Risk Factors for Hypertension and Diabetes Mellitus in Metallurgic and Siderurgic Company's Workers

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Objective: To study the factors associated with arterial hypertension (AH) and diabetes mellitus (DM) in a metal and steel company's workers with units in São Paulo and Rio de Janeiro, using a hierarchical risk model.

Methods: This is a cross-sectional study. We obtained information on demographic, occupational and lifestyle variables, in addition to the lipid profile, fasting glycemia and blood pressure of 3,777 employees, and we carried out descriptive statistical analysis and hierarchical multiple logistic regression analysis.

Results: The prevalence of AH was 24.7% and the hierarchical regression analysis indicated that male gender and age above 40 years presented statistically significant risk. Regardless of demographic characteristics, working in the metal company, intense work stress, sedentary lifestyle, alcohol consumption, body mass index above 25, altered cholesterol and altered triglycerides were associated with AH. The prevalence of DM was 11.5% and the hierarchical regression analysis indicated that male gender and age above 40 years presented statistically significant risk. Regardless of demographic characteristics, the same conditions were associated with DM.

Conclusion: The data evidenced that workers above 40 years are a priority for intervention actions aimed at improving the prevention of these two conditions. These actions should focus especially on eating habits and the practice of physical exercise, which could improve the control of obesity and of alterations in the lipid profile.

Key words: Hypertension, diabetes mellitus, worker's health, occupational health, risk factors.

Arterial hypertension (AH) and diabetes mellitus (DM) are important collective health problems in Brazil because of their high prevalences, the acute and chronic complications they originate and because they represent risk factors associated with cardiovascular diseases, implying high morbidity and mortality rates and social and economic costs resulting from the use of health care services, absenteeism, early retirement and decrease of the work ability[1-3].

In addition to their isolated importance, arterial hypertension and glycemia alterations also play a relevant role as components of the metabolic syndrome, believed to be the major cause of the increase in general and cardiovascular mortality[4].

Preventive actions have been demonstrated to have positive impacts in the reduction of morbidity and mortality associated with hypertension, diabetes and cardiovascular diseases[1,5]. In order to plan, develop and evaluate preventive actions and actions targeted at these conditions, it is necessary to know the distribution and the joint role played by the risk factors. Many studies have addressed the population in general, focusing on the elderly. However, there is little discussion about factors associated with these conditions in Brazilian workers. Considering this fact, this study aims at studying factors associated with AH and DM in workers of a metal and steel company with units in São Paulo and Rio de Janeiro, using a hierarchical risk model.

Methods

This is a cross-sectional study and was carried out in 1997 with workers of a metal and steel company with production and service units in various cities in the States of São Paulo and Rio de Janeiro, Brazil. The study was publicized among the workers through a newsletter and participation in the study was on a volunteer basis. The number of volunteers who adhered to the study reached 3,996. From this total number of volunteers, those with incomplete or wrong data were excluded, and the sample was made up of 3,777 individuals, corresponding to 50.0% of the total population of employees. The workers answered a questionnaire with questions on demographic, occupational and lifestyle characteristics, then had their weight and height checked and a blood sample collected. The collection of the sample for testing was carried out by trained health practitioners, and all the process of laboratory analysis of the samples was carried out by a single laboratory, except for the service units, which made use of different laboratories.

The dependent variables analyzed were AH and DM, defined with base on the parameters established in the guideline of the Brazilian Society of Hypertension for the diagnosis and treatment of the metabolic syndrome[4]. Individuals with diastolic blood pressure ≥ 85 mmHg or systolic blood pressure ≥ 130 mmHg were considered as having hypertension (Y=1), otherwise they were considered as

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not having hypertension (Y=0). Workers with fasting glycemia ≥ 110 mg/dl were considered as having DM (Y=1).

