Prevalence and Risk Factors Associated with Peripheral Arterial Disease in the Hearts of Brazil Project

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Summary

Background: Peripheral arterial disease (PAD) is associated with increased cardiovascular risk. In Brazil, data on PAD prevalence and risk factors are scarce.

Objective: To assess prevalence and risk factors related to PAD in Brazilian urban centers with more than 100,000 inhabitants.

Methods: National, multicenter, cross-sectional study of 1,170 individuals (≥18 years), from 72 major Brazilian urban centers participating in the "Hearts of Brazil Project". PAD diagnosis was based on ankle-brachial index (ABI) ≤ 0.90. The statistical analysis used the corrected Chi-square (Pearson) test for complex samples and confidence intervals. P< 0.05 was considered statitically significant.

Results: PAD prevalence was 10.5%. Intermittent claudication (IC) was present in only 9% of PAD patients. A significant association was found between PAD and the following factors: diabetes, total and abdominal obesity, stroke and ischemic heart disease (IHD). There was a trend of higher PAD prevalence among individuals with hypertension, heart failure, chronic renal failure on dialysis, as well as those who had smoked over 20 pack-years. For females, presence of IHD was associated with a 4.9-fold greater risk of PAD. Among males, a 6.6-fold increased risk of PAD was found for diabetic in comparison to non-diabetic individuals.

Conclusion: PAD prevalence was markedly high, considering the low mean age of the studied population (44±14.7 yrs). IC was detected in a minority of PAD subjects, indicating a considerable number of asymptomatic individuals. Diabetes, obesity, stroke and IHD were the stronger predictors of PAD. The authors concluded that ABI measurement should be considered in the evaluation of moderate to high cardiovascular risk patients. (Arq Bras Cardiol 2008;91(6):370-382)

Key words: Arterial occlusive diseases; prevalence; risk factors; Brazil; intermittent claudication.

Introduction

It is estimated that 27 million individuals have peripheral arterial disease (PAD) in Europe and North America[1]. This number might be underestimated, as most of the patients is asymptomatic or does not present the classic symptom of the disease, intermittent claudication[2].

The PAD, both symptomatic and asymptomatic, is associated to obstructive arterial disease in other vascular beds (coronary, cerebral, carotid) and, consequently, to a higher risk of cardiovascular events (death, acute myocardial infarction, cerebral vascular accident), of around 4 to 6% a year, in individuals with the disease[3-5].

The assessment of the asymptomatic PAD through the ankle-brachial index (ABI) has become an important tool in the stratification of cardiovascular risk, especially in patients with intermediate risk[6-7].

In Brazil, study data related to the prevalence of DAP and its risk factors are scarce and restricted to specific populations, with almost all of them carried out in the Southeast region of the country. Among them, two population-based studies are noteworthy: The Bambui Project, which evaluated 1,485 elderly individuals (≥ 65 years) that lived in Bambui (state of Minas Gerais), and showed a prevalence of 2.5% of intermittent claudication[8] and the Epidoso Study, which evaluated 176 elderly individuals (≥ 75 years), living in the city of Sao Paulo, through the ABI and found a prevalence of 36.4% of PAD[9]. A more recent study, also carried out in the state of Minas Gerais, found 37.5% of PAD in patients with pre-dialytic chronic kidney disease[10].

Considering that, the primary objective of the present study was to evaluate, through the ABI, the prevalence

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Manuscript received on 06/30/08; revised manuscript received on 08/06/08; accepted on 08/15/08.

of symptomatic and asymptomatic PAD in a proportional population sample from 72 Brazilian urban centers with more than 100,000 inhabitants. The secondary objective was to correlate the diagnosis of PAD to several sociodemographic variables, presence of cardiovascular risk factors and the presence of comorbidities.

Methods

Study Design

Transversal, multicenter observational cohort study.

Population

The universe of the study consisted in the set of inhabitants of Brazilian urban centers with more than 100,000 inhabitants in 2004, aged ≥ 18 years.

Sample Plan

This is a stratified sample with a bietapic sampling, calculated as 2,500 interviews, distributed in the regions proportionally to the number of inhabitants, per sex and age range, based on data from IBGE (Instituto Brasileiro de Geografia e Estatística - The Brazilian Institute of Geography and Statistics). A total of 72 cities were chosen in the five regions. The minimum sample size was set at 15, for smaller towns, up to 400, for the city of Sao Paulo. In the selected cities, the "households" constituted the second-stage units, with one interview per household.

The choice of the individual occurred in three stages. In the cities, the census sectors were selected. In the sectors, one street was elected and following randomization rules (random start and fixed interval of 10 households), the household was chosen. The respondent was selected based on pre-defined criteria (birth date closest to the date of the interview), respecting the stratification per sex and age. When the respondent was not present at the first contact, he/she could be sampled at two subsequent visits at another date, by the same interviewer. The interviewees were invited to attend a medical consultation on an appropriate day. The planning previewed 7 to 8 interviews per census sector, characterizing a third stage in the sample plan.

