

Research Article

Factors Associated with Metabolic Syndrome in Patients with Mental Disorders in Mexico

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Abstract

Background: Metabolic syndrome (MS) is a public health problem globally and nationally, with a prevalence of up to 26%; associated with mental disorders, the magnitude and chronicity may be increased.

Methods: We carried out a clinical, cross sectional study of a secondary database of patients (n = 216) with mental illness. We used descriptive analysis, bivariate analysis and a logistic regression model with STATA software in order to define factors associated with MS.

Results: The prevalence of MS was 28.7%. Raw odds ratios (OR) indicated a significant association between MS and gender (women), weight (being overweight or obese), a family history of obesity, a sedentary lifestyle, and age (above 35 years old). When adjusted for all other variables, only gender (OR 4, 23), weight (OR 1.07) and age (OR 2.31) remained significantly associated with MS. Notably, none of the mental health-related variables were significantly associated with MS.

Conclusions: Within this population, being female and over 35 years old were the most important risk factors for MS. In future studies, it will be important to determine how variables related to mental health might interact with gender, age, and metabolic and cardiovascular variables, in order to define a risk profile for patients with mental disorders.

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Background

Metabolic Syndrome (MS) is defined by the presence of biochemical, physiological, and anthropometric abnormalities linked to insulin resistance, which increase the risk of diabetes mellitus and/or cardiovascular disease, as well as alterations such as abdominal obesity, glucose intolerance or diabetes mellitus, hypertension and dyslipidemia^[1].

According to the International Diabetes Federation (IDF), abdominal obesity is not currently a prerequisite for MS, but it is important criteria within those five that classify the syndrome.^[1,2] They recommend that the threshold for waist circumference that would define abdominal obesity should be established according to the country and population type, considering factors such as ethnicity. Thus, in the case of Central America and South America, the waist threshold circumference would be equal or larger than 90 cm in men and 80 cm in women^[1,2]. In Mexico, in order to make a clinical diagnosis of MS, the criteria proposed by the IDF have been adopted, (Annex 1)^[1,3]. The prevalence of MS reported by the WHO is from 1.6 to 15%, which increases according to a similar increase in the body mass

index (BMI), and older population^[4]. In Mexico, the estimated prevalence of MS is 26.6%.^[5] By 2025, it is estimated that 11.7 million people will have diabetes mellitus type 2, which is the main factor for incapacity caused by this syndrome in the long term^[6].

The relationship between mental disorders and MS is gradually becoming a major public health problem, due to its magnitude and scope, the health damage mental disorders cause, and the attention they require in both mental and general health sectors^[7]. In 2010, in the world, 54% of the global burden caused by morbidity measured in terms of disability-adjusted life years (DALYs), was attributable to non-communicable diseases, out of which 7.4% was attributed to mental disorders^[8]. This is to say, mental disorders contribute to 14% of the global disease burden worldwide, and they are the main contributors to premature morbidity and mortality^[9]. Epidemiological studies estimate a prevalence of mental disorders in adults through their lifetime between 12.2% and 48.6%^[10].

In Mexico, the National Survey of Psychiatric Illnesses in 2003 reported that 28.6% of the Mexican population suffered

from a mental disorder at some point in their lives^[11].

Clinical studies indicate a high prevalence of MS in people with serious mental disorders such as schizophrenia and bipolar disorder^[12,13]. These mental conditions increase the risk for cardiovascular disease and death^[14] it has been determined that this association reaches up to 60% in excess of mortality. In a 6-month screening of patients with psychotic disorders, the incidence of MS was 26.3%^[15]. Unhealthy lifestyle habits, such as sedentariness and smoking, double or triple the relative risk of obesity, dyslipidemia, hypertension, diabetes and MS^[16]. Such risk increases when they are under treatment with antipsychotic medication, due to a decrease in insulin sensitivity, increase in serum glucose and lipids, in a manner completely independent of body weight^[17,18]. The association of MS and antipsychotic medication has been reported with prevalence of 25%,^[19] which increases in patients with psychotic disorders and, as the evolution of the psychosis becomes extended in duration,^[20,21] antipsychotic treatment becomes a more important factor, since these medications give way to an increase in body weight^[22,23].

In a population with severe mental disorders, according to criteria by IDF, 58% presented the diagnostic criteria of MS, and 20% presented a 20% higher risk of cardiovascular diseases within the next 10 years^[24]. Lifestyle and certain treatments increased such risk^[25]. Moreover, schizophrenic patients have up to 30% of relatives with a diagnosis of diabetes mellitus, hypertension or other kinds of chronic diseases^[26,27]. MS prevalence of 21.2% was reported in a study of patients with obsessive-compulsive disorder, also associated with an antipsychotic treatment^[28]. In this sense, a group of experts point out the need to acknowledge factors which increase morbidity and mortality in patients with mental disorders who initiate antipsychotic treatment, paying special attention to personal and family antecedents of cardiovascular and metabolic risks^[29,30].