The independent variables were: the demographic characteristics *gender* (male and female) and *age* (< 41, 41-50 and > 50 years); the functional characteristics *line of business* (metal and steel comapany), *activity* (administrative and operational) and *work stress* (reported feeling of stress: absent/mild/moderate and intense); characteristics relating to lifestyle such as *physical activity* (no physical activity and some activity), *smoking habit* (non-smokers, smokers) and *alcohol consumption* (non-use, sporadic consumption, daily consumption of alcohol); and clinical characteristics *overweight* (body mass index > 25), *total cholesterol – TC* ≥ 200 mg/dl (borderline or high), *LDL-C fraction or low density lipoproteins – LDL* ≥ 130 mg/dl (borderline, high or very high), *HDL-C fraction or high density lipoproteins – HDL* < 40 mg/dl (low) and *triglycerides – TG* ≥ 150 mg/dl (borderline, high or very high). For the classification of the workers' lipid profile, the cut-off points were established with base on the parameters of the Brazilian Society of Cardiology[6], and borderline or elevated values were categorized as alterations.

We carried out a descriptive analysis of the data and, after this we developed univariate logistic regression models to verify the association between the dependent variables (arterial hypertension and diabetes mellitus) and the independent variables. Finally, we carried out a hierarchical nonconditional multiple logistic regression analysis following the same outline presented in figure 1. The risk measure used was *odds ratio* (OR), and we used the 5% level of significance for all the analysis.

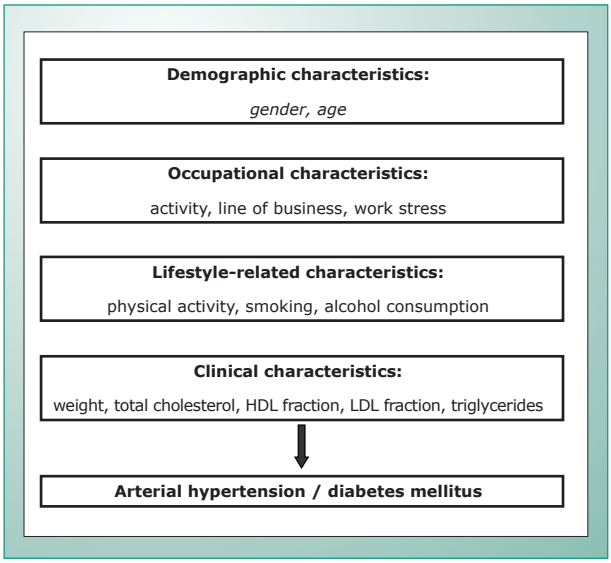


Fig. 1 - *Model of hierarchical analysis of hypertension and diabetes mellitus.*

Characterization of the workers and of the variables of the study - The 3,777 workers studied were distributed in different units: São Paulo (38.7%), Pindamonhangaba (12.6%), Rio de Janeiro (11.2%), Mogi das Cruzes (11.0%), Sumaré (10.4%), Sorocaba (6.6%), Service Units (5.2%), Diadema (2.6%) and São Caetano do Sul (1.8). Most workers were engaged in operational activities (74.5%): 55.0% were metal workers and the remaining were steel workers, and male subjects prevailed (93.7%) (table 1). Most workers were 40 years of age or less, in that the mean age observed was 36.2 years, with a standard deviation of 9.3 years.

Characteristics	% *
Operational activity	74,5
Metal company	55,0
Steel company	45,0
Aged until 40	65,5
Male	93,7

** Percentage calculated over 3,777 participants.*

Table 1 - Demographic and functional characteristics of employees of a metal/steel company, 1997

Graph 1 and table 2 show the prevalences found for AH and DM and for the lifestyle risk factors and clinical variables. The prevalence of workers presenting blood pressure alterations was 24.7%, whereas the prevalence of fasting glycemia alterations was 11.5%. Among the clinical variables, we observed that 42.7% of the workers were overweight or obese and that there were high prevalences of dyslipidemia (alterations of 39.8% for the HDL-C fraction, 35.5% for total cholesterol, 34.1% for LDL-C fraction and 26.9% for triglycerides). As regards lifestyle characteristics, we observed that 63.6% of the workers did not practice any kind of physical activity; 23.3% were smokers; 9.4% reported intense work stress; and 3.6% reported daily consumption of alcoholic beverages.

Factors associated with arterial hypertension - The univariate analysis showed that, with the exception of the type of work activity and HDL-C fraction, the remaining risk factors analyzed were associated with blood pressure alterations. Higher chances of presenting arterial hypertension were observed among males - and these chances increased with age; with metallurgy-related activities; among individuals with a perception of strong work stress; among those with a sedentary lifestyle; among smokers, increased with the increase in alcohol consumption; among those with excess weight; and among workers presenting alterations in total cholesterol, LDL-C fraction or triglycerides (table 3).

