

# Metabolic syndrome and cardiovascular risk factors among female employees of a private educational institution in the Federal District, Brazil

Perfil de componentes metabólicos e fatores de risco cardiovascular em servidoras de uma instituição particular do Distrito Federal

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**ABSTRACT** | **Background:** Metabolic syndrome (MetS) is independently associated with type 2 diabetes and cardiovascular disease. **Objective:** To establish the frequency of MetS components and cardiovascular risk profile of female employees of a private educational institution in the Federal District, Brazil. **Methods:** Cross-sectional study performed with 120 female workers aged 20 to 59 years old allocated to the administration and outsourced departments. We administered a questionnaire to investigate demographic, socioeconomic and lifestyle characteristics, and performed anthropometric, blood pressure and biochemical measurements. **Results:** The sample comprised 120 participants, the largest proportion were aged 31 to 40 years old (47.5%) and 74 (61.7%) participants reported to be brown skinned. About 73.3% of the participants were rated insufficiently active, 81.7% reported not to smoke and 65% to consume alcohol 3 times/week. About 40% of the sample exhibited increased waist circumference and 43.3% excess weight. About 26.7% of the participants exhibited high blood sugar, 56.7% high triglyceride and 61.7% low HDL levels. About 10.1% of the sample exhibited borderline blood pressure levels. We found association between number of MetS components and age range and physical activity ( $p < 0.05$ ). **Conclusion:** The participants exhibited a large number of MetS components and cardiovascular risk factors, high prevalence of excess weight, sedentary lifestyle and lipid profile abnormalities. Implementing public policies for health promotion, protection and support for workers likely to improve their working and living conditions in the medium and long term is indispensable.

**Keywords** | occupational health; risk factors; metabolic syndrome.

**RESUMO** | **Introdução:** A síndrome metabólica está independentemente associada ao diabetes mellitus tipo 2 e às doenças cardiovasculares. **Objetivo:** Identificar a frequência dos componentes da síndrome metabólica e o perfil de fatores de risco cardiovascular em servidoras de uma instituição particular de ensino do Distrito Federal. **Métodos:** Estudo transversal com 120 mulheres com idade entre 20 e 59 anos, que atuavam no setor administrativo e terceirizado da instituição. Foi aplicado um questionário com dados demográficos, socioeconômicos, antropométricos e estilo de vida. Verificamos também as medidas da pressão arterial sistólica e diastólica e exames bioquímicos. **Resultados:** Participaram do estudo 120 funcionárias, entre 31 e 40 anos (47,5%), e 74 (61,7%) referiram ser da cor parda. Em relação ao estilo de vida, 73,3% foram classificadas como insuficientemente ativas; 81,7% não fumavam e 65% afirmaram ingerir álcool 3 vezes por semana. De acordo com os dados antropométricos, 40% apresentavam circunferência abdominal elevada, e 43,3%, excesso de peso. Sobre os dados bioquímicos, 26,7% estavam com a glicemia elevada; 56,7%, com taxa de triglicérides elevada; 61,7%, com HDL-colesterol baixo. Em relação aos dados pressóricos, 10,1% apresentaram níveis pressóricos limítrofes. Houve associação das variáveis socioeconômicas e de estilo de vida com a quantidade de componentes da síndrome metabólica, a faixa etária e atividade física ( $p < 0,05$ ). **Conclusão:** As participantes apresentaram elevados componentes para síndrome metabólica e fatores de risco cardiovascular. Assim, é imprescindível a implementação de políticas públicas para a promoção, a proteção e o apoio às trabalhadoras, que, em médio e em longo prazo, proporcione melhores condições de trabalho e de vida.

**Palavras-chave** | saúde do trabalhador; fatores de risco; síndrome metabólica.

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## INTRODUCTION

Changes in the dietary and nutritional patterns and demographic, socioeconomic and epidemiologic profile of modern society took place in the past decades, leading to substantial modifications in the situation of chronic diseases, particularly cardiovascular disease (CVD)<sup>1</sup>.

