Original Article

Association of Fitness and Waist Circumference with Hypertension in Brazilian Elderly Women

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Summary

Background: **The protective effect of cardiorespiratory fitness, regardless of obesity, has been recognized in adults. However, this association is still not clear in elderly individuals.**

Objective: **To analyze the association between hypertension and cardiorespiratory fitness in 1,064 elderly Brazilian women.**

Methods: **Central obesity was estimated by waist circumference and cardiorespiratory fitness by the 6-minutes walk test. ANOVA one way, chi-square and logistic regression were used for the statistical analysis.**

Results: **The prevalence of hypertension was 53.9%. The central obesity group had higher odds for hypertension when compared with the non-central-obesity group, in the same cardiorespiratory fitness group. Furthermore, both the central obesity and non-central obesity groups had a progressive increase in the odds ratio for hypertension, from the highest to lowest fitness groups, indicating an inverse relation between fitness and central adiposity. The non-central obesity group had the lowest odds ratios (OR), 1.49 (95%IC 0.97-2.28) and 1.54 (95%IC 0.94-2.51); whereas the central obesity group had an OR of 2.08 (95%IC 1.47-2.93), 2.79 (95%IC 1.79-4.33) and 3.09 (95%IC 1.86-5.12).**

Conclusion: **Our findings indicated that the waist circumference measurement is a strong predictor of hypertension and suggested that the protective effect of cardiorespiratory fitness can be extended to elderly women, even to those with central obesity. (Arq Bras Cardiol 2009;93(1):2-7)**

Key words: **Obesity; physical fitness; aged; blood pressure; disease prevention; abdominal circumference; women; Brazil.**

Introduction

Hypertension has a high prevalence in adults, tending to affect more women than men all over the world. It is well recognized that its prevalence is increasing gradually with advancing age, affecting approximately half of the elderly Brazilian people[1-7].

One of the main factors related to the genesis of hypertension is an increase in the adipose tissue, which currently has been defined as "obesity hypertension". Although central obesity has been shown to alter the cardiovascular, renal, and metabolic systems, triggering inflammatory responses, the cause-effect relationship between adiposity and hypertension is not quite understood. However, it is common agreement that individuals with elevated central adiposity have an increase in the risk for hypertension, cardiovascular disease and mortality[3,6,8-12]. Additionally, central obesity has been strongly associated with a high prevalence of hypertension[6,8-10,12-20].

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According to the findings from the MONICA study, a 2.5 cm increase in waist circumference (WC) for women corresponds to an increase in systolic blood pressure of 1mmHg[6]. Furthermore, the JNC 7[3] have reported that the relationship between blood pressure and risk of CVD is continuous, consistent and independent of other risk factors; thus, it is suggested that hypertensive individuals become more vulnerable to acquire other health problems, particularly elderly individuals who have been suffering the time-accumulated deleterious effect of aging and cumulative time exposure of risk factors for longer periods of time[1,2,6].

This scenario has become a crescent concern for public health professionals, and primary prevention has been the main focus, which includes weight loss, balanced diet control, changes in alcohol and smoking habits and especially, exercise practice[1-3,7,13,15,18,21]. In spite of the JNC 7[3] and the V Brazilian Recommendations for Hypertension[5] advice, as a lifestyle modification, that all individuals (hypertensive or not) engage in regular aerobic physical activity due to the protective effect of high fitness in relation to health risks and mortality in adults, even with excess of adiposity, this tendency has been less explored in elderly women[1,22-30]. For this reason, the main purpose of this study was to determine the association between hypertension and cardiorespiratory fitness (CRF), and to examine the joint effect of the CRF and central obesity with hypertension in elderly Brazilian women.

Methods

Design

The present study was carried out in the city of Curitiba, state of Parana, Brazil. The sample consisted of elderly women that participated in community groups in the entire city. These groups were randomly selected. Subjects were invited to participate in this investigation after receiving a detailed clarification of the procedures involved in this research, including benefits and possible risks. All subjects signed the informed consent form, indicating that their participation was voluntary.