The results of the hierarchical multiple analysis are on table 3 and showed that men had 2.93 times the chance of having arterial hypertension as compared to women, and that individuals aged between 41 and 50 and above 50 had, respectively, 2.14 and 3.92 times the chance of having AH, as compared to younger subjects.

Among the occupational characteristics associated with arterial hypertension, after adjustment for demographic characteristics, it became apparent that individuals with a perception of intense work stress are at a higher risk of having blood pressure alterations, and that steel workers are at a lower risk than metal workers.

Among lifestyle characteristics, after adjustment for occupational and demographic variables, sedentary lifestyle and alcohol consumption were statistically associated with arterial

hypertension. Sedentary workers had 1.29 times the chance of having AH as compared with those who practiced some kind of physical activity. The risk of occurrence of AH increased with the increase in alcohol consumption and workers who consumed alcoholic beverages daily had 3.01 times the chance of presenting hypertension as compared with abstemious individuals.

Clinical characteristics – body mass index, total cholesterol and triglycerides - remained statistically associated to blood pressure alterations after adjustment for the remaining variables, and workers with excess weight, alteration in total cholesterol and triglycerides presented respectively, 2.37, 1.38 and 1.58 times the chance of having arterial hypertension.

Factors associated with diabetes mellitus - The univariate analysis showed that the risk factors associated with alterations in fasting glycemia were gender, age, occupational activity, smoking habit, physical activity, alcohol consumption, body mass index, total cholesterol, LDL-c fraction e triglycerides. Higher odds of having DM were observed among men, and increased with age; among workers engaged in operational activities; among sedentary individuals; among smokers, increased with the increase in alcohol consumption; among individuals with excess weight; and among workers with alteration in total cholesterol, LDL-c fraction or triglycerides (table IV).

The results of the hierarchical multiple analysis are on table IV and show that men had 2.00 times the chance of presenting alteration in glycemia as compared to women, and that individuals aged between 41 and 50 and above 50 had respectively 3.10 and 5.43 times the chance of presenting alteration in glycemia, as compared to the younger subjects.

Among the occupational characteristics associated with DM, after adjustment for demographic characteristics, the type of occupational activity and the line of business remained, and workers engaged in operational activities were shown to have 1.35 more chances than those involved in administrative activities, and that steel workers were at lower risk than metal workers.

Among lifestyle characteristics, after adjustment for demographic and occupational variables, sedentary lifestyle and alcohol consumption remained statistically associated with DM. Sedentary workers presented 1.28 times the chance of having DM, as compared to those who reported some type of physical activity. The risk for DM increased with the increase in alcohol consumption: workers who reported consuming alcohol sporadically presented 1.10 times the chance of having glycemia alterations; those who reported daily consumption of alcoholic beverages had 2.50 times the risk as compared with those who informed that they did not consume alcohol.

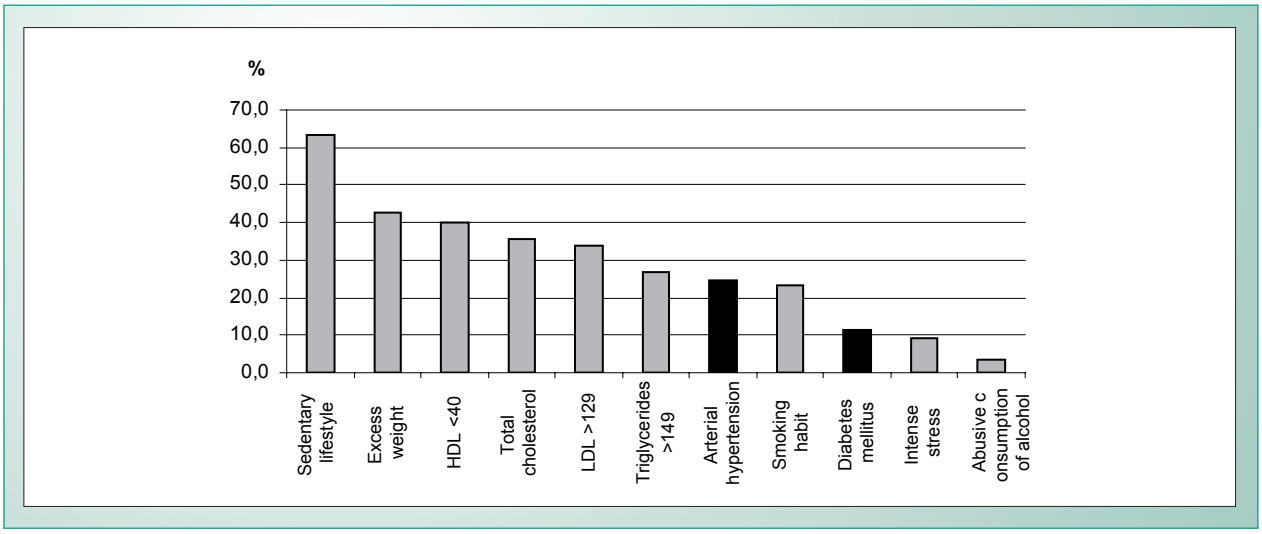
All of the clinical characteristics were statistically associated with fasting glycemia alterations after adjustment for the remaining variables, and workers with excess weight, alteration in total cholesterol and triglycerides presented respectively 1.93, 1.30 and 1.88 times the chance of having DM.

