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Prevalence of Some Factors Associated to Metabolic Syndrome at Mexico Hospital

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Abstract

Objective: To determine associated factors to metabolic syndrome in the populations that participated in the Mexico hospital health fair in February 2007. Materials and Methods: A retrospective, descriptive transverse and analytic study of the population interviewed during the Health Fair held from February 19 to 22. A descriptive analysis was done as well as a single-variable and multivariate analysis of the main variables. Results: San Jose Province reported a higher percentage of cases with 40.7%, followed by Heredia with 26.0% and Alajuela with 24.9%. In the case of Lemon, the percentage was 0.4% only. Most of the interviewed ones are Costa Ricans, representing 94.0%. The female predominance was notorious with 72.6%. The single-variable and multivariate analysis presented an association among blood pressure, glucose, besides of the body mass index related to the metabolic syndrome. Conclusion: The blood pressure, the glucose, and the body mass index are to be considered as associated factors to metabolic syndrome.

Keywords

1. Introduction

It is called metabolic syndrome (MS) to the group of metabolic disorders conforming the central distribution obesity, decreasing concentrations of lipoprotein cholesterol united to the high density, elevated levels of triglycerides, increasing blood pressure and the hyperglycemia [1].

The metabolic syndrome is a major public health problem of XXI Century associated with a 5-time increase in the prevalence of type 2 diabetes and 2 - 3 times in cardiovascular disease [1] [2].

Metabolic syndrome is not a new disease; its description took place at least 80 years ago (in the early twenties)

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by Kylin, a Swedish physician, who defined the association among hypertension, hyperglycemia and gout [3]. Marañón, the founder of modern endocrinology in Spain, explicitly stated that "hypertension is a prediabetic state; this concept also applies to obesity and there must be some form of general predisposition to diabetes association (in adults) with hypertension so that diet is essential for prevention and treatment of these disorders" [4]. In 1947, Vague published an article which drew attention to the fact that the phenotype of obesity with excessive accumulation of fat in the upper body (android type obesity or male) was associated with metabolic alterations that were observed in type 2 diabetes and cardiovascular disease [5]. Twenty years later, Avogaro *et al.* documented the simultaneous occurrence of obesity, hyperinsulinemia, hypertriglyceridemia and hypertension [6]. The clinical significance of the metabolic syndrome was highlighted again 20 years later by Reaven [7], who described the existence of a set of metabolic abnormalities, whose central pathophysiological feature was insulin resistance. Reaven called this condition "syndrome X" but, surprisingly, he did not include obesity; however, obesity has been present on the concept of metabolic syndrome in all posterior definitions [8].

Since the first official definition of metabolic syndrome by the Working Group of the World Health Organization (WHO) [8] in August 1999, various definitions have been proposed as alternative. The most accepted ones were elaborated by the European Group for the Study of Insulin Resistance (EGIR) [9] and by the Adult Treatment Panel III (ATP-III) of the National Cholesterol Education Program (NCEP) [10] [11]. In recent years, metabolic syndrome has gained an increasing prominence in the literature and in clinical practice. This syndrome generates a lot of controversy concerning both the definition, to its pathogenesis and, to its clinical utility. The proportion of people who meet diagnostic criteria for metabolic syndrome is high and evolves into a progressive increase in their number. Thus, in the country with the largest number of publications, the United States, the prevalence in large samples such as the NHANES between the years 1988-1994 was around 24.1 percent adjusted to age, among adults 20 or more years and using the ATP-III criteria. These numbers increased significantly in the NHANES 1999-2002, with prevalence among men of 33.7 percent with ATP-III criteria and 39.9 percent with criteria IDF (International Diabetes Federation) and among women by 35.4 and 38.1 percent, respectively [12].

Regarding the prevalence of metabolic syndrome in Spain SIRS (Spanish Insulin Resistance Study) study numbers are 20.8 percent among men and 30.9 percent among women, according to ATP-III criteria [13]. In the study MESYAS [14], 82.4% of the working populations of 7256 workers in a car factory and some large department stores in Valencia-Spain, with an average age of 45.4 ± 8.9 years, were men workers; and the prevalence found was 10.2%.