Observed sample

Of a total of 2,520 home interviews, 1,134 individuals attended the medical consultation. The distribution of these individuals did not follow the distribution of the household sample and some urban centers did not have volunteers for the second phase. Consequently, a supplementary sampling was carried out, with 498 telephone interviews in Sao Paulo, Rio de Janeiro, Belo Horizonte and Florianopolis. In those cities, 141 individuals attended the medical consultation and underwent a medical assessment. Two cities - Manaus and Vitoria – were disregarded from the analysis of risk factors, as they had only one individual in this sample. The sample, with ABI measurement and risk factor information, consisted of 1,170 individuals. The Project was approved by the Ethics Committee in Research of the Institute of Arterial Hypertension of Minas Gerais and, as suggested by The National Committee of Ethics in Research (Comissao Nacional de Etica em Pesquisa - CONEP), was submitted and approved by the National Council of City Secretaries of Health (Conselho Nacional dos Secretarios Municipais de Saude - CONASEMS), which facilitated the contact between the field researchers and the City Secretaries of Health. All the participants signed the Free and Informed Consent Form.

Data collection

The data collection occurred in two stages. The first, started in July 2004, was carried out by professionals from the Vox Populi Survey Institute, which applied structured questionnaires during the household interview. At the second stage, a standard medical consultation was carried out, with medical questionnaires, clinical examination, blood pressure measurements, anthropometric measurements, ABI and biological material collection.

PAD Assessment

The presence of PAD was assessed through the measurement of ABI, which was measured at rest in the supine position, with a portable vascular Doppler equipment (MEDPEJ DV-2001, 10 MHZ) and sphygmomanometer. The cuff size was selected based on the right brachial circumference (BC, measured at midpoint between the acromion and the olecranon: BC < 25 cm (small size), BC = 25-32 cm (middle size), BC= 32-42 cm (large size) and BC > 42 cm (thigh). To standardize the ABI measurement technique, at least one researcher from each center (doctor and/or nurse) was trained in ABI workshops, coordinated by the main author. The systolic pressure was measured twice in each artery, in the arms (brachial artery) and ankles (pedal artery and posterior tibial artery).

The pressure recorded for each artery was the mean of two measurements, as long as the difference between them was ≤ 6 mmHg; otherwise, another pair of measurements was carried out. To calculate the ABI, we used the highest systolic pressure of the ankle (mean pedal or mean posterior tibial pressure), divided by the highest arm pressure (right brachial or mean left pressure), with a value of ABI being calculated for each lower limb[11].

ABI values ≤ 0.90 in one or both lower limbs were considered diagnostic of PAD. The absence of PAD was defined as levels of ABI from 0.91 to 1.40, in the absence of arterial revascularization of the lower limbs. ABI values > 1.40 were excluded from the analysis, as they do not define the diagnosis of PAD.

Intermittent claudication assessment

The presence of intermittent claudication was defined by the criteria of the Edinburgh Claudication Questionnaire, validated for Brazilian Portuguese[12].

Definition of ankle pulse abnormalities

The palpation of the ankle pulses was carried out bilaterally in the pedal and posterior tibial arteries and classified as present or absent.

Laboratory assessment

At the second stage, after fasting, capillary examinations were carried out by the use of the point-of-care technology (Roche Diagnostics, Accu-Check) for the assessment of capillary glycemia, total cholesterol and triglycerides.

Statistical analysis

The prevalence estimates were calculated based on a complex sampling model. Each individual was assigned a weight, according to his/her sex, city and region. The association between PAD and each variable was determined by Pearson's Chi-square test (X^2), corrected by the complex sampling plan. P values ≤ 0.05 were considered indicative of significant association between PAD and the variable. The comparison of the means of the continuous variables was carried out through confidence intervals (CI), based on the complex sampling plan. In the absence of overlapping between the CI, it was considered that there was a significant difference.

A multivariable logistic regression model was constructed according to the methodology of Hosmer and Lemeshow[13]. Initially, univariable analyses were performed to obtain crude Odds Ratios (OR). Then, the multivariable analysis was started, including the listed variables (sex, smoking status, hypertension, diabetes, age, obesity, cholesterol and triglycerides) as possible predictors of PAD and the socioeconomic variables that could have an impact on the health-related phenomena, such as family income and schooling.

The variables sex, smoking status, hypertension, diabetes, age and obesity were categorized as 0 (absent) or 1 (present) and the variables cholesterol and triglycerides were included as continuous variables. Individuals were considered hypertensive when they were known to be hypertensive, used antihypertensive medication, or whose blood pressure on the day of the medical consultation showed to be > 140x90 mmHg; individuals were considered diabetics when they were known to have diabetes, used antidiabetic drugs medication or had capillary glycemia > 126 mg/dL on the day of the medical consultation; individuals were considered to be hypercholesterolemic when they were known to have hypercholesterolemia, used lipid lowering medication or had total cholesterol > 200 mg/dL on the day of the medical consultation.

At this phase, variables included in the model presented a $p < 0.25$. Due to the multicolinearity between income and schooling, only the variable schooling, categorized as 0 (illiterate), 1 (complete or incomplete Elementary School) or 2 (High School or College/University) was maintained.

The data were analyzed with the software packages Stata (Release 9) and SPSS 13.0 for Windows (Statistical Package for Social Sciences), Complex Samples module.

At the third phase, the possible interactions with a biological meaning and/or evidence of importance at the analyses of the crossed tables were included, considering p (entry) < 0.25. In the final model, the variables that presented significance at 5% remained or those which, even though were not significant, were confounders. The modeling process was concluded and the colinearity and confounding were tested between the risk factors at each step. The adjusted statistical model was represented by the equation:

$$\log it(y) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_1 * x_2 + \beta_6 x_2 * x_3 + \beta_7 x_5 + \beta_8 x_4 * x_5 ,$$

where βi (i = 0,1,...,8) are the coefficients of the terms of the model, x_1 = Diabetes, x_2 = Sex, x_3 = Ischemic heart disease (IHD), x_4 = Hypertension, x_5 = College/University education.

