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Original

Prevalence of Metabolic Syndrome and Associated Factors in Basic Education Teachers

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ABSTRACT

Objective: To verify the prevalence of metabolic syndrome in basic education teachers and the risk factors associated with this syndrome.
Methods: Observational study with cross-sectional design in 200 public school teachers, with a mean age of 43.2±10.2 years. Waist circumference, triglycerides, high density lipoprotein, blood pressure and diabetes were evaluated for classification of metabolic syndrome. The odds ratio was calculated to determine the effect size between the variables and the significance level adopted was 5%.
Results: The prevalence of metabolic syndrome found was 20%. The most prevalent factors were high waist circumference (49.5%), followed by low high density lipoprotein (35%), high triglycerides (27%), hypertension (24%) and diabetes mellitus (11%). Most reviews (60%) had between one and three risk factors. There was association of metabolic syndrome with age, nutritional status and physical activity level.
Conclusion: Thus, the study showed a high prevalence of metabolic syndrome in the basic education teachers with significant risk factors associated with it.
Keywords: Cardiovascular diseases; Risk factors; Metabolic syndrome; Teachers.

Prevalencia del síndrome metabólico y factores asociados en profesores de la educación básica

RESUMEN

Objetivo: Determinar la prevalencia del síndrome metabólico en profesores de la educación básica, así como los factores de riesgo asociados a este síndrome.
Métodos: Se realizó un estudio observacional y transversal donde fueron evaluados 200 profesores de escuelas públicas, con una edad media 43.2±10.2 años. Para la clasificación del síndrome metabólico, se evaluó: la circunferencia de cintura, los triglicéridos, la lipoproteína de alta densidad, la presión arterial y la diabetes. Se calculó la *odds ratio* para determinar la fuerza de asociación entre las variables y se utilizó para todos los tratamientos de un nivel de significación del 5%.
Resultados: Se encontró una prevalencia de síndrome metabólico de un 20%. Los factores más prevalentes fueron: la circunferencia de cintura aumentada (49.5%); el bajo lipoproteína de alta densidad (35%); los triglicéridos elevados (27%); la hipertensión arterial (24%); y la diabetes (11%). Más de la mitad de los evaluados (60%) presentaron entre uno y tres factores de riesgo. Hubo asociación del síndrome metabólico con la edad, el estado nutricional y nivel de actividad física.
Conclusión: El estudio demostró una alta prevalencia del síndrome metabólico en los profesores de educación básica con factores de riesgo significativamente asociados con este síndrome.
Palabras clave: Enfermedades cardiovasculares; Factores de riesgo; Síndrome metabólico; Profesores.

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Prevalência de síndrome metabólica e fatores associados em professores da educação básica

RESUMO

Objetivo: Verificar a prevalência de síndrome metabólica em professores da educação básica, bem como os fatores de risco associados à presença desta síndrome.
Métodos: Estudo observacional com um delineamento transversal, em 200 professores da rede pública, com média de idade 43.2 ±10.2 anos. Para classificação da síndrome metabólica, foram avaliadas a circunferência de cintura, triglicerídeos, lipoproteína de alta densidade, pressão arterial e diabetes. Calculou-se a razão de chances para determinar a força de associação entre as variáveis, sendo adotado para todos os tratamentos um nível de significância de 5%.
Resultados: A prevalência de síndrome metabólica encontrada foi de 20%. Sendo que, os fatores mais prevalentes foram circunferência de cintura elevada (49.5%), seguido pela lipoproteína de alta densidade baixa (35%), triglicerídeos elevado (27%), hipertensão arterial (24%) e diabetes *mellitus* (11%). A maioria dos avaliados (60%) apresentaram entre 1 e 3 fatores de risco. Houve associação da síndrome metabólica com a idade, estado nutricional e nível de atividade física.
Conclusão: O estudo mostrou uma elevada prevalência de síndrome metabólica nos professores da educação básica, com importantes fatores de risco associados a mesma.
Palavras-chave: Doenças cardiovasculares; Fatores de risco; Síndrome metabólica; Professores.