The modernization of contemporary society has brought an increase in obesity and T2DM, both in developed countries such as those in the process of development [15]. In parallel to the increase in these risk factors, cardiovascular disease mortality (CD), especially coronary ischemic heart disease has increased in Costa Rica in recent decades [16]. Therefore, the aim of the study is to determine the prevalence of factors associated with metabolic syndrome in people interviewed in the health fair held at Mexico Hospital.

2. Materials and Methods

2.1. Population

The sampling scope of the study consisted of interviewed people (from 15 to 83 years old) who attended the health fair at Mexico Hospital during the period from the 19th to 22nd of February 2007.

2.1.1. Inclusion Criteria
People who attended the health fair at Mexico Hospital during the period of time the study was conducted. There was no distinction by age, ethnicity or geographical region.

2.1.2. Exclusion Criteria
People with any medical condition confirmed previously to the study, also incomplete and unverifiable data in the records of the collection forms.

2.2. Sample Size and Sampling Design

A retrospective, transversal, descriptive and analytical study design was implemented. The sample size was obtained using the formula suggested by Rothman (1986) [17]. Accordingly, it required a minimum of 90 patients;

however, it was possible to obtain a total of 285 patients which increased the power of the study.

2.3. Data

2.3.1. Source

The data correspond to the records of those people interviewed in the hospital during the study period.

The information was used in the strictest confidentiality to safeguard the privacy of patients. The interviewed population authorized the gathering and analysis of such data.

2.3.2. Editing and Reduction

Data were reviewed to avoid typing errors or lost data and, at the same time the appropriate format for the variables was established; so that the hypothesis test was permitted by convenient methods; thus, the discrete variables were coded increasingly in regards to risk. The same criterion was applied to continuous variables by turning them into dichotomous or polytomous.

It was classified as a possible factor associated with MS to those patients who met at least 2 criteria of the International Diabetes Federation (FID) [11].

This definition emphasizes the importance of central obesity. To define a person as carrying SM must submit:

• Diameter of abdominal circumference > 94 in men and >80 in women or BMI > 30 and more than 2 of the following criteria;

• Total TG > 150 mg/dL or being on treatment;

• HDL cholesterol < 40 mg/dL in men and <50 in women or being on treatment;

• BP > 130/85 mmHg or being on treatment;

• Blood glucose > 110 mg/dl or a diagnosis of type 2 diabetes.

It was created a database in Epi Info 2005 (CDC, 2005) [18] with the information obtained from the selected population. The data was edited and revised by using descriptive statistics and using tests of normality, tests for trend (biological gradient) and the extreme or implausible data were removed.

2.3.3. Analysis

1) Descriptive statistics

The description of respondents included in this study was carried out by using frequency measurements with their respective confidence intervals for each stratum.

2) Single-variable analysis

A single-variable analysis was performed in an early stage of the study by using tables $2 \times k$, through which it was calculated the magnitude and direction of association between the event factors associated with SM with each independent variable via the odds ratios (Odds Ratio). Additionally the fraction attributable to each variable was calculated.

3) Multivariate analysis

They were included the variables that under the single-variable analysis had value $p \leq 0.25$. It was followed a step by step reverse modeling strategy, based on the p value of the likelihood ratio test [19]. Both analyzes (single-variable and multivariate) were performed using the program EGRET® [20].

3. Results

3.1. Descriptive Analysis

San Jose Province had the highest percentage of participants with 40.7%, followed by 26.0% Heredia and Alajuela with 24.9%, while the province of Limon contributed only 0.4%. Most respondents are Costa Rican with 94.0% also females predominated with 72.6%.

In this table it is also presented the percentages of marital status and age groups with their respective confidence intervals as shown in (**Table 1**).

Table 2 shows the history of Diabetes Mellitus and Hypertension with their percentages, also the percenttages of respondents with blood pressure, body mass index and glucose with their respective confidence intervals.

Table1. Distribution of participants at Mexico Hospital who were included in the study to determine risk factors associated to metabolic syndrome, (Health Fair February 19 to 22, 2007), according to province, nationality, sex, marital status and age.

