

Prevalence of Cardiovascular Risk Factors in a Population of Brazilian Industry Workers

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Summary

Background: Determining the cardiovascular risk factors is essential for the primary and secondary prevention of circulatory system diseases.

Objective: To obtain the prevalence of cardiovascular risk factors in a population of industry workers in Brazil.

Methods: Transversal cohort study, with a sociodemographic interview to identify cardiovascular risk factors, anthropometric and blood pressure measurements and capillary blood collection for blood glucose, cholesterol and triglyceride measurement in food industry workers of both sexes.

Results: A total of 1,047 workers were assessed, with 913 (87%) of them being males, with a mean age of 36 ± 8 years. The frequency of a sedentary lifestyle was 83% and of overweight, 63%. Systemic arterial hypertension was identified in 28% of the individuals and 45% were in the pre-hypertension range. Alterations in the blood glucose levels were identified in 49% of the participants, as well as high levels of cholesterol and triglycerides in 7% and 11% of the population, respectively. The body mass index (BMI) levels were not associated to income, but there was an inverse association with the level of schooling.

Conclusion: Overweight and a sedentary lifestyle are the main cardiovascular risk factors in a population of industry workers. (Arq Bras Cardiol 2009;92(1):15-21)

Key words: Risk factors; coronary disease; atherosclerosis; cerebrovascular disease; epidemiology; Brazil.

Introduction

Coronary disease has been the main cause of death in Brazil since the 70s¹. Several risk factors for coronary disease have been identified, since the first studies derived from the Framingham Heart Study²⁻⁴. Several epidemiological assessments verified the elevated presence of risk factors among the Brazilian population, but with distinct regional patterns^{1,5,6}. Throughout the last decades, partly due to changes in dietary habits and the degree of physical activity of the population, an increase in the incidence of overweight, even at the younger age ranges, has been observed, creating the conditions for the onset of diabetes and possibly, of coronary disease. Recently published studies with data of the Latin American population showed a high prevalence of risk factors in patients that were hospitalized due to unstable myocardial ischemic syndromes^{7,8}.

An accurate characterization of the cardiovascular risk factors in a specific population group is essential for the implementation

of educational campaigns and intervention protocols that can optimize the use of the available resources. In Brazil, the prevalence of risk factors presents a regional variation^{9,10}, with an inverse association between the socioeconomic situation and cardiovascular mortality^{11,12}. However, there have been few comparative studies on the distribution of risk factors considering the socioeconomic differences.

The objective of the present study was to evaluate the prevalence of cardiovascular risk factors in a population of industry workers in Brazil.

Methods

From August 2002 to July 2003, the employees of a carbonated beverage plant, located in the city of Itu, state of Sao Paulo, Brazil, were evaluated. The study was approved by Ethics Committee in Research of *Hospital das Clínicas* of the School of Medicine of Ribeirão Preto of the University of São Paulo.

The study procedures were carried out by one of the authors of the study (RSLC) and by interviewers that were previously trained to conduct the several phases of the data collection, including the clinical and biochemical data. The collection of the material used in this study was carried out in five weekly periods (two mornings, two afternoons and one

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evening), which coincided with the presence of the employees at the company's Medical Service to undergo routine annual medical assessment, during their work shifts, with a previous fasting of at least 4 hours.

A standardized interview was carried out, together with an anthropometric assessment, blood pressure measurement and biochemical data collection, which lasted approximately 25 minutes. The standardized interview consisted in the collection of personal information such as age, income range and level of schooling, as well as personal life habits such as sedentary lifestyle (defined as fewer than three weekly periods of physical activity during leisure time with at least 30 minutes of duration) and previous knowledge of the presence of risk factors such as systemic arterial hypertension (SAH), smoking and diabetes, in addition to a family history of early coronary disease (men younger than 55 years and women younger than 60 years). The anthropometric measurements were obtained with the employee in the standing position, barefoot and with no upper-body garments, according to the manual of anthropometric procedures produced by the National Health and Nutrition Examination Survey (NHANES), revised in December 2000¹³. Weight and height were obtained using a Filizzola™ mechanical scale (model 31, São Paulo, Brazil). The body mass index (BMI) was obtained by dividing the weight in kilograms by the square of the height in meters. The abdominal circumference (AC) and the hip circumference (HC) were assessed, using an inextensible metric tape. The ratio between the AC and the HC (AHR) was calculated through the quotient of these values.

