Research Article
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Women on the move are healthy women - Correlation between physical activity and health indicators

Abstract

It is well described in the literature that physical activity (PA) contributes to the maintenance of health in general, and especially to the prevention of cardiovascular diseases (CVD). The aim of the present study was to verify the association between PA and CVD. Women (n=325) between 18 and 77 years old were volunteers for this study. They responded to a 3-day physical activity recall (3DPAR), had blood pressure affection and blood collected for analysis of blood lipids. The results showed that there is an inverse association between the amount of PA performed and the risk indexes for diseases, that is, the more activity, the lower the risk.

Keywords: physical activity, cardiovascular disease, cholesterol, blood pressure, body mass index

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Abbreviations: PA, physical activities; WHO, World Health Organization; CVD, cardiovascular diseases

Introduction

It is widely demonstrated in the literature the benefits of the practice of physical activities (PA) for the benefit of people's health.[1,2] Recently, the World Health Organization (WHO) modified its guidelines,[3] increasing the minimum amount of weekly physical activity to avoid the risk of several diseases, including cardiovascular diseases (CVD).

CVD is a group of diseases that involve the heart and arteries and have different etiologies. However, the contemporary hypoactive lifestyle, in which technology is increasingly replacing human effort, has proved to be an isolated risk factor greater than smoking, and obesity, among others.[2,3] Several clinical indicators are available to physicians and other health professionals to diagnose these diseases. We can exemplify this from anthropometric tests (such as Body Mass Index - BMI), blood pressure measurements, and even blood tests to check blood lipids and cholesterol-carrying lipoproteins.[4,5] Once diagnosed, the patient will need treatment that may involve the use of one or more drugs and other lifestyle changes (usually exercise and diet).

The WHO and other associations have been trying to show that it is more important to prevent people from being carriers of these diseases, avoiding expensive treatments with possible side effects. Thus, the present study aims to verify whether there is a correlation between higher levels of daily physical activity and some of the CVD indicators in women. We hope to find the hypothesis that women who have more active behavior will present lower values in CVD indicators.

Material and methods

A total of 500 women living in small and medium-sized cities in the southeastern region of Brazil were invited to participate in the study. Of these, 175 did not complete the study, as shown in Figure 1. The remaining 325 voluntarily participated in the study, which was approved by the research ethics committee of Universidade Iguaçu – Campus V.

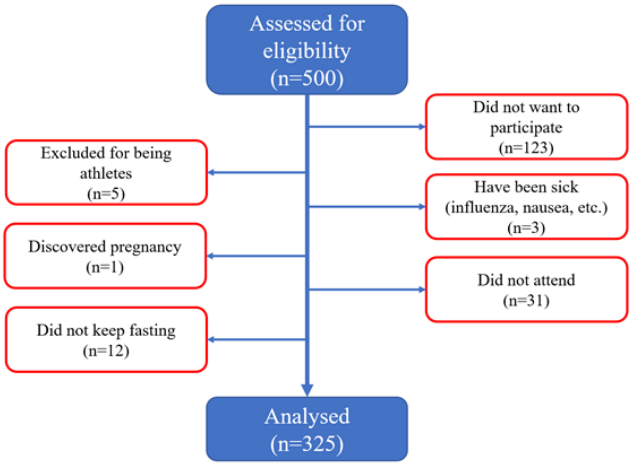

Figure 1 Flow diagram of participants.

Initially, each step of the process was explained in detail and the participants signed an informed consent form. They then answered a questionnaire and completed the 3-Day Physical Activity Recall - 3DPAR.[6] Weight, height, and resting blood pressure were measured. BMI was calculated according to Gutin.[4] After that, they were instructed to return to the laboratory the following day after a 12-hour fast for venous blood collection.

Blood collection and handling were carried out following Brazilian standards determined by the National Health Surveillance Agency,[7] by qualified professionals using disposable materials. From the volume removed, total triglycerides, lipoproteins (LDL, HDL, and VLDL), and total cholesterol were measured. From the measurements of blood lipids, Castelli indices 1 and 2 were calculated.[5]

The Shapiro-Wilk tests were used to determine whether the distribution between the variables was normal, when non-normality was verified, the data were presented in medians and quartiles. To verify the association between the amount of energy daily used in physical activities performed by women (3DPAR) and the other variables (Age, BMI, blood pressure, total cholesterol, triglycerides, and lipoproteins) the Friedman test was used. The significance adopted was $p<0.05$ and the tests were performed in JAMOVI 1.8 software.

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Results

Participants ranged in age from 18 to 87 years, with 182 having a normal BMI (<25.0) and the other 143 being overweight or obese. Details of the characteristics of the participants can be seen in Table 1.