Metabolic syndrome (MetS) is currently the most frequent metabolic disorder. It is considered to be the main cause of cardiovascular events<sup>2</sup> and is associated with considerable increase of cardiovascular mortality<sup>3</sup>. MetS accounts for about 7% of deaths by any cause worldwide and 17% of deaths by CVD<sup>4</sup>, and increases the risk of CVD by 34 and 16% among men and women, respectively. High blood pressure (33%) and low HDL (high-density lipoprotein cholesterol, 25%) are the MetS components most significantly associated with morbidity<sup>5</sup>.

Workers spend most of their time in the workplace. Reduced productivity and increases in costs due to chronic diseases and sick leave have negative impacts on organizations. Obese individuals, for instance, exhibit considerable physical limitations at work and higher rates of hypertension, type 2 diabetes, dyslipidemia and MetS<sup>6</sup>. The working environment might represent a privileged setting to screen for chronic disease and preventive programs, given the close availability of occupational health services<sup>7</sup>.

The current situation of chronic diseases is a cause of concern in Brazil and many other countries, not only as a function of the high morbidity and mortality associated with these conditions, but also and mainly for considerably affecting young adults<sup>8</sup>. Therefore, practical methods for detection of MetS are needed, bearing in mind that this syndrome is silent in its early stages.

Given the aforementioned considerations, the aim of the present study was to establish the frequency of MetS components and the cardiovascular risk profile of adult female employees of a private educational institution in the Federal District, Brazil.

## METHODS

The present cross-sectional study was performed with 120 female employees, aged 20 to 59 years, of a private educational institution in the Federal District selected

by convenience sampling (availability on the date set for data collection) from the population of workers allocated to the administration department and cleaning (n=217). We returned twice to the premises to interview employees who had not been available on the first visit. All the participants signed an informed consent form. The study was approved by the ethics committee of University Center of the Federal District (UDF), CAAE: 55019116.3.0000.5650. Information on the study aims was provided by e-mail.

The participants were interviewed at the corresponding departments during the working hours, their supervisors being aware of their participation. Following personal introductions and explanations about the study aims, the participants received self-report questionnaires. Pregnant employees were not included in the study.

Data collection took place from September 2016 through April 2017. It included a questionnaire to investigate socio-economic and lifestyle (smoking, alcohol consumption, physical activity) characteristics, measurement of MetS components, including waist circumference (WC) and blood pressure (BP), and collection of blood samples for measurement of venous serum sugar, triglycerides (TG) and HDL.

The participants' socioeconomic level was established based on a questionnaire developed by the Brazilian Market Research Association (ABEP). As a function of their purchasing power, the Brazilian population is decreasingly allocated to five economic classes (A1, A2, B1, B2, C1, C2, D and E).

The short version of the International Physical Activity Questionnaire (IPAQ)<sup>9</sup> was used to investigate the participants' level of physical activity. IPAQ eight questions are designed to make respondents describe the time spent in physical activity the previous week. The results are categorized as very active, active, irregularly active A, irregularly active B and sedentary. According to recommendations in vigor, physical activity should be performed at least 5 days or 150 minutes per week. In the present study, we dichotomized IPAQ five categories as "insufficiently active" (irregularly active A, irregularly active B and sedentary) and "active" (very active and active).

Investigation of the lipid profile included measurement of total cholesterol (TC), HDL and TG after 12-hour fasting. LDL (low-density lipoprotein cholesterol) was calculated according to the Friedewald equation<sup>7</sup>:  $TC - (G/5) - HDL$ . TC, TG and blood sugar were measured

by means of an automated enzymatic method, and HDL by means of the direct enzymatic colorimetric method using analyzer ADVIA 1650 (Siemens, Tokyo, Japan). The participants were instructed to avoid vigorous physical activity and drinking alcohol 24 hours before blood sample collection.