The systemic arterial hypertension was obtained with the employee in the sitting position, using an automated device (OMRON-Model HEM 705-CP, Japan), according to the methodology described at the V Brazilian Directives of Arterial Hypertension¹⁴. Three measurements, with a minimum interval of one minute between them, were carried out and the final result was expressed as their arithmetic mean. The values were grouped according to the classification proposed by the VII Joint National Committee¹⁵.

Three drops of blood for biochemical measurements were collected through digital puncture from each employee, and each drop was directly applied to the disposable test strips, previously coupled to each device used for such purpose.

The capillary glucose was obtained through the GLUCOMETER ELITE (Bayer Elite, Japan) and total cholesterol and triglycerides were measured using the Accutrend GCT device (Boehringer Mannheim, Germany).

The values are expressed as means and standard deviations. Comparisons between the two variables were carried out using Student's *t* test for continuous variables and Fischer's exact test for comparison between proportions.

Analysis of variance (ANOVA) was used for the comparison among three or more groups of continuous variables and in case of statistically significant difference, post-test, the comparison of the pairs of variables was carried out by Bonferroni's method. The Chi-square test was used to compare 3 or more variables, with analysis of tendency. Pearson's correlation was carried out to observe the association between two continuous variables. The level of significance was set at <5%.

Results

Demographic Data

A total of 1047 employees were assessed, of which 913 (87%0 were males. This number corresponds to the total number of individuals that worked at the plant unit, except for those that were on sickness leave on the day of the routine medical assessment or were dismissed before the annual medical assessment. The mean age of the studied population was 36 ± 8 years. Around 2/3 were 30 to 50 years of age. Regarding the level of schooling, none of them were illiterate and most had finished High School or College (68%). Regarding the distribution per income range, in relation to the number of current minimum wages at the time, it was observed that most workers received more than 3 minimum wages (94%) and that the lower salaries predominated among women (20% of the women and 4% of the men received 1 to 3 minimum wages). Such fact was probably due to the type of less specialized activity performed by the women. Table 1 summarizes the demographic data.

Prevalence and distribution of cardiovascular risk factors

The data are summarized in Table 2. Regarding blood pressure, it was observed that only 27% of the population presented BP levels that were considered normal or desirable. In contrast, the pre-hypertensive individuals comprised 45% of the population and systemic arterial hypertension (SAH)

Table 1 - Demographic data related to age range, level of schooling and income range of the studied population according to gender

Sex	Female (n)	%	Male (n)	%	Total (n)	%
Age range (yrs)						
≤ 30	33	25	268	29	301	29
31 – 40	55	41	395	43	450	43
41 – 50	34	25	197	22	231	22
> 50	12	9	53	6	65	6
Total	134	100	913	100	1047	100
Level of schooling						
Elementary	61	45.5	271	29.7	332	32
High School	52	38.8	393	43.0	445	42
College/ University	21	15.7	249	27.3	270	26
Total	134	100	913	100	1047	100
Income range (MW)						
1 to 3	27	20	35	4	62	6
3 to 6	53	40	363	40	416	40
6 to 10	29	22	293	32	322	31
> 10	25	18	222	24	247	23
Total	134	100	913	100	1047	100

MW - minimum wages.

Table 2 - Prevalence and distribution by sex of Systemic Blood Pressure, Glycemia, Total cholesterolemia, Triglyceridemia, Family history and Smoking in the studied population of industry workers

