Original article

PHYSICAL ACTIVITY TO PREVENT DIABETES IN A BLACK-SKINNED POPULATION. HOW MUCH IS NEEDED?

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ABSTRACT

OBJECTIVE. To determine the intensity and duration of physical activity, both total physical activity and physical activity in four different domains (work, commuting, housework, and leisure time) that is predictive of absence of diabetes in a black-skinned population.

METHODS. This was a cross-sectional study of a sample of 2305 adults aged 20 to 96, living in the city of Salvador, Brazil, 902 (39,1%) of whom were male. Receiver Operating Characteristic (ROC) curves were constructed to compare the area under the curve (AUC) for the relationship between amount of physical activity in the four domains and absence of diabetes. Sensitivity and specificity were also calculated in order to identify the best cutoff points for amount of physical activity against absence of diabetes. Based on these cutoff points, a multivariate model was constructed to identify the association between physical activity and diabetes.

RESULTS. The AUC-ROC results demonstrating the greatest statistical significance among the different quantities of physical activity were for total physical activity, moderate activities performed during leisure time and at work for the men and as transport for the women. Walking was not alone a good predictor of absence of diabetes for the men. It was also observed that 185 minutes of physical activity per week accumulated in all domains for men and 215 minutes per week for women were the best cutoff points for predicting absence of diabetes.

CONCLUSION. Physical activity accumulated in different domains should be recommended in the quantity appropriate for black-skinned populations in order to contribute to diabetes prevention.

Key words: Motor activity. Diabetes mellitus. Disease prevention.

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INTRODUCTION

The benefits of regular physical activity for prevention and treatment of diabetes have been reported by many different studies, [1,2,3] but the quantity of exercise that is needed in order to maximize its beneficial effects is still the subject of speculation, both for the general population and for black-skinned populations.

Diabetes is a severe public health problem and one of the most important risk factors for cardiovascular diseases. We are currently experiencing increases in the prevalence of diabetes in many different parts of the world and it has been predicted that the diseases will affect 300 million people by the year 2030. [4] A recent study [5] conducted specifically with black-skinned people demonstrated that the prevalence of diabetes is greater in this group than in other population groups.

Physical activity is defined as any bodily movement produced by the action of the skeletal musculature which results in greater energy expenditure than the resting state. [6] It can be broken down into the domains of occupational activities (PA-OCC), transport activities (PA-TRA), housework activities (PA-HOU) and leisure time (PA-LT). Some studies have indicated that the black-skinned population has lower physical activity levels than other racial groups. [7,8]

Regular physical activity can prevent diabetes or help with its treatment because it helps to reduce and/or maintain body weight, reduces oral antidiabetic drug requirements,

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attenuates insulin resistance and contributes to improved glycemic control, which, in turn, reduces the risk of diabetes-related complications. [9]

Despite all of these benefits, the quantity of physical activity needed to prevent or treat diabetes is not yet well-established, particularly not with relation to black-skinned populations. A recent publication [10] demonstrated that a total of 185 to 285 minutes per week of physical activity accumulated within the different domains may be the correct amount of activity for preventing diabetes in adults, but further studies are needed to confirm these findings.

Information on the most appropriate quantity or the amount necessary could be used to design physical activity programs to provide the most appropriate benefits for prevention or treatment of diabetes.

Therefore, the objective of this study was to identify the total physical activity level (TPA, quantified in terms of both duration and intensity) and the quantity in each domain (occupational, transport, housework, leisure) that are predictive of an absence of diabetes in a black-skinned population.

Methods

Study design and location

This was a cross-sectional study conducted in Salvador, BA, Brazil, during the second half of 2007 investigating non-transmissible chronic diseases and their risk factors. The municipality of Salvador is subdivided into 12 healthcare districts for the purposes of health administration. Four of these healthcare districts have populations that are more than 75% black-skinned and two of these, both densely populated and with similar murder rates, were chosen for this study: Liberdade, where all seven neighborhoods were sampled, and Barra-Rio Vermelho, where 56% of the neighborhoods were sampled.

Sampling strategy

The sample size was estimated on the basis of a 35% arterial hypertension prevalence that was observed among black people who took part in a study conducted in Salvador in 2000 investigating people of all skin colors. [7] In order to obtain an error of less than 2%, at a 95% confidence level, the minimum sample size was estimated at 2185 (» 2200) black-skinned adults aged ≥ 20. As a general rule, only one person per housework was sampled and so the number of households selected was based on the number of participants being recruited. However, in the (rare) event that two or more non-consanguineous families were living in the same housework, one participant per family was permitted.

