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Ischemic heart disease and correlates in adults from Ribeirão Preto, Brazil

ABSTRACT

OBJECTIVE: To identify the prevalence of ischemic heart disease (IHD) and correlates in an adult population.

METHODS: Cross-sectional population-based epidemiological study including a weighted sample of 2,471 adults of both sexes and with age 30 years or older residing in Ribeirão Preto, Southeastern Brazil, in 2007. The Rose Questionnaire was administered, and IHD prevalence was calculated with point estimates and 95% confidence intervals. To identify correlates (sociodemographic, cardiovascular risk factors, and those related to access to health services and to physical activity level), crude and adjusted prevalence ratios were estimated using Poisson regression.

RESULTS: IHD prevalence was higher in females than males at all age strata. In the final model, the following variables were independently associated with IHD: work status (PR = 0.54 [0.37;0.78]); family history of IHD (PR=1.55 [1.12;2.13]); hypertension (PR = 1.70 [1.18;2.46]); self-reported health status (PR = 2.15 [1.40;3.31]); smoking duration (third tertile) (PR = 1.73 [1.08;2.76]); adjusted waist circumference (PR = 1.79 [1.21;2.65]) and hypertriglyceridemia (PR = 1.48 [1.05;2.10]). Linear trend test of PR across self-reported health status categories was statistically significant ($p < 0.05$).

CONCLUSIONS: A high prevalence of IHD was found, and the factors associated with the outcome are almost all modifiable and potentially influenced by public policy interventions.

DESCRIPTORS: Adult. Myocardial Ischemia, epidemiology. Risk Factors. Cross-Sectional Studies.

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INTRODUCTION

In regions that attain or pass the intermediate transitional variant of the epidemiological transition, progressive aging of the population results in an increased prevalence of chronic diseases, with cardiovascular diseases (CVD) making a large contribution.[19] Although ecological studies indicate a decline in mortality from CVD,[17] changes in lifestyle have contributed to increase risk factors, which together with the marked aging of the population, promotes an increased prevalence and incidence of ischemic heart disease (IHD), especially in developing countries.[31]

Estimates from the Global Burden of Disease Study for 2020[18] revealed that CVD will contribute with 13.2% of disability-adjusted life years (DALYs) in Latin American and 22% in developed countries. The magnitude of DALYSs attributable to IHD for 2020 places this group of diseases as the third largest contributor to DALYs in developing countries. In Brazil, CVD corresponded to 13% of DALYs in 1998, surpassed only by infectious diseases, maternal and perinatal conditions and nutritional deficiencies (24%). CVD was responsible for the greatest health spending in the country; in 2007, it was responsible for 12.7% of hospitalizations unrelated to pregnancy and 27.4% of hospitalizations among older adults.[22]

In Brazil, a substantial portion of the epidemiologic understanding regarding CVD comes from ecological, descriptive or non-representative studies. Population based analytic studies are still rare, although they contribute to identify specific risk factors for IHD or interactions between these factors and the environment, given the geographic differences of Brazil. On the other hand, although CVD is still the leading cause of death in Brazil,[22] little is known about its prevalence or incidence in the population, which is a weakness in comparison to developed countries.

Considering the above, the present study sought to determine the prevalence of IHD and identify associated factors, in adult residents of Ribeirão Preto, São Paulo, Brazil, in 2007.

METHODS

A population based cross-sectional epidemiological study was conducted in Ribeirão Preto, São Paulo, in 2007, as part of a study entitled "Prevalence of cardiovascular disease and identification of risk factors in adult residents of Ribeirão Preto, SP – Project EPIDCV". The sampling strategy was performed in three stages: in the first, 81 census tracts[a] (primary sampling unit) were randomly selected. Then 1,672 households and 1,395 participants corresponded to the second and third stages of sampling. The cluster randomized method, with probability proportional to size was adopted in the first stages. Stratification by average income of the head of household was performed in the second stage, and in the third stage, one person aged 30 or older was selected among the residents of the households. Pregnant women and women with recent deliveries were excluded (selection criteria), since their anthropometric measurements would not be comparable to the general population. In total, 1,133 participants of both sexes were interviewed. The response rate was 81.2%. Loses (18.8%) were due to change of address (4.8%), death (0.5%) and refusals (13.5%), with people considered as refusals after five attempts to contact them for interview at different days and times. The variability resulting from the multiple stages of sampling was corrected by calculating a sample weight that considered the eligible number of people in each household and the rate of non-respondents for each census tract, resulting in a weighted sample of 2,471 participants with age 30 years or more, living in the urban area of the municipality.[24] The sample weight (sw) was calculated from the inverse product of the sample fractions w1 and w2, where:

$$w1 = \frac{\text{number selected}}{\text{number eligible}}$$

and

$$w2 = \frac{\text{number interviewd}}{\text{number selected}}$$

The outcome was represented by the combination of angina with possible myocardial infarction, after administration of the complete version of the Rose questionnaire (Q-Rose).[20] According to the questionnaire, angina is defined by affirmative response to the following questions: 1) presence of pain or discomfort in the chest at some time in life (cumulative event); 2) worsening of the pain with effort; 3) relief of pain within ten minutes or less after cessation of effort; and 4) location of pain on the sternum (upper, middle or lower), left anterior chest or the left arm. The definition of possible infarction, according to Q-Rose, corresponds to an affirmative response to the following question: "have you ever had severe chest pain (very strong) that lasted from 30 minutes or longer?". These two variables were subsequently combined into a single binary variable that was coded "1" for participants classified as positive for angina and/or possible infarction and coded "0" for people without these conditions.

The independent variables were classified into three groups: sociodemographic factors, cardiovascular risk factors, and factors related to access to health services and to physical activity level.

Participants from both sexes were included in the group of sociodemographic factors. Age in years completed was obtained by this calculation: [(date of interview – date of birth/365.25], subsequently classified in intervals of 10 years. Level of education was classified into four categories according to the number of years completed in formal education. Individual monthly income, in Reais, using the month before interview as the reference period, was classified according to tertiles of the distribution, and participants that did not report a monthly income were classified as without income. The presence or absence of a partner at the time of interview was also considered, irrespective of a formal union, with marital status classified as with or without partner. Employment status was classified in two categories, using the month before interview as the reference period.

[a] Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2000. Rio de Janeiro; 2001.

Cognitive performance was evaluated using the Mini-Mental State Exam (MMSE),[8] and the participants were classified according to the cutoff that corresponded to the median of the distribution. The presence of family history of angina and/or infarction was reported to the third generation of ancestors. Three consecutive measurements of arterial pressure, both systolic and diastolic, were taken, using portable sphygmomanometers (Geratherm Medical AG, Geschwenda, Germany), considering respectively the average of them. Arterial hypertension (AH) was defined as a history of AH diagnosed by a physician, use of anti-hypertensive medication or blood pressure levels ≥ 140 mmHg for systolic pressure, and ≥ 90 mmHg for diastolic,[16] with the variable classified in a dichotomous manner. Health status, compared to friends, was classified in three categories: same as yours, worse than yours or better than yours. This classification of self-perceived health status, besides being a proxy for morbidity, allows for evaluation of an effect gradient between the first and third categories. The duration of the habit of cigarette smoking was classified according to the tertiles distribution, with non-smokers as the reference category. Anthropometric measurements were taken by trained and calibrated interviewers.[5] Weight in kilograms was obtained by electronic scales made by Tanita (model BF 680), with a precision of 100 grams. Height in centimeters was obtained using wall stadiometers (SECA, Hamburgo, Germany), using the techniques recommended by Habicht & Bultz.[10] The stadiometer was fixed at 2.20 vertical meters, in relation to the floor, and calibrated with a technical square of 60 degrees, which was also used to find the right angle between the floor and the wall where the stadiometer was affixed. Nutritional status was classified in three categories: normal, pre-obese and obese according to cutoff for body mass index (BMI).[30] For the measures of abdominal circumference (in centimeters) inelastic measuring tapes were used (SECA, Hamburgo, Germany), including the shortest circunference between the costal border and the iliac crest and using sex-specific cutoffs.[1] All measurements were obtained twice, and the average of the two measurements was used. Diabetes mellitus (DM) was defined as a history of DM diagnosed by a physician, and also by oral glucose tolerance tests performed with fasting of 12 hours and after 2 hours following ingestion of 75 grams of pure glucose. Blood sugar (mg/dL) was ascertained from capillary blood by the colorimetric reflection method, using Accutrend portable glucometer (Roche Diagnostics GmbH, Mannheim, Germany) and the cutoffs recommended by WHO.[29] Biochemical levels were measured (in mg/dL) for total cholesterol, cholesterol fractions, triglycerides, C reactive protein and plasma fibrinogen, after 12 hours fasting, in a reference laboratory with a certification of proficiency for laboratory trials, using recommended cutoffs, with the exception of plasma fibrinogen, which was classified according to the tertiles distribution.