Sex	Female (n)	%	Male (n)	%	Total (n)	%
BP Class						
Normal	69	51	213	23	282	27
Pre-SAH	46	34	426	47	472	45
Stage 1	17	13	214	23	231	22
Stage 2	02	2	60	7	62	6
Total	134	100	913	100	1047	100
Glycemia (mg/dL)						
< 100	74	55	457	50	531	51
≥ 100 and < 126	47	35	375	41	422	40
≥ 126	13	10	81	9	94	9
Total	134	100	913	100	1047	100
Cholesterol total (mg/dL)						
Desirable (<200)	121	90	857	94	978	94
Borderline (200 to 239)	10	7	45	5	55	5
Elevated (≥ 240)	3	3	11	1	14	1
Total	134	100	913	100	1047	100
Triglycerides (mg/dL)						
Normal (<150)	119	89	758	83	877	84
Borderline (150 to 199)	3	2	50	5	53	5
Elevated (200 to 499)	10	7	97	11	107	10
Very elevated (≥ 500)	2	2	8	1	10	1
Total	134	100	913	100	1047	100
Family History						
Positive	62	46	247	27	309	30
Negative	63	47	663	72	726	69
Unknown	9	7	3	1	12	1
Total	134	100	913	100	1047	100
Smoking						
Current	11	8	101	11	112	11
Prior	17	13	185	20	202	19
Never	106	79	627	69	733	70
Total	134	100	913	100	1047	100

BP - blood pressure; SAH - systemic arterial hypertension.

(stage 1 or 2) was identified in 293 individuals, corresponding to 28% of the studied population, with most of them being males (94%).

Regarding glucose intolerance, it was observed that 51% of the evaluated population presented glycemia below 100 mg/dl and 40 % were in the glucose intolerance range, showing glycemia levels ≥ 100mg/dL and < 126 mg/dL. The distribution per gender (41% of males and 35% of females) was similar regarding the presence of glucose intolerance (Chi-square: p=0.62). Glycemia > 126 mg/dl was detected in 9% of the individuals.

Elevated capillary cholesterol was found in 7% of the population and 11% presented increased levels of total triglycerides. Borderline levels of triglycerides were found in 2% of the female and 5% of the male employees. Thus, 16% of the population presented triglycerides levels above the desirable.

A prior family history of coronary artery disease (CAD) in first-degree relatives was verified in 41 women, which corresponded to 31% of the female population and 184 men (20% of the 913 male individuals) presented this known risk

factor. It was not possible to accurately establish the presence of cardiovascular disease in family members in 12 individuals (9 females).

Smoking was present in 11% of the population, with no significant difference between genders ($p=0.37$). Regarding employees that reported previous smoking habit, the standardized interview showed that 185 men and 17 women had been smokers, which corresponded to 19% of the studied population. A total of 314 employees reported current or previous smoking habit, indicating that 30% of the studied population is or has been exposed to this risk factor.

A high level of sedentary lifestyle was observed (83%), with a similar distribution in both sexes. Regarding the physical activity practiced by the non-sedentary individuals, it was aerobic type activity in most cases: 42% walked, 15% developed aerobic activities or resistance exercises in health clubs or fitness centers and around 12% played soccer on a regular basis.

Anthropometric variables

It was observed that, except for the women aged 40 years or younger, the population presented mean BMI values within the pre-obesity range. The mean values for the female sex for the age ranges of 30 years or younger, 31 to 40 years, 41 to 50 years and older than 50 years were 25.5 ± 4.2 , 24.9 ± 3.5 , 26.2 ± 3.9 and 27.5 ± 6.3 , respectively, with no significant difference observed among the several age ranges (ANOVA: $P=0.19$). On the other hand, the BMI in the male sex presented a positive correlation with the increased age range ($r = 0.21$; $p < 0.001$). The mean BMI values for the same age ranges described above for the female sex were 25.9 ± 4.2 , 26.4 ± 3.7 , 27.9 ± 4.0 and 28.0 ± 3.7 . However, the significant difference observed between the younger and the older age ranges was more relevant (ANOVA: $p < 0.001$).

The data summarized in Table 3 indicate an elevated prevalence of overweight in the studied population (63%), which was higher among the men than among the women (64% and 51%, respectively). The pre-obesity range (46%

of the participants) was the one that presented the highest percentage of individuals. Among the possible associations that determined the elevated prevalence of overweight, two were analyzed in particular, as they are acknowledged as important variables regarding cardiovascular risk factors: income and level of schooling.

Table 4 shows the distribution of the normal or altered BMI according to the income range. The female population, within the income range of 6 to 10 minimum wages, presented the highest concentration of female employees with BMI > 25 kg/m². For the male sex, except for the lowest income range, there was a predominance of pre-obesity and obesity in all the others, being close to or higher than 2/3 of the population in the higher income ranges. In both sexes, it was not possible to identify statistically significant differences in the mean BMI among the several income ranges (ANOVA: $p = 0.30$ for the male sex and $p = 0.91$ for the female sex).