BP was measured with a calibrated BD sphygmomanometer, with the participants sitting, the arm placed on a firm surface and after 5–10 minute rest; a second measurement was performed 1–2 minutes later. The average of the two measurements was considered for analysis. WC was measured with 0.5-cm precision flexible tape measure, on the bare abdomen at the midpoint between the lowest rib and the iliac crest, with the participants standing up and breathing normally. Body weight and height were measured using a Filizola anthropometric mechanical scale, with 150 kg of maximum capacity and 100-gram precision, maximum height 2 meters and 0.5-cm precision, respectively; measurements were performed with the participants wearing light clothes and no shoes. Body mass index (BMI) was calculated by dividing the body weight by height squared [BMI=weight (kg)/height<sup>2</sup> (m<sup>2</sup>)]. Based on BMI, the participants were categorized following the World Health Organization classification<sup>10</sup> as with normal weight (18.5–24.9 kg/m<sup>2</sup>), overweight (25–29.9 kg/m<sup>2</sup>) or obesity ( $\geq 30$  kg/m<sup>2</sup>).

MetS components were categorized following the *National Cholesterol Education Program Adult Treatment Panel III* (NCEP-ATP III)<sup>11</sup>, according to which diagnosis of MetS is established when three or more of five risk determinants are present. These determinants were attributed definite cut-off values, as follows: abdominal obesity (WC women >88 cm, men >102 cm); TG ( $\geq 150$  mg/dL); HDL (women <50 mg/dL, men <40 mg/dL); high blood pressure ( $\geq 130/\geq 85$  mmHg); and high fasting glucose ( $\geq 100$  mg/dL).

Laboratory tests were performed after 12-hour fasting at an external laboratory. Blood samples were collected at the institutional nursing department.

The data were entered twice on a spreadsheet, checked for possible inconsistencies and subjected to descriptive analysis to calculate frequencies, means and standard deviations. The  $\chi^2$  and Fisher-Freeman-Halton tests were used to investigate associations among variables. All the analyses were performed with software STATA 12.0. The significance level was set to 5% ( $p < 0.05$ ).

## RESULTS

The sample comprised 120 participants; the largest proportion were aged 31 to 40 years old (47.5%); 74 participants (61.7%) reported to be brown skinned.

Sixty-nine participants (57.5%) were categorized as socioeconomic class C, with average income BRL 2.180,00.

Table 1 describes the sample distribution according to lifestyle. About 71.3% of the participants were categorized as insufficiently active, 81.7% reported not to smoke and 65% to consume alcohol 3 times per week.

According to the anthropometric measurements performed, 40% of the participants exhibited high WC and 43.3% excess weight (overweight/obesity).

About 26.7% of the sample exhibited high blood sugar, 56.7% high TG, 61.7% low HDL and 10.1% borderline BP levels (Table 2).

Table 3 describes the relationship of MetS components with socioeconomic and lifestyle variables. We did not find any association between socioeconomic class and number of risk factors for MetS. However, the number of concomitant risk factors was higher for the participants categorized as with low socioeconomic level (C). Also the participants who reported to consume alcohol exhibited a larger number of concomitant risk factors. Finally, we found statistically significant association between number of concomitant risk factors and age range and physical activity ( $p < 0.05$ ).

**Table 1.** Distribution of female employees of a private educational institution in the Federal District, Brazil, 2017, relative to lifestyle variables (n=120).

Variables	n	%
Physical activity		
Active	32	26.7
Insufficiently active	88	73.3
Smoking		
Yes	22	18.3
No	98	81.7
Alcohol*		
Yes	78	65
No	42	35

\*At least three times/week.

## DISCUSSION

The number of studies on MetS is increasing in the literature as a function of the relationship of this condition with CVD. MetS is associated with higher prevalence of damage in several organs<sup>12</sup>. Cardiovascular risk increases by 30–40% among individuals with MetS depending on the analyzed population, diagnostic criteria and length of follow-up. There are few studies on this highly relevant subject conducted with the Brazilian population<sup>13</sup>.