Discussion

The prevalences of AH and DM identified in this study were respectively 24.7% and 11.5%. The AH prevalence was lower than the prevalence observed in other studies[7,8], but it is difficult to make this comparison because different criteria are used to define hypertension. DM prevalence was similar to the prevalence observed in the city of São Paulo, where 11.0% of men aged between 30 and 39, and 11.3% of men between 40 and 49 presented glycemia alterations[8].

The prevalences identified in this study may be affected by the "healthy worker effect", that is, a progressive selection occurs of the healthier and fittest individuals for the job, with the exclusion of those workers in poorer health through dismissal or medical removal. Another aspect is that the group of workers studied has the support of a healthcare insurance plan and of health care services at the workplace, which facilitates access to early diagnosis and proper treatment of health problems. Therefore, the validity of the results of this study for application to other populations should be regarded with caution due to the specific characteristics of these workers concerning their work conditions.

An additional aspect to be considered is the 50.0% rate of workers' adherence to the study: since more elevated rates



Graph 1 - *Prevalence of risk factors determined by clinical alterations and by lifestyle in employees of a metal/steel company, 1997*

Variable (categories)	Dependent variables							
	Arterial hypertension				Diabetes			
	Nº *	% *	Chi **	p	Nº *	% *	Chi **	p
Gender								
Female	22	9.3	32.2	<0.0001	12	5.1	10.2	0.0014
Male	911	25.7			421	11.9		
Age								
< 41	464	18.7	161.9	<0,0001	168	6.8	176.0	<0.0001
41 – 50	360	33.6			200	18.7		
> 50	109	48.4			65	28.9		
Activity								
Administrative	227	23.5	1.0	0.3259	87	9.0	7.7	0.0056
Operational	706	25.1			346	12.3		
Line of business								
Metal industry	579	27.9	24.8	<0.0001	254	12.2	2.6	0.1053
Steel industry	354	20.8			179	10.5		
Work stress								
Absent, mild, moderate	823	24.1	8.3	0.0039	397	11.6	0.7	0.4110
Intense	110	31.0			36	10.1		
Physical Activity								
Some type	292	21.2	14.1	0.0002	124	9.0	12.8	0.0003
Sedentary lifestyle	641	26.7			309	12.9		
Smoking habit								
Non smoker	694	24.0	3.7	0.0536	330	11.4	0.1	0.7988
Smoker	239	27.2			103	13.3		
Alcohol consumption								
Never	231	19.0	64.3	<0.0001	129	10.6	35.2	<0.0001
Sporadic consumption	637	26.3			267	11.0		
Daily consumption	65	48.1			37	27.4		
Overweight	**337**	**15.6**	**228.2**	**<0.0001**	**151**	**7.0**	**101.0**	**<0.0001**
No	596	37.0			282	17.5		
Yes	337	15.6	228.2	<0.0001	151	7.0	101.0	<0.0001
Total cholesterol								
Normal	477	19.6	97.6	<0.0001	210	8.6	55.0	<0.0001
Altered	456	34.1			223	16.7		
HDL fraction								
Normal	537	23.6	3.5	0.0618	261	11.5	0.0	0.9555
Altered	396	26.3			172	11.4		
LDL fraction								
Normal	528	21.2	48.0	<0.0001	251	10.1	13.8	0.0002
Altered	405	31.5			182	14.1		
Triglycerides								
Normal	543	19.7	139.9	<0.0001	226	8.2	108.7	<0.0001
Altered	390	38.4			207	20.4		