One thousands and sixty-four non-institutionalized women, aged between 60.0 – 88.8 years, agreed to participate in the study. The sample consisted predominantly of Caucasian subjects, classified as of low or middle socio-economic level.

All the assessments were performed between 08:00 and 10:00 am, to avoid the influence of circadian variations. Furthermore, the participants were instructed not to ingest any food two hours before the tests, as well as to avoid any vigorous physical activity for 24 hours before testing. The assessments were carried out at the Physiology Laboratory of the Exercise and Sports Research Center of the Universidade Federal do Parana.

The study protocol was approved by the Ethics Committee of the Universidade Federal do Parana, according to the norms established in the Resolution 196/96 of the National Health Council, concerning researches involving human subjects.

Measurements

Blood pressure was measured according to JNC 7[3] recommendations, using the auscultatory method by a trained physician who made sure that the subjects were comfortably seated for at least five minutes on a chair (with feet placed on the floor), in a quiet environment, and with their right arm supported at heart level. Hypertension was determined when the systolic blood pressure was ≥ 140 mmHg and diastolic blood pressure ≥ 90 mmHg or when the subject self-reported the current use of antihypertensive medication. In addition, the subjects were asked if their physician had ever told them that they were hypertensive.

Waist circumference (WC) was measured according to the procedures by Lohman et al[31]. In order to avoid inter-examiner variability, this measurement was performed by only one trained examiner for all participants.

The 6-min walk test (6MW) was administered to estimate cardiorespiratory fitness. The test was performed on a 54.4 m rectangular course (18.0 m length x 9.2 m width). The maximum distance walked in 6 minutes was recorded for each subject. The test was discontinued if, at any time, a participant showed signs of dizziness, pain, nausea, or undue fatigue[32].

Additionally, participants reported family history of cardiovascular disease and smoking status (current smoker – CS or not). Socioeconomic status was determined by a validated national socioeconomic questionnaire.

Statistical analyses

The Kolmogorov Smirnov test of normality was used to determine that the distribution of the sample data was parametric. Subsequently, means, standard deviations and relative frequencies were calculated for the descriptive values according with blood pressure classification – normo/hypertensive. A one-way analyses of variance (ANOVA) was used to identify differences between age, socioeconomic status, systolic and diastolic blood pressure, waist circumference and cardiorespiratory fitness in the normo/hypertensive groups. The Chi-Square test was used to determine if frequencies of smoking status and family history of cardiovascular disease significantly differed between the normo/hypertensive groups.

Logistic regression analysis was used to determine the association between central adiposity (WC) and cardiorespiratory fitness (CRF) with hypertension. Hypertension was treated as a dichotomous variable (yes/no). WC and CRF were divided into quartiles at the univariate analysis. Odds Ratio (OR) and their 95% confidence intervals (95%CI) were calculated using age and adjusted-models, which included the potential confounders' variables – socioeconomic status, family history of cardiovascular disease and smoking status, and central adiposity or cardiorespiratory fitness. To investigate the joint effect of central adiposity and cardiorespiratory fitness with hypertension, the following variables were created: CRF ≥ 490.2 and WC < 88.0 (referential group) and ≥ 88.0 cm; CRF < 490.2 - ≥ 431.0 and WC < 88.0 and ≥ 88.0 cm; CRF < 431.0 - ≥ 330.8 and WC < 88.0 and ≥ 88.0 cm; CRF < 330.8 and WC < 88.0 and ≥ 88.0 cm. The division of the groups provided the information from high to low CRF quartiles for the non-central (WC < 88.0) and central obesity (WC ≥ 88.0 cm) groups. All analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 13.0) for Windows.

Results

Of the 1,064 participants, 574 subjects were classified as hypertensive (53.9%). The one-way analysis of variance and chi-square analysis showed significant differences between normo/hypertensive groups for the following variables: age, socioeconomic status – SES, systolic blood pressure – SBP, diastolic blood pressure – DBP, waist circumference – WC, cardiorespiratory fitness – CRF, and family history of cardiovascular disease – FH_CVD. Smoking status – CS did not differ between groups (Table 1).