About 60% of the participants in the present study exhibited at least one risk factor for MetS, 56.6% two risk factors

**Table 2.** Anthropometric data and metabolic syndrome components (NCEP-ATP III, 2001) relative to employees of a private educational institution in the Federal District, Brazil, 2017 (n=120).

Variables	n	%
Waist circumference		
Normal	72	60
High	48	40
Fasting glucose		
Normal	88	73.3
High	32	26.7
Triglycerides		
Normal	52	43.3
High	68	56.7
HDL cholesterol		
Normal	46	38.3
Low	74	61.7
Blood pressure		
Excellent	83	69.1
Normal	25	20.8
Borderline	12	10.1
BMI		
Normal	68	56.7
High	52	43.3

HDL: high-density lipoprotein; BMI: body mass index.

and 40% three. These data indicate high prevalence of MetS components (40%) among the analyzed population.

In a study conducted with 3,601 participants aged 20 to 70 years in the United States<sup>14</sup>, the prevalence of MetS was 34.5% as per the NCEP-ATP III criteria (33.7% for men and 35.4% for women) and 29% according to the criteria formulated by the International Diabetes Federation (IDF) (39.9% for men and 38.1% for women).

A study performed with 2,1912 rural workers in China<sup>15</sup> found that 86% of the sample exhibited four concomitant risk factors (abdominal obesity, abnormal TG, HDL and fasting glucose); this condition was associated with 15–70% higher risk of uncontrolled hypertension. MetS was the strongest independent predictor of uncontrolled and treatable BP (baseline: odds ratio–OR 2.02; 95% confidence interval–CI 1.12–3.09; follow-up: OR 1.60; 95%CI 1.28–1.96).

In a study with health workers in Turkey<sup>16</sup>, the prevalence of MetS according to the NCEP-ATP III criteria was 5.2% for women and 12.7% for men.

The prevalence of MetS as per the NCEP-ATP III criteria was 10.2% among 7,256 employees of a large car factory and a department store in Spain<sup>17</sup>. In a study performed in Germany with chemical industrial workers<sup>18</sup>, MetS was found in 23.5% of the sample. The prevalence of MetS among workers varies considerably in the literature, probably as a function of the characteristics of the analyzed populations and of the criteria applied to define MetS.

In a study performed with employees of a university hospital in Florianopolis, Santa Catarina, Brazil<sup>19</sup>, the prevalence of MetS among workers aged 40 to 49 years old was 67.5%.

Most authors point to the relevance of identifying and quantifying risk factors for CVD. Most of the participants in the present study had a sedentary lifestyle (73.3%), the largest proportion exhibited excess weight (43.3%) and most abnormal results on the biochemical tests—high TG for 68 participants (56.7%) and low HDL for 74 (61.7%), which points to a high prevalence of cardiovascular risk factors in the analyzed population.

According to some authors<sup>20</sup>, WC is the anthropometric measurement most consistently associated with MetS components. Elevated BMI in combination with high serum lipid levels is a risk factor for coronary events and MetS<sup>21</sup>.

Based on the IPAQ results, we found that only 26.7% of the participants were physically active. Also in other studies

conducted in Brazil IPAQ was administered to employees of public universities. The rate of physically active individuals was 50.6% at State University of Bahia<sup>22</sup>. Among administrative employees of Universidade Estadual do Piauí (UESPI), 53.6% were rated moderately and 13.9% very active<sup>23</sup>.

People increasingly tend to work in jobs which require less physical effort and to use modes of transport which do

not demand significant expenditure of energy; these factors together increase the rate of physical inactivity. In addition to contributing to the occurrence of noncommunicable diseases, insufficient physical activity might also increase the odds of osteoporosis, cancer, depression and anxiety, among other health problems. Therefore, workers should receive orientation incentivizing regular physical activity,

**Table 3.** Relationship between metabolic syndrome components and socioeconomic and lifestyle variables relative to employees of a private educational institution in the Federal District, Brazil, 2017 (n=120).