The purpose of the present study was to determine risk factors associated with MS in a population of patients with mental disorders.

Methods

The present study was of a transverse design, with the analysis of a secondary data base. The study sample comprised patients who were rushed to the emergency wing of the Psychiatric Hospital "Fray Bernardino Alvarez" during January to June 2008.

Sample size formula

Using the formula of the sample size for a proportion:
 Where: Z^2 1- $\alpha/2$ =Confidence level, type 1 error (alpha)

$$n = \frac{Z^2 1 - \frac{\alpha}{2} pq}{d^2}$$

p = Percentage of the characteristic of interest

q = 1-p (probability of finding the characteristic)

d²=level precision

Estimated power of the sample: 0.85 (adequate value) when a

50% proportion in the population is expected (p=0.5000).

Patients older than 18 years of age who signed the informed consent were included in the present study. Patients reporting that they had been diagnosed with any metabolic or cardiovascular disease, or those that did not sign the informed consent, were not included.

The psychiatric diagnosis was made according to criteria by International Classification of Diseases (ICD) 10th Revision. Due to the large number of diagnostic entities, and having a clear clinical investigative purpose, diagnosis was grouped based on primary pathology or base, such as: group 1: psychotic disorders (schizophrenia, schizoaffective disorder, delirious ideas disorder); group 2: disorders associated with an abuse of psychoactive drugs; group 3: personality disorders; and group 4: affective disorders.

For the statistical analysis, the presence or absence of a diagnosis within each of these 4 diagnostic groups was considered. The diagnostic groups were mutually exclusive. The following biological variables were determined: blood pressure, body mass index (weight/height), abdominal circumference; all measurements were made with calibrated instruments. The quantification of triglycerides, HDL-C and glucose was conducted through an enzymatic, colorimetric and homogeneous method in a Roche/Hitachi automatic analyzer; the clinical lab where this quantification was made is certified ISO 9000-2008. The association between independent variables was determined: sex, age, weight, BMI, time of mental disease, time in treatment with any psychotropic medication, diagnosis, sedentariness, smoking, and family antecedents with metabolic and cardiovascular risks. Diagnosis of metabolic syndrome was a dichotomous variable, with a value of 1 indicating its presence, and 0 its absence.

With respect to diagnostic criteria of MS, we followed the diagnostic proposal by IDF, adapted and modified for the Mexican population. The presence of MS was integrated for abdominal obesity: abdominal circumference of 90 cm in men and 80 cm in women; and two of the following criteria: triglycerides, 50mg/Dl; HDL-C 40mg/Dl in men and 50mg/Dl in women; fasting glucose levels higher or equal to 100mg/Dl, and blood pressure higher than 130 mmHg systolic and/or 85 mmHg diastolic.

Statistical analysis

The statistical analysis comprised inferential or descriptive statistics, bivariate (t-test) and a model of logistic regression, using the statistical software STATA. In order to determine the occurrence probability of the study event, the odds ratios were measured (odds ratio of prevalence due to being a transversal design).

Results

The study population comprised 216 patients, having an average age of 34 (range: 18 – 72, standard deviation or variation of 12.96%).

Table 1. Characteristics of the study population

Characteristics of the sample (N=216 patients)	Mean	
Sex	Male 90 (42%)	Female 126 (58%)
Age	34 years, range (18 - 72)	
Plasma levels of:		
HDL-C	Male 43.8 mg/Dl SD 10.51 Range (23 - 79)	Female 46.1 mg/Dl SD 13.78 Range (23- 94)
Triglycerides	144.81 mg/Dl SD 87.33 Range (35 - 671)	
Cholesterol	167.15 mg/Dl SD 38.61 Range (96 - 296)	
Glucose	92.68 mg/Dl SD 15.46 Range(58 - 164)	
Abdominal circumference	Male 89.6 cm SD 13.08 Range (56 - 129)	Female 89 cm SD 16.26 Range (45 - 126)
Systolic/Diastolic blood pressure	113/75 mmHg SD Systolic 11.44 SD Diastolic 8.01 Range Systolic(90 - 160) Diastolic (60 - 100)	
The average duration of mental disorder	9.4 years SD 8.19 Range (1- 48)	
The average treatment duration	4.6 years SD 5.85 Range (1- 40)	
Medication continuously within the six months prior to the inclusion in the study:		
Antipsychotic	26%	
Antidepressant	26%	
Anticonvulsant	20%	
Benzodiazepines	19 %	
Diagnosis (according to primary pathology):		
Psychotic disorders	44%	
Disorders associated with abuse of psychoactive substances	6%	
Personality disorders	32%	
Affective disorders	18%	
Sedentariness	75%	
Smoking habits	42%	
Family Antecedents:		
Diabetic	Mother 17%, Father 12%, Fraternal 3%	
Hypertension	Mother 18%, Father 7%, Fraternal 1%	
Hypertriglyceridemia and HDL-C alteration	Mother 5%	
Obesity	Mother 16%, Father 10%, Fraternal 5%	