Physical activity was ascertained by the International Physical Activity Questionnaire (IPAQ) short-version.[14] Total metabolic energy expenditure (METs*minutes*week^{-1}) was classified according to the median of the distribution. The variable for "sitting time" was also obtained per the IPAQ protocol and classified into tertiles distribution. The number of medicines taken in the last 15 days was classified in four categories: none; 1-2; 3-4; 5 or more. The variables for seeking ambulatory health services (in the past six months) and for the occurrence of hospitalization (in the past two years) were classified in a dichotomous manner.

The data were collected by structured interviews performed in eligible houses by a team of trained interviewers. Before final data entry (double data-entry), quality control was evaluated by replicating 12.5% of interviews, using kappa statistic[6] to evaluate reproducibility. The kappa coefficient for all the questions included in the repeated interviews was above 0.80.

Specific IHD prevalences, according to sex and age and 95% confidence intervals were calculated. The prevalence of IHD was also estimated, with point estimates and confidence intervals, for specific strata of sociodemographic factors, cardiovascular risk factors and behavioral factors. In the descriptive phase of the study, overall associations between the above mentioned factors and the outcome were tested using the F statistic (significance level $\alpha = 0.05$). In the analytical phase, Poisson regression was used to obtain prevalence ratios, estimated by points and confidence intervals.[3] After univariate analysis, the variables with p values ≤ 0.25 for the Wald statistic were selected for subsequent models. Then prevalence ratios were estimated in partially adjusted models, including respectively sociodemographic factors, cardiovascular risk factors and behavioral factors. In the subsequent phase, the model was begun, including the variables from each of the three groups with a p value < 0.10 for the Wald statistic. The final model consisted of variables that after simultaneous adjustment remained significant at $p < 0.05$. The estimates were calculated considering the design effect,[24] using specific commands for surveys in Stata, version 10.1.

Project EPIDCV was approved by the Research Ethics Committee of the Nursing School of Ribeirão Preto, University of São Paulo, and registered under number 0725/2006. All participants signed voluntary informed consent forms, per the recommendations of Resolution nº 196/96 of the National Health Council.

RESULTS

Almost half (40.3%) of the sample was male. The median of age, level of education and monthly income were respectively: 47.1 years, 8.0 years and R$600.00.

Table 1. Prevalence of ischemic heart disease (IHD) with confidence intervals, according to sex and age groups. Ribeirão Preto, São Paulo, Brazil, 2007.

Variable		Male IHD		Female IHD	
Age group (years)	wn[a]	no (95%CI)[b]	yes (95%CI)[b]	no (95%CI)[b]	yes (95%CI)[b]
30-39	661.3	91.42 (85.91;94.90)	8.58 (5.10;14.09)	84.39 (77.94;89.21)	15.61 (10.79;22.06)
40-49	765.7	92.33 (86.74;95.68)	7.67 (4.32;13.26)	86.04 (81.81;89.41)	13.96 (10.59;18.19)
50-59	507.3	89.03 (80.48;94.11)	10.97 (5.89;19.52)	88.03 (81.88;92.30)	11.97 (7.70;18.12)
60 and older	536.6	87.32 (77.58;93.20)	12.68 (6.80;22.42)	85.07 (78.45;89.92)	14.93 (10.08;21.55)

[a] wn = weighted n
[b] Weighted estimates, considering the design effect of the sampling strategy

In regards to marital status, 66.6% lived with a partner, while 65.7% participated in the job market. The crude prevalence of IHD was 12.3% (95%CI 10.4:14.4). The design effect was 1.07214.