** N. and % of workers with arterial hypertension and diabetes in each category; ** Chi-square test.*

Table 2 - Associated risk factors identified through univariate analysis, employees of a steel/metal company, 1997

Model	Univariate		Hierarchical multiple		
	OR raw	p	OR adjusted	p (category)	CI95% (ORa)
Demographic characteristics					
Gender					
Female	1.00		1.00		
Male	3.39	<0.0001	2.93	<0.0001	[1.9;4.6]
Age					
< 41	1.00		1.00		
41 – 50	2.20	<0.0001	2.14	<0.0001	[1.8;2.5]
> 50	4.09	<0.0001	3.92	<0.0001	[3.0;5.2]
Occupational characteristics*					
Activity					
Administrative	1.00		1.00		
Operational	1.09	0.3252	1.01	0.9070	[0.8;1.2]
Line of business					
Metal industry	1.00		1.00		
Steel industry	0.68	<0.0001	0.64	<0.0001	[0.5;0.7]
Work stress					
Absent, mild, moderate	1.00		1.00		
Intense	1.42	0.0041	1.27	0.0622	[1.0;1.6]
Lifestyle characteristics**					
Physical Activity					
Some type	1.00		1.00		
Sedentary lifestyle	1.35	0.0002	1.29	0.0028	[1.1;1.5]
Smoking habit					
Non smoker	1.00		1.00		
Smoker	1.18	0.0538	0.98	0.8661	[0.8;1.2]
Alcohol consumption					
Never	1.00		1.00		
Sporadic consumption	1.52	<0.0001	1.50	<0.0001	[1.3;1.8]
Daily consumption	3.96	<0.0001	3.01	<0.0001	[2.0;4.4]
Clinical characteristics***					
Overweight					
No	1.00		1.00		
Yes	3.19	<0.0001	2.37	<0.0001	[2.0;2.8]
Total cholesterol					
Normal	1.00		1.00		
Altered	2.12	<0.0001	1.38	0.0002	[1.2;1.6]
Triglycerides					
Normal	1.00		1.00		
Altered	2.55	<0.0001	1.58	<0.0001	[1.3;1.9]

** Adjusted for demographic characteristics; ** Adjusted for demographic and occupational characteristics; *** Adjusted for demographic, occupational and lifestyle characteristics.*

Table 3 - Risk factors associated with arterial hypertension, identified through hierarchical logistic regression analysis, employees of a steel/metal company, 1997

Model	Univariate		Hierarchical multiple		
	OR raw	p	OR adjusted	p (category)	CI95% (ORa)
Demographic characteristics					
Gender					
Female	1.00		1.00		
Male	2.53	0.0020	2.00	0.0231	[1.1;3.6]
Age					
< 41	1.00		1.00		
41 – 50	3.16	<0.0001	3.10	<0.0001	[2.5;3.9]
> 50	5.59	<0.0001	5.43	<0.0001	[3.9;7.4]
Occupational characteristics*					
Activity					
Administrative	1.00		1.00		
Operational	1.42	0.0059	1.35	0.0276	[1.0;1.8]
Line of business					
Metal industry	1.00		1.00		
Steel industry	0.85	0.1056	0.76	0.0117	[0.6;0.9]
Work stress					
Absent, mild, moderate	1.00		1.00		
Intense	0.86	0.4114	0.75	0.1249	[0.5;1.1]
Lifestyle characteristics**					
Physical Activity					
Some type	1.00		1.00		
Sedentary lifestyle	1.49	0.0004	1.28	0.0349	[1.0;1.6]
Smoking habit					
Non smoker	1.00		1.00		
Smoker	1.03	<0.0001	0.89	0.2299	[0.7;1.1]
Alcohol consumption					
Never	1.00		1.00		
Sporadic consumption	1.04	0.7165	1.10	0.4418	[0.9;1.4]
Daily consumption	3.18	<0.0001	2.50	0.0001	[1.6;3.9]
Clinical characteristics***					
Overweight					
No	1.00		1.00		
Yes	2.83	<0.0001	1.93	<0.0001	[1.5;2.4]
Total cholesterol					
Normal	1.00		1.00		
Altered	2.12	<0.0001	1.30	0.0278	[1.0;1.6]
Triglycerides					
Normal	1.00		1.00		
Altered	2.87	<0.0001	1.88	<0.0001	[1.5;2.4]