Regarding the level of schooling (Table 5), we observed that the behavior was distinct between the genders. There were no

Table 3 - Distribution of BMI by sex, according with the classification of the World Health Organization

BMI Classification (WHO)	Female sex (n)	%	Male sex (n)	%	Total (n)	%
Low weight	1	1	6	1	7	1
Normal weight	65	49	319	35	384	37
Pre-obesity	50	37	429	47	479	46
Obesity Class I	15	11	127	14	142	13
Obesity Class II	2	1	24	2	26	2
Obesity Class III	1	1	8	1	9	1
Total	134	100	913	100	1047	100

BMI - body mass index.

Table 4 - Percentage distribution of the prevalence of normal weight, pre-obesity and obesity in relation to income range in the female sex

Sex	Income range (MW)	BMI < 24.9 (n)	%	BMI between 25-29.9 (n)	%	BMI > 29.9 (n)	%
Female	1 to 3	15	56	7	26	5	18
	3 to 6	28	53	19	36	6	11
	6 to 10	11	38	13	45	5	17
	> 10	12	48	9	36	4	16
	Total	66	49	48	36	20	15
Male	1 to 3	18	51	14	40	3	9
	3 to 6	127	35	170	47	66	18
	6 to 10	107	36	134	46	52	18
	> 10	73	33	111	50	38	17
	Total	325	36	429	47	159	17

MW - minimum wages; BMI - body mass index (Kg/m²).

Table 5 - Distribution of BMI (kg/m²), expressed in means and SD, according to gender and Level of Schooling

Level of Schooling	Female sex	Male sex*
Elementary School	26.3 ± 3.6	27.2 ± 3.7
High School	24.8 ± 4.0	26.5 ± 4.1**
College or University	25.6 ± 5.5	26.4 ± 4.0***

* ANOVA: $P = 0.03$; post-test with Bonferroni: ** $P < 0.05$ vs Elementary School; *** $P < 0.01$ vs Elementary school. BMI - body mass index (Kg/m²).

significant variations in BMI for the female sex (ANOVA $p = 0.18$) at the different levels of schooling. However, the male sex presented higher BMI values in the group with lower level of schooling (ANOVA $P = 0.03$).

The analysis among the subgroups (Bonferroni) showed that there was tendency toward lower BMI values among the individuals with higher levels of schooling, when compared to those with the lower levels of schooling.

Abdominal circumference, hip circumference and abdominal circumference/hip circumference ratio

The female sex did not present any significant alteration in the AC and HC, in spite of the increment observed in the AC after 40 years of age. The mean AC values for the age ranges 30 years or younger, 31 to 40 years, 41 to 50 years and older than 50 years were 83.7 ± 9.5 , 83.7 ± 9.1 , 88.1 ± 11.1 , 91.3 ± 16.9 ($p = 0.05$), respectively. For the same age ranges the HC values were: 102.3 ± 9.8 , 97.8 ± 11.5 , 96.8 ± 11.7 and 103.3 ± 17.2 respectively ($p = 0.12$).

Regarding the AC/HC ratio (AHR), there was statistical significance only when comparing the first and the third age ranges (Bonferroni: $p = 0.02$), with the following respective values: 0.82 ± 0.09 , 0.86 ± 0.1 , 0.93 ± 0.24 and 0.89 ± 0.16 .

The behavior of these anthropometric variables in the male population was distinct and is summarized in Table 6. In this case, all the variables increased with age, with statistical significance for AC and AC/HC ratio at the analysis per age range. The AC presented a significant increase with age, starting from a range where the association with lower cardiovascular risk is well-known, reaching clearly worrying dimensions at the older ranges. Regarding the HC, there was a variation only after 40 years of age, to a much lower extent.