The prevalence of IHD for females was greater in magnitude than the estimates for males at all age groups (Table 1). The prevalences for the first two age groups among females were almost twice the respective prevalence among males. In bivariate analysis, the variables sex, income, employment status and level of education were associated with the outcome ($p < 0.05$) (Table 2). The prevalence of IHD declined with increased income and education ($p < 0.02$).

Cognitive performance, family history of IHD, hypertension, self-perceived health status, nutritional status, waist circumference, diabetes, triglycerides and C reactive protein showed statistically significant associations in relation to the outcome in crude analysis ($p < 0.05$) (Table 3). A linear trend was observed for IHD prevalence ($p < 0.05$) for the categories of self-perceived health status and nutritional status.

The number of medicines taken in the past 15 days and hospitalization in the past two years were also associated with the outcome ($p < 0.05$), depicting a linear trend in IHD prevalence with increased consumption of medicines ($p < 0.05$) (Table 4).

The final model (Table 5) was adjusted by sex and age. Besides that adjustment, the following variables remained independently associated with IHD: employment status, family history of IHD, hypertension, self-perceived health status, smoking duration, waist circumference and triglycerides. The prevalence ratios for self-perceived health status presented a statistically significant linear trend ($p < 0.01$).

DISCUSSION

The results of the study show a high prevalence of IHD in the population, especially among women aged less than 50 years. Potentially modifiable risk factors, such as arterial hypertension, smoking duration, central obesity and hypertriglyceridemia, were associated with the outcome.

Recent results[15,17,26] from epidemiological studies carried out in Ribeirão Preto may explain the finding of a higher prevalence of IHD among women less than 50 years of age. Two population-based cross-sectional studies indicated that women less than 50 years of age presented greater daily averages for sitting time[26] and less adherence to recommended consumption levels of fruits and vegetables.[15] In this same population, results from a time series study[17] regarding the period 1980-2004 indicated a declining trend in mortality rates from diseases of the circulatory system, across all age groups and both sexes. The largest proportion in average annual decreases occurred among women aged 30 to 39 years (-7.1%).

In regards to level of education and income, it is plausible to assume that the inverse relationship with IHD prevalence can be attributed to greater access to information, adoption of a healthy lifestyle, greater access to health services and adherence to prevention programs for chronic and degenerative diseases.

The methodological rigor applied in all steps of the study, including design and data analysis, the high response rate, and the reproducibility of the information, together lend credibility to the results and reinforce their internal validity, since the results did not suffer from selection bias, information bias or confounding.

The use of the Rose questionnaire[20] to detect angina and possible infarction is a strategy of fundamental importance in prevalence studies conducted in different areas of the world, especially in developing countries. The questionnaire has a high specificity, low cost and ease of administration by a duly trained team.

Results from the *Isfahan Healthy Heart Program*, conducted among Iranian adults in 2000,[21] in which the authors applied the Rose questionnaire revealed that IHD prevalence was higher among Iranian women than men at all age groups. In this study, prevalence measures, obtained from electrocardiographic results coded by the Minnesota Code, indicated the same

Table 2. Prevalence of ischemic heart disease (IHD) with confidence intervals, according to sociodemographic factors. Ribeirão Preto, São Paulo, Brazil, 2007.