(Table 1) shows a descriptive analysis of the patient population. We found that 28.70% (n = 62) presented the diagnostic criteria for MS. Notably, 71% (n = 44) of the patients with MS were women. Psychotic and affective disorders were the most frequent diagnoses in patients with MS (48.38% and 20.96% of subjects with MS, respectively), but these frequencies were only slightly greater than those observed in patients without MS (42.2% and 16.23%, respectively), (Table 2).

With respect to the prevalence of each of the individual MS criteria, we found that 63% of the total patient population presented with an abdominal circumference greater than the established level, 55% presented alterations in HDL-C, 32% presented elevated plasma triglycerides, 23% with alterations in plasma glucose, and 9% with hypertension. When grouped

according to the number of MS criteria that were present, it is notable that the majority of patients presented at least one component for metabolic syndrome, while only 15.28% did not present any of the criteria. (Table 3).

Table 2. Characteristics of the study population with and without MS

Variable	With Metabolic Syndrome: 28.70% (n=62)	Without Metabolic Syndrome: 71.30% (n=154)
Sex	Men 29.03% (n=18) Women 70.96% (n=44)	Men 46.75% (n=72) Women 53.25% (n=82)
Age	39 years SD 12.31 Range (18 - 72)	33 years SD 12.61 Range (18-72)
The average duration of mental disorder	9.5 Years SD 6.62 Range (7.82-11.18)	9.3 years SD 8.76 Range (7.93-10.72)
The average treatment duration	4.3 years SD 4.64 Range (3.16- 5. 52)	4.7 years SD 6.28 Range (3.71-5.72)
Antipsychotic	27.41%	25.97%
Antidepressant	27.41%	25.32%
Anticonvulsant	17.74%	20.77%
Benzodiazepines	19.35%	18.83 %
Psychotic disorders	48.38%	42.20%
Disorders associated with abuse of psychoactive substances	3.22%	7.14%
Personality disorders	27.41%	34.41%
Affective disorders	20.96%	16.23%
Sedentariness	85.48%	71.42%
Smoking habits	40.32%	42.20%
Family Antecedents: Diabetic	Denied---50.08% Present---41.93	Denied---72.07% Present---27.92
Family Antecedents: Hypertension	Denied---66.12% Present---33.87%	Denied---76.62% Present---23.37%
Family Antecedents: Hypertriglyceridemia	Denied---93.54% Present---6.45%	Denied---96.10% Present---3.89%
Family Antecedents: HDL-C alteration	Denied---95.16% Present---4.83%	Denied---96.75% Present---5.19%
Family Antecedents: Obesity	Denied---56.45% Present---43.54%	Denied---73.37% Present---26.62%

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Table 3: Criteria for Metabolic Syndrome in our study population.

CRITERIA	FREQUENCY	PERCENT	AGGREGATE
0	33	15.28	15.28
1	59	27.31	42.59
2	62	28.70	71.30
3	40	18.52	89.81
4	19	8.80	98.61
5	3	1.39	100.00
TOTAL	216	100.00	

Frequency and percent of patients that Presented 0 to 5 of the diagnostic criteria for MS

Using the T-test, we confirmed that the diagnostic variables of MS differed significantly between patients that fulfilled the diagnostic criteria for MS and those that did not (Table 4). Although they do not comprise part of the MS diagnostic criteria, the variables of weight and BMI are included in (Table 4) due to their clinical relevance.