Since black people accounted for 75% of the population in the areas sampled, they should be found within the general population and, assuming 25% of white people, in principle it would be necessary to visit 2950 households - 2200 inhabited by black people and ≈ 750 by white people, who would be excluded. A further 25% (≈ 740 households) was added to cover uninhabited, non-residential or ruined properties and to cover households where everybody was less than 20 years old or where nobody was found after two successive attempts, increasing the sample size to 3690 households. To this figure a further 15% (553) was added to cover losses due to household or individual refusal. The total number of households was estimated at 4243 and then rounded to 4250, which were chosen probabilistically from all of the roads and streets within the sample areas.

After surveying the entire area with the aid of several different types of map in order to define which roads were included and to count residences, simple randomized samples were selected of: a) streets; b) residences on the streets chosen (n = 4250); and c) one eligible person for households inhabited by one family or two eligible people for households inhabited by two non-consanguineous families.

Eligibility

The following criteria were obligatory for eligibility: self reporting as black (black or brown), minimum age[3] of 20 years and consent to take part in both stages of the investigation: 1) home interview 2) attending the health service for supplementary tests. People were ineligible if they self-reported as white, were pregnant or did not have the mental capacity to respond to the questionnaire or to attend the health center that served as the base for the fieldwork conducted in the second stage. Before the participant from each household was chosen, residents were asked what their skin color was, choosing from among the possible answers provided in surveys conducted by the Brazilian Institute of Geography and Statistics (IGBE - *Instituto Brasileira de Geografia e Estatística*). Only those people who agreed to take the tests were included in the sampling process. If the person chosen by the sampling method decided not to take the tests on the day set for their interview, they were considered to have refused to take part and were excluded from the investigation.

Data collection instrument

All participants in the study were interviewed at home to collect sociodemographic data and physical activity data. The data collection instrument was an electronic questionnaire programmed in Java and run on a Palm Z-22. The instrument was planned and discussed within the project team and then with a programmer from the IT department to ensure that the program was fit for purpose and to discuss the several different types of replies and coding. Weekly, or more frequently if necessary, one of the project coordinators downloaded the questionnaires from the Palms directly into Excel running on a personal computer. Each handheld was capable of storing up to 100 questionnaires of the size used (163 questions with countless permutations) and each interviewer's Palm was programmed to create up to 100 questionnaires numbered consecutively. Once this batch of 100 questionnaires had been downloaded, another 100 were allocated. Training in the use of the Palm was provided by the programmer, first training the coordinators and then the ten interviewers in the presence of the entire team. After training a pilot test was conducted. All of the interviewers were educated to high school graduation level and had a great deal of experience in interviewing. Each interviewer administered ten questionnaires. The pilot also served to test the performance of the Palms, how easy the interviewers found them to use and the duration of each interview, which was automatically recorded by the program. In the field, interviewers were under direct supervision by graduate technicians.

Study variables

The following variables were used: diabetes (dependent variable), TPA and its sub-domains: PA-OCC, PA-TRA, PA-HOU and PA-LT (independent variables) in addition to sex, age, educational level, socioeconomic status, body mass index (BMI), triglycerides and cholesterol (covariables).

The long version of the International Physical Activity Questionnaire (IPAQ) was used to quantify physical activity in the different domains. The questionnaire consists of questions on the frequency and duration of physical activities (walking, moderate and vigorous) at work, for transport, as part of household tasks and during leisure activities. [11] Results for each physical activity domain are reported as minutes/week by multiplying the weekly frequency by the duration of each of the activities engaged in. Educational level was divided into three strata: 0 = very low (from illiterate to 5th grade of primary education); 1 = low (at least primary education completed); 2 = medium/high (at least secondary education completed, including professional technical qualifications acquired and higher education, whether completed or not). Social class was coded according to the methodology used by the *Associação Brasileira de Pesquisa de Mercado* (ABPEME - Brazilian Market Research Association), which has classifications from A to E. For the purposes of this study, classes were grouped and coded as follows: low = 0 (classes D + E); mid/high= 1 (classes C + B + A). Age was coded as follows: 0 if age $<$ 40 years, 1 if age is from 40 to 59 and 2 if age $\geq$ 60 years.