Variable		IHD	
	wn[a]	no (95%CI)[b]	yes (95%CI)[b]
Sex[c]			
Male	995.7	90.43 (87.28;92.86)	9.57 (7.14;12.72)
Female	1,475.0	85.89 (83.10;88.28)	14.11 (11.72;16.90)
Age group (years)			
30-39	661.3	87.99 (84.50;90.78)	12.01 (9.22;15.50)
40-49	765.7	88.31 (85.23;90.82)	11.69 (9.18;14.77)
50-59	507.3	88.40 (83.13;92.18)	11.60 (7.82;16.87)
60 and older	536.6	85.88 (80.41;90.01)	14.12 (9.99;19.59)
Marital status			
Single	824.8	86.89 (82.82;90.12)	13.11 (9.88;17.18)
With partner	1,646.0	88.13 (85.17;90.57)	11.87 (9.43;14.83)
Monthly income (in R$)[c,d]			
None	848.9	81.46 (77.07;85.16)	18.54 (14.84;22.93)
1st tertile (≤ 700.00)	549.7	90.60 (86.44;93.59)	9.40 (6.41;13.56)
2nd tertile (> 700.00 ≤ 1,400.00)	506.0	90.18 (85.66;93.39)	9.82 (6.61;14.34)
3rd tertile (> 1,400.00)	566.4	92.09 (87.19;95.22)	7.91 (4.78;12.81)
Employment status[c]			
No	847.8	81.42 (76.98;85.16)	18.58 (14.84;23.02)
Yes	1,623.0	91.01 (88.54;92.99)	8.99 (7.01;11.46)
Education (years)[c,d]			
0-3	343.8	81.12 (75.04;85.99)	18.88 (14.01;24.96)
4-7	739.8	86.47 (82.89;89.39)	13.53 (10.61;17.11)
8-11	821.5	89.12 (85.42;91.98)	10.88 (8.02;14.58)
12 or more	540.8	91.31 (85.84;94.79)	8.69 (5.21;14.16)

[a] wn = weighted n
[b] Weighted estimates, considering the design effect of the sampling strategy
[c] p value < 0.05 for the F statistic
[d] p value < 0.02 for the linear trend test

trend in regards to sex. Alves et al,[2] in a population based cross-sectional study, conducted in a sample of adults residents in Pelotas, Rio Grade do Sul, Brazil, in 2007, found that the prevalence of angina based on the Rose questionnaire was also greater among females (9.8%; 95%CI 7.9-11.7) than among males (5.9%; 95%CI 4.1-7.6). In addition, that study found a direct relationship with age and inverse relationships with education and income, trends that agree with the current study. In Ribeirão Preto, higher IHD prevalence in both sexes and all age groups may be the result of the fact that the present study considered as an outcome the combination of angina and potential infarction, in contrast to Alves et al,[2] who considered only angina as the dependent variable.

Different hypotheses appear to at least partially explain the apparent contradiction related to the sex-specific incidence, prevalence and mortality rates of IHD: 1) higher mortality rates among men may inflate the relative prevalence among women; 2) in incidence studies, lower IHD rates among women may be explained by the fact that a large portion of women that report typical symptoms do not present obstructive disease when measured by catheterization, which may result in under-estimation of rates in relation to men;[23] 3) cohort studies have shown that women with symptomatic IHD delay more than men to seek care and present ambiguous symptoms, delaying or complicating diagnosis, with a resultant decrease in incidence rates;[13,25,28] and 4) results from time series studies conducted in Olmsted County, Minnesota, USA, showed that while the incidence of infarction and the prevalence of atherosclerosis decreased among men, they remained stable or even increased among women and older adults, which may indicate less effective primary prevention among these groups.[9]

In a recent review of studies conducted in different countries, Blum & Blum[4] investigated potential

Table 3. Prevalence of ischemic heart disease (IHD), according to cardiovascular risk factors. Ribeirão Preto, São Paulo, Brazil, 2007.