The highest prevalence of hypertension was found in the highest central adiposity group (WC ≥94.0 cm), indicating a direct association between these variables (Figure 1). In contrast, a trend of an inverse association was found between the prevalence of hypertension and CRF (Figure 2).

The logistic regression analysis determined a gradual increase in odds ratio (OR) across the WC quartiles. Table 2 indicates three-fold odds for hypertension for those women with higher central adiposity (WC ≥94.0 cm) regardless of age or confounder variables. However, after adjusted for CRF the odds was slightly attenuated, being around 5% for those with WC ≥94.0 cm and 8% for those with WC of 87 - 93.9cm. Table 3 shows the association between hypertension and

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Table 1 - Subjects' characteristics by blood pressure status

	Normotensive (n=490)	Hypertensive (n=574)	
	(mean (SD) or %)	(mean (SD) or %)	F or X^2
Age (years)	68.9 (6.0)	69.9 (6.2)	6.90**
Socioeconomic status (SES, score)	13.9 (5.0)	13.0 (4.2)	9.73**
Current smoker (CS, %)	5.3	4.2	NS
Family history of CVD (FH_CVD, %)	60.4	52.1	7.31**
Systolic blood pressure (SBP, mmHg)	126.1 (10.1)	138.4 (15.0)	233.4*
Diastolic blood pressure (DBP, mmHg)	78.1 (7.3)	83.0 (10.1)	76.17*
Waist circumference (WC, cm)	84.9 (9.7)	89.0 (10.6)	42.01*
Cardiorespiratory fitness (CRF, m)	496.2 (82.2)	478.7 (83.8)	11.69*

*SD – standard deviation; ANOVA (F) and Chi-Square (X^2); *p≤0.001; **p<0.01; NS - non significant.*