** Adjusted for demographic characteristics; ** Adjusted for demographic and occupational characteristics; *** Adjusted for demographic, occupational and lifestyle characteristics.*

Table 4 - Risk factors associated with diabetes mellitus, identified through hierarchical logistic regression analysis, employees of a steel/metal company, 1997

were observed in sites where there was greater involvement and collaboration of the management, the possibility of sampling bias should be taken into account.

As regards the dyslipidemias, we identified elevated prevalences of alterations in TC, HDL-c, LDL-c and TG. Comparing these results with those of other studies in Brazil[9,10-14], we observed a wide variability of the results, since the cut-off points adopted to categorize the dyslipidemias varied among these studies, thus making it difficult to compare them.

In the set of demographic characteristics, the higher AH and DM prevalences observed among men have also been reported in the literature[3,15]. It is worth pointing out that the population of this study comprises mostly individuals under 50, and it is known that the prevalences of these conditions are higher among men up to their 40s, and that after this age, with the hormonal changes related to menopause, prevalences among women increase[3,15].

Age, among all variables, was the one which had greater impact on AH and DM, a situation which is consistent with the literature that demonstrates that the risk for AH and DM increases with age[1,8,16].

Working in the steel line of business showed to be a protective factor against AH and DM. The explanation does not seem to be related to the job's physical conditions, since steel activities are more demanding from the physical point of view than metal activities due to greater exposure to risk factors such as heat, noise and load's transportation. A possible explanation for the protective effect of steel activities would be the psychosocial work environment with better conditions as regards interpersonal relationships, compensation, responsibilities, autonomy, job stability and company's policies among other factors. However, the confirmation of this hypothesis requires an analysis which is not within the scope of this study. Likewise, there is no clear explanation for the higher risk of DM observed among workers involved in operational activities, as the current epidemiological knowledge on DM does not point at work-related issues as risk factors. We may, however, consider that issues relating to work conditions and organization have an indirect effect on DM prevalence just as is the case with AH.

Still on the topic of work, the perception of intense stress was associated with arterial hypertension. This finding is consistent with the literature that shows that stress resulting from work conditions and organization may act in conjunction with other risk factors to favor the development of arterial hypertension[17,18].

In the group of lifestyle characteristics, after adjustment for demographic variables and occupational characteristics, sedentary lifestyle and alcohol consumption showed to be risk factors for AH and DM. Sedentary lifestyle is a known risk factor and the practice of physical activity is recommended to prevent and control AH, DM and the metabolic syndrome[1,4,19].

Although multiple variables interfere (such as consumption pattern, clinical characteristics, stress, and others) and the mechanisms through which alcohol induces arterial hypertension have not yet been clarified, the association between alcohol consumption and arterial hypertension has been demonstrated indicating that increased consumption is associated with increased blood pressure, especially in individuals with high consumption of ethanol[20,21,22]. The association between alcohol consumption and DM observed in this study can be explained by the calorie content of alcohol. Because of its high calorie content, excessive alcohol consumption favors weight gain, hyperlipidemia and increase in glycemia, so that excess consumption of alcohol should be avoided by individuals with hypertriglyceridemia, obesity or poor metabolic control[2,23].

An aspect to be considered is that alcohol consumption is part of the Brazilians' cultural habits. Paradoxically, although it is encouraged from a social point of view, it is hidden when it takes place in the work environment or when it becomes abusive, which makes it difficult to measure. Therefore, the low prevalences observed for sporadic consumption, and especially for daily consumption may be underestimated, and this may constitute a problem of greater magnitude than it appears to be.

The most frequent lipidic alterations in diabetic individuals are hypertriglyceridemia, low HDL fraction rates and the formation of small and dense LDL particles, which, because of its atherogenic effect, are one of the major risk factors for cardiovascular disease in diabetic patients[1]. Among the workers of the population of the study, the total cholesterol and the triglycerides were risk factors for DM.

