Original Article

ASSOCIATION BETWEEN PHYSICAL ACTIVITY AND CARDIOVASCULAR RISK IN ADULT USERS OF A LINEAR PARK IN SÃO PAULO

ASSOCIAÇÃO DA ATIVIDADE FÍSICA COM O RISCO CARDIOVASCULAR EM FREQUENTADORES ADULTOS DE UM PARQUE LINEAR DE SÃO PAULO

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ABSTRACT

The practice of leisure-time physical activity (PA) in public parks is a strategy recommended to reduce the global cardiovascular risk (GCR) of the population. Linear parks present distinct characteristics than conventional parks, which makes it important to investigate the relationship between PA and GCR in its users. Thus, this study was conducted to identify the GCR and the leisure-time PA of the users of Minhocão Park in São Paulo and to analyze the association between these factors. Data were obtained in a punctual health intervention conducted in the park through an interview about PA and the presence of cardiovascular risk factors (CRF) in addition to measuring body mass, height, abdominal circumference and blood pressure. Data from 143 participants (64 women, 44±9.2 years old) were analyzed, and they were divided into those who met (62.2%) or did not meet (37.8%) the goal for weekly PA practice recommended by the World Health Organization. Those who met this goal were subsequently divided into those who included (43.8%) or did not include (56.2%) vigorous PA to meet this goal. Most of the participants who met the PA goal presented low GCR (59.4%) and they also had a lower frequency of altered diastolic blood pressure compared to those who did not meet the goal (6.3±5.7 vs. 7.1±6.4%, p=0.492). Those who included vigorous PA to meet the health goal had lower GCR than those who only practiced moderate PA (2.9±4.3 vs. 6.2±6.3%, p=0.009). In conclusion, users of Minhocão Park were mainly active and presented low GCR. Among them, meeting the recommended PA levels, particularly with the inclusion of vigorous activity, was associated with a lower GCR.

Keywords: leisure-time physical activity; global cardiovascular risk; urban parks; public health policies.

RESUMO

A prática de atividades físicas de lazer (AF) em parques públicos é uma estratégia recomendada para a redução do risco cardiovascular global (RCG) da população. Parques lineares possuem características distintas dos tradicionais, sendo necessário avaliar a relação entre AF e RCG nos frequentadores desses locais. Este estudo objetivou identificar o RCG e a AF de lazer de frequentadores do Parque Minhocão em São Paulo, analisando a relação entre esses fatores. Os dados foram obtidos de forma transversal numa atuação de saúde realizada no parque através de entrevista sobre a prática de AF e a presença de fatores de risco cardiovascular (FRC), bem como pela medida da massa corporal, estatura, circunferência abdominal e pressão arterial. Foram analisados 143 frequentadores (64 mulheres, 44±9 anos), que foram separados nos que cumpriam (62,2%) ou não (37,8%) a meta de AF semanal preconizada pela Organização Mundial de Saúde. Adicionalmente, os que cumpriam a meta foram separados nos que incluíam (43,8%) ou não (56,2%) a AF vigorosa nessa prática. A maioria dos frequentadores que cumpria a meta de AF possuía RCG baixo (57,4%) e a frequência de pressão arterial diastólica alterada foi menor nesses frequentadores (76±8 vs. 79±10 mmHg, p=0,050). Entre os participantes que cumpriam a meta, os que incluíam AF vigorosa apresentaram RCG menor que os que não incluíam (2,9±4,3 vs. 6,2±6,3, p=0,009). Em conclusão, os frequentadores do Parque Minhocão se caracterizaram por serem ativos e com baixo RCG. Neles, cumprir a meta de AF, particularmente incluindo atividades vigorosas, se associou a um menor RCG.

Palavras-chave: atividades físicas de lazer; risco cardiovascular global; parques urbanos; políticas de saúde públicas.

Introduction

The high prevalence of physical inactivity in the Brazilian population is an important public health problem[1] since physical inactivity is an important risk factor for the development of almost all the chronic non-communicable diseases and, in particular, the cardiovascular diseases that are known as the main cause of death in Brazil[2] and worldwide [3]. In view of these circumstances, national and international health institutions have emphasized the benefits of the regular practice of leisure-time physical activity (PA)[4,5]. In Brazil, the Strategic Action Plan to Combat the Chronic Non-Communicable Diseases 2021-2030 of the Ministry of Health has,

as one of its main foundations, the promotion of interventions to increase the number of physically active individuals in the country[6].

