in conditions of socioeconomic vulnerability or distant from large urban centers.

Quilombo communities comprise inhabitants of black ancestry (quilombolas) that have their own social, cultural and religious characteristics[7]. The few studies involving relatively small samples of adult quilombolas have shown an expressive variation in the prevalence of MS, from 26.2%[8] to 55.4%[9], which can reach much higher rates than those observed in other populations[2,3].

Divergences regarding the association of MS with sociodemographic, behavioral, environmental and biological factors and comorbidities have been reported in the literature[2,4,8,9], a fact that impairs adequate screening for this condition and the identification of its main predisposing factors.

In this respect, race and skin color are known to influence indicators of MS. Furthermore, little information is available about the prevalence of MS in specific populations, particularly black populations, as well as its associated and/or predisposing factors, which negatively interferes with the development of preventive and clinical actions. Therefore, the objective of this study was to analyze the prevalence of MS and associated factors in adult quilombolas.

Materials and Methods

This study is derived from a cross-sectional population-based study entitled "Epidemiological Profile of Quilombolas Baianos", which was approved by the Ethics Committee on Research Involving Humans of Universidade do Estado da Bahia. The present study was conducted between February and November 2016.

The geographic microregion of Guanambi/Bahia, which comprised 42 certified[7] contemporaneous quilombos until 2016, distributed over 10 municipalities, represented the empirical field. Because of the lack of official data on the number of quilombo inhabitants in this microregion of Bahia, the population was estimated considering 80 families per quilombo[10], with two adults (≥ 18 years) per family in each community, totaling 6,720 adults. For sample size calculation, correction for a finite population, an unknown prevalence of the outcome (50%), 95% confidence interval, a sampling error of five percentage points and a design effect of 1.5 for the cluster were considered, adding 30% for refusals and 20% for losses and confounding. The estimated sample was 818 subjects.

The sample was selected in two steps: random sampling of the quilombos (cluster), followed by census collection. First, the quilombos were selected by drawing lots. Through the respective resident associations, 14 selected units allowed visits for the study and three refused to participate. Considering all adults in the eligible quilombos, the resident associations informed the presence of 1,025 adults during the period of data collection. All adults were invited and received information about the objectives of the study, ensuring equal chance of participation. A total of 850 quilombolas attended the data collection procedures and agreed to participate by signing the free informed consent form or by providing a fingerprint, thus composing the final sample; 17.07% did not attend the activities, characterizing refusals. The data were collected in a joint effort on weekends and holidays.

Subjects with cognitive impairment or independente communication were excluded from the interviews. Bedridden and amputated subjects, subjects using a plaster cast, pregnant women and women breastfeeding for less than 6 months were excluded from the anthropometric measurements. Losses were defined by the lack of performing some measurement or test, or the lack of responding to a question in the interview.

The data were collected by interview, blood collection, blood pressure measurement, and anthropometric assessment. These procedures were performed by teams consisting of health professionals and/or researchers according to their skills after training in the respective function.

The anthropometric variables (body weight, height, waist circumference) were determined according to the protocol of the International Society for the Advancement of Kinanthropometry (ISAK)[11], in duplicate for equality. In the case of difference, a third measurement was obtained and the median was used for analysis. The measurements were made in a closed environment on a single occasion by an ISAK certified evaluator, with the subjects barefoot and wearing minimal clothing.

Body weight was measured with a digital scale (Omron, model hbf-514c, with a capacity of 150 kg and precision of 100 g); height was measured with a portable metal stadiometer (Sanny, model Caprice) to the nearest 0.1 mm, and waist circumference was obtained with a steel measuring tape (Sanny, model sn-4010, 2 m long and 0.6 cm wide) to the nearest 0.1 mm. The intra-evaluator technical error of measurement[12] was 0.12% for height, 0.20% for body weight, and 0.39% for waist circumference, indicating adequate precision in the anthropometric measurements.

Body fat percentage (%F) was determined by bioimpedance in the morning before breakfast using a validated scale (Omron hbf-514c, with a capacity of 150 kg and precision of 0.1%)[13]. The measurements were made in duplicate for equality and a third measurement was obtained in the case of difference, using the median for analysis. The subjects were asked not to consume alcoholic beverages or caffein and not to perform intense physical activity during the 24 hours prior to the measurements. The participants were also instructed to remove metal objects and to rest for 5 minutes before the tests.

