Physical activity and anthropometric indicators related to hypertension in women


Introduction: The following research aims at identifying the relationship between physical activity, body mass index (BMI) and waist circumference (WC) with hypertension among women. Materials and Methods: It was chosen 145 women submitted to height, BMI, WC and blood pressure measurements. The cut-off points for BMI and WC followed previous definitions shown in literature. The evaluation of physical activity was given by the International Physical Activity Questionnaire (IPAQ), short version. The descriptive method, frequency distribution and logistic regression, directed to obtain the Odds Ratio, with confidence interval (CI) of 95% adopting p<0.05, were used. Results: Physical activity did not associate with hypertension, and significant Odds Ratio was found for overweight (OR=6.36; IC=1.49-27.09; p=0.01), obesity (OR=26.70; IC=6.19-115.09; p=0.00) e WC level of action 2 (OR=25.71; IC=6.44-102.70; p=0.00). Discussion: The regular physical activity is recommended for the blood pressure control; nevertheless, this research found no ratio to hypertension, but the anthropometric indexes were efficient on this proposal.

Keywords: Hypertension; Body Mass Index; Abdominal Fat; Physical Activity; Women.

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Resumo

Introdução: O presente estudo visa identificar a relação da atividade física, do índice de massa corporal (IMC) e da circunferência de cintura (CC) com a hipertensão arterial em mulheres. Materiais e Métodos: Foram selecionadas 145 mulheres adultas que foram submetidas a aferições de estatura, massa corporal, CC e pressão arterial. Os pontos de corte do IMC e CC seguiram definiciones prévias dadas pela literatura. A avaliação da atividade física ocorreu pelo International Physical Activity Questionnaire (IPAQ), versão curta. Foram utilizados o método descritivo, a distribuição de frequência e a regressão logística direcionada à obtenção do Odds Ratio (OR), com intervalo de confiança (IC) de 95%, adotando p<0,05. Resultados: A atividade física não se relacionou com a hipertensão arterial, porém foram encontradas razões de chances significativas para sobrepeso (OR=6,36; IC=1,49-27,09; p=0,01), obesidade (OR=26,70; IC=6,19-115,09; p=0,00) e CC nível de ação 2 (OR=25,71; IC=6,44-102,70; p=0,00). Discussão: A atividade física regular é recomendado para o controle da pressão arterial, porém no presente estudo esta não obteve relação com a hipertensão arterial, já os indicadores antropométricos foram eficientes neste propósito.

Palavras-Chave

Hipertensão; Índice de Massa Corporal; Gordura Abdominal; Atividade Física; Mulheres.

Resumen

Introducción: Este estudio tiene como objetivo determinar la relación de la actividad física, el índice de masa corporal (IMC) y la circunferencia de la cintura (CC) con hipertensión arterial (HA), en mujeres. Materiales y Métodos: Fueron seleccionadas 145 mujeres adultas, sometidas a mediciones de talla, IMC, CC y presión arterial. Los puntos de corte de IMC y CC siguieron definiciones dadas por la literatura. La evaluación de la actividad física se llevó a cabo a través del International Physical Activity Questionnaire (IPAQ), versión corta. Se utilizaron el método descriptivo, la distribución de frecuencia y la regresión logística para obtener Odds Ratio (OR), con intervalo de confianza (IC) del 95% y adopción de p<0.05. Resultados: La actividad física no está relacionada con la hipertensión arterial, no obstante, el OR fue significativo para el sobrepeso (OR=6.36; IC=1.49-27.09; p=0.01), obesidad (OR=26.70; IC=6.19-115.09; p=0.00) y CC a nivel de acción 2 (OR=25.71; IC=6.44-102.70; p=0.00). Discusión: La actividad física regular se recomienda para controlar la presión arterial, pero en este estudio no logram esta relación con la hipertensión arterial, ya que los indicadores antropométricos fueron eficaces en este sentido.

Palabras Clave

Hipertensión; Índice de Massa Corporal; Grasa Abdominal; Actividad Física; Mujeres.

Introduction

Recent data from the Ministry of Health show that, in Brazil, the diseases of the circulatory system are responsible for 32.2% of all deaths that occurred in 2005. In females, among these diseases, the cerebrovascular disease is responsible for 11.8% of the total of deaths, the ischemic diseases from the heart are responsible for 9.5%, the hypertensive, for 4.7% and cardiac insufficiency for 4.1%.

Such complications are particularly influenced by arterial hypertension (AH), which represents one of the greatest causes of cardiovascular morbidity in Brazil.