The benefits of PA on health is partly due to its effects in controlling the cardiovascular risk factors (CRF), such as improving glucose metabolism, lowering blood pressure, improving lipid profile, and helping in weight control, which ultimately reduces the global cardiovascular risk (GCR)[5,6,7]. In view of these benefits and the recommendation of the health institutions, the practice of PA has increased in the Brazilian population in the last decade[8]. However, when PA is performed inadequately, it can impose risks, such as being the trigger for acute cardiovascular events, specially, in individuals with high GCR[9].

PA can be performed in different places and the public parks are particularly favorable for its practice[9,10,11]. However, in parks, PA usually occurs without professional guidance, being important to evaluate the GCR of the practitioners. In previous studies, we reported a high percentage of PA practitioners with high GCR in conventional public parks of the São Paulo city[12,13]. Recently, linear parks, often derived from public roads, have emerged in the national urban scenario, and the Minhocão Park is an example in the São Paulo city[14]. This park is a highway open to car traffic on some periods of the week and released for leisure activities of the population on other periods. As these parks are available for leisure use at different times from the conventional parks, they are used by a different population than the conventional parks[15]. Thus, it is important to evaluate the PA levels and the GCR of the population that frequents this specific leisure place, i.e., the linear parks, such as the Minhocão Park.

Based on the previous background, the objectives of this study were: a) to identify the GCR and the leisure PA practice of the adult users of the Minhocão Park; and b) to analyze the possible relationships between the PA levels and the GCR in these users.

Methods

Design and Ethical Aspects

This study had observational, cross-sectional, descriptive, and relational characteristics. It was carried out by the structure of the "Exercise and Heart" Project. This project conducts health interventions regarding PA practice in public places for care and research purposes[9]. The present study is part of the investigations of this project that were approved by the Research Ethics Committee of the Institution (CAAE: 01565318.0.0000.5391).

Participants

The study used a convenience sample formed by the users of the Minhocão Park who participated in a specific intervention of the project held in this park. The inclusion criteria were adults between 30 and 59 years, who had no known heart disease and allowed the use of their data for research by signing a consent form. There were no additional exclusion criteria.

Procedures

The health intervention was conducted in the Minhocão park on September 14th and October 20th, 2019. It consisted of an interview aiming to obtain the following data: personal characteristics, cardiovascular health condition, and PA level. Anthropometric and blood pressure measurements were also taken. After the data collection, the participants received guidance for the safe practice of PA. Additionally, when necessary (presence of health problems without medical follow-up for more than 6 months or measurements with altered values), they were instructed to seek medical attention.

The personal data used in this study were sex and age. GCR was obtained by asking about the regular use of medications, as well as the presence of cardiovascular symptoms, heart disease (coronary heart disease, arrhythmia, heart failure, among others) and CRF (heredity,

hypertension, diabetes, dyslipidemia and smoking). Anthropometric data (body mass and height) were obtained on a scale with a stadiometer (Filizola, Brazil) and the body mass index (BMI) was calculated by the quotient between body mass (kg) and the square of height (m^2). Waist circumference was measured with a non-elastic tape positioned at the line of the umbilical scar[16]. Blood pressure was measured on the right arm after five minutes of seated rest by trained evaluators and the auscultatory method[17]. The measurement was performed using a properly calibrated aneroid sphygmomanometer, cuffs of appropriate size for the participant's arm circumference, and phases I and V of the Korotkoff sounds were, respectively, considered to determine systolic and diastolic blood pressures. One measurement was performed and if the values were greater than 140 mmHg for systolic blood pressure and/or 90 mmHg for diastolic blood pressure, the measurement was repeated, and the second measure was accepted for the analysis.