Table 4: Metabolic Syndrome Variables, within the group with (1) or without (0) MS

	Group	N	Average	Standard deviation	P value
Systolic	0	154	111.23	10.31	
	1	62	115.96	13.36	
		216	112.59	11.44	
		Difference	-4.73		0.0005
Diastolic	0	154	73.44	7.26	
	1	62	78.38	8.72	
		216	74.86	8.01	
		Difference	-4.94		0.0000
HDL	0	154	45.60 Women 49.72 Men	12.36	
	1	62	40.62 Women 34.63 Men	9.14 7.19	0.0000
		216	45.17	12.55	
		Difference	9.47		0.0000
Tri-glycerides	0	154	117.30	61.03	
	1	62	213.16	104.32	
		216	144.81	87.33	
		Difference	-95.85		0.0000
Abdominal circumference	0	154	83.5 Women 84.5 Men	10.26 14.72	
	1	62	100.7 Women 103.3 Men	10.02 12.36	
		216	89.26	14.99	
		Difference	-14.53		0.0000
Glucose	0	154	89.17	13.13	
	1	62	101.41	17.37	
		216	92.68	15.46	
		Difference	-12.24		0.0000
Weight	0	154	66.15 Women 59.74 Men	10.78 12.51	
	1	62	78.99 Women 74.78 Men	12.73 11.72	
		216	66.40	13.98	
		Difference	-9.62		0.0000
BMI	0	154	23.40 Women 24.33 Men	3.28 4.28	
	1	62	27.69 Women 30.00 Men	3.13 4.59	
		216	25.36	4.53	
		Difference	-3.90		0.0000

The average in the variables that make up the Metabolic Syndrome was determined, in the groups with or without Metabolic Syndrome. The variables weight and BMI were also included. Even though they do not take part in the syndrome criteria, they do have a great clinical and epidemiological significance. The statistical test was applied and it was determined that this difference in averages is statistically important: p value < 0.0001

In order to determine the probability of occurrence of MS, given the specific characteristics of the studied variables, the raw odds ratios (OR) were determined, for each independent variable and its relationship with the dependent variable MS. Then, the OR was adjusted taking into consideration all other variables included in the model, (Table 5).

Table 5: Multiple Logistic Regression Model

Variables	Odds Ratio	95% IC	P value	Odds Ratio (Adjusted)	95% IC	P Value
Sex	2.14	1.13; 4.08	0.01	4.23	1.85; 9.69	0
Weight	1.05	1.03; 1.07	0	1.07	1.04; 1.10	0
Treatment with anti-psychotics	1.07	0.55; 2.09	0.82	1.04	0.40; 2.68	0.93
Treatment with antidepressants	1.11	0.57; 2.17	0.75	1.23	0.49; 3.06	0.66
Treatment with Anti-convulsants	0.82	0.38; 1.76	0.61	0.71	0.26; 1.95	0.5
Treatment with Benzodiazepine	1.03	0.49; 2.19	0.92	0.63	0.24; 1.70	0.36
Psychiatric diagnosis 1	1.28	0.70; 2.32	0.4	1.44	0.43; 1.87	0.7
Psychiatric diagnosis 3	0.71	0.37; 1.38	0.32	0.73	0.10; 5.23	0.75
Psychiatric diagnosis 4	1.36	0.64; 2.89	0.4	0.59	0.07; 4.57	0.61
Diabetes family history	1.35	0.96; 1.89	0.08	1.08	0.68; 1.72	0.74
Hypertension family history	1.27	0.85; 1.93	0.24	1.24	0.75; 2.04	0.4
HDL alteration family history	0.93	0.24; 3.61	0.91	0.22	0.01; 4.18	0.31
Hypertriglyceridemia family history	1.7	0.46; 6.24	0.42	5	0.35; 72.01	0.23
Obesity family history	1.47	1.06; 2.02	0.01	1.14	0.70; 1.83	0.6
Sedentary lifestyle	2.35	1.07; 5.18	0.03	1.18	0.47; 2.97	0.72
Smoking	0.93	0.51; 1.68	0.79	0.79	0.38; 1.64	0.53
Time of treatment > 1 year	0.75	0.38; 1.47	0.4	1.05	0.40; 2.77	0.91
Time of treatment > 5 years	1.46	0.80; 2.79	0.22	0.78	0.29; 2.14	0.63
Sickness evolution time > 1 year	0.75	0.38; 1.47	0.4	0.92	0.24; 3.59	0.9
Sickness evolution time > 5 years	1.46	0.80; 2.70	0.22	1.64	0.45; 6.05	0.45
Age older than 30	2.06	1.12; 3.78	0.01	2.31	1.02; 5.20	0.04
Age older than 45	1.03	0.49; 2.18	0.92	1.19	0.43; 3.24	0.73

The occurrence probability of the Metabolic Syndrome was determined if the characteristics contained in the study variables are present. P value < 0.005

Considering the raw odds ratios, the factors of sex, weight, family history of obesity, sedentary lifestyle, and age were significantly related to MS. Thus, an MS diagnosis was more prevalent in women (OR, 2.14), and was associated with sedentariness (OR, 2.35) or being older than 30 (OR, 2.06). MS was moderately or weakly associated with obesity (OR, 1.05) and familial antecedents of obesity (OR, 1.47). All of these associations were statistically significant ($p < 0.05$). When adjusted odds ratios were calculated, 3 of these variables remained significantly associated with MS: sex (OR, 4.23, women at greater risk than men), age older than 30 (OR, 2.31), and obesity remained weakly, but significantly, associated with MS (OR, 1.07).