Anthropometric and biochemical variables were collected at health centers that were supporting the project. BMI was calculated by dividing body mass by height squared, with body mass expressed in kilograms (kg) and height in meters (m). [12] Body mass was measured using a calibrated balance (Filizola, Brazil), with a maximum capacity of 150 kg and accuracy of 0.1 kg. height was measured with a vertical stadiometer that was part of the balance, was 210 cm long and had a scale with 0.1 cm divisions.

Blood samples were taken after 12 hours' fasting for analysis of plasma lipids and glycemia. Cholesterol and triglycerides were assayed using the enzymatic Trinder method. Blood glucose was assayed using the oxidase GOD-ANA enzymatic method. Diabetes was defined as present if fasting glycemia was $\geq$ 126mg/dl [13] or if subjects were being treated for diabetes, even if glycemia was under control.

Analysis procedures

Variables are presented as means, standard deviations, ranges and frequencies. Sex-based distribution of the variables was compared using Student's t test for independent samples (continuous data) and the chi-squared test (categorical data).

Receiver Operating Characteristic (ROC) curves, which are often used to identify cutoff points in diagnostic tests or for screening, were used to determine the predictive power and cutoff points for quantity of physical activity in each of its domains for predicting absence of diabetes. [14]

Initially, the area under the ROC curve (AUC-ROC) for absence of diabetes against quantity of physical activity (TPA) in minutes per week of walking, moderate activity and vigorous activity was calculated for the four domains (PA-OCC, PA-TRA, PA-HOU and PA-LT). The greater the AUC-ROC, the greater the discriminatory power for diabetes absence. The confidence interval (CI) used was 95%. [15]

Sensitivity and specificity, in addition to cutoff points, were then calculated for absence of diabetes, in minutes per week for TPA (walking, moderate activity and vigorous activity) and for its domains (PA-OCC, PA-TRA, PA-HOU and PA-LT). For this stage of the analysis, physical activity was treated as a continuous variable, whereas diabetes was stratified as follows: diabetes present = 0 and diabetes absent = 1.

After identification of the cutoff points, a multivariate analysis was conducted of physical activity against diabetes. The first step was stratification for the analysis of effect modification and confounding. The analysis of effect modification was performed by means of observation of the crude stratum-specific measures and their confidence intervals. Effect modification is indicated wherever the crude measure of a factor, in a given specific stratum, was not contained within the confidence interval of the other factor in the same stratum. Mantel-Haenszel method 95% confidence intervals were used. Analysis of confounding was conducted by comparing the odds ratios (OR) for the crude association with those after adjustment for possible confounding factors. The parameter used to identify the difference between associations was 10%.

A logistic regression analysis was then conducted. The model was constructed using the backward method, starting with the full model and removing possible confounding factors one by one which, when removed, were responsible for a change greater than or equal to 10% of the crude measure of the association between total physical activity and diabetes.

[16] Finally, an OR for the relationship between physical activity and diabetes was calculated using the model that best explained this association.

The variables that were considered potential modifiers of effect or confounders in the association between physical activity and diabetes were: sex, age, educational level, socioeconomic status, BMI, triglycerides and cholesterol. As explained above, these variables were included in the model in stratified form, with the exception of BMI, triglycerides and cholesterol, which were included as continuous variables. During this stage of the analysis, physical activity was stratified as follows; for men: total physical activity < 185 minutes per week = 0 and ≥ 185 minutes per week = 1; for women: total physical activity < 215 minutes per week = 0 and ≥ 215 minutes per week = 1. Diabetes was stratified as follows: present = 1 and absent = 0.

The modeling process demonstrated that age was a confounding variable and the analysis of effect modification indicated that only sex was an effect modifier. Therefore, the best model for analyzing the association between total physical activity and diabetes was stratified by sex and adjusted for age. Data were analyzed using *STATA*, version 7.0.

This project was approved by the Ethics Committee at the UFBA *Instituto de Saúde Coletiva* under number 002-07 and there were no conflicts of interest whatsoever. All of the participants in the study signed informed consent forms.

Results

A proportion (1.2%) of the original sample of eligible participants refused to undergo the supplementary tests (partial refusal) and were excluded. Two-thirds of these refusals were reversed spontaneously during the study. Overall, there were 4.6% more participants enrolled than the estimated minimum sample size, with a final sample of 2305 black people (902 men and 1403 women) who agreed to take part in both stages of the study.