The practice of PA was evaluated as in previous studies[9,12,13,18,19,20] based on two blocks of questions: 1) *Do you walk regularly in your leisure time? If yes: on which days of the week, how long, at what intensity* (20-point Borg scale) and *for how long;* 2) *Do you practice other PA (running, swimming, gymnastics, other) in your leisure time? If yes: which, on which days of the week, for what duration, at what intensity* (20-point Borg scale) and *for how long*. The participants were informed that leisure time referred to free time that is not related to work, household chores and/or locomotion. The volume of each PA was calculated by multiplying the weekly frequency by its duration, while the Borg scale was used to classify the intensity as light (<12), moderate (12 or 13) or vigorous (≥ 14)[21]. The weekly volume of moderate PA was obtained by adding the weekly volume of walking to the weekly volume of other moderate PAs. The weekly volume of vigorous PA was calculated by the sum of activities performed at vigorous intensity[4,5,7].

The characteristics of the participants were analyzed in relation to sex (men or women). The presence of CRF was considered by the following criteria: 1) <u>sex/age</u>: men over 45 years and women over 55 years; 2) <u>heredity</u>: presence of father, mother or siblings with cardiovascular disease diagnosed before 55 years of age, if men, and before 65 years of age, if women; 3) <u>arterial hypertension, dyslipidemia and diabetes</u>: presence of diagnosis of these factors or the use of medications to control them; and 4) <u>smoking</u>: report of current smoking or having quit smoking in the last 6 months. Considering the measures, the values were considered altered when: 1) <u>obesity</u> - BMI equal to or greater than 30 kg/m^2, 2) <u>central obesity</u> - abdominal circumference greater than 102 cm in men and 88 cm in women; and 3) <u>high blood pressure</u> - systolic and/or diastolic blood pressures equal to or greater than 140 and 90 mmHg, respectively[22].

The GCR was calculated using the simplified method of the *Framingham score*[23,24] that includes data of sex, age, systolic blood pressure, use of antihypertensive medication, presence of smoking, presence of diabetes, and BMI to classify the risk as: low, moderate or high, considering, respectively, the risk of up to 6%, 6 to 20%, and more than 20% for developing cardiovascular diseases in 10 years.

The PA level was analyzed in 3 stages. Initially, the participants were classified as: 1) inactive - when they did not perform any moderate/vigorous PA; 2) insufficiently active – when they performed moderate/vigorous PA, but did not achieve at least 150 min/week of moderate/vigorous PA or 75 min/week of vigorous PA; 3) active - when they performed from 150 to 299 min/week of moderate/vigorous PA or from 75 to 149 min/week of vigorous PA; and 4) very active - when they performed at least 300 min/week of moderate/vigorous PA or 150 min/week of vigorous PA[25]. Additionally, the participants were also classified as those who met (active + very active) and who did not meet (inactive + insufficiently active) the World Health Organization's weekly PA goal for health[5]. Finally, the participants who met this PA

goal were divided into those who performed only moderate PA and those who met this goal including vigorous PA.

Statistical analysis

Data were analyzed with double entry with the subsequent adjustment of inconsistencies. Comparisons between the groups (different sexes or different PA levels) were made using Chi-square or Fisher tests for categorical variables and *T-tests* for continuous variables, using the SPSS program (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). The value of $p<0.05$ was considered significant.

Results

Two hundred and eighty users of the Minhocão Park participated in the project's health intevention, but 15 did not sign the consent form. Of the remaining 265, 121 were out of the age group covered by this study and/or had heart disease, and 1 participant was excluded due to lack of data. Thus, the final sample was composed of 143 participants (79 men and 64 women) with a mean age of 44±9 years.

Considering the CRFs reported by the participants (Table 1), sex-age was the most frequent (32.2%), followed by smoking, heredity, hypertension, dyslipidemia, and diabetes. Among the factors assessed by measurements, central obesity had the highest frequency (28.0%), followed by obesity and high blood pressure. Considering the comparison between the sexes, the frequency of the sex-age factor was significantly higher in men than women ($p= 0.002$), while the frequencies of dyslipidemia and central obesity were higher in the women ($p=0.026$ and $p=0.000$, respectively). Regarding the GCR, most of the participants presented low risk (59.4%), followed by moderate and high risks. This distribution was different between the sexes ($p=0.000$), with women presenting a higher frequency of low risk than men.