Total cholesterol and triglycerides were also risk factors for AH, and this risk may be understood by considering the weight gain resulting from the dyslipidemias. The association between obesity and arterial hypertension has been demonstrated in a consistent manner[3,19]. Among other mechanisms, the level of leptin in obese individuals has been considered as especially important both due to the activation of the sympathetic nervous system and to the direct effect on the kidneys, thus resulting in the increased absorption of sodium which causes the elevation of the blood pressure[24].

As to DM, after adjustment for the remaining variables, excess weight was the variable with the greater impact on DM. Excess weight – and especially abdominal obesity – is a major risk factor for developing diabetes, since the accumulation of adipose tissue is associated with glucose intolerance and hyperinsulinemia. Small weight loss (5% to 10%) is associated with an improvement in metabolic control and with a decrease in DM-related mortality[25].

In the group of clinical variables, the HDL-c and LDL-c fractions were excluded from the joint analysis because they correlated strongly with total cholesterol.

The prevalences of arterial hypertension, diabetes and dyslipidemias observed in this study, in a population of relatively young workers, justify the fact that these conditions are to be treated relentlessly, as these prevalences are related with morbidity and mortality resulting from cardiovascular diseases. Arterial hypertension is a condition that accounts for a large part of cardiovascular morbidity and mortality in industrialized countries, and it is one of the major risk factors for developing coronary artery disease, cerebrovascular accident, heart failure, kidney failure and peripheral arterial disease[3]. Barroso et al.[26] point out that the risk for cardiovascular diseases in individuals

with Type II diabetes mellitus is considerably increased, and it is estimated that four out of five diabetic individuals will develop cardiovascular diseases, and the risk of death due to this type of disease after a twelve-year follow-up is three times higher as compared with non-diabetic individuals. In addition to this, the same individual frequently has an association of arterial hypertension, diabetes mellitus and dyslipidemias, which characterizes the plurimetabolic syndrome that greatly increases the risk of morbidity and mortality[2,26].

The Ministry of Health and the Brazilian Society of Hypertension, considering a 50.0% possibility of association of the two diseases and the existence of common aspects as to the etiopathogenesis, risk factors, progression and treatment of the two diseases indicate that a joint approach be adopted[4,27]. The Ministry of Health highlights the importance of actions at the basic prevention level (to raise awareness on the part of citizens), and at the primary (removal of risk factors), secondary (early detection and treatment) and tertiary (reduction of complications)[27] levels. The strict control of blood pressure and of the levels of glycemia and lipids can also significantly reduce cardiovascular events, the progression of kidney disease, retinal lesion and peripheral vascular disease[26].

The data resulting from this study evidenced that workers above 40 years of age are a priority as regards interventions to favor the primary and secondary prevention of both conditions. These actions should focus on eating habits and the practice of physical exercise, thus favoring the control of obesity and dyslipidemia. The data have also evidenced the existence of common factors associated with both AH and DM, thus characterizing the occurrence of metabolic syndrome among the workers studied, which translates into increased chances of developing cardiovascular diseases. Additionally, if, on the one hand, older workers present higher prevalences and higher risks, on the other hand, younger workers have a potential to develop these conditions. These characteristics justify the implementation of systematic programs to prevent and control these conditions in the company.

Considering the recommendations for a joint approach, the information obtained and the limited scope of health care services at the workplace, we suggest the following strategies: development of health education actions focusing on a healthy diet, weight control, physical activity and the fight against alcohol addiction; maintaining the preventive approach that drives the PCMSO – Occupational Health Medical Control Program developed by the company; implementation of protocols for the diagnosis and treatment of arterial hypertension and diabetes mellitus in the company's health care facilities; and implementation of special control groups (such as hypertensive, diabetic, dyslipidemic or obese individuals).

In addition to this, although work-related aspects analyzed have not emerged as the factors with the greatest risk for arterial hypertension and diabetes mellitus among the workers studied, work-related issues should not be overlooked, since, in addition to the effects arising directly from work conditions, the way work is organized may be a source of stress and thus influence workers' habits and behavior.

We also have to take into account that, because of the time elapsed as of the collection of data, changes in work conditions may have occurred, which could justify a new assessment of the work environment and organization.

Potencial Conflict of Interest

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

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