The statistical power of this sample for identifying the association between physical activity and diabetes was calculated after the fact and, assuming an 8% prevalence of diabetes among the not exposed, it would be possible to detect odds ratios (OR) less than or equal to 0.61 with a 95% confidence interval and 80% power.

Table 1 lists the general characteristics of the sample with relation to the variables analyzed in the study. It was observed that there was no difference between the sexes in terms of moderate intensity PA-HOU in the yard/garden, TPA, educational level or socioeconomic status, whereas all other physical activity strata, age group, weight, height, BMI, triglycerides levels, cholesterol levels and presence/absence of diabetes did differ between men and women.

Table 2 lists the AUC-ROC, with confidence interval, for the quantity of physical activity (duration and intensity) in different domains as predictors of absence of diabetes. Separate ROC curves were constructed for men and women. The greatest statistical significance among the different strata of physical activity was detected in the AUC-ROC for TPA, for moderate activities in the leisure and occupational domains among the men and for transport among the women. Walking was not a good predictor of absence of diabetes among men.

physical activity in transport domain; PA-HOU: physical activity in housework domain; PA-LT; physical activity in leisure domain; TPA: physical activity in all four domains (PA-OCC, PA-TRA, PA-HOU, PA-LT)

Table 3 lists cutoff points, together with their respective sensitivities and specificities, for TPA quantity (duration and intensity) as predictors of absence of diabetes in men and women analyzed separately. The table also lists age-adjusted associations between TPA and diabetes. It was found that 185 minutes of TPA per week for men and 215 minutes per week for women were the best cutoff points for predicting absence of diabetes. However, after multivariate analysis, the association between physical activity and diabetes was only detected for men.

It was not possible to fix cutoff points for the individual physical activity domains because their AUC-ROC were not significant and/or because their sensitivity and specificity were inadequate.

Discussion

The objective of this study was to describe the quantity of TPA (in terms of duration and intensity) and its sub-domains (PA-OCC, PA-TRA, PA-HOU and PA-LT) that could predict absence of diabetes in a black-skinned population. Additionally, the study identified cutoff points, in minutes of exercise per week, based on the best balance between sensitivity and specificity for detecting absence of diabetes.

Researcher's interest in identifying the most appropriate quantity of physical activity to confer health benefits is not recent. Since 1992, [17] attempts have been made to identify the dose of physical activity that would have the most significant effect for protection against a range of different health problems. Initially, it was suggested that adults should spend at least 30 minutes a day walking in order to obtain significant clinical benefits for their health.

In 1995, two internationally recognized institutions, [18] the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) recommended that in order to be protected from metabolic and cardiovascular disorders, adults should spend 30 minutes engaged in moderately intensive physical activity on the majority of the days in each week.

Additionally, many different authors have demonstrated that physical activity can provide benefits for the prevention or treatment of diabetes, [19,20] but few studies have attempted

Table 1 - General characteristics of the sample with relation to the variables analyzed in the study

VARIABLES	Male (n=902)	Female (n=1403)	p
AGE (years)	41.8 ± 15 (20-91)	45.2 ±15 (20 -96)	0.00
WEIGHT (kg)	73.8 ± 15.3 (39.2-141.5)	68.1 ± 15.6 (33.8-150)	0.00
HEIGHT (cm)	171.3 ± 11 (150-195.8)	158.5 ± 7.5 (136-190)	0.00
BMI (kg/m2)	25 ± 4.6 (14.4-46.4)	27.1 ± 5.8 (15.3-54.9)	0.00
TRIGLYCERIDES (mg/dl)	145.0 ± 109.7 (24-1273)	122.5 ± 78.4 (18-1142)	0.00
CHOLESTEROL (mg/dl)	190.0 ± 41.3 (77-410)	201.2 ± 44.3 (83-351)	0.00
PA-OCC (min/week)			
Walking	45.2 ± 135.6 (0 - 1260)	24.1 ± 97.6 (0 - 1260)	0.00
Moderate	22.2 ± 80.2 (0-630)	10.7 ± 54.1 (0-720)	0.00
Vigorous	8.6 ± 51.6 (0-540)	0.8 ± 10.8 (0-200))	0.00
Total	76.1 ± 216.6 (0-1830))	35.6 ± 135.6 (0-1980)	0.00
PA-TRA (min/week)			
Walking	105.9 ± 135.6 (0 - 840)	81.9 ± 112.8 (0 - 840)	0.00
Cycling	11.6 ± 48 (0-420)	1.4 ± 14 (0-300)	0.00
Total	117.5 ± 144.3 (0-860)	83.3 ± 114.1 (0-840)	0.00
PA-HOU (min/week)			
Moderate in the house	49.4 ± 112.8 (0 - 840)	142.7 ± 176.3 (0 - 840)	0.00
Moderate in the yard/garden	21.0 ± 89.6 (0-840)	23.5 ± 77 (0-840)	0.27
Vigorous in the yard/garden	8.6 ± 38.3 (0-480	14.7 ± 44 (0-480)	0.00
Total	79.0 ± 158.2 (0-1080)	181.2 ± 203.3 (0-1680)	0.00
PA-LT (min/week)			
Walking	35.4 ± 99.3 (0 - 840)	23.2 ± 81.6 (0 - 840)	0.00
Moderate	20.4 ± 67.9 (0-840)	2.1 ± 25.1 (0-600)	0.00
Vigorous	9.0 ± 45.7 (0-630)	1.9 ± 20 (0-420)	0.00
Total	64.8 ± 141.5 (0-1470)	27.2 ± 90.4 (0-840)	0.00