Table 1. Global cardiovascular risk and leisure-time physical activity levels of the participants, comparison between sexes.

	Total		Men		Women		X²
	n	**%**	**n**	**%**	**n**	**%**	
Number of participants	143	100.0	79	55.2	64	44.8	
Reported risk factors							
Sex-age	46	32.2	34	43.0	12	18.8	**0.002 ***
Smoke	24	16.8	15	19.0	9	14.1	0.433
Heredity	22	15.4	14	17.7	8	12.5	0.686
Hypertension	17	11.9	9	11.4	8	12.5	0.837
Dyslipidemia	17	11.9	6	7.6	11	17.2	**0.026 ***
Diabetes	10	7.0	4	5.1	6	9.4	0.249
Measured risk factors							
Obesity	27	18.9	12	15.2	15	23.4	0.210
Central Obesity	40	28.0	8	10.1	32	50.0	**0.000 ***
Altered BP	22	15.4	15	19.0	7	10.9	0.185
Global cardiovascular risk							
Low	85	59.4	32	40.5	53	82.8	
Moderate	52	36.4	43	54.4	9	14.1	**0.000 ***
High	6	4.2	4	5.1	2	3.1	
Physical Activity Level							
Inactive	28	19.6	15	19.0	13	20.3	
Insufficiently Active	26	18.2	13	16.5	13	20.3	0.734
Active	35	24.5	18	22.8	17	26.6	
Very active	54	37.8	33	41.8	21	32.8	
PA Goal for Health							
Did not Meet (inactive and insufficiently active)	54	37.8	28	35.4	26	40.6	0.525
Met (active and very active)	89	62.2	51	64.6	38	59.4	
Met PA Goal for Health							
Only Moderate PA	50	56.2	27	52.9	23	60.5	0.807
Including Vigorous PA	39	43.8	24	47.1	15	39.5	

Note: BMI = body mass index. BP = blood pressure. * significant difference between the sexes ($p < 0.05$).
Source: The authors.

Regarding the practice of PA, most of the participants were classified as very active (37.8%), followed by active, inactive and insufficiently active. There were no differences between the sexes in these frequencies. Thus, most of the participants met the PA goal for health (62.2%), with no significant difference between the sexes in this frequency. Considering the practitioners who met the PA goal (active + very active, n=89), most of them did only moderate

PA (56.2%). There was no difference between the sexes in the frequency of those who met the goal with only moderate PA and those who included vigorous PA.

Comparing the CRF of participants who met or did not meet the PA goal for health (Table 2), the frequency of participants with altered blood pressure was significantly lower in those who met the goal (p=0.025), while the frequency of the other factors was similar between the groups.

Table 2. Comparison of global cardiovascular risk between the participants who met or did not meet the goal of leisure-time physical activity for health maintenance.

	Did Not Meet the Goal (Inative + Insufficient) N=54		Met the Goal (Active + Very active) N=89		p
	n	%	n	%	
Reported risk factors					
Sex-age	18	33.3	28	31.5	0.816
Heredity	8	14.8	14	15.7	0.524
Smoke	8	14.8	16	18.0	0.624
Hypertension	9	16.7	8	9.0	0.108
Dyslipidemia	7	13.0	10	11.2	0.156
Diabetes	4	7.4	6	6.7	0.564
Measured risk factors					
Obesity	11	20.4	16	18.0	0.723
Central Obesity	16	29.6	24	27.0	0.731
Altered BP	13	24.1	9	10.1	**0.025 ***
Global cardiovascular risk					
Low	31	57.4	54	60.7	
Moderate	20	37.0	32	36.0	0.789
High	3	5.6	3	3.4	

Note: BMI = body mass index. BP = blood pressure. * significant difference (p<0.05).
Source: The authors.