Blood samples (15 ml), properly separated and identified, were collected after a minimum fast of 8 hours by puncture of the median antecubital vein using a vacuum system, according to the protocol of the Brazilian Society for Clinical Pathology and Laboratory Medicine[14]. The collected samples were stored in a refrigerated thermal box and transported to the certified laboratory where the material was centrifuged and analyzed. Glucose, HDL and triglycerides were determined by automated colorimetric enzymatic methods (Cobas Mira Plus, Roche®).

Blood pressure was measured in triplicate with a validated semi-automated sphygmomanometer (Omron HEM-742INT)[15] after a 10-minute rest. For the measurement, the subject was sitting, feet on the floor, left arm at the height of the heart, and palm of the hand facing upwards[16]. The arithmetic mean of the three blood pressure measurements was used for analysis.

Metabolic syndrome, the dependent variable, was determined according to the Joint Interim Statement criteria based on the simultaneous presence of at least three of the following factors[1]: 1) elevated triglycerides when ≥ 150 mg/dL or use of medications to treat hypertriglyceridemia; 2) increased fasting glucose when ≥ 100 mg/dL or use of diabetes medications; 3) reduced HDL when < 40 mg/dL (men) and < 50 mg/dL (women) or use of medications to treat low HDL; 4) high blood pressure (systolic ≥ 130 mmHg and/or diastolic ≥ 85 mmHg) or use of antihypertensive medications; 5) increased waist circumference when > 90 cm for men or > 80 cm for women (the cut-offs suggested for Latin America were adopted)[6].

The sociodemographic variables were gender (female, male), marital status (with and without a partner), age group (< 40 years, ≥ 40 years), education level (≤ 5 years, > 5 years), and employment situation (unpaid, paid).

The lifestyle-related variables (according to the questions validated for adult quilombolas)[17] included self-reported smoking (smoker, ex-smoker, and never smoked); self-reported alcohol consumption (yes, no); self-reported sleep quality ("very good" and "good" grouped as good quality, regular, and "poor" and "very poor" grouped as poor quality); leisure-time physical activity (In the last 3 months, did you practice any type of physical exercise or sport other than physiotherapy? – yes, no), and sedentary behavior (On average, how many hours per day do you watch television? - ≤ 3 hours/day, > 3 hours/day).

The health condition-related variables were self-reported health ("very good" and "good" grouped as positive, regular, and "poor" and "very poor" grouped as negative); self-reported arthritis/arthrosis (yes, no), and self-reported presence of deficiency (physical, visual and/or auditory –

yes, no) according to the questions validated for adult quilombolas[17]. In addition, overweight was determined by the body mass index (BMI) (> 25 kg/m^2 defining "overweight", ≤ 25 kg/m^2 defining "no overweight") and obesity by bioimpedance (> 25% for men and > 30% for women indicating "obese", ≤ 25% for men and ≤ 30 for women indicating "non-obese")[18].

Absolute and relative frequencies of the sociodemographic, lifestyle and health condition-related variables were used for characterization of the population studied. For analysis of the association of predictors with MS, prevalence ratios (PR) were estimated by Poisson regression. First, the crude PR were determined. Variables showing a p-value < 0.20 were included in multiple analysis. A hierarchical model was used for adjusted analysis, in which the first level included the sociodemographic variables, the second level the lifestyle variables, and the third level the health condition-related variables (Figure 1). Variables with a p value < 0.05 in the level remained in the other steps until the model was saturated. The magnitudes of the associations were estimated by the 95% confidence interval (95%CI). All analyses were performed with the Statistical Package for the Social Sciences, version 22.0.