Continuation: Table 1 - General characteristics of the sample with relation to the variables analyzed in the study			
VARIABLES	Male (n=902)	Female (n=1403)	p
TPA (min/week)			
Walking	186.6 ± 232.4 (0 - 1575	129.2 ± 180.1 (0 - 1440)	0.00
Moderate	124.6 ± 195.5 (0-1340)	180.4 ± 205.2 (0-1680)	0.00
Vigorous	26.2 ± 79.2 (0-630)	17.7 ± 50.3 (0-480)	0.00
Total	337.4 ± 372.2 (0-2680)	327.4 ± 306.9 (0-2160)	0.48
SOCIOECONOMIC STATUS n (%)			
Low	592 (65.6)	968 (69)	0.09
Medium/High	310 (34.4)	435 (31)	
EDUCATIONAL LEVEL			
Very low	354 (39.2)	559 (39.8)	
Low	184 (20.4)	238 (17)	
Medium/High	364 (40.4)	606 (43.2)	0.10
DIABETES			
Yes	57 (6.3)	125 (8.9)	
No	845 (93.7)	1278 (91.1)	0.02

p values calculated using Student's t test for continuous variables and chi-square test for categorical variables; PA-OCC: physical activity in occupational domain; PA-TRA: physical activity in transport domain; PA-HOU: physical activity in housework domain; PA-LT; physical activity in leisure domain; TPA: physical activity in all four domains (PA-OCC, PA-TRA, PA-HOU, PA-LT)

to identify the most appropriate quantity, specifically analyzing the different domains of physical activity in a black-skinned population.

In this study it was observed that TPA, accumulated in all four domains, moderate activity in the leisure and occupational domains for men and in the transport domain for women, were the best predictors of absence of diabetes. Similar results were reported in a recent publication [10] where it was demonstrated that TPA and PA-LT were the best predictors of absence of diabetes.

Another recent publication [21] also reported similar results to those of our study, with relation to the leisure and occupational domains, after analyzing the association between physical activity and diabetes in 1651 Native Americans. In that study it was found that people who took part in any type of physical activity had a lower risk of diabetes than those who did not engage in physical activities.

Another notable feature of the results of this study is the fact that walking was not an independent predictor of diabetes absence in the men in any of the physical activity domains analyzed. In partial agreement with these results, a recent publication[10] demonstrated that walking was not alone a good predictor of absence of diabetes in men or in women. Conflicting results were observed in a study of 11073 Japanese men. [22] It was observed that walking in the occupational domain for more than 21 minutes per day reduced the risk of diabetes.

In the present study, cutoff points were also quantified in minutes per week of physical activity as predictive of absence of diabetes. It was found that it was only possible to determine cutoff points for TPA accumulated in all domains (PA-OCC, PA-TRA, PA-HOU and PA-LT analyzed together), with 185 minutes of physical activities per week for men and 215 minutes per week for women. When each domain was analyzed individually, the AUC-ROC was not significant and/or the sensitivity and specificity were inadequate.