The OR of the variables not present in the interactions were obtained by the exponentiation of the β coefficients. When there is an interaction between a factor and another variable, the OR estimate for the factor depends on the value of the variable that is interacting with it. In this situation, due to the impossibility of estimating the OR by simple exponentiation of the β coefficient, we used the differences between logits, defined as a function of model. As the statistical packages did not have a routine to calculate OR and CI for interactions, they were calculated manually by the team based on the methodology of Archer and Lemeshow[14]. The final model contains the interactions Diabetes X Sex, IHD X Sex and Hypertension X College/University education. The model adjustment was verified by the test of Hosmer and Lemeshow, with the software Stata, using an adequate procedure (Archer, K.J. & Lemeshow S., 2006) developed for the aforementioned test in complex samples. With this procedure, we obtained the value: F-*adjusted* = 0.266 and p = 0.98.

Results

Of a total of 1,170 individuals, 11 were excluded due to ABI > 1.40 (0.85%), resulting in a final sample of 1,159. There was a predominance of young adults (53.6% aged up to 45 years, 30.8% between 45 and 59 years and 15.6% ≥ 60 years) and the mean age was 43.82 ± 14.68 years (95%CI: 43.02 – 44.64), women (53.3%) and Caucasian ethnicity (Caucasian: 56.9%, Afro-descendants: 9.2%, Brazilian mulattoes: 31,8%, Brazilian natives: 0.9% and others:1.3%). Most of them had finished Elementary School (Illiterate: 2.4%, did not finish Elementary School: 9.6%, finished Elementary School: 45.0%, finished High School: 32,9% and finished College/University: 10.0%) and family income of up to 5 minimum wages (MW) (≤ 1 MW: 8.9%, from 1 to 5 MW: 54.3%, from 5 to 10 MW: 22.6% and > 10 MW: 14.2%). Figure 1 shows the distribution of the participants regarding the Brazilian regions.

The prevalence of PAD was 10.5% (n=134), distributed as follows in the Brazilian regions: North/Midwest=17.8% (n=22/119), South=12.0% (24/199), Southeast=11.7% (76/592), Northeast=4.6% (12/173). There was no significant difference regarding prevalence of PAD among the regions (p=0.35).

Univariate analysis

The comparisons between the groups with and without PAD regarding the sociodemographic characteristics, life habits, coexisting clinical conditions, medication use, presence of symptoms, pulse evaluation and laboratory assessment are shown in Tables 1, 2, 3 and 4, respectively.

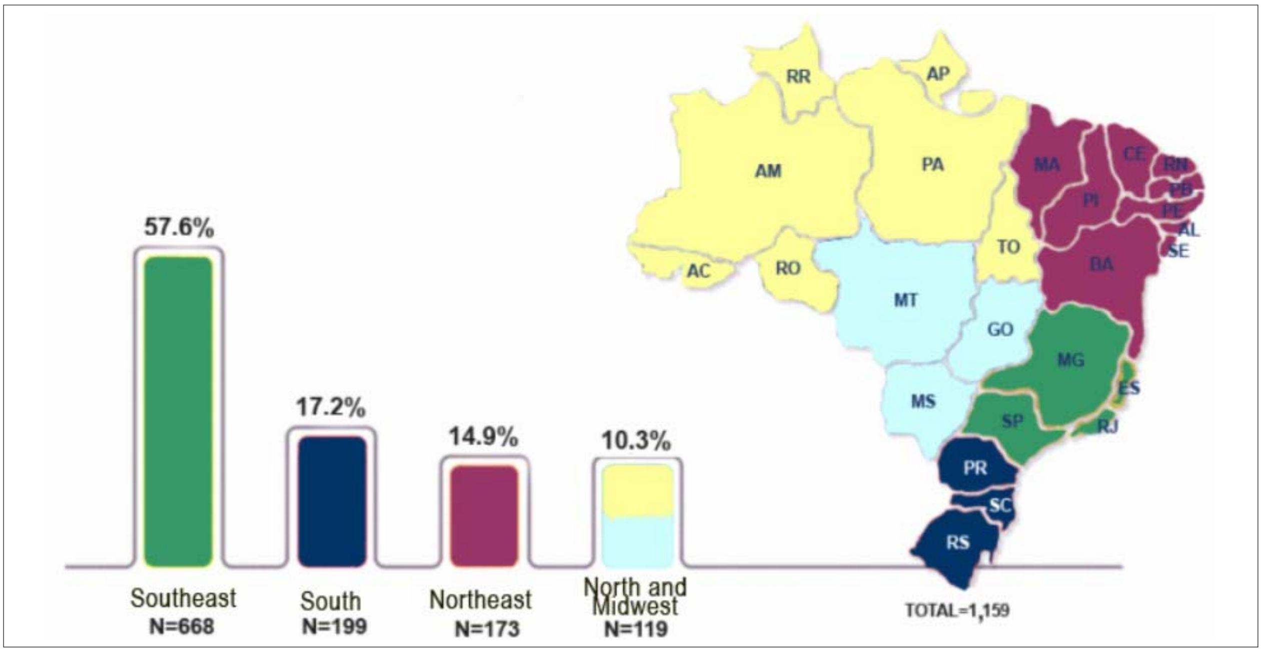

Figure 1 - Distribution of the 1,159 participants of the "Hearts of Brazil Project" per region of Brazil.