Discussion

This study has identified a relatively young population with a high prevalence of cardiovascular risk factors. It is noteworthy the fact that alarming rates of sedentary lifestyle (83%) and overweight (63%) were observed. Brazilian population studies have frequently demonstrated sedentary habits¹⁶⁻¹⁸ at the same rates reported in the present study and in distinct populations and regions. The elevated prevalence in such a young population group is an alarming fact. Similarly, overweight has been detected more often in several national^{19,16} and international studies, with the presence of subclinical atherosclerosis being relatively frequent in this group of individuals¹⁹. Additionally, in a relatively young population,

such overweight prevalence suggests elevated risk for obesity at a long-term follow-up, as observed by Framingham²⁰, although these data cannot be directly transported to our population sample. This may be partially verified in an indirect and statistically significant way through the increase in the abdominal circumference, currently considered an important predictor of metabolic alterations caused by the accumulation of visceral fat, in the several age ranges of the male sex (Table 6) and by the positive correlation of the BMI.

The analysis of the influence of the socioeconomic level shows that individuals with a higher level of schooling present lower BMI, especially in the male sex. This result is in accordance with previous studies that demonstrated the higher prevalence of obesity among the classes with lower levels of schooling²¹. On the other hand, income ranges (Table 4) did not influence the BMI profile, which presented a similar distribution among the several evaluated ranges. The presence of overweight concomitantly to other cardiovascular risk factors²², was also verified in the present study.

We also observed a high prevalence of SAH and very markedly, of pre-hypertension, especially among male individuals. Considering that it has been demonstrated that individuals with borderline BP levels will present future BP increase²³, one can infer that, without the occurrence of intervention, there is an important tendency that this young population will present an elevated number of hypertensive individuals, according to results from international series.

Similarly, there was a high prevalence of individuals with glucose intolerance (40%), with 9% of them presenting glycemia > 126 mg/dL. The national literature presents epidemiological data where the glucose intolerance was lower, but the studies considered as glucose intolerance only glucose levels > 110 mg/dL and the present study used the recent classification by the American Diabetes Association, which classifies as glucose intolerance values between 100 and 125 mg/dL²⁴.

Although no fasting glycemia levels were measured, the detection of elevated capillary glycemia levels after at least 4 hours of fasting is an indication of a disorder in the glucose homeostasis, as a certain equivalence between the capillary glycemia and the conventional venous glycemia has been described in the literature²⁵. Considering the elevated prevalence of overweight in the studied population, such fact is a relevant one, indicating a higher possibility of the future development of type 2 diabetes mellitus, if the current inadequate lifestyle habits are maintained.

Regarding dyslipidemia, we observed that the prevalence of hypercholesterolemia was lower than in studies with similar populations^{26,27} and at a lower percentage than most of the other classic risk factors, with triglyceride level alterations being most commonly found.

Due to the type of professional activity, several educational campaigns developed by the company itself have reduced smoking, but almost one third of the employees still present the risk factor, due to current or previous smoking habits.

Our data are similar to that of other national studies in selected groups^{17,27}. Similarly, there is a strict internal policy that restricts alcohol consumption and the employees' daily

diet record showed low alcohol consumption. Additionally, thanks to mechanization, there is no contact with the carbonated beverage, with most of the activities associated with the processing of supplies, packaging and transport. Something that could be of concern, the free access to carbonated beverages in the cafeteria, which could favor an exaggerated consumption of soft drinks, was neither observed nor reported in the diet reports.

Finally, the high prevalence of alterations in the abdominal circumference, especially in male individuals must be pointed out. As a marker of the occurrence of the metabolic syndrome, the pattern of alterations observed indicates that there can be a high prevalence of cases of metabolic syndrome, although a study aiming at that question has not been carried out, but where the nutritional intervention alone can be highly beneficial for the control of several risk factors and decrease of the global cardiovascular risk.

In conclusion, this study identifies the elevated prevalence of cardiovascular risk factors in a differentiated population group regarding socioeconomic aspects. The confirmation that modifiable risk factors predominate, suggests that educational programs can be useful in preventing further complications

caused by an identified non-healthy lifestyle. It is important to mention, however, that these programs must not be focused only on specific groups, but extended to include more comprehensive actions, through modifying actions of social behavior patterns, as many educational programs can be relevant for the primary prevention of several chronic diseases, such as the promotion of the practice of physical activity and a healthy diet.

Potential Conflict of Interest

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

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Study Association

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