Variable		IHD	
	wn[a]	no (95%CI)[b]	yes (95%CI)[b]
Cognitive performance[c]			
Below median (≤ 30)	1,298.0	85.46 (82.63;87.89)	14.54 (12.11;17.37)
Above median (> 30)	1,163.0	90.13 (87.21;92.44)	9.87 (7.56;12.79)
Family history[c]			
No	838.1	91.60 (88.41;93.97)	8.40 (6.03;11.59)
Yes	1,633.0	85.72 (83.04;88.04)	14.28 (11.96;16.96)
Systemic arterial hypertension[c]			
No	1,487.0	91.47 (88.85;93.52)	8.53 (6.48;11.15)
Yes	983.8	82.04 (77.91;85.53)	17.96 (14.47;22.09)
Self-perceived health status[c,d] (compared to friends)			
equal to yours	1,293.0	90.31 (87.40;92.61)	9.69 (7.39;12.60)
worse than yours	854.3	89.29 (85.92;91.94)	10.71 (8.06;14.08)
better than yours	320.2	72.89 (63.95;80.29)	27.11 (19.71;36.05)
Length of smoking habit			
non-smoker	1,361.0	89.40 (86.42;91.79)	10.60 (8.21;13.58)
1st tertile (1-14 years)	369.2	87.96 (81.78;92.24)	12.04 (7.76;18.22)
2nd tertile (15-25 years)	396.1	85.51 (79.76;89.84)	14.49 (10.16;20.24)
3rd tertile (> 25 years)	344.9	83.34 (75.58;88.99)	16.66 (11.01;24.42)
Nutritional status[c,d]			
Normal	892.0	91.58 (88.25;94.03)	8.42 (5.97;11.75)
Pre-obese	905.2	87.64 (83.99;90.56)	12.36 (9.44;16.01)
Obese	673.8	82.70 (78.07;86.51)	17.30 (13.49;21.93)
Waist circumference[c,e]			
Normal	921.5	93.39 (90.63;95.39)	6.61 (4.61;9.37)
Abnormal	1,549.0	84.34 (81.34;86.93)	15.66 (13.07;18.66)
Diabetes[c]			
No intolerance	1,621.0	88.47 (86.18;90.43)	11.53 (9.57;13.82)
Diabetics	465.1	81.32 (75.05;86.30)	18.68 (13.70;24.95)
Total cholesterol (mg/dL)			
Normal (< 200)	1,391.0	87.93 (84.96;90.37)	12.07 (9.63;15.04)
High (≥ 200)	1,080.0	87.44 (84.36;89.99)	12.56 (10.01;15.64)
HDL-Cholesterol (mg/dL)			
Normal (> 35)	2,206.0	88.31 (86.20;90.14)	11.69 (9.86;13.80)
High (≤ 35)	265.2	82.75 (74.35;88.81)	17.25 (11.19;25.65)
LDL-Cholesterol (mg/dL)			
Normal (< 130)	1,649.0	88.17 (85.52;90.39)	11.83 (9.61;14.48)
High (≥ 130)	822.4	86.81 (82.74;90.03)	13.19 (9.97;17.26)
Tryglicerides[c] (mg/dL)			
Normal (< 150)	1,854.0	89.33 (87.09;91.22)	10.67 (8.78;12.91)
High (≥ 150)	617.0	82.86 (77.04;87.45)	17.14 (12.55;22.96)
C reactive protein[c] (mg/dL)			
Normal (< 0.5)	2,180.0	88.38 (86.30;90.19)	11.62 (9.81;13.70)
High (≥ 0.5)	291.0	82.71 (74.85;88.49)	17.29 (11.51;25.15)

Continue

Table 3. Continuation

Variable		IHD	
	wn[a]	no (95%CI)[b]	yes (95%CI)[b]
Plasma fibrinogen (mg/dL)			
1st tertile (≤ 302.5)	857.3	89.66 (86.19;92.33)	10.34 (7.67;13.81)
2st tertile (> 302.5 ≤ 355.22)	819.7	88.24 (84.32;91.28)	11.76 (8.72;15.68)
3rd tertile (> 355.22)	794.0	85.08 (80.70;88.60)	14.92 (11.40;19.30)

[a] wn = weighted n
[b] Weighted n, considering the design effect of the sampling strategy
[c] p value < 0.05 for the F statistic
[d] p value < 0.05 for the test of linear trend
[e] Cutoffs: male ≥ 94 cm and female ≥ 80 cm

mechanisms to better understand sex difference in IHD incidence, comparing the size and location of atheromatous plaques. The authors found that despite men having a greater average percent blockage from atheromatous plaques compared to women, women present a greater incidence of chest pain than men and worse clinical outcomes accentuated by age. Also in the majority of these studies, although women presented greater prevalence of arterial hypertension, obesity, elevated plasma lipids and triglycerides when compared to men, women were less disposed to atheromatous plaques.

