ISSN 2380-548X

International Journal of Endocrinology and Metabolic Disorders

Research Article | Volume: 3.3 | Open Access

Association between Metabolic Syndrome and Socioeconomic Status

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Received date: 08 Sep 2017; **Accepted date:** 27 Oct 2017; **Published date:** 31 Oct 2017.

Citation: Vieira RM, Bortoletto MSS, Silva AMR, Gonzáles AD, Cabrera MAS (2017) Association between Metabolic Syndrome and Socioeconomic Status. Int J Endocrinol Metab Disord 3(3): doi http://dx.doi.org/10.16966/2380-548X.142

Abstract

A cross-sectional population-based study conducted in a town in southern Brazil, composed of 1,066 people at the age of 40 or over. The objective of the study is to analyze the relationship between metabolic syndrome and Socio Economic Status (SES) in adults. The results showed that the association of the syndrome with SES is found in females, in which women with lower SES had a higher prevalence of the syndrome ($p<0.001$). In men, although no significance was found, higher SES showed a higher incidence of the syndrome ($p=0.07$). Regarding age it was identified that among the components of the syndrome, pressure levels and diabetes mellitus are more likely to occur after the age of 60 ($p<0.001$). The association between the syndrome and level of education was significant only among women, the ones with lower levels of education showed a higher prevalence of the syndrome ($p<0.001$). In men, the same situation was found ($p=0.55$). It was concluded that the metabolic syndrome is directly associated with gender, educational level, and socioeconomic status of a population.

Keywords: Metabolic syndrome; Socioeconomic status; Educational level

Introduction

Metabolic Syndrome (MS) is a set of associated factors, those being central obesity, alterations in blood pressure, hyperglycemia, HDL cholesterol and triglyceride levels [1]. The diagnosis occurs when an individual has three or more of those factors [2]. This condition increases the risk of developing diabetes, cardiovascular diseases, mortality from general causes and from cardiovascular events [3,4].

The syndrome is a condition of global relevance and many countries are treating it as a public health problem [5,6]. Data indicates that 20% to 25% of the world population has the MS. In European countries, the estimated percentage is 19.8% to 24% and in the United States 20.5% to 26.7% [7]. In Latin American countries, prevalence rates are even higher, ranging from 18.8% in Quito in Ecuador to 43.3% in San Juan in Puerto Rico [8], and numbers are expected to grow due to unhealthy living habits in a great portion of the population [9].

In Brazil, there are no specific epidemiological data for the population and the prevalence of the MS is also unknown. In 2005, the 1st Brazilian Guideline for the Diagnosis and Treatment of Metabolic Syndrome was launched, and the data base used was from the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults-ATP III [10]. However, it is possible to report that a significant increase in the obesity index in the country and a high rate of deaths caused by cardiovascular disease are related to the MS [6].

Some factors that influence the development of the syndrome are gender, genetics, age, ethnicity, life habits and having other diseases [4,10-12]. In addition to those, socioeconomic status has also been explored in studies from different countries showing a strong relationship between family income, level of education and prevalence of the syndrome [9,13,14]. It is understood that educational level can influence on the access to healthy lifestyle information. The socioeconomic level is related to the occupation of individuals and their life habits, which influence their health directly [3,15].

Most studies have reported the relationship between socioeconomic level and the prevalence of MS in European and Asian countries, and in the United States [2,11,15]. It is possible that the same relation found in different territories applies to the Brazilian population. However, the subject has not been much discussed in the country, highlighting the need for greater exploration of the subject, which will contribute to findings of epidemiological data on MS [7].

The objective of the present study is to analyze whether the incidence of the MS is related to the socioeconomic level of a population. Based on other population studies it was found that there is a strong link between the two elements, however, there is not much information relating them to the Brazilian population [3,15-17].

Research Design and Methods

Participants

This population-based study is part of a more comprehensive study entitled "Cardiovascular diseases in the State of Paraná: mortality, risk profile, drug therapy and complications" [18], and developed in Cambé-PR, a town with 96,733 inhabitants, where 96.1% live in urban areas and 36.9% are at the age of 40 or over [19].

The study population consisted of a representative sample of adults at the age of 40 and over, resident in all urban census tracts. The definition of the sample size considered a 50% expected prevalence, a 3% margin of error and a 95% confidence interval. The final sample, stratified by gender and quinquennial age groups, totaled 1,339 individuals at the age of 40 or older, with 25% of possible losses and proportionality guaranteed in each sector. The exclusion criterion was individuals who were unable to answer the interview questions and were not accompanied by a caregiver.

In the first half of 2011, information was collected from interviews, measurements and laboratory tests. The study was approved by the Ethics and Research Committee of the State University of Londrina, and all participants agreed to participate by signing a free and informed consent form prior to the study.