The comparison of the measurements performed between these two groups (Figure 1) revealed lower diastolic blood pressure in the group that met the goal than in the group that did not meet it (76±8 vs. 79±10 mmHg, p=0.050). On the other hand, BMI, waist circumference, and systolic blood pressure were similar in both groups. There was no difference in the GCR of those participants who met or did not meet the PA goal for health (6.3±5.7 vs. 7.1±6.4%, respectively, p=0.492).
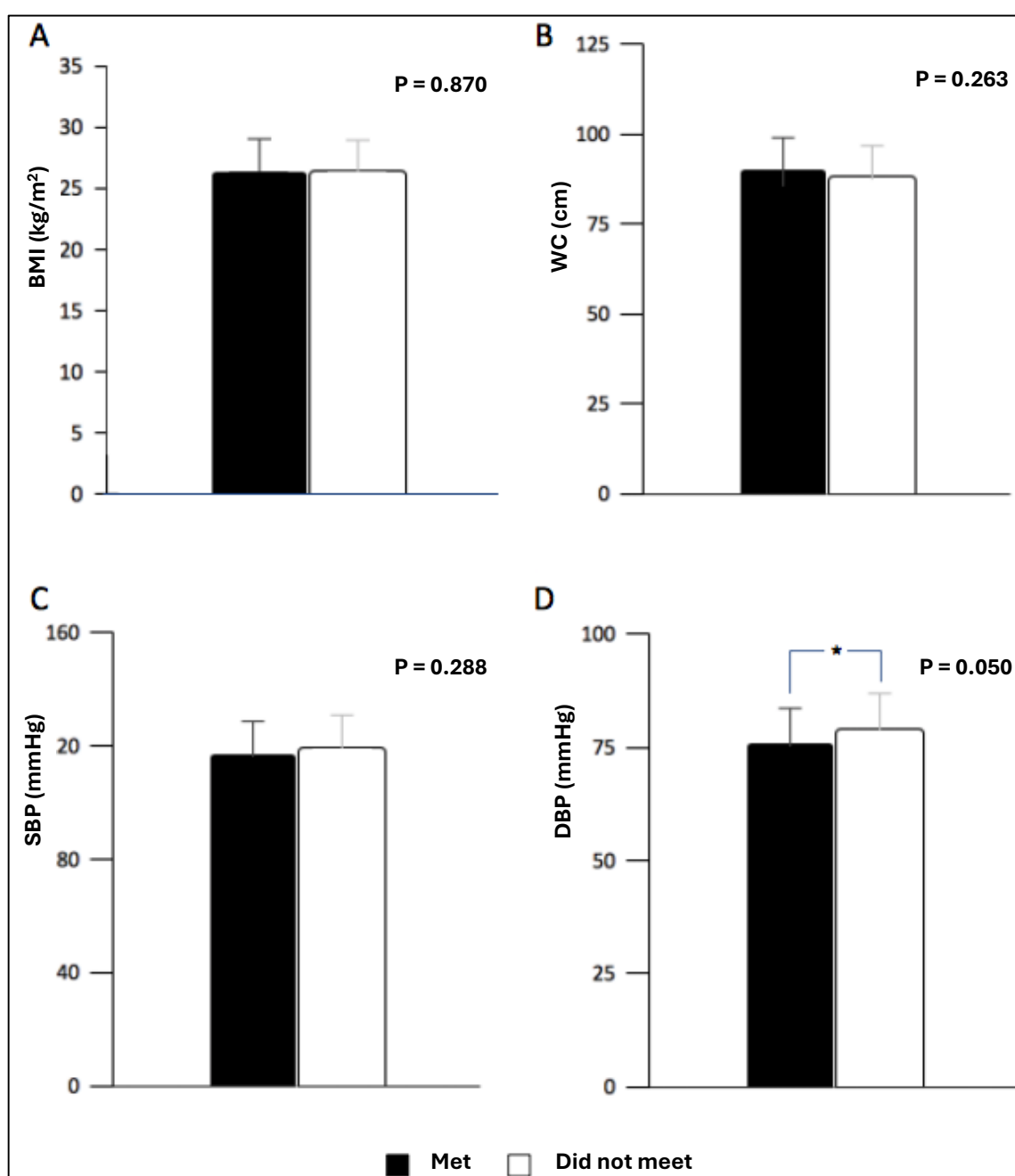
Figure 1. Body mass index (BMI, panel A), waist circumference (WC, panel B), systolic blood pressure (SBP, panel C), and diastolic blood pressure (DBP, panel D) measured in the participants who met (active + very active, black bars) and those who did not meet (inactive + insufficiently active, white bars) the goal of leisure-time physical activity for health maintenance. * Significant difference between the groups ($p<0.05$).
Source: The authors.