Results from the Rotherdam Study[12] indicate that calcium deposits in coronary arteries were greater among men than women at all age groups. Nonetheless, in regards to corotid thickness, small differences were reported in regards to sex and age. Results from the Interheart Study[32] revealed that modifiable risk factors can explain more than 90% of acute infarctions, in both sexes, independent of age group or ethnicity. The following factors

Table 4. Prevalence of ischemic heart disease (IHD) with confidence intervals, according to factors related to access to health services and level of physical activity. Ribeirão Preto, São Paulo, Brazil, 2007.

Variable		IHD	
	wn[a]	no (95%CI)[b]	yes (95%CI)[b]
Nº of medicines (past 15 days)[c,d]			
None	504.7	92.70 (88.74;95.34)	7.30 (4.66;11.26)
1-2	1,102.0	89.11 (85.79;91.74)	10.89 (8.26;14.21)
3-4	530.8	85.68 (80.89;89.42)	14.32 (10.58;19.11)
5 and more	333.1	78.78 (71.04;84.90)	21.22 (15.10;28.96)
Health services (past six months)			
No	647.9	91.27 (86.77;94.34)	8.73 (5.66;13.23)
Yes	1,823.0	86.45 (83.81;88.72)	13.55 (11.28;16.19)
Hospitalization (past two years)[c]			
No	2,010.0	88.82 (86.57;90.73)	11.18 (9.27;13.43)
Yes	461.4	82.90 (77.31;87.34)	17.10 (12.66;22.69)
METs*minutes*week^{-1}			
less than median (≤ 346.5)	1,244.0	87.89 (84.65;90.52)	12.11 (9.48;15.35)
more than median (> 345.5)	1,227.0	87.54 (84.41;90.11)	12.46 (9.89;15.59)
Average sitting time (minutes*day^{-1})			
1st tertile (≤ 180.0)	873.9	87.67 (84.47;90.29)	12.33 (9.71;15.53)
2nd tertile (> 180.0 ≤ 308.6)	709.0	90.53 (86.93;93.21)	9.47 (6.79;13.07)
3rd tertile (> 308.6)	886.5	85.49 (81.26;88.90)	14.51 (11.10;18.74)

[a] wn= weighted n
[b] Weighted estimates, considering the design effect of the sampling strategy
[c] p value < 0.05 for the F statistic
[d] p value < 0.05 for the test of linear trend
MET: Metabolic equivalent of tas

Table 5. Crude and adjusted prevalence ratios with respective confidence intervals for the final model. Ribeirão Preto, São Paulo, Brazil, 2007.

Variable	Crude PR	95%CI	Adjusted PR[a]	95%CI
Employment status				
No	1		1	
Yes	0.48	0.35;0.67	0.54	0.37;0.78
Family history				
No	1		1	
Yes	1.70	1.20;2.41	1.55	1.12;2.13
Arterial hypertension				
No	1		1	
Yes	2.11	1.49;2.98	1.70	1.18;2.46
Self-perceived health status (compared to friends)				
Equal to yours	1[b]		1[b]	
Worse than yours	1.10	0.74;1.64	1.17	0.80;1.72
Better than yours	2.80	1.82;4.31	2.15	1.40;3.31
Length of smoking habit				
non-smoker	1		1	
1st tertile (1-14 years)	1.14	0.68;1.89	1.27	0.78;2.07
2nd tertile (15-25 years)	1.37	0.90;2.08	1.41	0.94;2.09
3rd tertile (>25 years)	1.57	1.00;2.48	1.73	1.08;2.76
Waist circumference[c]				
Normal	1		1	
High	2.37	1.60;3.51	1.79	1.21;2.65
Tryglicerides				
Normal (< 150)	1		1	
High (≥ 150)	1.61	1.12;2.30	1.48	1.05;2.10