The prevalence of AH varies from 22.3 to 43.9%, according to the studied area, and as a risk factor for this pathology, it is possible to mention age, sex and ethnicity, socioeconomic factors, high salt swallow, obesity, swallow of alcoholic drinks and sedentarism.

There is evidence about the benefit of physical activity for health, and the main ones concern the increase of longevity and the reduction of premature mortality.

Otherwise, the sedentary life style is presented as a strong risk factor for the increase of arterial pressure, due to the apparition of other associated factors, mainly those related to insulin resistance (obesity, diabetes and dyslipidaemias).

Among these associated factors, it can be seen that obesity plays an important role for the increase of pressure levels and is presented as one of the most important cardiovascular risk factors and, besides that, fat distribution predominantly visceral can be more related to the increase of arterial pressure (AP) levels than to the generalized obesity.

There are several methods for the identification of global and local obesity; however, the anthropometric
indexes are efficient tools, of ease use and low cost. Among them, the body mass index (BMI), as an identifier of global obesity, and the waist circumference (WC) as an indicator of abdominal obesity, are emphasized.

The cut points recently used for the BMI are suggested by the World Health Organization (WHO) and, for the WC, the one presented by Lean, Han and Morrison in a study carried out with English people is used.

From the point of view of the relation between physical activity and AH, there is still the need of other elucidations on the influence of the physical activity levels in the AH in women, since studies did not show the relation between physical activity with the reduction of risks of AH. With regard to the anthropometric indexes, the use of BMI as an indicator related to the cardiovascular risk can be affected by the distribution of body fat, and the universal use of the cut points of WC for such means is questionable, due to the population differences.

Thus, this study aims at identifying the relation between physical activity and cut points for the BMI and the WC with AH in adult women.

MATERIALS AND METHODS

Subjects and sample

The present study does not present any potential conflict of interests; it was conducted according to resolution 196/96 of the National Health Counsel and was initiated after the participants signed an Informed Consent Form, agreeing with the procedures to be carried out. The research protocol of the present study was approved by the Ethics Committee of Universidade Federal do Paraná, under the protocol number 018-06.

Hence, 145 women with ages varying from 18 to 60 years old, residents in the cities of Jacarezinho and Siqueira Campos, Paraná, Brazil, agreed in participate in the present investigation.

Instruments and procedures

Women were submitted to anamnesis, aiming at identifying the use of anti-hypertensive drugs, stature evaluations, body mass, waist circumference, AP and evaluation of the level of physical activity.

The anthropometric measures were carried out according to the proposal of Heyward and Wagner. To accomplish the stature’s measure, an anthropometric metallic ribbon in the wall was used and phased in 0.1m; the participant was barefoot, with the weight distributed between relaxed foot and arms, and instructed to maintain as much straight as possible. The head was positioned in a manner that the face was kept in the vertical.

To determine body mass, a digital balance, brand G-Lite Cristal, with a resolution of 0.1kg was used. The subjects were barefoot and used light clothes, when they rose up in the balance were guided to distribute body mass index between both feet.

BMI was defined dividing body mass index by the squared stature, BMI = body mass index (kg).stature (m)², according to the collected data.

The WC was obtained by means of a metallic anthropometric ribbon phased in 0.1m, positioned in the most narrowing part of the back, when seen in the anterior aspect, the middle point between the last costal arch and iliac crest.

The cut points used for the BMI were <18.5kg.m⁻² (underweight), ≥18.5kg.m⁻² and <25kg.m⁻² (euthrophic), ≥25kg.m⁻² and <30kg.m⁻² (overweight) and ≥30kg.m⁻² (obesity). For the WC, the cut points used were <80cm (normal), ≥80 cm and <88cm (level of action 1) and ≥88cm (level of action 2).

For the obtainment of the level of physical activity, the International Physical Activity Questionnaire (IPAQ), short version, accredited internationally and translated to Portuguese, was used, for it enables the categorization of subjects in “very active”, “active”, “irregularly active A”, “irregularly active B” and “sedentary”. In order to analyze the data, women defined as “very active” and “active” were categorized as active, the ones defined as “irregularly active A and B” were categorized as gradually active and the “sedentary people” maintained their categorization.