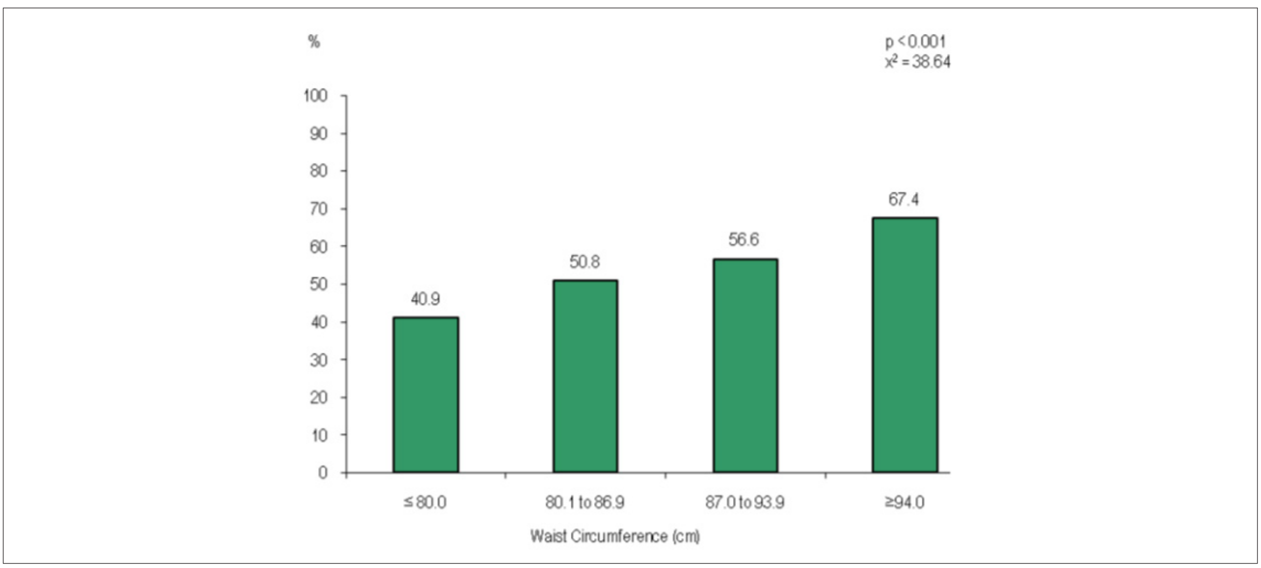

***Figure 1 -** Hypertension prevalence according to waist circumference quartiles.*

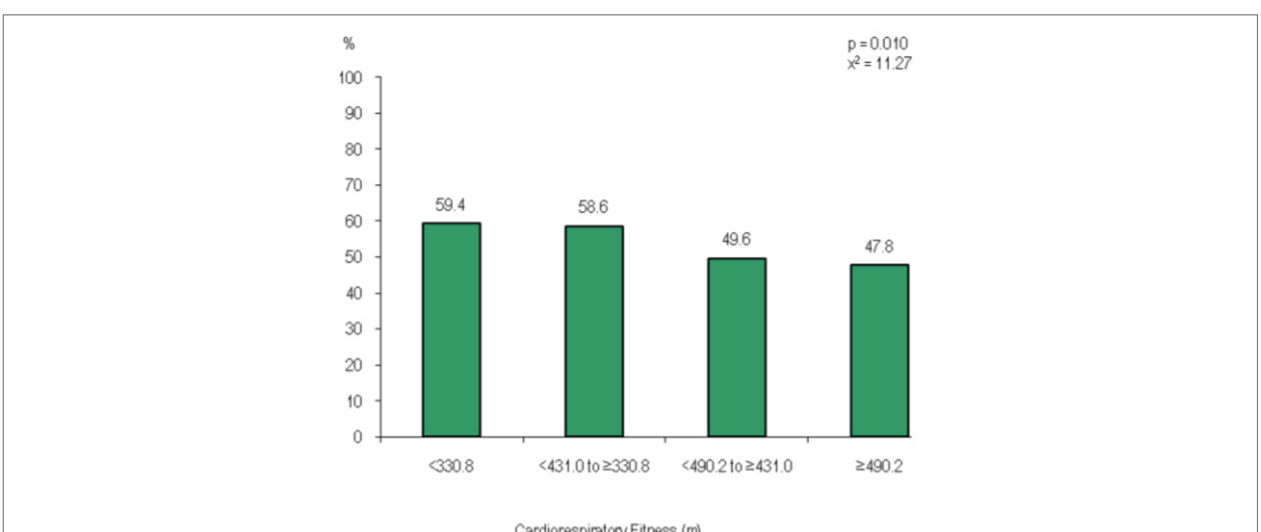

***Figure 2 -** Hypertension prevalence according to cardiorespiratory fitness quartiles.*

CRF. The two highest CRF groups had a reduction of 33 and 36%, respectively, in the odds for hypertension. However, after including WC in the regression model, the odds ratio increased to 0.76 and 0.75 in the same two highest CRF groups, respectively.

Figure 3 shows a tendency that central obese elderly women (WC ≥88.0cm) had a higher odds for hypertension when compared with the non-central-obesity (WC <88.0cm), in the same CRF group. Therefore, the greater CRF the lower the odds for hypertension for non-central and central obesity group (WC≥88.0cm).

Discussion

Excess of adiposity has been directly associated with the prevalence of hypertension, supporting our findings that showed that women with higher WC had an increase of three-fold in the odds ratio for hypertension, indicating that WC is a strong predictor of hypertension in this sample. Several investigations have shown that WC is an indicator of central obesity in adults and elderly women[1,8-12,21,23,33], consequently it is directly associated with health risks[17,18,34]. Additionally, WC has a greater predictive cutoff point for hypertension than BMI in men[19] and mainly in the first WC cutoff point (WC ≥80) in adult women[14], WC has an odds ratio for hypertension of 1.76 between 80-88cm and OR 2.18 for WC ≥88cm[13], and it is a strong predictor of CVD in women aged 25 to 74 years[34].