Variables	No risk factor n (%)	1-2 risk factors n (%)	3-5 risk factors n (%)	p-value*
Age range				
30	7 (33.3)	10 (47.6)	4 (19.1)	0.001
31-40	17 (29.8)	25 (43.9)	15 (26.3)	
41-50	9 (21.4)	28 (66.7)	5 (11.9)	
Ethnicity				
White	5 (15.6)	16 (50.1)	11 (34.3)	0.745
Black	2 (14.4)	8 (57.1)	4 (28.5)	
Brown	15 (20.3)	38 (51.4)	21 (28.3)	
Socioeconomic class				
A	2 (25)	4 (50)	2 (25)	0.179
B	7 (29.2)	11 (45.8)	6 (25)	
C	13 (18.8)	46 (66.7)	10 (14.5)	
D	6 (31.5)	9 (47.4)	4 (21.1)	
Physical activity				
Active	10 (31.3)	14 (43.7)	8 (25)	0.184
Insufficiently active	18 (20.4)	42 (47.7)	28 (31.9)	
Alcohol				
Yes	13 (16.7)	38 (48.7)	27 (34.6)	0.886
No	9 (21.5)	15 (35.7)	18 (42.8)	
Smoking				
Yes	5 (22.7)	10 (45.5)	7 (31.8)	
No	12 (12.3)	47 (47.9)	39 (39.8)	

\*p<0.005.

also because physical inactivity increases the risk of premature death by 20–30%<sup>24</sup>.

A study that investigated physical activity in the workplace and during leisure time found that only 45.3% of a representative sample of Dutch workers exhibited high levels, while work contributed with 30% of their total physical activity<sup>25</sup>. The prevalence of workers in the Jequitinhonha Valley, Minas Gerais, Brazil, who reported to perform physical activity 150 minutes/week was 17.1%<sup>26</sup>.

About 43.3% of the sample analyzed in the present study exhibited excess weight, which finding corroborates those of other studies which also reported high prevalence rates<sup>27</sup>. The average prevalence of excess weight among adults in Brazilian state capitals is 52.5%<sup>28</sup>. The prevalence of excess weight was 63.6% among employees of Universidade Federal de Santa Catarina (UFSC), Brazil, and 59.7% among those of a university in Rio de Janeiro, Brazil, 59.7%<sup>28</sup>. However, the prevalence of excess weight found in the present study is lower to that found in Puerto Rico (78.4%)<sup>29</sup> and Kuwait (77.3%)<sup>30</sup>.

The high prevalence of excess weight in the analyzed sample should call the attention of occupational health departments as a function of the significant impact of this condition on the health of workers<sup>5</sup>. Excess weight is associated with cardiovascular and metabolic disorders, among other health problems, and higher mortality<sup>8</sup>.

Due to its cross-sectional design and the fact it was conducted with a particular population of employees with definite characteristics, there are limits to the generalization of the results of the present study to the overall population of workers. In addition, its cross-sectional design did not enable establishing causal relationships between variables.

One further limitation derives from the small number of employees available on the dates set for data collection.

Nevertheless, the results of the present study point to the relevance of programs to improve the quality of life of workers to reduce or prevent risks and health problems. Such programs are useful to improve the health of workers in the medium and long term, and thus they lead to better working and living conditions. Orientation on healthy habits and periodic laboratory tests are relevant for the preservation of health.

## CONCLUSION

The participants exhibited a large number of MetS components and cardiovascular risk factors, as well as high prevalence of excess weight, sedentary lifestyle and lipid profile abnormalities.

Most participants exhibited one or two MetS components, which might represent risk factors for future MetS and CVD. These findings point to the relevance of early diagnosis and follow-up to reduce the risk of occurrence of chronic comorbidities in the analyzed population. They might also serve as grounds for clinical practice and for the planning of health public policy actions aiming at health promotion, protection and support of workers, likely to improve their working and living conditions in the medium and long term.

We also suggest periodic monitoring and educational actions by duly trained multidisciplinary staff in the workplace, focusing on risk factors and aiming at the prevention chronic diseases.

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