Comparing the participants who met the goal without or with vigorous PA (Table 3), the frequencies of those who had hypertension ($p=0.000$), diabetes ($p=0.025$), altered BMI ($p=0.000$), central obesity ($p=0.008$), and altered blood pressure ($p=0.000$) were significantly lower in the participants who included vigorous PA for meeting the PA goal. The frequencies of participants with low, moderate and high GCR were significantly different between these two groups ($p=0.000$), with the group that included vigorous PA presenting a higher frequency of low risk.

Table 3. Comparison of cardiovascular risk among the participants who met the leisure-time physical activity goal for health maintenance by performing only moderate physical activities or including vigorous physical activities.

	Only Moderate		With Vigorous		p
	n	%	n	%	
Reported risk factors					
Sex-age	19	38.0	9	23.1	0.133
Smoke	10	20.0	6	15.4	0.574
Heredity	7	14.0	7	17.9	0.612
Hypertension	6	12.0	2	5.1	0.000
Dyslipidemia	5	10.0	5	12.8	0.676
Diabetes	6	12.0	0	0.0	**0.025 ***
Measured risk factors					
Obesity	13	26.0	3	7.7	**0.000 ***
Central Obesity	19	38.0	5	12.8	**0.008 ***
Altered BP	8	16.0	1	2.6	**0.000 ***
Global cardiovascular risk					
Low	25	50.0	30	76.9	
Moderate	23	46.0	8	20.5	**0.000 ***
High	2	4.0	1	2.6	

Note: BMI = body mass index. BP = blood pressure. * significant difference ($p<0.05$).
Source: The authors

Considering the factors assessed with measurements (Figure 2), BMI (27.5 ± 4.3 vs. 25.1 ± 3.7 kg/m^2. p=0.009), waist circumference (93 ± 11 vs. 87 ± 9 cm. p=0.002) and diastolic blood pressure (80 ± 7 vs. 79 ± 9 mmHg. p=0.001) were lower in the group that included vigorous PA. The GCR was also significantly lower in the group that included vigorous activities compared to the group that only practiced moderate PA for meeting the PA goal (2.9 ± 4.3 vs. $6.2\pm6.3\%$, respectively. p=0.009).
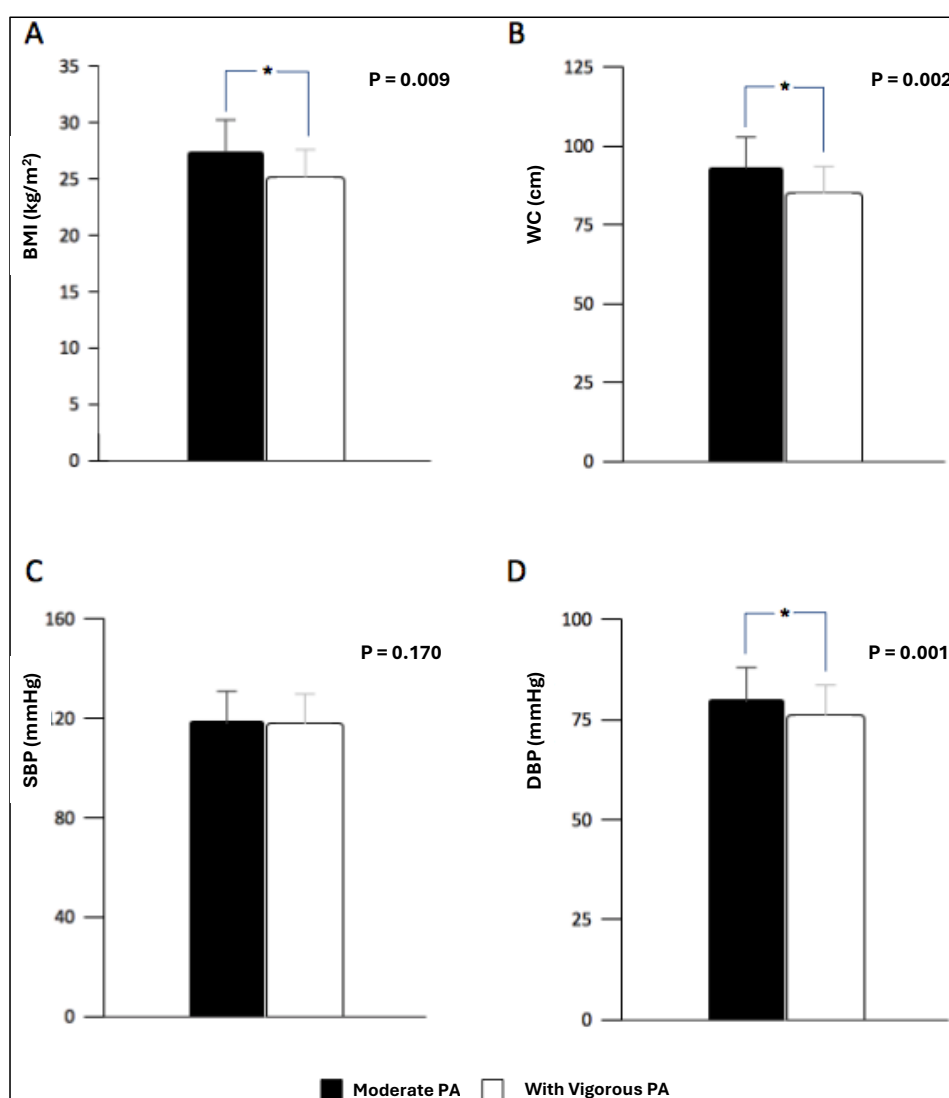
Figure 2. Body mass index (BMI, panel A), waist circumference (WC, panel B), systolic blood pressure (SBP, panel C), and diastolic blood pressure (DBP, panel D) measured in the participants who met the leisure-time physical activity goal for health maintenance with only moderate activities (black bars) or including vigorous activities (white bars). * Significant difference between the groups (p<0.05).
Source: The authors