Despite the recognized importance to maintain moderate-high CRF, even in individuals with excess of adiposity[23,25,27,35,36], this approach seems to be yet little explored for elderly women. Our results verified that the CRF mean was higher in the normotensive than in the hypertensive group and indicated an inverse association between the prevalence of hypertension and CRF. These findings are supported by a recent investigation that examined the effects of CRF and incidence of hypertension in the Aerobic Center Longitudinal Study (ACLS), which was carried out in normotensive women without CVD at baseline. Those results indicated an inverse relation between CRF and hypertension after follow-up. Furthermore, at the multivariate model, the OR was 0.61 for a moderate fitness level and 0.35 for a high fitness level, indicating a strong protective effect of CRF. Similarly, our results of the univariate analysis indicated a decrease of 24 and 25% in the odds for hypertension in the two highest CRF quartiles, respectively, even after the WC measurement was included in the model. It seems that CRF has a protector effect in hypertension; the same effect was confirmed for women with prehypertension[33] and for elderly[5]. Hu et al[16] also indicated a protective effect of the physical activity level (PAL) for hypertension in women aged 25 to 64 years.

Although the results of the previously presented studies were not specific for elderly women, being determined using a sample stratified by age groups[30], or adjusted by age[16,27,34], they still support our findings that CRF has a protective effect for hypertension, and consequently, this CRF effect can be extended specifically to elderly women, regardless of the non-central obesity or central obesity classification.

Similarly to what was reported by ACLS researchers[23] our purpose was not to minimize the effect of obesity on elderly women's health, but to confirm the benefits of the maintenance of CRF in this specific population. Currently, there is an increased concern about what strategy can be more efficient against hypertension, because it is supposed that even normotensive individuals, younger than 65 years, have a remaining lifetime risk of developing hypertension of approximately 90%. In addition, it seems that several cases

Table 2 - Univariate analysis of hypertension according to waist circumference quartiles - odds ratio (95% CI)

	Waist Circumference (cm)			
	≤ 80 (n=269)	80.1 to 86.9 (n=298)	87.0 to 93.9 (n=241)	≥ 94.0 (n=254)
Model 1	1.00	1.49 (1.06-2.08)	1.88 (1.32-2.68)	3.02 (2.11-4.33)
Model 2	1.00	1.51 (1.08-2.12)	1.89 (1.32-2.70)	3.01 (2.09-4.34)
Model 3	1.00	1.51 (1.08-2.13)	1.81 (1.26-2.60)	2.96 (2.04-4.28)

Confounders - socioeconomic status, family history for CVD and smoking status; Model 1 - Adjusted by age; Model 2 - Adjusted by age and confounders; Model 3 - Adjusted by age, confounders, and CRF.

Table 3 - Univariate analysis of hypertension according to cardiorespiratory fitness quartiles - odds ratio (95% CI)

	Quartiles of Cardiorespiratory Fitness (m)			
	< 330.8 (n=273)	330.9 to 431.0 (n=278)	431.1 to 490.2 (n=271)	≥ 490.2 (n=229)
Model 1	1.0	0.96 (0.69-1.36)	0.67 (0.48-0.94)	0.63 (0.44-0.90)
Model 2	1.0	0.96 (.68-1.36)	0.67 (0.48-0.95)	0.64 (0.45-0.93)
Model 3	1.0	0.99 (.69-1.40)	0.76 (0.53-1.08)	0.75 (0.51-1.08)

Confounders - socioeconomic status, family history for CVD and smoking status; Model 1 - Adjusted by age; Model 2 - Adjusted by age and confounders; Model 3 - Adjusted by age, confounders, and central obesity.