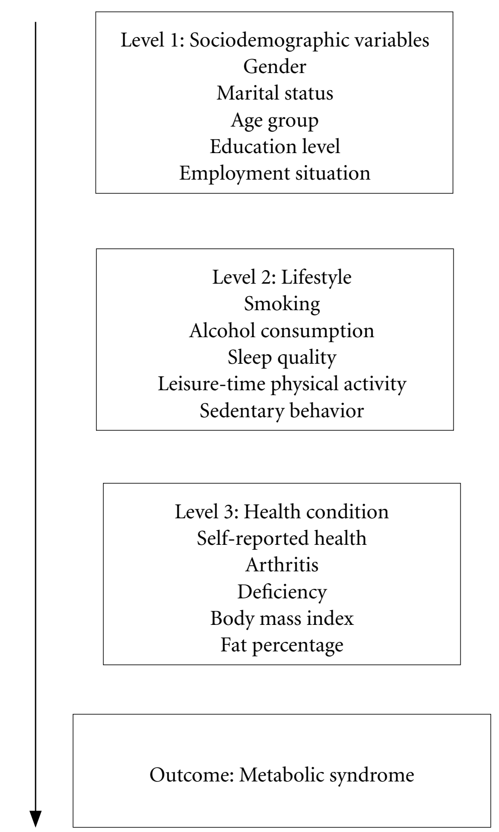

Figure 1. Hierarchical model for analysis of the factors associated with metabolic syndrome in adult quilombolas.

Results

The prevalence of MS in adult quilombolas was 25.8% (95%CI: 22.8:28.7). The median age was 45.0 years, with a predominance of women (61.2%, 95%CI: 57.9:64.5), and 86.5% of the participants self-reported as being black. There were 36 losses for %F, 21 women and 15 men, the variable with the highest rate.

Crude analysis (Table 1) indicated a higher prevalence of MS (p<0.05) among women, subjects ≥ 40 years, and subjects with ≤ 5 years of schooling. Regarding lifestyle, MS was more associated with being ex-smoker and poor sleep quality. The health condition-related variables associated with MS were regular and negative self-reported health, a diagnosis of arthritis, having some deficiency, a BMI indicating overweight, and %F indicating generalized obesity

The following variables remained independently associated with MS after adjustment in multiple regression analysis by hierarchical modeling (Table 2): gender, age group, sleep quality, overweight, and obesity. It should be noted that gender and sleep quality remained in the saturated model due to their epidemiological importance during analysis in their respective hierarchical level. Adjusted analysis thus indicates that women are 1.24 times more likely to have MS. The risk of MS tended to be 4.20 times higher for subjects ≥ 40 years, 1.40 times higher for those with poor sleep quality, 1.63 times for overweight individuals, and 3.48 times higher for obese individuals.

Discussion

The main findings of this study indicate that approximately 1/4 of the participants had MS. Female gender, age ≥ 40 years, reporting poor sleep quality, overweight and obesity significantly increased the risk of MS among adult quilombolas.

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Table 1. Prevalence ratios (PR) of metabolic syndrome (MS) and their 95% confidence intervals (95%CI) according to sociodemographic, lifestyle and health condition variables. Bahia, Brazil, 2016 (n = 850).

Variable	n (%)	% with MS	PR (95%CI)	p-value
Gender				
Male	325 (38.6%)	68 (20.9%)	1	
Female	517 (61.4%)	149 (28.8%)	1.377 (1.034:1.835)	0.029
Marital status				
Without partner	191 (23.3%)	39 (20.4%)	1	
With partner	630 (76.7%)	173 (27.5%)	1.345 (0.950:1.904)	0.095
Age group				
< 40 years	352 (41.8%)	28 (8.0%)	1	
≥ 40 years	490 (58.2%)	189 (38.6%)	4.849 (3.260:7.211)	< 0.001
Education level				
> 5 years	320 (41.6%)	41 (12.8%)	1	
≤ 5 years	450 (58.4%)	156 (34.7%)	2.706 (1.918:3.816)	< 0.001
Employment situation				
Paid work	440 (53.5%)	109 (24.8%)	1	
Unpaid work	382 (46.5%)	103 (27.0%)	1.088 (0.831:1.425)	0.537
Smoking				
Never	555 (69.2%)	132 (23.8%)	1	
Ex-smoker	175 (21.8%)	61 (34.9%)	1.466 (1.082:1.985)	0.014
Smoker	72 (9.0%)	16 (22.2%)	0.934 (0.556:1.570)	0.798
Alcohol consumption				
No	576 (70.2%)	157 (27.3%)	1	
Yes	244 (29.8%)	54 (22.1%)	0.812 (0.596:1.106)	0.187
Sleep quality				
Good	538 (65.8%)	113 (21.0%)	1	
Regular	186 (22.7%)	54 (29.0%)	1.382 (0.999:1.912)	0.050
Poor	94 (11.5%)	44 (46.8%)	2.229 (1.573:3.157)	< 0.001
Leisure-time physical activity				
Yes	319 (39.5%)	70 (21.9%)	1	
No	489 (60.5%)	137 (28.0%)	1.277 (0.957:1.703)	0.096
Sedentary behavior				
≤ 3 hours/day	677 (91.6%)	170 (25.1%)	1	
> 3 hours/day	62 (8.4%)	13 (21.0%)	0.835 (0.475:1.468)	0.531
Self-reported health				
Positive	402 (48.9%)	79 (19.7%)	1	
Regular	343 (41.7%)	100 (29.2%)	1.484 (1.105:1.993)	0.009
Negative	77 (9.4%)	33 (42.9%)	2.181 (1.453:3.274)	< 0.001
Arthritis				
No	713 (87.0%)	157 (22.0%)	1	
Yes	107 (13.0%)	54 (50.5%)	2.292 (1.682:3.122)	< 0.001
Deficiency				
No	309 (37.5%)	39 (12.6%)	1	
Yes	514 (62.5%)	173 (33.7%)	2.667 (1.884:3.775)	< 0.001
Body mass index				
No overweight	395 (47.4%)	47 (11.9%)	1	
Overweight	439 (52.6%)	170 (38.7%)	3.254 (2.356:4.495)	< 0.001
Fat percentage				
Non-obese	301 (37.1%)	25 (8.3%)	1	
Obese	511 (62.9%)	189 (37.0%)	4.453 (2.934:6.758)	< 0.001