Discussion

The main findings of this study indicated that the sample of middle-aged users of the Minhocão Park was primarily composed by men with low GCR and active in leisure time. Compliance with the PA goal for health in this sample was associated with a lower frequency of altered blood pressure and lower diastolic blood pressure values, while compliance with this goal with the inclusion of vigorous PA was associated with a lower frequency of hypertension, diabetes, obesity, and central obesity, in addition to lower BMI values, waist circumference and diastolic blood pressure.

To our knowledge this is the first study to evaluate and associate PA with GCR in the users of the Minhocão Park that is a linear park used by a younger population than that who uses the conventional parks[15]. The present study expands the knowledge by demonstrating that this population also has different frequencies of CRF than those reported in conventional

parks[11]. For example, a master's dissertation carried out with the users of the Fernando Costa Park[26], located in the same region of the city as the Minhocão Park, reported frequencies of hypertension, dyslipidemia, obesity, diabetes, and smoking of, respectively, 41, 33, 24, 10, and 6%, which are, except for smoking, higher than those observed here in the Minhocão Park (12, 12, 19, 7, and 17%, respectively). The difference between these studies is probably due to the age difference between the populations included in the studies, but it also reveals the different reality of a linear park in relation to the GCR of its users, which strengthens the need for different interventions in these parks. Interestingly, in this study, although the frequencies of CRF were generally similar between the sexes and the frequencies of dyslipidemia and central obesity were higher in women, the low GCR was less frequent in the men because the sex/age factor was more prevalent in the males, defining a highest Framingham score. This result is consistent with the greater cardiovascular protection observed in young women compared to middle-aged and elderly women due to their fertile period and that disappears with advancing age[27].

Regarding the level of PA, 62.2% of the users of the Minhocão Park reported to be active, which is similar to the results observed in conventional parks[11,26] and is consistently higher than that reported in the adult population of Brazil (39%), São Paulo State (34.6%) and São Paulo city (44% and 27% for men and women, respectively)[28]. Similarly, unlike what is commonly reported for the general population, in which men tend to be more active[28], in the present study, the frequency of inactive, insufficiently active, active, and very active participants did not differ between the sexes. This discrepancy should reflect the fact that people who use public parks, whether men or women, do it primarily for practicing PA, which has already been reported for the Minhocão Park[15].