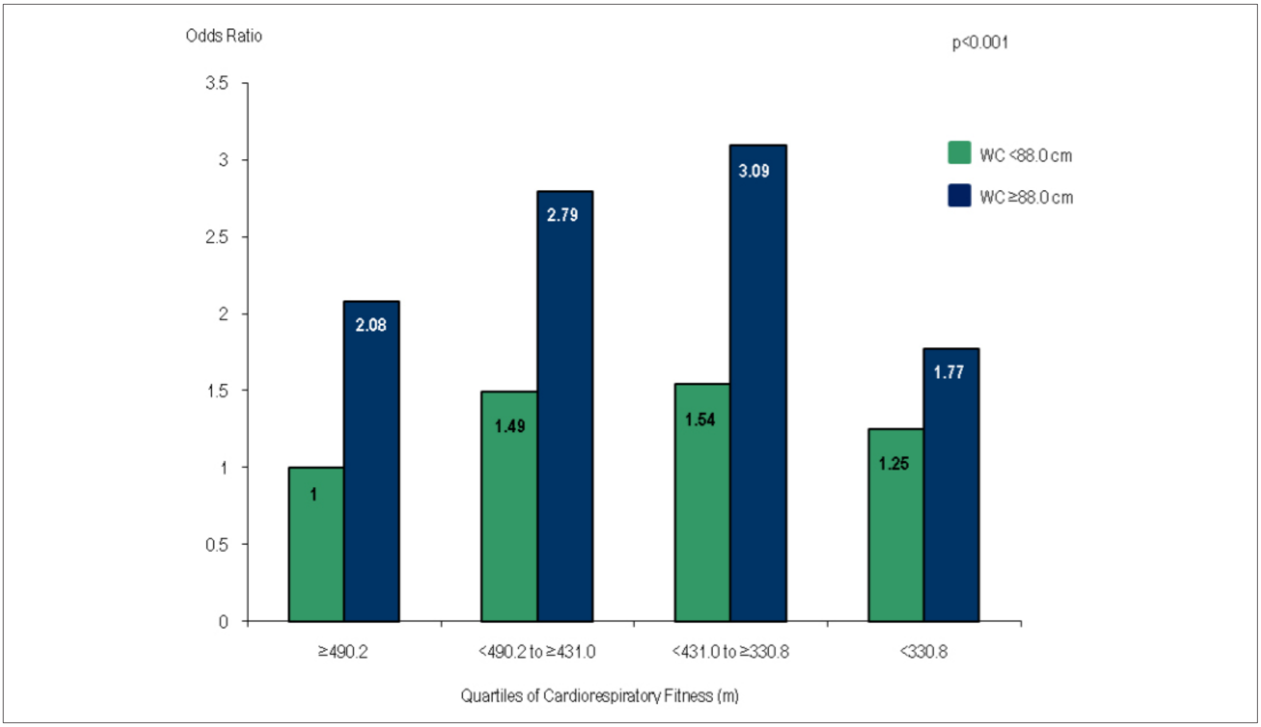

Figure 3 - Joint effect of fitness and central adiposity on hypertension; Odds Ratios were adjusted by age, and confounders – socioeconomic status, family history for CVD, smoking status.

of pharmacological treatment have not been effective in the control of this condition, mainly in older women[1,2]. For these reasons, the primary prevention has been recognized as the most important one[3,5], such as regular practice of aerobic exercises, which has been highly recommended. The maintenance of a moderate-high CRF through aerobic exercise, mainly when performed since the adult age, seems to promote health benefits and to help sustain them for a long time[22,26].

Our findings have clinical and public health implications, supporting the premise that the protective effect of CRF over hypertension can be extended to elderly women, even to those with central obesity. It is suggested that health professionals should encourage their patients to increase physical activity levels, especially with aerobic exercises, as regular physical activity has been considered a common denominator for the clinical therapy of low fitness and excess of weight[5,23].