Similar results were observed in another study conducted recently, [10] in which it was proposed that the best cutoff points for predicting absence of diabetes were 185 minutes per week of moderate physical activity accumulated in all different domains and 285 minutes per week of physical

Table 2 - AUC-ROC and 95%CI for quantity of TPA as predictor of absence of diabetes among adults of both sexes

PHYSICAL ACTIVITY	MALE AUC-ROC (95%CI	FEMALE AUC-ROC (95%CI)
PA-OCC		
Walking	0.54 (0.49-0.59)	0.51 (0.48-0.54)
Moderate	0.54 (0.51-0.56) *	0.51 (0.49-0.52)
Vigorous	0.51 (0.49-0.53)	0.50 (0.49-0.51)
Total	0.55 (0.51-0.59) **	0.51 (0.48-0.54)
PA-LT		
Walking	0.48 (0.42-0.53)	0.51 (0.48-0.54)
Moderate	0.56 (0.52-0.59) *	0.50 (0.49-0.51)
Vigorous	0.52 (0.50-0.55) *	0.51 (0.50-0.51) *
Total	0.53 (0.47-0.59)	0.51 (0.48-0.54)
PA-TRA		
Walking	0.54 (0.46-0.61)	0.59 (0.54-0.64) *
Cycling	0.54 (0.52-0.56) *	0.51 (0.50-0.51) *
Total	0.56 (0.49-0.64)	0.59 (0.54-0.65) *
PA-HOU		
Moderate in the house	0.56 (0.49-0.62)	0.56 (0.51-0.62)*
Moderate in the yard/garden	0.46 (0.41-0.52)	0.48 (0.45-0.52)
Vigorous in the yard/garden	0.52 (0.49-0.55)	0.53 (0.49-0.56)
Total	0.55 (0.48-0.61)	0.56 (0.51-0.62)*
TPA		
Walking	0.53 (0.45-0.60)	0.57 (0.52-0.63) *
Moderate	0.61 (0.53-0.68) *	0.56 (0.50-0.62) *
Vigorous	0.55 (0.51-0.59) *	0.54 (0.51-0.57) *
Total	0.60 (0.53-0.68) *	0.58 (0.52-0.64) *

AUC-ROC: area under the curve of the receiver operating characteristic *: AUC-ROC illustrating discriminatory power for absence of diabetes; 95%CI: 95% confidence interval; PA-OCC: physical activity in occupational domain; PA-TRA:

Table 3 - Cutoff points, sensitivity and specificity for TPA as a predictor of absence of diabetes and the association between TPA and diabetes adjusted for age

TOTAL PHYSICAL ACTIVITY	Cutoff point (minutes/week)	Sensitivity (%)	Specificity (%)	OR (1C95%)
MALE	≥ 185	59	59	0.54 (0.30-0.96)
FEMALE	≥ 215	58	52	0.97 (0.63-1,43)

OR: odds ratio; CI: confidence interval; TPA: total physical activity

activity (walking, moderate and vigorous) in all domains, for men and women analyzed together.

In a directive on physical activity for adults published in Canada recently, [23] it was suggested that moderate intensity physical activity every day of the week was necessary to reduce the risk of a range of chronic conditions, particularly coronary artery disease, arterial hypertension and diabetes.

It should be borne in mind that after multivariate analysis the age-adjusted association between physical activity and diabetes was only significant for the men, demonstrating that the effect of regular physical activity is more relevant for members of the male sex.

One probable limitation of this study was the fact that physical activity was analyzed using a questionnaire, which, despite being a data collection method that is widely used in epidemiological studies, can result in information bias because it demands that respondents are able to remember the information requested.

Furthermore, considering that the sample was probabilistic (selected on the basis of streets, households and participants), that sample losses were minimal and that interviewers and procedures were standardized, it can be assumed that the study has internal validity for the population with the inclusion criteria described. However, considering that the sample was not extracted from all of the city's administrative districts, only from those with the greatest proportion of black-skinned residents, covering a large number of neighborhoods, and also that the results cannot be extrapolated to entire neighborhoods, since 25 to 30% of the population are not black-skinned, assumptions about the study's external validity should be made with caution.

Conclusions

The results of this study support the inference that TPA accumulated in all four domains (PA-OCC, PA-TRA, PA-HOU and PA-LT) is a good predictor of absence of diabetes in the black-skinned population. With relation to the quantity of physical activity needed, it is suggested that 185 minutes/week for men and 215 minutes/week for women are enough to confer protection. It was also observed that only walking is probably not a good strategy for prevention of diabetes, particularly among men. The results also suggest that further studies are needed to investigate the most appropriate quantity of physical activity to confer protection against other metabolic and cardiovascular disorders, both in the general population and in black-skinned populations.

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Conflicts of interest: none

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