In accordance with the knowledge that regular practice of PA, specially aerobic PA reduces blood pressure[29,30] and the GCR[13,20], the present study revealed that the users of the Minhocão Park who met the leisure PA goal proposed by the World Health Organization[5] had a lower frequency of altered blood pressure than those who did not meet this goal. However, these groups did not differ in relation to the other CRF, such as the frequency of dyslipidemia, diabetes, obesity, and central obesity, as well as in the mean values of BMI and waist circumference. In agreement, the GCR was also similar between those who met and did not meet the PA goals, although epidemiological studies have reported an inverse association between PA level and these parameters[13,20].

Nevertheless, it is interesting to observe that among the participants who met the PA goal for health, those who included vigorous PA in their practice had lower frequencies of cardiometabolic factors (hypertension, diabetes, obesity and central obesity) and high GCR as well as lower values of BMI, waist circumference and diastolic blood pressure compared to those who met the goal with only moderate PA, which suggests an important role of PA intensity. However, as this is an observational and relational study, it is not possible to establish the presence or direction of a causal relationship between these variables despite the association between them[31]. It is possible that individuals with a higher frequency of hypertension, diabetes, central obesity, and altered blood pressure are less prone to perform vigorous PA[32,33]. On the other hand, a greater effect of higher intensity (i.e., vigorous) PA on GCR has been suggested[34,35] since higher intensities of PA promotes greater increase in cardiorespiratory fitness that has an independent inverse association with GCR[36]. Taken together, the results of the present study suggest that PA performed at any intensity and reaching the recommended goal promotes health benefits, but if this practice includes vigorous activities, the benefit may be more evident, which needs to be proven by future interventional studies.

Unlike what was observed in conventional parks, such as in Curitiba (10.3%)[11], a considerable part of the users of the Minhocão Park (27.3%) performed vigorous PA, which may be due to the linear aspect of the park that facilitates some commuting activities that

commonly occur at a higher intensity, such as running and cycling. In fact, a previous study reported that, respectively, 32.5% and 14.0% of the users of the Minhocão Park performed these PA modalities[15]. Supporting this hypothesis, some studies indicate that the characteristics of the type of the urban park design as well as its facilities can influence the intensity of the PA practice[37,38,39].

Thus, the findings of this study may have important practical applications for planning interventions to encourage the improvement and maintenance of the health for the population who use the Minhocão park, and may serve as inspiration for similar interventions in other linear parks. Considering that an important part of the users of these parks already performs a high level of PA (more than 60% of the users were active or very active) and that they have low GCR, it is possible to propose that interventions stimulating the inclusion of vigorous activities in this practice may have greater potential to generate additional benefits to the cardiovascular health in this specific population and should be encouraged.

Despite the interesting results of the present investigation, it is important to point out its limitations. Data collection was conducted in a health intervention and not with a specific epidemiological survey design. The observational, cross-sectional, and descriptive characteristics of the study make it impossible to establish a cause-and-effect relationship. Data collection was carried out only on weekend days, not allowing for the evaluation of the characteristics of the users during the weekdays, however almost half of the participants (44.8%) reported to use the park also during the week days. Finally, the PA level was obtained using a specific questionnaire already used in previous studies but without specific validation. Nevertheless, its results are in agreement with those obtained in the topic of leisure-time PA of the long-version of the International PA Questionnaire (ICC = 0.81 and kappa = 0.848, respectively – unpublished data).

Conclusions

The middle-aged users of the Minhocão Park have, in general, low GCR and high level of PA. In this population, meeting the recommended weekly PA goal is associated with health benefits, and the inclusion of vigorous PA practice to meet this goal was associated with even greater benefits, especially on GCR. Thus, these results suggest that, in linear parks, interventions aiming to improve the health of the users may recommend the inclusion of vigorous PA for the participants who already meet the World Health Organization PA goal, but future interventional studies need to be conducted to confirm these potential benefits.

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