Although the self-reported hypertension was confirmed by actual measurements of blood pressure or by a previous medical diagnosis, this factor can be considered a limitation for our findings. Unfortunately, our survey did not include other risk factors for hypertension, such as alcohol consumption and dietary habits (i.e., sodium and potassium intake) to be used as adjustments in the regression analysis. CRF was determined using a submaximal exercise test, which could have over/underestimated our results. However, this test is considered a valid option to estimate CRF specifically in elderly subjects that were not recommended to be exposed to a maximal effort[37]. Both non-central and central obesity groups with lower CRF had an insufficient number of participants (n=25 and 24, respectively) in our final regression analysis, not allowing consistent results to be drawn about these specific groups. However, the tendency found across all groups was significant. Considering that the design of this study is cross-sectional it is not possible to provide evidence for causality or the time effect on hypertension based on our results.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any post-graduation program.

References

1. Potyk D. Hypertension in older women. Women's Heath in Primary Care. 2005; 8: 397-8.

2. Lloyd-Jones DM, Evans JC, Levy D. Hypertension in adults across the age spectrum: current outcomes and control in the community. JAMA. 2005; 294: 466-72.

3. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. Hypertension. 2003; 42: 1206-52.

4. Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. JAMA. 2003; 290: 199-206.

5. Sociedade Brasileira de Cardiologia. V Diretrizes Brasileiras de Hipertensão Arterial. Arq Bras Cardiol. 2007; 89 (3): e24-e79.

6. Doll S, Paccaud F, Bovet P, Burnier M, Wietlisbach V. Body mass index, abdominal adiposity and blood pressure: consistency of their association across developing and developed countries. Int J Obes Relat Metab Disord. 2002; 26: 48-57.

7. Camarano AA. The aging of the Brazilian population: a demographic contribution. Rio de Janeiro: Instituto de Pesquisa e Estatística Aplicada – IPEA; 2002. p. 1-97.

8. Cabrera MA, Gebara OC, Diament J, Nussbacher A, Rosano G, Wajngarten M. Metabolic syndrome, abdominal obesity, and cardiovascular risk in elderly women. Int J Cardiol. 2007; 112 (2): 224-9.

9. Cabrera MA, Wajngarten M, Gebara OCE, Diament J. Relação do índice de massa corporal,da relação cintura-quadril e da circunferência abdominal com a mortalidade em mulheres idosas: seguimento de 5 anos. Cad Saúde Pública. 2005; 21 (3): 767-75.

10. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, et al. Obesity and cardiovascular disease: pathophysiology, evaluation and effect of weight loss: an update of the 1997 American Heart Association scientific statement on obesity and heart disease from the obesity committee of the council on nutrition, physical activity, and metabolism. Circulation. 2006; 113: 898-918.

11. Aneja A, El-Atat F, McFarlane SI, Sowers JR. Hypertension and obesity. Recent Prog Horm Res. 2004; 59: 169-205.

12. Davy KP, Hall JE. Obesity and hypertension: two epidemics or one? Am J Physiol Regul Integr Comp Physiol. 2004; 286 (5): R803-13.

13. Jardim PCBV, Gondim MRP, Monego ET, Moreira HG, Vitorino PVO, Souza WKSB, et al. High blood pressure and some risk factors in a Brazilian Capital. Arq Bras Cardiol. 2007; 88: 398-403.

14. Peixoto MRG, Benicio MH, Latorre MRDO, Jardim PCBV. Waist circumference and body mass index as predictors of hypertension. Arq Bras Cardiol. 2006; 87: 462-70.

15. Rezende FAC, Rosado LEFPL, Lanes RCL, Vidigal FC, Vasques ACJ, Bonard IS, et al. Body mass index and waist circumference: association with cardiovascular risk factors. Arq Bras Cardiol. 2006; 87: 666-71.

16. Hu G, Barengo NC, Tuomilehto J, Lakka TA, Nissinen A, Jousilahti P. Relationship of physical activity and body mass index to the risk of hypertension: a prospective study in Finland. Hypertension. 2004; 43: 25-30.

17. Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. Am J Clin Nutr. 2004; 79: 379-84.

18. Janssen I, Katzmarzyk PT, Ross R. Body mass index, waist circumference, and health risk. Arch Intern Med. 2002; 162: 2074-9.