Multivariable logistic regression

In order to analyze the interaction IHD x Sex, the OR of the IHD were estimated for each sex (Table 5). The OR value for IHD present for the male sex was 1.21 (0.44; 3.31), which was non-significant, whereas for the female sex it was 4.92 (2.52; 9.59), highly significant, clearly showing the interaction. The analysis of the interaction Diabetes *versus* Sex shows that the effect of Diabetes in the male sex was highly significant OR = 6.65 (2.6; 17.01). For the female sex, this risk was not significant, with an OR = 1.19 (0.55; 2.57) (Chart 1).

The discriminatory performance of the model was validated using the C-index, which corresponds to the area under the ROC (Receiver Operation Curve). An area of 0.621 95%CI (0.568; 0.675) was obtained.

Discussion

The "Hearts of Brazil" Project is an epidemiological study on the prevalence of cardiovascular risk factors in a random population sample from 72 Brazilian urban centers. A population sample aged ≥ 18 years, which resided in urban centers with more than 100,000 inhabitants, was analyzed. This project was a pioneer one in Brazil, by objectively evaluating the prevalence of PAD, both symptomatic and asymptomatic, through the measurement of ABI and the Edinburgh Claudication Questionnaire[12].

The prevalence of PAD was 10.5%, which means approximately 6 million individuals, considering that there are 57 million inhabitants in Brazil with the characteristics of the population evaluated in this study (IBGE).

The mean age was older in those individuals with PAD in comparison with individuals that did not present the disease (49.02 years x 44.23 years, p=0.049). There was an association trend between PAD and age range (p=0.08), with an increasing prevalence of the disease as the age range increased. The small number of individuals older than 60 years, as the study was not specifically designed to evaluate the prevalence of PAD, but to evaluate the several risk factors and to be representative of the Brazilian population and the broad age ranges of the study (43.82 ± 14.68) might have reduced the power of the sample to detect such association with a p value < 0.05. However, the p value obtained indicated a consistent trend that the association between PAD and age range really existed. Studies that specifically evaluated the elderly (≥ 65 years), reported a prevalence between 7% and 36%[9,15-18] whereas, in younger populations, as the one in the present study, the prevalence ranged from 3% to 16% [19-24]. In populations with high cardiovascular risk, it ranged from 29% to 40.5%[25,26].

In the present study there was a higher prevalence of PAD among the women, similar to other published studies[9,20,21,27], although a higher frequency is often reported among men[16,17,22,23]. In the GetABI study, the prevalence was higher among men at the younger age ranges (65-74 years), whereas it was higher among women at the older age ranges (≥ 75 years)[16].

We observed a trend of higher prevalence of PAD among those that did not practice physical activity (p=0.08). The sedentary lifestyle can be seen as a risk factor for the development of PAD as well as the result of the functional impairment of the lower limbs, caused by the disease[28]. The prevalence of PAD was 2-fold higher among individuals that smoked > 20 years/pack when compared to those who smoked fewer cigarettes. Similar data were reported by the GetABI study (34.5% and 19.5% among those who smoked > 20 years/pack and < 20 years/pack

Table 1 - Comparison of sociodemographic characteristics between individuals with and without Peripheral Arterial Disease (PAD).

	PAD Present (n=134)		PAD Absent (n=1,025)		Total (n=1,159)	
	Estimated prevalence	n	Estimated Prevalence	n	n	p
Age, years (mean)	49.02	134	44.23	1,025	1,159	0.0494
Age range						
Up to 45 yrs	47.0%	63	54.4%	558	621	0.0897
From 45 to 59 yrs	31.3%	42	30.7%	315	357	
60 yrs or more	21.6%	29	14.8%	152	181	
Sex						
Male	41.0%	55	47.4%	486	541	0.0150
Female	59.0%	79	52.6%	539	618	
Ethnicity						
Caucasian	60.4%	81	56.4%	578	659	0.4472
Afro-descendant	9.7%	13	9.1%	93	106	
Brazilian Mulatto	28.4%	38	32.2%	330	368	
Brazilian Native	1.5%	2	0.8%	8	10	
Others	0	0	1.5%	15	15	
Schooling						
Illiterate	4.5%	6	2.2%	23	29	0.1952
Did not finish Elem. School	12.7%	17	9.2%	94	111	
Finished Elem. School	44.8%	60	45.1%	462	522	
Finished High School	31.3%	42	33.1%	339	381	
Finished College/University	6.7%	9	10.4%	107	116	
Family Income						
Up to 1 MW	6.7%	9	9.1%	93	102	0.2389
From 1 to 5 MW	59.0%	79	53.3%	546	625	
From 5 to 10 MW	23.1%	31	22.3%	229	260	
More than 10 MW	9.7%	13	14.6%	150	163	

MW - minimum wage

respectively) [16]. There was no association between alcohol consumption and PAD. The Rotterdam study showed an inverse association between alcohol consumption and PAD only in non-smoking individuals[29].