AP was measured by the auscultator method in the right arm of each patient, through the use of a stethoscope and an analogical sphygmomanometer; they were for at least five minutes in rest, sat with uncrossed legs, and feet supported in the floor and back reclined in the chair. The arm was positioned at the heart’s height with the palm of the hand turned up and the elbow slightly flexed. The cuff of the sphygmomanometer was positioned in about 2 to 3cm of the cubital cesspool and the bellflower of the stethoscope over the brachial artery without excessive compression. Two gauging were realized with a minimum interval of two minutes between them, and the mean values were used for the analysis.

For the gauging, the assessed, obligatorily, could not have practiced physical exercises from 60 to 90 minutes before the evaluation, nor had drank alcoholic drinks, coffee, food and had smoked in the previous 30 minutes from its realization.

The systolic AP (APS) was determined when the first sound appeared (phase I of Korotkoff), and the diastolic AP (DAP) with the sound disappearance (phase V of Korotkoff). The patients were defined as hypertensive if the APS were higher or equal to 140mmHg and the DAP...
higher or equal to 90mmHg, or in the identification of the use of anti-hypertensive drugs*.

**Statistical analysis**

The descriptive method was used for the sample’s characterization, expressing minimum, maximum, mean and standard deviation values. The frequency distribution was used to obtain the prevalence of the levels of physical activities and of altered BMI and WC values. The contingency table was used to obtain the prevalence of AH to each level of physical activity presented and for the respective cut points of BMI and WC.

In order to estimate the Odds Ratio (OR) of women with low physical activity, BMI ≥25 and <30kg.m⁻² (overweight), ≥30kg.m⁻² (obesity) and WC in the levels of action 1 and 2 to present AH, the binary logistic regression was applied using as reference values the active physically, BMI ≥18.5 and <25kg.m⁻² and WC <80cm. The adopted level of significance was of p<0.05 and 95% confidence interval.

All the procedures were carried out with the software SPSS® for Windows®, version 15.0.

**RESULTS**

The characteristics of the studied population expressed in minimum, maximum, median and standard deviation (sd) values, according to the level of physical activity, are described in Table 1.

The incidence of sedentaryism in the studied sample was of 15.9%, when analyzing the anthropometric variables it was verified that overweight, given by the classification of BMI, reached 23.4% of the sample and the obesity 13.1%, but for the WC it was found that 17.9% of the sample showed level of action 1 and the same percentage values were found for level of action 2. The proportion of cut points of BMI and WC, according to the levels of physical activity, is disposed in Table 2.

In relation to AH, it was possible to note that 12.4% presented this pathology, and its proportion according to the categories of physical activity and cut points of BMI and WC together with the results obtained from binary logistic regression are seen in Table 3.

The variable of physical activity, it was stated that an increase of the proportion of subjects with AH according to the decrease of their levels, however, the presented values for the group of ‘active patients’ and ‘gradually active patients’ presented similar results (10.9 and 11.9%, respectively). Women with lower levels of physical activity (‘gradually active patients’ and ‘sedentary patients’) did not present higher OR of AH in comparison to the most actives.

The increase of subjects that presented AH with the increase of BMI was also evidenced, as the overweight category presented higher OR in relation to the eu-throphic ones, and it was also observed in the obesity category, since the non-hypertensive and hypertensive subjects proportion was similar in this group (52.6 versus 47.4%, respectively).

The dynamic of increase of hypertensive women with the increase of WC values was also seen, however, the level of action 1 (WC≤80 and <88cm) did not have higher OR than WC≤80cm of presenting AH, level of action 2 (WC≥88cm) had more OR than AH in relation to the reference value, and the proportion of hypertensive subjects approximated from the non-hypertensive in this category (46.2 versus 53.8%, respectively).

**DISCUSSION**

According to the physical activity categories of the present study, it was stated that 37.9% of women were classified as actives, 46.2% as gradually actives and 15.9% as sedentaries. In a study carried out in 29 cities of the state of São Paulo, with 1,048 women and with the same evaluation instrument, Matsudo, Matsudo and Araujo20 found 52.7% of active women, 39.3% gradually active women and 8% sedentary women.

Overweight and obesity reached 23.4 and 13.1% of the studied sample, respectively. Similarly, Sama and Monteiro21 found prevalence of 25.9% of overweight and 9.4% of obesity in 877 women from the city of São Paulo. As to WC, the mentioned authors demonstrate higher prevalence (31.8% in the level 1 and 23.6% in level 2) than those found in this study (17.9% for level 1 and 2). Other studies report prevalence of anthropometric levels similar in women of the Brazilian population22,23.

The proportion of hypertensive women was of 12.4%, value below the values exposed by Sociedade Brasileira de Cardiologia*, which shows prevalence of 26.1% for hypertension in women.