19. Zhu SK, Wang Z, Heshka S, Heo M, Faith MS, Heymsfield SB. Waist circumference and obesity-associated risk factors among whites in the third National Health and Nutrition Examination Survey: clinical action thresholds. Am J Clin Nutr. 2002; 76: 743-9.

20. Rexrode KM, Carey VJ, Hennekens CH, Walters EE, Colditz GA, Stampfer MJ, et al. Abdominal adiposity and coronary heart disease in women. JAMA. 1998; 280: 1843-8.

21. Warburton DER, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. CMAJ. 2006; 174: 801-9.

22. Ades PA, Toth MJ. Accelerated decline of aerobic fitness with healthy aging: what is the good news? Circulation. 2005; 112: 624-6.

23. Blair SN, Church TS. The fitness, obesity, and health equation: is physical activity the common denominator? JAMA. 2004; 292: 1232-4.

24. Janssen I, Katzmarzyk PT, Ross R, Leon AS, Skinner JS, Rao DC, et al. Fitness alters associations of BMI and waist circumference with total and abdominal fat. Obes Res. 2004; 12: 525-37.

25. Farrell SW, Braun L, Barlow CE, Cheng YJ, Blair SN. The relation of body mass index, cardiorespiratory fitness, and all-cause mortality in women. Obes Res. 2002; 10: 417-23.

26. Wang BWE, Ramey DR, Schettler JD, Hubert HB, Fries JF. Postponed development of disability in elderly runners: a 13-year longitudinal study. Arch Intern Med. 2002; 162: 2285-94.

27. Stevens J, Cai J, Evenson KR, Thomas R. Fitness and fatness as predictors of mortality from all causes and from cardiovascular disease in men and women in the Lipid Research Clinics study. Am J Epidemiol. 2002; 156: 832-41.

28. Delvaux K, Philippaerts R, Lysens R, Vanhees L, Thomis M, Claessens AL, et al. Evaluation of the influence of cardiorespiratory fitness on diverse health risk factors, independent of waist circumference, in 40-year-old Flemish males. Obes Res. 2000; 8: 553-8.

29. Wei M, Kampert JB, Barlow CE, Nichaman MZ, Gibbons LW, Paffenbarger RSJ, et al. Relationship between low cardiorespiratory fitness and mortality in normal-weight, overweight, and obese men. JAMA. 1999; 282: 1547-53.

30. Barlow CE, LaMonte MJ, FitzGerald SJ, Kampet JB, Perrin JL, Blair SN. Cardiorespiratory fitness is an independent predictor of hypertension incidence among initially normotensive healthy women. Am J Epidemiol. 2006; 163: 142-50.

31. Lohman TG, Roche AF, Martorell R. Anthropometric standardization reference manual. Abridged Edition. Champaign IL: Human Kinetics; 1988.

32. Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. J Aging Phys Act. 1999; 7: 129-61.

33. Sorti KL, Brach JS, FitzGerald SJ, Bunker CH, Kriska AM. Relationships among body composition measures in community-dwelling older women. Obes Res. 2006; 14: 244-51.

34. Hu G, Tuomilehto J, Silventoinen K, Barengo N, Jousilahti P. Joint effects of physical activity, body mass index, waist circumference and waist-to-hip ratio with the risk of cardiovascular disease among middle-aged Finnish men and women. Eur Heart J. 2004; 25: 2212-9.

35. Lee C, Blair SN, Jackson AS. Cardiorespiratory fitness, body composition, and all-cause and cardiovascular disease mortality in men. Am J Clin Nutr. 1999; 69: 373-80.

36. Farrell SW, Kampert JB, Kohl III HW. Influences of cardiorespiratory fitness levels and other predictors on cardiovascular disease mortality in men. Med Sci Sports Exerc. 1998; 30: 899-905.

37. Rikli RE, Jones CJ. The reliability and validity of a six-minute walking test as a measure of physical endurance in older adults. J Aging Phys Act. 1998; 6: 363-75.