The individuals with PAD presented a 3-fold increase in the prevalence of stroke and a 2-fold increase in the prevalence of IHD, manifesting as angina pectoris and/or myocardial infarction, in comparison to the group without PAD. The coexistence of PAD and atherosclerotic lesions in other vascular beds has been reported, especially among the elderly. In one of these studies, in the presence of DAP, the prevalence of IHD was 68% and of stroke, 42%[30].

There was a trend of higher prevalence of arterial hypertension, dialytic CKF and heart failure in the group with PAD. Several studies have reported these associations. In the SHEP (Systolic Hypertension in the Elderly Program) study, the prevalence of PAD among hypertensive individuals was 27%[31]. Among those with advanced CKF, the prevalence of the disease varied from 17 to 48%[32] and in the Cardiovascular Health Study, the presence of PAD was an independent predictor of HF (RR = 1.61)[33].

Regarding dyslipidemia, there was no association between PAD and reported dyslipidemia and no significant difference was observed concerning the mean levels of cholesterol and triglycerides between the groups. The use of lipid lowering drugs was similar in the groups with and without PAD and must not have contributed to the lack of association between the variables. In the GetABI study, the power of the association between lipidic parameters and PAD was considered limited, when compared to the other cardiovascular risk factors[34]. It is noteworthy the fact that although 24.6% of the individuals with PAD reported dyslipidemia, only 4.5% used lipid lowering drugs.

The prevalence of diabetes among individuals with PAD was 2.7-fold higher, when compared to individuals without PAD. The glycemia levels were slightly more elevated in the group with PAD; however, this difference did not have

Table 2 - **Comparison of life habits and coexisting clinical conditions among individuals with and without Peripheral Arterial Disease (PAD)**

	PAD Present (n=134)		PAD Absent (n=1,025)		Total (n=1.159)	
	Estimated prevalence	n	Estimated prevalence	n	n	p
Life habits						
Physical activity						
Does not practice any physical activity	69.4%	93	64.2%	658	751	0.089
Practices < 3 days/week or < 30 minutes/at a time	22.4%	30	21.7%	222	252	
Practices ≥ 3 day/week and ≥ 30 minutes/at a time	8.2%	11	14.1%	145	156	
Smoking						
Have you ever smoked cigarettes?						
Yes and still smokes	20.1%	27	21.8%	223	250	0.412
Yes, in the past	25.4%	34	24.8%	254	288	
No	54.5%	73	53.2%	545	618	
Number of years/packet						
< 10 yrs/packet	26.7%	16	41.1%	195	211	0.053
Between 10 and 20 yrs/packet	18.3%	11	21.7%	103	114	
> 20 yrs/packet	55.0%	33	37.1%	176	209	
Alcohol consumption (Mean frequency of alcohol intake in the last 12 months)						
> 3 times a week	2.2%	3	4.8%	49	52	0.300
≤ 3 times a week	14.2%	19	19.8%	203	222	
1 to 3 times a month	9.7%	13	12.2%	125	138	
Gets drunk at least once a month	0.7%	1	0.5%	5	6	
Less than once a month	12.7%	17	13.3%	136	153	
None	60.4%	81	49.5%	507	588	
Coexistent clinical conditions						
Stroke (CVA)						
Yes	5.2%	7	1.7%	17	24	0.027
No	94.8%	127	98.3%	1008	1135	
Angina pectoris						
Yes	6.0%	8	2.6%	27	35	0.002
No	94.0%	126	97.4%	998	1124	
Diabetes						
Yes	15.7%	21	5.9%	60	81	0.001
No	84.3%	113	94.1%	965	1078	
Hypercholesterolemia						
Yes	24.6%	33	17.9%	183	216	0.217
No	75.4%	101	82.1%	842	943	
Arterial Hypertension						
Yes	45.5%	61	35.1%	360	421	0.097
No	54.5%	73	64.9%	665	738	
Myocardial Infarction						
Yes	5.2%	7	2.6%	27	34	0.027
No	94.8%	127	97.4%	998	1125	

Original Article

Continuation - Table 2 - **Comparison of life habits and coexisting clinical conditions among individuals with and without Peripheral Arterial Disease (PAD)**

Heart Failure						
Yes	8.2%	11	5.3%	54	65	0.084
No	91.8%	123	94.7%	971	1094	
Kidney Failure						
Yes	7.5%	10	6.0%	61	71	0.226
No	92.5%	124	94.0%	964	1088	
Dialytic Kidney Failure						
Yes	0.7%	1	0.1%	1	2	0.075
No	99.3%	133	99.9%	1024	1157	
Obesity – Body Mass Index (BMI)						
BMI < 18.5	1.5%	2	2.1%	21	23	0.049
BMI between 18.5 and 25	32.3%	43	38.8%	395	438	
BMI between 25 and 30	36.1%	48	37.0%	377	425	
BMI > 30	30.1%	40	22.1%	225	265	
Abdominal obesity - Abdominal Circumference						
Men - > 102 cm	13.4%	18	9.4%	96	114	0.121
Women - > 88 cm	30.6%	41	25.4%	259	300	
Others	56.0%	75	65.1%	663	738	
Abdominal obesity – Waist/hip ratio						
Men - > 0.95	20.9%	28	19.8%	202	230	0.015
Women - > 0.80	50.0%	67	42.8%	436	503	
Others	29.1%	39	37.3%	380	419	
Medication use						
Antihypertensive drugs						0.005
Yes	35.8%	48	20.7%	212	260	
No	64.2%	86	79.3%	813	899	
Oral antidiabetic drugs and insulin						0.118
Yes	7.5%	10	3.8%	39	49	
No	92.5%	124	96.2%	986	1110	
Lipid lowering drugs						0.482
Yes	4.5%	6	3.1%	32	38	
No	96.9%	128	96.9%	993	1121	
Medication for angina/infarction						0.581
Yes	1.5%	2	0.7%	7	9	
No	98.5%	132	99.3%	1018	1150	
Medication for heart failure						0.142
Yes	3.7%	5	1.1%	11	16	
No	96.3%	129	98.9%	1014	1143	