n (%): Number of subjects; % with MS: Percentage with metabolic syndrome; PR: prevalence ratio; 95%CI: 95% confidence interval.

Table 2. Poisson multiple regression analysis of factors associated with metabolic syndrome in adult quilombolas. Bahia, Brazil, 2016.

Variable	PR * (95%CI)	p-value	PR ** (95%CI)	p-value
Gender				
Male	1		1	
Female	0.611 (0.452:0.826)	< 0.001	1.243 (0.898:1.722)	0.190***
Marital status				
Without partner	1			
With partner	1.137 (0.786:1.645)	0.495[a]		
Age group				
< 40 years	1		1	
≥ 40 years	4.330 (2.745:6.830)	< 0.001	4.202 (2.788:6.334)	<0.001***
Education level				
> 5 years	1			
≤ 5 years	1.387 (0.944:2.040)	0.096[a]		
Smoking				
Never	1			
Ex-smoker	1.023 (0.735:1.424)	0.891[b]		
Smoker	0.800 (0.468:1.367)	0.414[b]		
Alcohol consumption				
No	1			
Yes	1.149 (0.816:1.617)	0.425[b]		
Sleep quality				
Good	1		1	
Regular	1.166 (0.836:1.626)	0.365	1.176 (0.848:1.633)	0.331***
Poor	1.555 (1.084:2.231)	0.017	1.401 (0.980:2.002)	0.064***
Leisure-time physical activity				
Yes	1			
No	1.097 (0.819:1.468)	0.535[b]		
Self-reported health				
Positive	1			
Regular	1.058 (0.773:1.447)	0.726[c]		
Negative	1.117 (0.710:1.757)	0.632[c]		
Arthritis				
No	1			
Yes	1.302 (0.929:1.825)	0.126[c]		
Deficiency				
No	1			
Yes	1.083 (0.726:1.617)	0.696[c]		
Body mass index				
No overweight	1		1	
Overweight	1.637 (1.121:2.391)	0.011	1.630 (1.117:2.380)	0.011***
Fat percentage				
Non-obese	1		1	
Obese	3.401 (2.015:5.740)	< 0.001	3.478 (2.064:5.860)	< 0.001***

PR: prevalence ratio; 95%CI: 95% confidence interval; * Poisson regression adjusted for levels; ** multiple Poisson regression; *** variables that remained in the saturated model according to the hierarchical model. a Variables eliminated in the first level; b variables eliminated in the second level; c variables eliminated in the third level.

Estimates of the prevalence of MS contribute to the effective planning of strategies for the control of this syndrome and its aggravating factors in a given population[19]. To our knowledge, this is

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the first study analyzing this outcome in a representative sample of a geo-economic microregion in Brazil.

In view of the high prevalence found among adult quilombolas, it is important to emphasize that MS is associated with greater health risks than the sum of relative risks of its individual components[3]. This scenario may be aggravated by socioeconomic vulnerability and limited access to health services, two characteristics possibly present in some quilombo communities.