Although few studies recommend regular physical activity as a way to control the AP24, the present study did not show a significative relation between the low levels of physical activity and increased AP (OR=1.11; CI=0.36-3.41; p=0.86 for gradually active women and OR=1.72; CI=0.43-6.78; p=0.46 for the sedentary women). Likewise, Conceição et al.25 did not find significant relation of sedentarism with AH in women, presenting OR similar to the one found in the present study (OR=1.02; CI=0.46-2.25).

For BMI, cases of underweight were not found in the studied sample, thus only the classifications of ‘eu-throphic’, ‘overweight’ and ‘obesity’ were used in the analysis. Hence, it was possible to notice that women who
Table 1 - Minimum, maximum values, median and sd of the main variables according to the level of physical activity.

<table>
<thead>
<tr>
<th>Physical activity level</th>
<th>Active women</th>
<th>Moderately active women</th>
<th>Sedentary women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median/SD</td>
<td>Median/SD</td>
<td>Median/SD</td>
<td></td>
</tr>
<tr>
<td>(min-max)</td>
<td>(min-max)</td>
<td>(min-max)</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>32.4 ± 14.5</td>
<td>32.5 ± 14.6</td>
<td>28.2 ± 13.4</td>
</tr>
<tr>
<td></td>
<td>(18.0-59.6)</td>
<td>(18-58.3)</td>
<td>(18-53.9)</td>
</tr>
<tr>
<td>Stature (m)</td>
<td>1.62 ± 0.06</td>
<td>1.59 ± 0.8</td>
<td>1.61 ± 0.7</td>
</tr>
<tr>
<td></td>
<td>(1.49-1.73)</td>
<td>(1.43-1.80)</td>
<td>(1.48-1.76)</td>
</tr>
<tr>
<td>BM (kg)</td>
<td>62.9 ± 11.8</td>
<td>62.4 ± 12.8</td>
<td>61 ± 12.6</td>
</tr>
<tr>
<td></td>
<td>(45.0-94.0)</td>
<td>(45.2-101.9)</td>
<td>(50.2-113.1)</td>
</tr>
<tr>
<td>BMI (kg.m⁻²)</td>
<td>24.0 ± 4.7</td>
<td>24.7 ± 5.5</td>
<td>23.7 ± 5.7</td>
</tr>
<tr>
<td></td>
<td>(16.3-36.9)</td>
<td>(16.8-39.3)</td>
<td>(19.3-47.1)</td>
</tr>
<tr>
<td>WC (cm)</td>
<td>76.2 ± 11.2</td>
<td>76.6 ± 13.3</td>
<td>72.8 ± 12</td>
</tr>
<tr>
<td></td>
<td>(59.1-105)</td>
<td>(52.1-108.0)</td>
<td>(59.5-111.5)</td>
</tr>
<tr>
<td>ASP (mmHg)</td>
<td>109.4 ± 16.7</td>
<td>112 ± 16.5</td>
<td>115.6 ± 20.4</td>
</tr>
<tr>
<td></td>
<td>(88-170)</td>
<td>(90-170)</td>
<td>(92-182)</td>
</tr>
<tr>
<td>ADP (mmHg)</td>
<td>70.4 ± 9.3</td>
<td>71.3 ± 10.6</td>
<td>73.7 ± 12.3</td>
</tr>
<tr>
<td></td>
<td>(53-92)</td>
<td>(58-103)</td>
<td>(54-103)</td>
</tr>
</tbody>
</table>

sd: standard deviation; min-max.: minimum and maximum values found; BM: body mass; BMI: body mass index; WC: waist circumference; ASP: arterial systolic pressure; ADP: diastolic arterial pressure.

Table 2 - Proportion: cut points of BMI and WC according to the levels of physical activity

<table>
<thead>
<tr>
<th>Level of physical activity</th>
<th>Active women (%)</th>
<th>Moderately active women (%)</th>
<th>Sedentary women (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eutrophic</td>
<td>65.5</td>
<td>56.7</td>
<td>78.3</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.5</td>
<td>23.9</td>
<td>17.4</td>
</tr>
<tr>
<td>Obesity</td>
<td>9.1</td>
<td>19.4</td>
<td>4.3</td>
</tr>
<tr>
<td>WC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>60</td>
<td>62.7</td>
<td>78.3</td>
</tr>
<tr>
<td>Level of action 1</td>
<td>23.6</td>
<td>16.4</td>
<td>8.7</td>
</tr>
<tr>
<td>Level of action 2</td>
<td>16.4</td>
<td>20.9</td>
<td>13</td>
</tr>
</tbody>
</table>

BMI: body mass index; WC: waist circumference.