Introduction

Cardiovascular diseases (CVD) have shown high prevalence in the population, with coronary heart disease as the leading cause of death in the world.[1] Among the most important cardiovascular risk factors (CRF) are hypertension, hypercholesterolemia, obesity and type 2 diabetes (DM2).[2] The elevated waist circumference associated with at least two risk factors, characterizes the presence of metabolic syndrome (MS).[3]

MS is associated with insulin resistance and central deposition of fat. However, other factors may also be involved in the emergence of this syndrome such as genetics, physical inactivity, and sedentary behavior.[4,5]

Regarding the public expenditure resulting from CVD is interesting to observe the economic impact, as it has increased the costs of the health system and Social Security.[6] Some occupations have specific conditions in the workplace, affecting in greatly or less degree the prevalence of CRF, such as truck drivers[7] and mariners.[8]

Unleashing factors of MS in basic education teachers have also been verified[9] and can get worse by factors such as professional devaluation and low wages.[10] In addition, the low economic profile and high stress at work are also predisposing risk factors for CVD.[1] In the specific case of teachers, these variables can be corroborating.[11]

Therefore, it is plausible to speculate that the characteristics of teaching, especially in basic education teachers may be contributing to the development of favorable conditions for the installation of MS. Thus, this study aimed to verify the prevalence of MS in basic education teachers and the risk factors associated with this syndrome.

Methods

Subjects

This was an observational study with a cross-sectional design in the population of basic education teachers in Viçosa-MG, Brazil. Data collection included the period from March to October of 2013, after approval by the ethics committee for human research at Federal University of Viçosa (Of. Ref. No. 070/2012/ CEPH), following the 466/12 Resolution of National Health Council.

The sample size was calculated according to the equation: n = P x Q / $(E/1.96)^2$, where n is the minimum sample size required; P is the prevalence of disease in the population; Q = 100 - P; and E is the margin of sampling error tolerated.[12] Thus, with a P of 15% that was found by using the mean percentage of different CRF in Belo Horizonte's -MG population;[13] with a standard error of 5% within a 95% confidence interval, it was reached the value 196.

The study included eight schools randomly selected among the 10 state and 21 municipal belonging to the city. The divulgation was made together with the principal and teachers in order to clarify the research procedures. All teachers were invited to participate in the study, since meeting the inclusion criteria which consisted of at least three years of teaching practice, not be on medical license, and have no organic and/or metabolic impairment that prevented him from participating in the study. Initially, the study included 215 teachers, but the final sample consisted of 200 (27% of the total population).

Experimental design

The first stage was to collect data within the own school, in a private room, by two evaluators previously trained. At this moment, all doubts were clarified, as well as signing the informed consent. Then, the teachers evaluated filled personal data and questionnaires with smoking habit[14] and economic classification.[15]

The measurement of blood pressure was performed by an aneroid sphygmomanometer Premium® mark (ESFHS501 model, Wenzhou, China), with an accuracy of three mmHg. The measurements were performed after five minutes of rest in the sitting position. One measurement was done, but if the blood pressure found was changed, two more measurements were done to confirm the result.

A portable scale Plenna® (model Acqua SIM09190, Plenna, Brazil) with precision of 100g, was used for measuring the body mass. The height measurement was performed using a portable stadiometer WCS® (Cardiomed, Brazil) with a precision of one mm, with the assessed backwards to the tape without shoes and with arms loose along the body. It was later calculated and classified the body mass index (BMI = body weight (kg) / height$(m)^2$).

Waist and hip circumferences were measured using an inelastic anthropometric tape Sanny Medical® (SN4010 model, Sanny, Brazil), graduated in millimeters. The waist circumference (WC) was measured by placing the tape in the region of lesser curvature between the last rib and the iliac crest; and hip circumference in the most protuberant region of the hip. The waist-hip ratio was performed by dividing waist circumference by hip circumference.

The second part of the data collection was obtaining a venous blood sample, collected between seven and nine in the morning by a qualified professional in the Clinical Analysis Laboratory, after fasting for 12 hours. Fasting glucose (glucose oxidase method), total cholesterol, high density lipoprotein (HDL-C) and triglycerides (enzymatic colorimetric method) were analyzed. The apparatus used for analysis was Cobas Mira Plus (Roche Diagnostics, Montclair, NJ, USA), and kits belonging to Bioclin-Quibasa company. The atherogenic index of plasma was calculated by logarithmic transformation of the ratio between triglycerides and HDL-C.