Other relevant variables that demonstrated weak to moderate raw ORs (although they failed to reach statistical significance) were: having a family history of diabetes (OR 1.35) or family histories of obesity (OR 1.47), hypertriglyceridemia (OR 1.70) or hypertension (OR 1.27), having a duration of mental disease greater than 5 years (OR 1.46), or a duration of treatment greater than 5 years (OR 1.46). The raw ORs corresponding to each of the 4 psychiatric diagnoses were likewise weak and non-significant. Interestingly, the OR associated with antipsychotic treatment was low (1.07) and non-significant, as were the ORs for duration of treatment (0.75 and 1.46) and duration of mental illness (0.75, 1.46).

The variables included in the model explain almost 20% of the presence of MS in this population.

Discussion

Using the MS classification proposed by IDF, in the present study, a MS prevalence of 28.7% was found, which was slightly higher than those reported worldwide (1.6 -15%) and nationally in the general population (26.6%),^[4,5] and which was also higher than that found in the primary study that used the classification from NCEP ATP III (14%)^[31]. In the present study, the prevalence of MS was significantly higher in women; in fact, sex was the most important variable associated with MS. Having an age older than 30 (but not older than 45) was also significantly associated with MS in the present study. By contrast, in one study of subjects suffering from mental disorders, the prevalence of MS was higher in men, and the risk of MS was found to increase with age^[32].

The inherent chronicity of mental disorders, which requires lengthy pharmacological treatments that can promote weight gain or obesity, could be an important predisposing factor for developing cardiovascular and metabolic problems as well as chronic morbidity and mortality due to diseases such as Diabetes Mellitus type 2, which is the principal cause of death in Mexico, and which is showing a current trend to increase in women^[33]. In the present study, psychotic disorders was the main psychiatric diagnosis within the MS group; this has special interest because it is the mental disorder with the largest social and clinical impact, the greatest costs related to its treatment, and its level of chronic disability^[34]. However, in the present sample, neither the duration of mental illness, nor the specific psychiatric diagnosis or type of medication used, emerged as significant

factors associated with the MS diagnosis.

In addition to factors related to mental health, other factors, such as the presence of obesity in the individual's mother and a sedentary lifestyle, have been described in the literature as conferring greater risk for MS^[35]. Likewise, a family history of obesity and sedentariness were associated with MS in the present sample of mental health patients, although these factors were not significant when adjusted for all other factors.

In our study population, a significant proportion of patients presented with risk factors for cardiovascular or metabolic disease, especially dyslipidemia and weight gain, while not necessarily meeting the MS diagnostic criteria. This presence of these constant metabolic elements should be monitored carefully, as they confer greater risk for disease due to the fact that they have important clinical repercussions over time and when combined with certain lifestyles, such as sedentariness.

Our female population is of special interest with respect to MS risk, especially those who are older than 30 and overweight or obese, with a sedentary lifestyle and with significant maternal genetic antecedents for obesity. It is therefore important to establish a model of prevention focused on biological, genetic, environmental and social factors, aimed at making an impact on the nutritional and physical shape or state of the population, and, most importantly, on specific populations that may be at greater risk, such as women suffering from a mental disorder, emphasizing that the predisposition to the conjunction of cardiovascular and metabolic risk factors that comprise MS involves a group of biological factors and modifiable lifestyle characteristics, in addition to factors related to the chronicity of mental disorders and the specific pharmacotherapies used to treat them. Thus, it will be necessary to carry out further longitudinal studies in order to determine more precisely which metabolic and cardiovascular risk factors for MS are most relevant in the subpopulation of persons that suffer from mental disorders.

Conclusion

In the present study, a MS prevalence of 28.7% was found, which was slightly higher than those reported worldwide, significantly higher women suffering from a mental disorder, in fact, sex was the most important variable associated with MS. Having an age older than 30 was also significantly associated.

According to this study, the female population is of special interest with respect to MS risk, those who are older than 30 and overweight or obese, with a sedentary lifestyle and with significant maternal genetic antecedents for obesity, regardless of mental disorder.

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