Table 3 - Proportion and OR of AH according to the categories of physical activity and cut points of BMI and WC.

<table>
<thead>
<tr>
<th>Hypertension</th>
<th>Total</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>n</th>
<th>OR (IC95%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active women</td>
<td>89.1</td>
<td>10.9</td>
<td>55</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Moderately active women</td>
<td>88.1</td>
<td>11.9</td>
<td>67</td>
<td></td>
<td>1.11 (0.36 – 3.41)</td>
<td>0.86</td>
</tr>
<tr>
<td>Sedentary women</td>
<td>82.6</td>
<td>17.4</td>
<td>23</td>
<td></td>
<td>1.72 (0.43 – 6.78)</td>
<td>0.43</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eutrophic</td>
<td>96.7</td>
<td>3.3</td>
<td>92</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>82.4</td>
<td>17.6</td>
<td>34</td>
<td></td>
<td>6.36 (1.49 – 27.09)</td>
<td>0.01</td>
</tr>
<tr>
<td>Obesity</td>
<td>52.6</td>
<td>47.4</td>
<td>19</td>
<td></td>
<td>26.70 (6.19 – 115.09)</td>
<td>0</td>
</tr>
<tr>
<td>WC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>96.7</td>
<td>3.3</td>
<td>90</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Level of action 1</td>
<td>88.5</td>
<td>11.5</td>
<td>26</td>
<td></td>
<td>3.91 (0.74 – 20.67)</td>
<td>0.11</td>
</tr>
<tr>
<td>Level of action 2</td>
<td>53.8</td>
<td>46.2</td>
<td>26</td>
<td></td>
<td>25.71 (6.44 – 102.70)</td>
<td>0</td>
</tr>
</tbody>
</table>

OR: Odds Ratio; IC: confidence interval; BMI: body mass index; WC: waist circumference.
presented higher BMI obtained higher rate for chances of presenting AH (OR=6.36; CI=1.49-27.09; p=0.01 for overweight and OR=26.70; CI=6.19-115.09; p=0.00 for obesity), and similarly, Sarno and Monteiro showed an increase tendency in the AP with the increase of BMI in women. Weinstein et al. also found an increase of AP with the increase of BMI in women of the United States.

In this study, WC was used as an indicator of localized obesity, because, among the directed indexes for this purpose, it presents better simplicity in the evaluation and stratification of risk and, also, due to the extensive literature regarding its use as an indicator of cardiovascular risk.

Facing the results found for WC, it was observed that the level of action 2 (≥88cm) presented higher OR of AH related to WC<80 cm (OR=25.71, CI=6.44-102.70; p=0.00), however higher OR for the level of action 1 (WC≥80 and <88cm with OR=3.91; CI=0.74-20.67; p=0.11). Natale et al. found significant relation between the increase of WC in hypertensive women, using the cut point ≥88cm. Janssen, Katzmarzyk and Ross have also observed a significant relation between the increase of AP and WC in hypertensive adult women.

It was possible to notice the increase of AP in both classification levels of BMI (overweight and obesity), but as to the relation between the increase of WC and of AP, statistical significance was observed only when the abdominal obesity level was characterized as level of action 2, describing high cardiovascular risk and showing better sensibility of BMI in relation to hypertension.

As to physical activity, the use of the recordatory questionnaire aids the occurrence of imprecision in the results due to the dependence of the patients on capacity of remembering its practice. Yet, for population analysis its use is more possible in comparison to instruments of better precision and concomitantly higher cost, as the accelerometers. In a study carried out by Matsudo et al., which aimed at validating the short version of IPAQ, that is an instrument also used in the present study, a proximity in the results was observed when compared to the accelerometer CSA (r=0.76), considered as a gold standard for the evaluation of physical activity.

As an important factor, the non-inclusion of disbursed time with each intensity of activity (light, gradual and intense) with the non-identification of the sedentary habits limited the analysis of results, unabling a better comprehension on the effects of physical activity in AH in women.

As to the anthropometric indexes, further investigations are necessary for a better elucidation of their relation with AH in women, since the sample had a reduced number and did not have population representativity.

Before the proposed objective, it was seen that the physical activity did not have relation with AH in women, therefore, for the anthropometric indicators used, the BMI, as representing significant relation for both cut points (overweight and obesity), apparently was more efficient than WC, which had a significative relation only for level of action 2.

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