[a] In the final model, prevalence ratios are also adjusted by sex and age.
[b] p value < 0.01 for the of linear trend test
[c] Cutoffs: male ≥ 94 cm and female > 80 cm

were prominent: smoking habits, increased plasma lipids, central obesity, hypercaloric diets and stress. The authors concluded that the primary prevention of acute infarction should include complementary interventions upon these risk factors, in both sexes.

In comparison to a medical history of angina or electrocardiographic signs, the Rose questionnaire presented a higher level of specificity (close to 100%) than sensitivity in validation studies conducted in different countries.[7] There was a small proportion of false positives in relation to false negatives. The authors also identified a higher prevalence of IHD in women than in men in a study in Southeast Asia (India and Pakistan). These findings appear to reinforce the current study, lending credibility to the positive results identified by the Rose questionnaire, which certainly have a great probability of being true positives.

In the current study, the factors independently associated with IHD, with the exception of family history, are potentially modifiable and are compatible with the results from the Interheart Study.[32]

In the present study the authors opted to run the analysis for the full sample, instead of stratifying by sex. The decision was made because tests for interaction between sex and hypertension, waist circumference and triglycerides were not statistically significant ($p > 0.05$). In addition, the dilution of the sample after stratification by sex resulted in unstable estimates and lower statistical power.

Among the limitation of cross-sectional studies, the bias of reverse causality merits attention, as represented in the present study by the overall associations observed in the descriptive phase between IHD and the variables: consumption of medicines (past 15 days), health service access (past 6 months), hospitalization (past two years) and METs*minutes*week^{-1} (metabolic expenditure in physical activity). However, the independent effect of the variables remained in the final model does not appear to be due to this bias. Also, it was not possible to investigate the effect of sex-specific variables such as menopause, age of menopause onset and hormone replacement therapy, since they were not available for analysis. Nevertheless, even if it was possible, the inclusion of these variables would not explain the differences in IHD prevalence between men and women under 50 years of age.

The higher prevalence of IHD in women than in men is similar to results from Hemingway et al[11] in a meta-analysis of 74 studies carried out in different countries. The authors found, through the use of random effect models, that the prevalence of IHD among females was consistently greater than among men, independent of age, the baseline year of the study, the birth cohort, ethnic origin and mortality rates.

Epidemiological studies have not provided a consistent understanding of risk and protective factors that could explain sex differences in IHD prevalence. On the other hand, results reported by Ueshima,[27] in 2007, are controversial: the decrease in IHD mortality among Japanese, in the past 50 years, have occurred inversely to the trend of increasing cholesterol rates. This evidence may be explained in part by the cohort effect, since those that most contributed to the increased in cholesterol were young adults, and principally explained by the fact that the deleterious effects of hypercholesterolemia upon IHD mortality were compensated for by effective programs to control arterial hypertension and tobacco use.

Although ecological studies and individual-level studies have different inherent constructs, both study types appear to consolidate the paradigm where the effect of variables such as diabetes and C reactive protein upon IHD may by attenuated by the strong influence of variables such as arterial hypertension, smoking habits, dyslipidemia and central obesity. In the present study, although those variables presented crude associations with the outcome, they were not kept in the final model.

The existing lack of population based studies in Brazil, which consider the prevalence of IHD and the identification of associated factors, limits the comparison of the current findings to other Brazilian studies. Despite these limitations, we conclude that the high prevalence of IHD in the municipality of Ribeirão Preto reinforces its importance as a public health problem. Also, the list of modifiable factors that were independently associated with IHD indicates a need to adopt preventive and health promotional measures in the municipality, which should be directed to the population focusing the fight upon tobacco and central obesity and controlling arterial hypertension and dyslipidemia.

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