The third stage corresponded to the record of number of steps through a Digi-Walker® pedometer (CW-700 model, Yamax

Corporation, Tokyo, Japan). The teachers evaluated used the same instrument for six consecutive days, in the midline of the right thigh (positioned in the waistband). All teachers evaluated were instructed to use the device from day to day, as long as possible, removing it only when its use was unfeasible (bathing and aquatic activities), or gratefully impacted on step count (cycling and bike).

The first day of use of the apparatus was excluded, and later it was held an average of five days remaining for classifying the level of physical activity. The cut-off limit of 10000 steps / day was established for classification, to consider the individual as Active.[16]

The parameters proposed by the International Federation Diabetes (IDF)[17] for classification of MS were used. The Framingham risk score was calculated with data from age, total cholesterol, HDL-C, blood pressure, smoking and diabetes mellitus.

Statistical analysis

Data analysis began with the completion of Komolgorov-Smirnov test to verify the assumption of normality of the variables, and only the daily steps values were normally distributed. Later analysis of the data consisted in the descriptive exploration of the variables studied, and calculating the prevalence. The Student t-test was used to compare means between independent groups, and the Mann-Whitney test for nonparametric data. It was used the chi-square test to verify the associations between the dependent variable (MS) and each independent variable. The odds ratio was used to determine the effect size between variables, with a 95% confidence interval (CI). For all treatments it was accepted a 5% significance level. All statistical analyzes were performed using SPSS for Windows, version 20.0 (Chicago, USA).

Results

Two hundred teachers were evaluated, 26 (13%) were male. This distribution was similar to the proportion of basic education teachers in Minas Gerais, which is only 16.7% of man.[18] The mean age was 43.2±10.2 years, with 52% more than 45 years. A total of 187 teachers responded to the economic classification questionnaire,[15] and most of these are framed in class B (68.9%), followed by class A and C with 17.7% and 13.4%, respectively.

Only 7% of the sample reported being smokers, and 26.5% were able to accumulate an average of 10000 steps/day and were classified as Active. The prevalence of MS was found in 20% (95% CI 15-26) of teachers.

The most prevalent risk factor was high waist circumference, followed by low HDL-C (Figure 1). It is noteworthy that among the individuals classified with altered pressure, 64.6% were previously diagnosed as hypertensive and were using medicines.

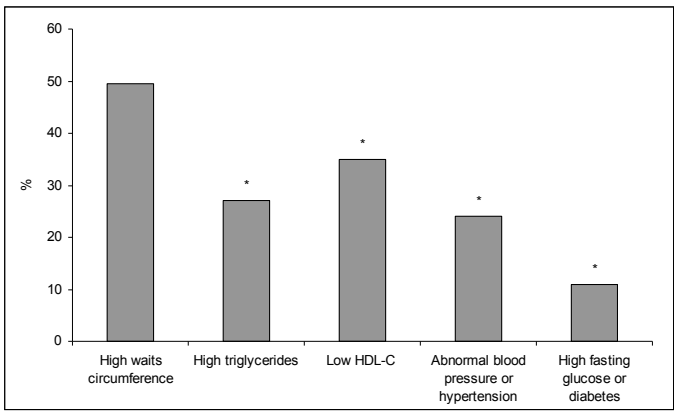

Figure 1. Prevalence of risk factors for metabolic syndrome in basic education teachers.
* p < 0.001 compared to subjects without a risk factor (chi-square test); HDL-C: high-density lipoprotein – Cholesterol.

When the number of risk factors for diagnosis of MS was analyzed, most teachers evaluated (60.5%) had between one and three CRF (Figure 2). Table 1 shows the characteristics of the sample according to the presence of MS.

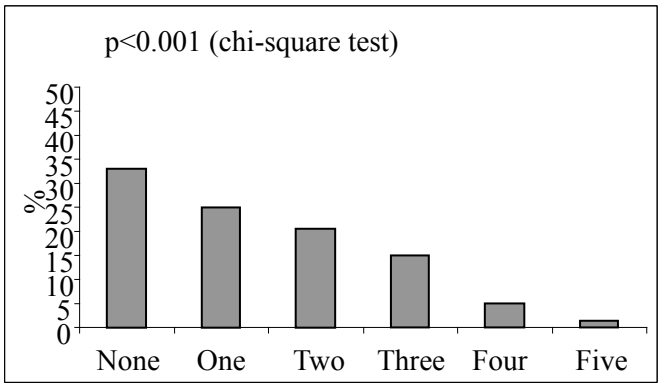

Figure 2. Number of risk factors for metabolic syndrome in basic education teachers.