Study variables

Definition of metabolic syndrome: Metabolic syndrome was defined according to the 2009 harmonized criterion [2] which establishes a positive condition for the presence of three or more of the following components: triglycerides ≥ 150 mg/dL or use of drugs for dyslipidemia; systolic blood pressure ≥ 130 mmHg, diastolic blood pressure ≥ 85 mmHg, or the use of antihypertensive drugs; fasting blood glucose test ≥ 100 mg/dL or use of diabetes medications; HDL cholesterol<40 mg/dL (male) or <50 mg/dL (female) or use of medications for dyslipidemia; and abdominal circumference ≥ 102 cm (man) or ≥ 88 cm (woman).

Biochemical quantifications were performed using the biochemical auto analyzer (Dimension® Clinical Chemistry System, Newark, NJ, USA), using Siemens kits. Total cholesterol was quantified through cholesterol oxidase technique. HDL cholesterol was quantified by the method of accelerating the reaction of cholesterol oxidase with non-esterified cholesterol oxidase by selectively dissolving with the use of a specific detergent. Triglycerides were analyzed by means of a bichromatic enzymatic technique, using lipase and glycerol dehydrogenase. All lipid parameters were expressed in mg/dL. Blood glucose analysis was performed using the hexokinase method.

For the measurement of the abdominal perimeter the individual was instructed to stand, with the abdomen relaxed and uncovered, arms loose and feet together. An inelastic tape measure was placed in a horizontal plane at the midpoint between the lower part of the last costal arch and the upper part of the anterosuperior iliac crest. The measurement was made at the end of a normal expiration to the nearest 0.1 cm [20].

Measurement of blood pressure was performed following all steps recommended in the VI Brazilian Guidelines for Hypertension [21]. For this procedure, the Omron HEM-742INT automatic blood pressure monitor was used.

Drug treatment for the components of MS (dyslipidemia, diabetes and hypertension) was considered when the interviewee presented the medications used or the medical prescription.

Independent variables: The other variables considered were the economic classification that evaluates family purchasing power and income [19]. The classification is performed through a questionnaire with points system ranging from 0 to 100, and is organized alphabetically as follows: A: (45-100); B1: (38-44), B2: (29-37), C1: (23-28), C2: (17-22), D and E: (0-16). For the analysis, the categories were grouped as follows: classes A and B high, C1 and C2 average, and D and E low. Educational level was questioned in years of study, which will later be categorized into 4 years or less, from 5 to 8 years and 9 years or more of study. The age was determined based on the date of birth and the time of the interview. Sex was classified as female and male.

Statistical analysis: Statistical analysis was performed using SPSS software version 19.0 (SPSS, Chicago, IL). Descriptive analyzes were performed on the prevalence of MS stratified by sex and age group. The analysis of the categorical variables was verified using the chi-square test. The means and respective standard deviation of the continuous data were analyzed, and the test applied was student's t. In both analyzes, the statistical significance was considered when p value ≤ 0.05.

Results

Initially, the number of individuals interviewed was 1,180 inhabitants in the town of Cambé. For the present study, 221 individuals were excluded due to non-performance of the tests and failure to perform anthropometric measurements, totaling 959 (81.2%) individuals, 426 (44.4%) women and 533 (55.6%) men.

The characteristics of the population are shown in table 1. The average age was 54.51 ± 10.28 (non-tabulated data). It is observed that men are taller, have higher weight and worse markers of triglycerides and diastolic blood pressure (p<0.001). Women presented higher HDL and worse economic classes (p<0.001). In both genders, it was observed that the values of body mass index (BMI) were classified as overweight.

The incidence of MS was significantly higher after the age of 60 in both genders (women=23.8% and men=7.5%). Blood sugar levels, in both genders, were lower among the younger population. Higher diastolic blood pressure (DBP), systolic blood pressure (SBP), and blood sugar in men younger than 60 years of age are observed and abdominal obesity is more incident among the elderly. In women, triglyceride and HDL levels are lower before the age of 60 and increase after this age.

Alterations of the syndrome increase significantly in women older than 60. High blood pressure levels are 71% higher, the WC is 61.8% higher and the HDL is 26.5% higher. In men, alterations in blood pressure levels increased 81% in the elderly, and changes in blood glucose levels increased by 29.4%.

Greater occurrence of the syndrome was observed in the population with lower educational level, as well as in the population with lower socioeconomic status. Regarding the women, the study showed that the ones with higher educational level are less likely to develop the syndrome, presenting a significant difference between educational level<4 years (51.3%) and >8 years (45.9%). In addition, women with the lower SES are more likely to develop MS, according to this study. In men, the highest level of education also has the lowest index of the syndrome, but the SES with the highest index of this diagnosis is level A, that is, the highest.