Variable	Level of variable	Interviewees (285)		
		n	%	IC 95%
Province	San José	116	40.7	34.9 - 46.7
	Heredia	74	26.0	21.0 - 31.5
	Alajuela	71	24.9	20.0 - 30.4
	Cartago	9	3.2	1.5 - 5.9
	Guanacaste	8	2.8	1.2 - 5.5
	Puntarenas	6	2.0	0.6 - 4.0
	Limón	1	0.4	0 - 1.9
Nationality	Costa Rican	268	94.0	90.6 - 96.5
	Nicaraguan	15	5.2	3.0 - 8.6
	Swedish	1	0.4	0 - 1.9
	Venezuelan	1	0.4	0 - 1.9
Sex	Female	207	72.6	67.0 - 77.7
	Male	78	27.4	22.3 - 32.9
Marital status	Married	155	54.4	48.4 - 60.3
	Single	75	26.3	21.3 - 31.8
	Divorced	27	9.5	6.3 - 13.5
	Widow	14	5.0	2.5 - 9.6
	Free Union	11	3.9	1.6 - 8.4
	Separated	3	1.1	0.2 - 3.0
Age	15 - 25	23	8.1	5.2 - 11.9
	26 - 45	98	34.4	28.9 - 40.2
	46 - 65	139	48.8	42.8 - 54.7
	>65	25	8.8	5.8 - 12.7

Table 2. Distribution of participants at Mexico Hospital who were included in the study to determine risk factors associated to metabolic syndrome, (Health Fair February 19 to 22, 2007), According to history of diabetes mellitus, antecedents of blood hypertension and body mass index.

Variable	Level of variable	Interviewees (285)		
		n	%	IC 95%
Antecedents of diabetes mellitus	Yes	175	61.4	55.5 - 67.1
	No	110	38.6	32.9 - 44.5
Antecedents of blood hypertension	Yes	189	66.3	60.5 - 71.8
	No	96	33.7	28.2 - 39.5
Blood pressure	Normal	181	63.5	57.6 - 69.1
	Pathological	104	36.5	30.9 - 42.4
Body mass index	Normal	160	56.1	50.2 - 62.0
	Pathological	125	43.9	38.0 - 49.2
Glycemia	Normal	221	77.5	72.2 - 82.3
	Pathological	64	22.5	17.7 - 27.8

3.2. Single-Variable Analysis

It was determined in the single-variable analysis (**Table 3**) that the antecedents of diabetes mellitus, arterial hypertension is not a factor that significantly influences relating to SM ($p > 0.05$); it also showed that categorized age was indeed associated significantly (based on α value of 0.05) with the SM based on the age group of 46 - 65 years (OR: 8.7, 95% CI 1.9 - 38.5, $p < 0.01$), also in those > 65 years (OR : 15.7, 95% CI 3.0 - 82.5, $p < 0.01$).

Moreover it showed that body mass index (OR: 5.4, 95% CI 3.2 - 9.0, $p < 0.01$), besides blood pressure (OR: 27.5, 95% CI 14.3 - 52.6, $p < 0.01$) and glucose levels (OR: 8.0, 95% CI 4.2 - 15.2, $p < 0.01$) actually can be significantly associated with MS.

The fraction attributable to the factors associated with MS by the abnormal increase in blood pressure was 65%, indicating that the proportion of respondents could be preventing the SM if their blood pressure were normal.

3.3. Multivariate Analysis

This analysis reaffirmed the findings of the single-variable analysis, so that histories of diabetes mellitus, hypertension besides the age of patients are not risk factors for MS.

Moreover it showed that body mass index (OR: 20.3, 95% CI 7.2 - 57.4, $p < 0.01$), plus levels of glucose (OR: 30.0, 95% CI 9.0 - 95.1, $p < 0.01$) and blood pressure (OR: 103.7, 95% CI 33.0 - 325.2, $p < 0.01$) may indeed be associated significantly with the SM respectively (**Table 4**).

Table 3. Single-variable analysis of factors associated to metabolic syndrome, (Health Fair February 19 to 22, 2007).