Table 1. Characteristics of the sample according to the presence of metabolic syndrome.

Variables	No Syndrome (n= 160)	With Syndrome (n= 40)	P-value
Age (years)	44.0 (25.0-63.0)	49.5 (28.0-68.0)	< 0.001*
Body mass index (Kg/m²)	24.9 (17.3-40.6)	30.1 (23.9-40.6)	< 0.001*
Waist circumference (cm)	78.7 (60.0-113.5)	91.5 (81.5-117.0)	< 0.001*
Waist-hip ratio	0.78 (0.63-1.01)	0.87 (0,75-1,07)	< 0.001*
Systolic blood pressure (mmHg)	110.0 (90.0-160.0)	120.0 (100.0-160.0)	< 0.001*
Diastolic blood pressure (mmHg)	70.0 (50.0-105.0)	80.0 (60.0-100.0)	< 0.001*
Glucose (mg/dL)	84.5 (67.0-159.0)	92.5 (72.0-261.0)	< 0.001*
Total cholesterol (mg/dL)	188.5 (127.0-295.0)	205.0 (121.0-259.0)	0.118*
HDL-C (mg/dL)	56.0 (30.0-92.0)	43.5 (22.0-70.0)	< 0.001*
Triglycerides (mg/dL)	94.0 (30.0-283.0)	175.0 (72.0-544.0)	< 0.001*
Atherogenic index	0.2 (-0.3-0.9)	0.6 (0.1-1.2)	< 0.001*
Framingham (%)	2.0 (1.0-25.0)	7.0 (1.0-27.0)	< 0.001*
Steps per day	8256.5 ± 3398.0	6076.8 ± 2368.7	< 0.001†

*Data are presented as median, and minimum and maximum values. Mann-Whitney test; † Data are presented as mean and standard deviation. Student's t-test; HDL-C: high-density lipoprotein.

Table 2 shows the factors associated with the presence of MS. It is possible to see that the nutritional status was strongly associated with the presence of the syndrome, in addition, it is noteworthy that the overweight (BMI ≥ 25 kg/m²) was present in 58% of the evaluated teachers.

Table 2.- Analysis of factors associated with metabolic syndrome in basic education teachers.

Variables	Metabolic Syndrome n (%)	Odds Ratio (IC95%)	P-value
Sex			1.000*
Female	35 (20.1)	1	
Male	5 (19.2)	0.95 (0.33-2.68)	
Age (years)			0.001*
25-44	9 (9.4)	1	
45-68	31 (29.8)	4.11 (1.84-9.18)	
Nutritional Status			< 0.001*
Normal	2 (2.4)	1	
Overweight	38 (32.8)	19.97 (4.66-85.61)	
Smoking			0.740†
No	38 (20.4)	1	
Yes	2 (14.3)	0.65 (0.14-3.02)	
Physical activity level			0.015*
Active	4 (7.5)	1	
Insufficiently active	36 (24.5)	3.97 (1.34-11.77)	

* Pearson's chi-square test with continuity correction; † Fisher's exact test; CI95% - 95% confidence interval.

Discussion

The prevalence of MS was found next to that seen in other studies, in residents in the city of Vitória/ES,[19] which found 29.8%; in the oil industry workers, with 15%;[20] and in a study with mariners,[8] with 17.6%. However, inferior to that found in nursing workers, with 38.1%[21] Thus, there are indications that the evaluated teachers are similar picture to that observed in other population extracts.

The use of different MS diagnostic criteria affect the comparison of results, as in the studies mentioned with residents from

Victoria/ES,[18] oil industry[19] and nursing[21] workers, who used the criteria proposed by the SBC,[22] while with mariners[7] was used the IDF criterion.[17] The difference between the two criteria is because IDF[17] advocates the need for high waist circumference for classifying the syndrome, while the SBC[22] considered only the presence of three risk factors. The cutoff points for the fasting glucose and waist circumference are also different between the two.