statistical significance. Diabetes is an important risk factor for the development of PAD. Studies that used the ABI to assess PAD among diabetic individuals demonstrated a prevalence of the disease between 20 and 29%[26,35].

Obesity was evaluated in this study based on the measurements of body mass index (BMI), abdominal circumference (AC) and waist/hip ratio (WHR). The BMI ≥ 30 as well as the increased WHR were associated with PAD, with the association between WHR and PAD more expressive among women. There was no association between AC measurement and PAD. Some studies have shown an association between PAD and abdominal obesity, but not with

Table 3 - **Comparison of symptoms and lower-limb pulse assessment among individuals with and without Peripheral Arterial Disease (PAD)**

	PAD Present		PAD Absent		Total	p
	Estimated prevalence	n	Estimated prevalence	n	n	
Pain or discomfort in the leg(s) when walking						0.0181
Yes	55.4%	72	39.3%	401	473 (41.3%)	
No	44.6%	58	58.2%	594	652 (57.0%)	
Does not walk	0	0	2.5%	26	26 (2.3%)	
Intermittent Claudication						0.490
Yes	9.2%	12	6.9%	70	82 (7.2%)	
No	90.8%	118	93.1%	951	951 (83.1%)	
Type of Claudication						0.495
Typical	83.3%	10	90.0%	63	73 (89.0%)	
Atypical	16.7%	2	10.0%	7	9 (11.0%)	
Posterior tibial pulses						
Both present	86.4%	114	94.0%	948	1062 (93.2%)	0.0003
Absence of the right and/or left posterior tibial pulse	13.6%	18	6.0%	60	78 (6.8%)	
Pedal pulses						
Both present	90.8%	119	94.2%	949	1,068 (93.8%)	0.039
Absence of the right and/or left pedal pulse	9.2%	12	5.8%	58	70 (6.2%)	

Table 4 - **Estimates of means and 95% confidence intervals of the continuous variables related to examinations carried out regarding the presence or absence of Peripheral Arterial Disease (PAD)**

Variables	PAD Present				PAD Absent				Significance
	n	mean	Lower Limit	Upper Limit	n	mean	Lower Limit	Upper Limit	
Capillary glycemia (mg/dL)	125	90.1	81.9	98.3	957	83.92	81.33	86.51	ns
Total Cholesterol (mg/dL)	91	198.11	188.78	207.44	629	192.52	189.44	195.6	ns
Triglycerides (mg/dL)	104	177.6	153.64	201.57	764	150.66	143.54	157.77	ns

BMI, while others have shown an association between PAD and total and abdominal obesity only among women[36,37].

The prevalence of intermittent claudication was 7%. In the literature, the prevalence varies from 0.4% to 14%, depending on the age, sex, risk profile and the diagnostic method that was used[2]. Among those with PAD, the prevalence of claudication was only 9% and its presence was not associated with PAD. In a study that evaluated different ethnic groups, the prevalence of claudication was 7.5%[38]. As most of the individuals with PAD is asymptomatic or presents unspecific symptoms, the claudication questionnaires, useful to identify symptomatic patients, are inefficient to asses PAD, which reinforces the role of the ABI measurement in the assessment of populations that are at-risk for the occurrence of the disease.

It is worth mentioning the association between the presence of pain or discomfort in the leg(s) during walking and PAD, even when the criteria for claudication have not been met, as such complaint was reported by more than half of the individuals with PAD, which suggests that its presence must be taken into account during the clinical assessment of these patients. Such finding had been previously described by our group in elderly individuals participating in the Epidoso study[9].

The absence of ankle pulses to palpation, especially of the posterior tibial pulses, was associated with PAD. The abnormalities in the posterior tibial pulses are more sensitive and specific for the presence of PAD than the abnormalities of the pedal pulses, as approximately 10% of the healthy population does not have these palpable pulses[39].

When we analyze the interaction between gender and the coexisting clinical conditions, we observed that the women with IHD included in the "Hearts of Brazil" Project presented an approximate 5-fold higher risk of having PAD than those without IHD, whereas diabetic men had a 6.6-fold higher risk of presenting PAD in comparison to nondiabetic ones. A possible explanation, in the case of the women, would be the trend to develop cardiovascular disease at an older age,