Discussion

Table 1 showed that in the general population, men are taller and the average weight between the genders is similar, this factor is in agreement with other study populations [3,16,22]. BMI of both genders was classified as overweight, as were other populations analyzed [7,16,23]. These results also follow the pattern of the Brazilian population, in which the majority of men and women are overweight according to BMI results [23].

Table 1: Prevalence of social, physical and biochemical characteristics of the study population by gender.

	Men (n=426)% ± SE	Women (n=533)% ± SE	P value
Age	54.01 ± 9.67	54.90 ± 10.73	0.18
Weight	76.56 ± 14.49	70.10 ± 14.57	<0.001
Height	1.68 ± 0.07	1.56 ± 0.06	<0.001
BMI*	27.07 ± 5.34	28.72 ± 5.56	<0.001
WC*	95.89 ± 11.57	94.22 ± 13.48	0.04
SES*	22.02 ± 5.92	20.68 ± 6.39	<0.001
SBP*	138.02 ± 18.84	134.99 ± 21.48	0.02
DBP*	84.58 ± 11.74	81.33 ± 10.62	<0.001
Triglycerides	174.87 ± 199.52	132.47 ± 82.28	<0.001
HDL-cholesterol	44.85 ± 15.30	49.57 ± 13.10	<0.001
Blood glucose	107.99 ± 30.82	102.60 ± 27.43	0.00

*BMI: Body Mass Index; *WC: Waist Circumference *SES: Socioeconomic Status *SBP: Systolic Blood Pressure *DBP: Diastolic Blood Pressure

There is a difference comparing genders and the components of MS. The incidence of HDL-cholesterol and WC are higher among women, while blood sugar and hypertension are higher in men [3,11,17]. There is evidence that life habits, such as sedentary lifestyle and unhealthy eating habits are directly related to the components of the MS [24]. In addition, higher pressure levels among men could be explained by the presence of the testosterone [25].

Studies have shown some factors that may be associated with higher HDL-cholesterol in women, such as the occurrence of dyslipidemia related to smoking, alcohol consumption, increased body mass and use of hormones [26,27]. As for WC, women experience an increase in abdominal adipose tissue after menopause [28,29], which occurs on average after 40 years [29], and that may explain the difference in WC between genders.

When comparing gender and age, or analyzing continuously or categorized, the association did not lose strength. The findings indicated that the incidence of MS after 60 years old is higher, and the same behavior is found in studies of other populations [6,9,22]. The nutritional status of the elderly can be an explanation, since obesity or malnutrition show a direct influence on the increase of the components of the syndrome [30]. Lack of physical activity was also found as a risk factor for the development of MS, and the level of sedentary lifestyle is high in the elderly population [31,32].

The table 2 showed that blood pressure levels have higher incidence after the age of 60. This result was also found in some other studies [9,33]. According to previous research, the renin-angiotensin-aldosterone system is affected in aging leading to a disfunction in sodium and potassium reabsorption, and causing an increase in BP, a possible justification for higher blood pressure levels after 60 years old [33,34].

Another significant factor showed in the table 2 was diabetes mellitus, which presents an increase in incidence in the age group over 60 years. The same result is found in another population [9]. One possible explanation for this is nutrition, which in some studies has shown to be directly related to the occurrence of DM in the elderly [35], including those who are obese and those who are malnourished. It is also found that people diagnosed with diabetes have a higher prevalence of associated diseases, such as hypertension [36], and that may lead to the diagnosis of MS.

In table 3, the analysis indicated that in a general population, the higher the educational level, the lower the risk of developing the syndrome, as other studies indicate [3,9,30,37]. The socioeconomic level showed that the lower the class, the greater the occurrence of individuals with MS, and the same was found in different study populations [5,9,22]. One of the explanations could be the fact that higher educational levels result in more knowledge about self-care (nutrition, healthy habits and balanced lifestyle) [16,38].

In addition to the educational level, income also has an influence on factors such as grocery shopping, limited access to health care and living in neighborhoods with less access to information about healthy lifestyle [11,31].

Women with higher educational levels were those with the lowest incidence of MS; it is found that higher educational levels improve self-care actions related to healthy habits, leading to a healthier lifestyle [38]. The Socioeconomic Disparities in Metabolic Syndrome Differ by Gender study (11,107 participants, United States) showed that better levels of education of women are directly related to a lower incidence of all the five components of the syndrome.

Observing the NSE data it is possible to identify that women in the high SES are the least likely to have MS and the difference in the prevalence compared to the medium and 3 low SES is quite significant. Several studies have addressed this issue [5,16,19,22], indicating that women with a higher SES are more likely to care for their health. In men, the same

Table 2: Comparison of characteristics and components of MS before and after 60 years stratified by gender.