In this context, it is interesting to highlight that central obesity was the major risk factor found in the sample, and this factor may contribute to reduce glucose uptake via insulin,[3] causing insulin resistance. This mechanism is due to pro-inflammatory adipokines that are released by adipose tissue such as tumor necrosis factor α and interleukin-6. Besides, the renin-angiotensin system is also activated, leading to hypertension.[3]

Alterations in HDL-C, triglycerides, and blood pressure were other risk factors of high incidence in this study. It is interesting to emphasize measures to control these factors, as high blood pressure levels damage the arteries, which, together with alterations in lipids metabolism, contribute to aggregation in the vascular endothelium.

When the simultaneity of risk factors among teachers was verified, it was observed that almost half of the evaluated group had at least two risk factors for diagnosis of the syndrome, being higher than that found in the mariners.[7] However, the latter included only men, and more than half of the sample were younger than 29 years old. Furthermore, different working characteristics between the two groups may explain the observed difference.

Evaluating the aggregation of risk factors in the individual contributes to the early diagnosis and intervention. A longitudinal study in the United States found that CVD risk is six times greater when four or more risk factors are present.[23]

When analyzed the CRF according to the presence of the MS, it is interesting to observe that only the total cholesterol showed no difference between groups, with all other factors significantly different. Still, the cholesterol may show unreliable results in diabetic individuals or with SM, which tend to have lower HDL-C.

However, the atherogenic index was significantly higher among this group, with an average of 0.6. This index represents the balance between protection and atherogenic lipoproteins, and values above 0.5 have been proposed as the cutoff point for atherogenic risk.[24] Therefore, these results together contribute to emphasize a higher cardiometabolic risk among MS carriers.

Seeking to verify if other factors would be associated with MS, it was found that age, nutritional status and physical activity level were associated. Indeed, aging is established as one of the predisposing to MS and CVD.[1] It is important to highlight that the mean age of teachers addressed in this study was 43.2±10.2 years. This age reflects professional yet fully active, which shows the need for behavioral changes in order to reduce the CRF, favoring the reduction of absences from work and expenses of Social Security.

Overweight was the behavioral risk factor that was more associated with the syndrome. Overweight/obesity is itself a factor associated with fat deposition in central region, which is one of the predisposing to MS.

Another factor associated with the occurrence of MS was the usual level of physical activity, with a lower number of daily steps in this group. It is interesting to that regular physical activity reduces the cardiovascular risk of each component of MS acting as primary prevention.[22]

In a study of individuals with MS who performed moderate walking exercise, three times a week for 50 minutes, there was a change in anthropometric, blood pressure, inflammatory and HDL-C parameters.[25] In this sense, behavioral changes, through regular physical activity, can be encouraged to minimize the occurrence of major cardiometabolic risk factors.[4]

It is important to highlight that this study has some limitations. First of all, it was used a cross-sectional design. However, it was attempted to make the sample calculation and randomization, helping to increase the validity of the study. Another limitation was not using other variables that could influence the MS and CRF, such as diet, alcohol consumption and psychological factors. Finally, using the pedometer to estimate the usual level of physical activity can adversely affect the results only by checking the number of steps, not differing intensity, change in inclination and neither walk with overload.

In conclusion, the prevalence of MS found among basic education teachers was 20%, similar to that observed in other studies. The predominant risk factor among the teachers evaluated was the high waist circumference, reiterating the central obesity on the genesis of the syndrome. The independent risk factors associated with MS found were age, nutritional status and the usual level of physical activity.

It is important to highlight the need for change in the teachers' lifestyle, mainly through regular physical activity, and greater precaution with food quality, early behavioral changes aiming at reducing the main CRF.

Authotship. All the authors have intellectually contributed to the development of the study, assume responsibility for its content and also agree with the definitive version of the article. **Conflict of interest.** All the authors report no conflicts of interest. **Provenance and peer review.** Not commissioned; externally peer reviewed. **Ethical Responsabilities.** *Protection of individuals and animals:* The authors declare that the conducted procedures met the ethical standards of the responsible committee on human experimentation of the World Medical Association and the Declaration of Helsinki . *Confidentiality:* The authors are responsible for following the protocols established by their respective healthcare centers for accessing data from medical records for performing this type of publication in order to conduct research/dissemination for the community. *Privacy:* The authors declare no patient data appear in this article.

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