Variable	Level of variable	OR	Interval reliability 95%	Fraction attributable	*p*
Age	15 - 25 = 0	1.0			
	26 - 45 = 1	4.2	0.9 - 19.1	0.45	0.05
	46 - 65 = 2	8.7	1.9 - 38.5	0.78	<0.01
	>66 = 3	15.7	3.0 - 82.5	0.75	<0.01
Antecedents of diabetes mellitus	No = 0 Yes = 1	1.0 0.9	0.5 - 1.5	0.08	0.37
Antecedents of blood pressure	No = 0 Yes = 1	1.0 0.7	0.4 - 1.2	0.10	0.12
Body mass index	No = 0 Yes = 1	1.0 5.4	3.2 - 9.0	0.44	<0.01
Blood pressure	No = 0 Yes = 1	1.0 27.5	14.3 - 52.6	0.65	<0.01
Glycemia	No = 0 Yes = 1	1.0 8.0	4.2 - 15.2	0.28	<0.01

Table 4. Multivariate analysis of factors associated to metabolic syndrome, studied at Mexico Hospital, (Health Fair 19 to 22 February, 2007).

Variable	OR	Interval of reliability 95%	*p*
Age	1.1	0.6 - 2.0	0.71
BMI	20.3	7.2 - 57.4	<0.01
Glycemia	30.0	9.0 - 95.1	<0.01
Blood pressure	103.7	33.0 - 325.2	<0.01
Antecedents DM	1.1	0.4 - 3.3	0.79
Antecedents BHT	0.7	0.2 - 2.0	0.47

BMI: Body Mass Index; DM: Diabetes Mellitus; BHT: Blood Hyper Tension.

4. Discussion

Understanding the metabolic syndrome is essential to allow the detection of people with high risk of disease. From an epidemiological perspective, metabolic syndrome confirms the relationship between conditions associated with lifestyle (obesity, cholesterol, increased blood pressure, insulin resistance, hyperglycemia, etc.). People with metabolic syndrome have a greater risk which doubles the likelihood of having a heart attack compared with other people without the syndrome [21]. Knowledge of the factors associated with this syndrome can help reduce the number of these events and their side effects, not only for the patient and relatives but for the overall health system. This study determined the prevalence of some factors associated with the syndrome. While not all of the factors associated with MS were analyzed due to lack of certain determinations, the results are revealing in the fact that it could be demonstrated the presence of some of these factors in the population studied. Factors such as obesity (BMI), blood pressure and blood sugar levels have a strong association with MS. Obesity is one of the most important metabolic alterations worldwide which is the cause of major health impacts as well as being the most important nutritional problem in the developed world, because 10% of such population is obese [22]. This condition affects all ages and sexes and is associated with the emergence of a number of diseases that are in the top place in the tables of morbidity and mortality of the population, as are ischemic heart disease, hypertension, diabetes mellitus type 2, brain stroke and some cancers surpassing its incidence relative to subjects with normal weight [23]. Recent studies indicate the role of glucose in blood pressure control. It has been demonstrated that it raises blood pressure in the presence of endothelial dysfunction and that the glucose values above the normal range are associated with increased cardiovascular mortality [24].

5. Conclusions and Recommendation

The changes in healthy lifestyle are recommended for the treatment of MS initial therapy. It is effective, multifactorial and individualized management of various factors that define, reducing the risk of cardiovascular disease. Not enough to deal separately with each component of the syndrome, it is necessary to try to stop their origin: resistance to insulin. It is essential to establish and maintain a healthy lifestyle through proper diet and regular physical exercise to achieve the ideal weight. The findings and conclusions of this investigation as well as others, agree on the importance of early detection of risk factors associated with MS through preventive health programs that are oriented in periodic determinations of blood glucose, blood pressure, obesity, as well as dyslipidemia and microalbuminuria. This study opens to the thoughts of other investigators to continue the research of others factors that can contribute in the metabolic syndrome.

The empowerment of the heath policies in the matter of prevention of metabolic syndrome in the Costa Rica's territory, can be done by the use of different strategies like health fairs, prevention programs and community education.

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