	<60 years (n=342)	≥ 60 years (n=191)	P value	<60 years (n=278)	≥ 60 years (n=148)	P value
DBP* (mmHg)	144.04 ± 18.56	14.80 ± 24.12	<0.001	135.72 ± 18.46	130.31 ± 18.38	<0.001
SBP* (mmHg)	82.08 ± 11.26	79.33 ± 10.37	<0.001	85.54 ± 11.80	82.13 ± 10.62	<0.001
Blood glucose (mg/dl)	115.08 ± 35.90	106.45 ± 24.41	0.04	105.30 ± 28.26	101.07 ± 28.44	0.00
Triglycerides (mg/dl)	128.59 ± 86.80	142.21 ± 69.00	0.02	185.91 ± 225.55	145.70 ± 97.96	0.37
HDL-cholesterol (mg/dl)	44.97 ± 14.12	50.32 ± 11.93	0.49	44.50±15.74	49.27 ± 13.55	0.25
WC* (centimeters)	97.52 ± 12.45	97.56 ± 11.66	0.00	95.27 ± 11.18	92.89 ± 13.94	<0.001
Components of Metabolic Syndrome (%)						
SM* (%)	51.2	75.0	<0.001	46.3	53.8	0.19
Hypertension (%)	14.5	85.5	<0.001	9.4	90.6	<0.001
Diabetes (%)	41.4	58.6	<0.001	36.8	63.2	0.01
Triglycerides (%)	48.7	51.3	0.02	58.1	41.9	0.44
HDL-cholesterol (%)	36.8	63.2	0.34	56.4	46.0	0.61
WC* (%)	19.1	80.9	<0.001	61.5	38.5	0.00

*SBP: Systolic Blood Pressure; *DBP: Diastolic Blood Pressure; *WC: Waist Circumference; *MS: Metabolic syndrome

Table 3: Comparison between men and women with and without MS related to educational level and socioeconomic status

	Total			WOMEN (%)			MEN (%)		
	Without MS	With MS	P value	Without MS	With MS	P value	Without MS	With MS	P value
Educational Level									
≤ 4 years	31.7	68.3	<0.001	31.7	68.3	<0.001	48.7	51.3	0.55
5-7 years	40.0	60.0	<0.001	40.0	60.0	<0.001	53.6	46.4	0.55
≥ 8 years	42.0	58.0	<0.001	56.6	43.4	<0.001	54.1	45.9	0.55
Socioeconomic Level									
High	50.9	49.1	<0.001	54.3	45.7	<0.001	47.6	52.4	0.07
Medium	43.7	56.3	<0.001	36.6	63.4	<0.001	47.0	53.0	0.07
Low	41.7	58.3	<0.001	30.6	69.4	<0.001	72.7	27.3	0.07

behavior as women related to educational levels is identified. Men with higher education are the ones with the lowest incidence of MS [5,38]. As for SES, the higher the SES the greater are the chances of MS occurrence.

Studies have shown that men with lower SES tend to have manual Jobs, acquiring more demanding physical activity to perform tasks [9,15], therefore they are less likely to present the components of MS [5]. On the other hand, men with higher SES develop more bureaucratic activities and tend to have less healthy living habits, with poor dietary habits and sedentary lifestyle [9,22].

Some weaknesses were found, one of them is the reverse causality of a cross-sectional study because it is not possible to identify in which order the analyzes were found, that is, if the factor that came first would be the cause or the effect of the results presented. Also, the work with laboratory measures, despite the given guidelines, can have variations, as for example in the control of fasting. However, counseling was made as to the time of fasting. This study only includes population over 40 years old, so it is not possible to generalize the results to a population under that age. Nevertheless, the data of the present study revealed significance and generated a good analysis of a Brazilian population.

Conclusion

The results of the study showed that the socioeconomic level is directly related to the incidence of MS. Women with lower SES and men with higher SES are the most affected population. The educational level showed significance in both genders, in the analysis it is possible to observe that the lower the educational level, the higher the MS indexes. Regarding age, the conclusion is that after the age of 60 the risks of developing MS are greater for both men and women.

Control and prevention measures have not yet been sufficient to effectively confront the risk controls. So, this study may contribute to a better understanding of the population behavior related to the incidence of MS in order to enable the development of health actions directed at certain age groups, socioeconomic levels and educational levels. With that, populations at risk can be identified and strategies can be created to reach broader groups, resulting in improved basic health education linked to healthy lifestyles, reducing rates of the syndrome.

Ethical Approval

This project was approved by the Ethical Committee of Search of the State University of Londrina (Comitê de Ética e Pesquisa da Universidade Estadual de Londrina (CNEE)). The ethical principles that guided this research are in the 196/96 resolution, which regulates the researches involving humans.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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