Risk indicators for cardiovascular diseases showed a significant negative correlation with the amount of physical activity performed by the participants daily. Except for the BMI and HDL, which did not present a significant correlation with the practice of physical activities. DBP and Castelli Index 2 showed a significant but negligible correlation with the amount of PA. (Table 2)

As there was a group of participants presenting blood pressure values above the recommended, we separated the 127 volunteers who presented values considered normal in healthy people and performed the correlation tests. In this group, we found a moderate negative correlation between PA with age (rho = -0.522; p<0.001). (Table 3)

Some of the women were overweight or obese (n=318), separating them from the main group, significant changes can be observed in the associations between daily activities and better health indices. (Table 4)

We separated for analysis the 86 participants who were not overweight, obese, or hypertensive. There was a strong negative correlation between BP and age (rho = -0.655; p<0.001). (Table 5)

Within the sample, 102 women were found who were already overweight or obese and associated with hypertension. Table 6 shows the associations between the amount of physical activity and health-related variables. Only age (rho = -0.242; p=0.014) showed weak and moderate associations, respectively. (Table 6)

Table 1 Characteristics of the participants

Characteristic	Median	25th percentile	75th percentile	Minimum	Maximum
Age (years old)	50	36	60	18	87
Weight (Kg)	65	56	73	39.5	113
Heigth (cm)	163	157	168	143	178
BMI	24.4	21.1	28.1	14.7	38.6
SBP (mmHg)	130	120	140	90	204
DBP (mmHg)	80	80	90	60	120
Cholesterol (mg/dl)	207	182	236	120	420
LDL (mg/dl)	140	120	156	44	222
VLDL (mg/dl)	28.2	19.4	38	5.2	76
HDL (mg/dl)	42	35	46	21	244
Triglycerides (mg/dl)	141	97	190	26	380
Castelli Index 1	5	4.5	5.7	1.7	13.9
Castelli Index 2	3.3	3	3.8	0.6	10.3

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL, low-density lipoprotein;VLDL, very low-density lipoprotein; HDL, high-density lipoprotein; 3DPAR, 3-day physical activity recall;

Table 2 Association between daily energy used in physical activities and indicators of cardiovascular diseases. The correlation strengthens according to Prion & Haerling[8]

Variables	Spearman Rho	Classification	P
Age (years old)	-0.381*	Weak	<0.001
BMI	0.226	-	1
SBP (mmHg)	-0.211*	Weak	<0.001
DBP (mmHg)	-0.118*	Negligible	0.017
Cholesterol (mg/dl)	-0.284*	Weak	<0.001
LDL (mg/dl)	-0.268*	Weak	<0.001
VLDL (mg/dl)	-0.288*	Weak	<0.001
HDL (mg/dl)	0.023	-	0.66
Triglycerides (mg/dl)	-0.288*	Weak	<0.001
Castelli Index 1	-0.260*	Weak	<0.001
Castelli Index 2	-0.193*	Negligible	<0.001

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL, low-density lipoprotein;VLDL, very low-density lipoprotein; HDL, high-density lipoprotein; 3DPAR, 3-day physical activity recall;

Table 3 Association between daily energy used in physical activities and indicators of cardiovascular disease in normotensive women (n = 127). The correlation strengthens according to Prion & Haerling[8]

Variables	Spearman Rho	Classification	P
Age (years old)	-0.522	Moderate	<0.001
BMI	0.197	-	0.987
SBP (mmHg)	0.077	-	0.805
DBP (mmHg)	0.08	-	0.815
Cholesterol (mg/dl)	-0.384	Weak	<0.001
LDL (mg/dl)	-0.307	Weak	<0.001
VLDL (mg/dl)	-0.32	Weak	<0.001
HDL (mg/dl)	-0.141	-	0.057
Triglycerides (mg/dl)	-0.32	Weak	<0.001
Castelli Index 1	-0.231	Weak	0.005
Castelli Index 2	-0.129	-	0.074

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL, low-density lipoprotein;VLDL, very low-density lipoprotein; HDL, high-density lipoprotein; 3DPAR, 3-day physical activity recall;

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Table 4 Association between daily energy used in physical activities and indicators of cardiovascular disease in non-overweight or obese women (n = 182). The correlation strengthens according to Prion & Haerling[8]

Variables	Spearman Rho	Classification	P
Age (years old)	-0.533	Moderate	<0.001
BMI	0.158	Negligible	0.034
SBP (mmHg)	-0.304	Weak	<0.001
DBP (mmHg)	-0.171	Negligible	<0.001
Cholesterol (mg/dl)	-0.368	Weak	<0.001
LDL (mg/dl)	-0.348	Weak	<0.001
VLDL (mg/dl)	-0.346	Weak	<0.001
HDL (mg/dl)	-0.086	-	0.249
Triglycerides (mg/dl)	-0.346	Weak	<0.001
Castelli Index 1	-0.354	Weak	<0.001
Castelli Index 2	-0.287	Weak	<0.001

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL, low-density lipoprotein; VLDL, very low-density lipoprotein; HDL, high-density lipoprotein; 3DPAR, 3-day physical activity recall;

Table 5 Association between daily energy used in physical activities and indicators of cardiovascular disease in non-overweight, non-obese and normotensive women (n = 86). The correlation strengthens according to Prion & Haerling[8]