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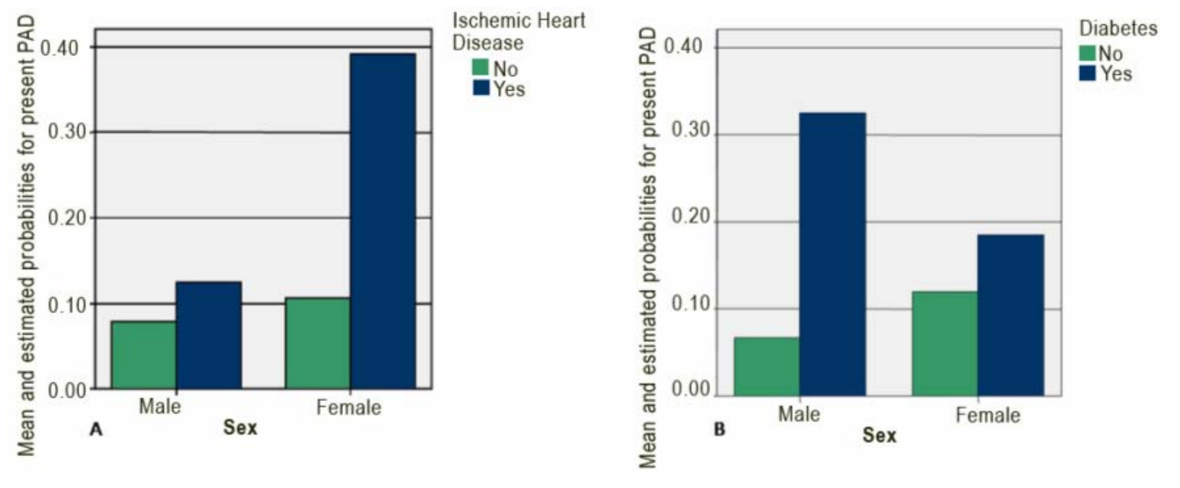

Chart 1 - Comparison of the probability means of having Peripheral Arterial Disease (PAD) estimated by the multivariable logistic regression model for Ischemic Heart Disease (IHD) (A) and for Diabetes (B) per Sex; The analyses show that the effect of the presence of IHD for the female sex was highly significant for the presence of PAD (OR=4.92, 95%CI=2.52-9.59); In the male sex, the presence of Diabetes is significantly associated to PAD (OR=6.65, 95%CI=2.6 -17.01).

Table 5 - **Estimates of the Differences of logits, Standard Error (SE), 95%CI for the Differences of logits, Odds Ratios and 95%CI for OR in interactions of the Multivariable Logistic Regression Model.**

		Dif. of logits	EP	CI for Dif. logits	OR	CI for OR
Sex X IHD						
Effect of:	Inside:					
IHD	Male	0.189	0.515	(-0.820 ; 1.198)	1.208	(0.440 ; 3.313)
	Female	1.592	0.341	(0.924 ; 2.260)	4.915	(2.520 ; 9.585)
Sex X Diabetes						
Effect of:	Inside:					
Diabetes	Male	1.894	0.480	(0.954 ; 2.834)	6.645	(2.595 ; 17.012)
	Female	0.170	0.395	(-0.603 ; 0.944)	1.186	(0.547 ; 2.570)
Superior X Hypertension						
Effect of:	Inside:					
Hypertension	Not superior	0.398	0.266	(-0.123 ; 0.919)	1.489	(0.885 ; 2.507)
	Superior	1.742	0.800	(0.175 ; 3.310)	5.711	(1.191 ; 27.391)

due to the hormonal protection factor. The post-menopausal period could increase the chance of manifestations of vascular involvement in more than one territory. On the other hand, male sex and diabetes are two factors that have been associated with PAD at younger age ranges[16].

Clinical implications

The data from the "Hearts of Brazil" Project raise a warning for the Brazilian medical community on the need to assess PAD in clinical practice. This warning is based not only on the elevated prevalence of PAD found in the study, but mainly in the expressive number of asymptomatic individuals (91%), who, if diagnosed early, could benefit from preventive measures to reduce the risk of acute myocardial infarction, stroke and cardiovascular death. The simple implementation of the ABI measurement as part of the assessment of patients with moderate and high cardiovascular risk would implicate in a significant impact on the early detection of asymptomatic individuals with PAD.

Limitations

This study was not designed with the objective of estimating the prevalence of PAD at city level, as in some of them the sample consisted of only 15 individuals, but at regional level. Its main limitation is not having enough sample power to be representative of he Brazilian population as a whole. Its power is enough to represent the Brazilian population of urban centers with more than 100,000 inhabitants, estimated as 57 million. A secondary limitation was that the complex study sample design excluded towns such as Marilia, Petropolis and Santa Maria from the analysis of the variable *mean duration time of the physical activities,* based on the insufficient number of valid individuals in the sample.

Acknowledgements

To the Board of the Brazilian Society of Cardiology (SBC) – 2004/2005 term, especially SBC President, Dr. Antônio Felipe Simão.

To the doctors, SBC members, nurses, medical and nursing students, nursing technicians, laboratory technicians who voluntarily participated in the 2nd phase of the study.

To the Sponsors, Instructors, Investigators and Field Coordinators of the "Hearts of Brazil Project" listed in the Appendix available at:

http://www.arquivosonline.com.br/2008/.

To the statisticians Elsa Cristina de Mundstock, M.Sc., Jandyra Maria Guimarães Fachel, Ph.D., and Vinicius Nunes Machado, B.Sc. in Statistics .

Appendix: sponsors, instructors, investigators and field coordinators of the "Hearts of Brazil Project".