The prevalence of MS found in adult quilombolas is similar to the lowest frequency, 25%, reported in the literature for Lain America[2] and the 26.2% reported for quilombolas in Maranhão[8]. However, this rate is slightly lower than the 28.9% reported as the lowest prevalence among non-quilombo Brazilians[3] and approximately half the prevalence, 55.4%, found among quilombolas in Piauí[9].

These differences or similarities in the prevalence of MS might be explained by differences in the criteria adopted for the diagnosis of MS, a recognized factor of divergences in the estimation of its prevalence[3,6]. For example, recent studies involving quilombolas[8,9] have used the National Cholesterol Education - Adult Treatment Panel III (NCEP-ATP III) criteria, which employ cut-off points of central obesity defined for predominantly Caucasian populations. In contrast, the present study used the Joint Interim Statement criteria, which indicate the use of the most specific cut-offs for the population analyzed[1]. In this respect, in view of the absence of specific cut-off points of central obesity for the quilombo, black or Brazilian population, we used the cut-offs suggested for the Latin American population[6], which are lower than those established by the NCEP-ATP III criteria. It should be noted that this difference in cut-off points may have led to subnotification of cases in other studies involving quilombolas.

In agreement with the present study, a review of Brazilian studies[3], a Central American survey[20], a meta-analysis of Latin American studies[2] and studies on quilombolas[8,9] also identified an association of MS with female gender. In this respect, women are known to be susceptible to hormonal changes that can cause metabolic alterations[21] and consequently increase the accumulation of body fat, a fundamental component for the development of MS.

The present findings also corroborate a review of Brazilian[3] and Latin American studies[2], a telephone survey conducted in Brazilian capitals[22] and a study on quilombolas in Piauí[9] by identifying an association between MS and older age. Aging causes a natural functional decrease in metabolism[23,24], which increases the probability of fat accumulation, insulin resistance, inflammatory processes and blood pressure elevation, events that interact and potentiate the risk of illness.

International studies have indicated an association between sleep problems and MS[25,26], as also identified in the quilombola population. Poor sleep quality is known to negatively affect metabolic function[27], causing hormonal changes that potentiate organic stress and are related to the increasing prevalence of chronic noncommunicable diseases.

Overweight determined by BMI and obesity determined by %F were important factors associated with MS in quilombolas. However, obesity showed a greater predictive capacity of MS. These results support the view that weight and fat gains are important predictors of illness and mortality[28,29].

Studies involving adults living in Brazilian capitals[22] and quilombolas in Piauí[9] also identified an association of MS with overweight. However, a survey of studies showed that overweight is a more important risk factor for disease and death in Caucasians than in blacks[29], a fact that could explain in part the better association of obesity determined by bioimpedance with MS in this study.

High prevalences of MS have been described. However, its components are responsive to positive lifestyle changes, weight loss and body fat reduction[6], strategies that should be applied prior to or concomitantly with pharmacological treatment.

A limitation of the present study is its cross-sectional design, which does not permit to establish a causal relationship between the outcome and explanatory variables. Bias in the understanding and memory of the subjects is another limitation, but this bias was minimized by standardization of the technique and training of the team of interviewers.

As a strength, the present study is one of the few national studies investigating rural quilombo communities. Additional strengths are the robustness of the representative sample of the regional population even in view of the complex visitation logistics in a broad geographic area, and the attendance, including laboratory blood tests, of some communities with insufficient health service coverage for their demand. Furthermore, this study provides data that may assist in the elaboration of actions to address and prevent health risk factors.

Conclusion

Metabolic syndrome was identified in 1 of 4 adult quilombolas and was associated with sociodemographic factors (female gender and older age), lifestyle (poor sleep quality), and health condition-related variables (overweight and obesity). This situation indicates the need for further and better preventive and corrective actions to minimize aggravation of the epidemiological profile, particularly those related to the early diagnosis and treatment of MS and its components. In this respect, maintenance and expansion of access to public health policies and services, as well as socioeconomic development, will certainly have a positive impact on the living and health conditions of quilombo communities.

Collaborations

RFF Mussi: conception and design of the study. RFF Mussi and EL Petróski: analysis and interpretation of data, drafting and critically revising the manuscript. All authors have approved the final version of the manuscript and declare to be responsible for all aspects of the work, guaranteeing its accuracy and integrity.

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