Variables	Spearman Rho	Classification	P
Age (years old)	-0.655	Strong	<0.001
BMI	-0.061	-	0.574
SBP (mmHg)	-0.046	-	0.677
DBP (mmHg)	0.048	-	0.663
Cholesterol (mg/dl)	-0.394	Weak	<0.001
LDL (mg/dl)	-0.314	Weak	<0.001
VLDL (mg/dl)	-0.359	Weak	<0.001
HDL (mg/dl)	-0.314	Weak	0.003
Triglycerides (mg/dl)	-0.359	Weak	<0.001
Castelli Index 1	-0.21	Weak	0.052
Castelli Index 2	-0.091	-	0.407

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL, low-density lipoprotein; VLDL, very low-density lipoprotein; HDL, high-density lipoprotein; 3DPAR, 3-day physical activity recall;

Table 6 Association between daily energy used in physical activities and indicators of cardiovascular disease in overweight, obese and hypertensive women (n = 102). The correlation strengthens according to Prion & Haerling[8]

Variables	Spearman Rho	Classification	P
Age (years old)	-0.242*	Weak	0.014
BMI	0.106	-	0.288
SBP (mmHg)	-0.088	-	0.379
DBP (mmHg)	-0.023	-	0.818
Cholesterol (mg/dl)	-0.115	-	0.25
LDL (mg/dl)	-0.126	-	0.207
VLDL (mg/dl)	-0.169	-	0.09
HDL (mg/dl)	-0.076	-	0.449
Triglycerides (mg/dl)	-0.169	-	0.09
Castelli Index 1	-0.077	-	0.44
Castelli Index 2	-0.012	-	0.903

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL, low-density lipoprotein; VLDL, very low-density lipoprotein; HDL, high-density lipoprotein; 3DPAR, 3-day physical activity recall;

We performed a Mann-Whitney U test comparing the group of normotensive and hypertensive participants. The results showed that the normotensive women performed an average of 2247±493 Kcal of daily PA against 2061±574 Kcal. The result showed a significant difference ($p<0.001$) with a moderate effect size ($\eta^2=0.253$). The Bayesian analysis ($BF_{10}=9.22$) with a 99.9% probability of the result is confirmed.

Discussion

The main finding of the present study was that there is a negative correlation between the amount of PA and variables related to CVD. The negative correlation means that the higher the daily energy expenditure, the lower the values of the variables associated with CVD, confirming the hypothesis of the study. The separation into groups according to pre-existing conditions (overweight, obesity, and hypertension) maintained patterns of correlation between the amount of PA and health indicators, even with some small differences in the classification of correlations.

As expected, age was negatively correlated with the amount of PA. The amount of PA in people in general, regardless of sex, tends to decrease with age. Although common to find this profile, it is not ideal, as aging has negative consequences for health, not only CVD but also for other organs and systems. This correlation was stronger among overweight and obese women. Sarcopenic obesity (loss of muscle mass and increased amount of body fat) has been shown to pose a great risk to the health of the elderly.[9]

Another important finding was that there was almost no association between PA and BMI. BMI has been increasingly criticized as an indicator of obesity and risk, as it takes into account the entire body

mass, and people with higher levels of physical activity tend to have more muscle mass, increasing BMI, without, however, increasing their risk of disease.[10] As in the group of participants, there was great variability in the practice of PA (~288%), but the correlations failed to find an association between these variables. Correlations between PA and blood pressure were weak or negligible (rho<0.021), this result contradicts the results of several studies that show regular PA practice prevents hypertension.[2,3,11] However, when comparing the groups of normotensive and hypertensive women, it can be seen that there was a significant difference in the amount of PA performed by these volunteers (normotensive 2247±493 Kcal vs hypertensive 2061±574 Kcal; p<0.001). This data is reinforced by the Bayesian analysis.

Total cholesterol is one of the most considered clinical markers in arterial disease assessments.[12] In all analyzes carried out in this study, there was a negative correlation between cholesterol and BP, except when only participants identified with a risk group (overweight, obesity, and hypertension) were included, in which there was no significant correlation. LDL and VLDL are lipoproteins considered atherogenic,[13] and therefore used to assess cardiovascular health. The results found show a negative and significant correlation in all comparisons performed, except for the 128 participants who were overweight, obese, and hypertension together. These lipidemia data together allow us to deduce that the low amount of energy spent daily with physical activities causes a reduction in homeostatic control, thus increasing the risk of cardiovascular diseases.

A limitation of the study is that the assessment of body composition was performed only by BMI. It would be interesting to observe the same analyzes based on lean mass and fat mass. That would give us a more accurate parameter. The increasing use of wearable equipment could also provide us with more accurate results of daily energy expenditure. A suggestion for future studies is that inflammatory status (such as interleukins dosage and pro- and anti-inflammatory factors) could be correlated with daily energy expenditure.

Conclusion

From the results found, we confirm the hypothesis that the practice of physical activities is associated with lower indicators of cardiovascular diseases. Also, physical activities act preventively, keeping blood lipid levels low, while less BP causes a homeostatic imbalance that increases the risk of diseases.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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