This study was carried out with data obtained at the "Hearts of Brazil Project" and the Peripheral Artery Disease Risk Factor had the institutional financial support of Libbs Pharmaceuticals. The "Hearts of Brazil Project" also had the institutional support of the following enterprises: AstraZeneca, Biosintética, Biolab, Novartis, Sanofi-Aventis, Omron, Roche Diagnósticos, Centrais Elétricas Furnas, Ministry of Health and Conselho Nacional de Secretários Municipais de Saúde (Conasems).

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5) Dr. Antonio Carlos Palandri Chagas (President of SBC);

6) Dr. Álvaro Avezum Junior (Previous President - SBC/FUNCOR);

7) Dra. Maria Elizabeth Navegantes Caetano Costa (President of the Department of. Cardiopathy and Pregnancy / SBC);

8) Dr. David de Pádua Brasil (Faculdade de Ciências Médicas de MG);

9) Dr. Eduardo Papa (Unifesp);

10) Dr. Fábio Rocha Farias (Unifesp);

11) Dr. Fábio Zanerato (Unifesp);

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14) Dr. Jairo Lins Borges (Instituto de Cardiologia Dante Pazzanese);

15) Dr. José Carlos Simões (Unifesp);

16) Dr. José Eduardo Krieger (InCor-USP);

17) Dr. Jorge Ilha Guimarães (Future President of SBC);

18) Dr. Lucélia Magalhães (Universidade Federal da Bahia);

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13) Paraíba - Campina Grande: Investigator: Dr. Miguel Pereira Ribeiro, Field Coordinator: Ademilda M. G. S. Garcia de Campo;

João Pessoa: Investigator: Dr. João Cavalcanti A. Filho, Field Coordinator: Jusara Gabriel Ramos da Costa;

14) Paraná - Cascavel: Investigator: Dr. Walter de Assumpção, Field Coordinator: Mauricio Figueiredo Lima e Marchese;

Curitiba: Investigator: Dr. Dalton Bertolim Precoma, Field Coordinator: Thaís Harén Rufino;

Foz do Iguaçú: Investigator: Dr. Odilon Sehn, Field Coordinator: Vera Lúcia Gomes; Londrina: Investigator: Dr. Wellington Antônio Moreira da Silva, Field Coordinator: Paulo Müller Ramos,

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São Gonçalo: Investigator: Dr. Adalberto Oliveira, Field Coordinator: Cláudia Márcia Cabral Feijó Oliveira;

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18) Rio Grande do Norte - Natal: Investigator: Dra. Maria Fátima de Azevedo, Field Coordinator: Fábio Gerson Sá Gabriel da Silva;

19) Rio Grande do Sul - Canoas: Investigator: Dr. Ilmar Kohler, Field Coordinator: Sandra Maria Borges;

Caxias do Sul: Investigator: Dr. Fábio Allgayer, Field Coordinator: Marciane Andréia Maschio;

Novo Hamburgo: Investigator: Dr. Leandro E. Roese, Field Coordinator: Cláudia Zuquetto;

Pelotas: Investigator: Dr. André Avelino Steffens, Field Coordinator: Katiuscia Milano Rosales;

Porto Alegre: Investigator: Dra. Leila Beltrami Moreira, Field Coordinator: Ricardo Flores da Costa;

Santa Maria: Investigator: Dr. Alexandre Antonio Naujorks, Field Coordinator: Simone Kroll Rabelo;

20) Santa Catarina - Blumenau: Investigator: Dr. Siegmar Starke, Field Coordinator: Daniela Moser Carlini;

Florianópolis: Investigator: Dr. Miguel de Patta, Field Coordinator: Dulcinéia Ghizoni Schneider;

Joinville: Investigator: Dr. Carlos Roberto Campos, Field Coordinator: Niucéia Lari Schor Krelling;

21) São Paulo - Araras: Investigator: Dr. Agnaldo Píspico, Field Coordinator: Alexandre Franco Garcia;

Bauru: Investigator: Dr. André Saab, Field Coordinator: Fabiana Cristina do Nascimento;

Campinas: Investigator: Dr. José Francisco Kerr Saraiva, Field Coordinator: Larissa Lopes de Assis Balsani;

Franca: Investigator: Dr. Ulisses Máquez Gianecchini, Field Coordinator: Cyntia Kallás Bachur;

Jundiaí: Investigator: Wagner Tadeu Ligabó; Field Coordinator: Lourenço Texeira Ligabó; Marília: Investigator: Dr. Ricardo José Tofano, Field Coordinator: Sueli Hissami Higute Ajeka;

Mogi das Cruzes: Investigator: Dr. Marcos Sleiman Molina,

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Presidente Prudente: Investigator: Dr. Luiz Carlos Pontes, Field Coordinator: Silvana Maria Furlanetto Tiezzi Pontes;

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22) Sergipe - Aracaju: Investigator: Dra. Geodete Batista Costa, Field Coordinator: Thiago Augusto Silva Nascimento.

Potential Conflict of Interest

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

Sources of Funding

This study was carried out with data obtained at the "Hearts of Brazil Project" and the Peripheral Artery Disease Risk Factor had the institutional financial support of Libbs Pharmaceuticals. The "Hearts of Brazil Project" also had the institutional support of the following enterprises: AstraZeneca, Biosintética, Biolab, Novartis, Sanofi-Aventis, Omron, Roche Diagnósticos, Centrais Elétricas Furnas, Ministry of Health and Conselho Nacional de Secretários Municipais de Saúde (Conasems).

Study Association

This study is not associated with any graduation program.

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