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Original / *Síndrome metabólico*

Metabolic syndrome and nutrition in a Granada's tropical coast population

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Abstract

Background: The metabolic syndrome (MS) is described as an association of health problems that a given person may simultaneously or successively develop, and it is considered a serious condition because it is related to a significantly increased risk of suffering diabetes, coronary disease and brain damage. Nutrition, along with other factors such as physical activity and genetic inheritance, has an influence on preventing MS.

Objective: The aim of this research is to demonstrate important aspects concerning the diagnosis, the prevalence, and the prevention of metabolic syndrome among the population of the tropical coast of Granada.

Methods: 119 individuals from the tropical coast of Granada were studied to collect personal data such as their body mass index, body fat percentage, glycaemia, total cholesterol, HDL cholesterol, LDL cholesterol, and food intake (through nutritional survey). **Results:** As a result of this research, a metabolic syndrome prevalence of 20,2% was obtained, 58,3% of which was related to women. The results obtained show significant statistical differences between individuals having metabolic syndrome and the control group. Particularly, these differences can be noted in parameters such as the BMI or the % of body fat. Nevertheless, there are no significant differences between the two groups concerning parameters related to nutrition such as % of fat, carbohydrates, proteins and kcal/day.

Conclusion: As a conclusion from the research, we can state that the metabolic syndrome prevalence among the population of the tropical coast of Granada is similar to the figure obtained for the population in the US and in other areas of Spain. In addition, this research shows that metabolic syndrome is more frequent among individuals whose BMI and % of body fat is higher than 30.

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Key words: *Metabolic syndrome. Diet. Obesity. Body Mass Index.*

SÍNDROME METABÓLICO Y NUTRICIÓN EN UNA POBLACIÓN DE LA COSTA TROPICAL DE GRANADA

Resumen

Antecedentes: El síndrome metabólico (SM) es una asociación de problemas de salud que pueden aparecer de forma simultánea o secuencial en un mismo individuo, y es importante porque se relaciona con un incremento significativo de riesgo de diabetes, enfermedad coronaria y enfermedad cerebrovascular. La nutrición junto a otros factores como es el ejercicio físico y la genética del individuo, influyen en la prevención del SM.

Objetivo: Conocer aspectos importantes como el diagnóstico, prevalencia y prevención del síndrome metabólico en población de la Costa Tropical Granadina.

Métodos: Se estudiaron en 119 individuos de la Costa Granadina parámetros como el índice de masa corporal, el porcentaje de grasa corporal, análisis clínicos de glucosa, colesterol total, colesterol HDL, colesterol LDL y estudiaron valores nutricionales mediante encuesta.

Resultados: En el estudio se obtuvo una prevalencia el Síndrome metabólico del 20,2%, del que el 58,3% correspondía a mujeres. Los resultados obtenidos reflejan diferencias estadísticas significativas entre los individuos con síndrome metabólico y el grupo control, observándose dichas diferencias en parámetros tales como IMC o el porcentaje de grasa corporal. Sin embargo en parámetros como porcentaje de lípidos, porcentaje de hidratos de carbono, porcentaje de proteínas y kcal/día no hay diferencias significativas entre los individuos con SM y los individuos control.

Conclusión: De esta manera podemos deducir del estudio que la prevalencia de síndrome metabólico en la población de la Costa Tropical Granadina se asemeja a la obtenida en EE.UU y a la obtenida en algunas zonas estudiadas en España. Igualmente, se puede apreciar en este estudio como el síndrome metabólico es más frecuente en personas con IMC y % de grasa corporal superior a 30.

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Palabras clave: *Síndrome metabólico. Dieta. Obesidad. Índice de masa corporal.*

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Abbreviations

SM: Metabolic Syndrome.

BMI: Body Mass Index.

WHO: World Health Organization.

HTN: High Blood Pressure or Hypertension.

ATP III: Adult Treatment Panel III.

HDL: High Density Lipoprotein.

LDL: Low Density Lipoprotein.

MESYAS: Metabolic Syndrome In Active Subjects.

GOD-POD METHOD : Enzymatic colourimetric test Glucose Oxidase, Peroxidase.

CHOD-PAP METHOD: Test Chol. Esterase, chol. Oxidase, Peroxidase.

Introduction

The Metabolic Syndrome (MS) was called X Syndrome by Reaven,¹ and although several authors had been warning about the cardiovascular risk of suffering dyslipidemia, obesity, arterial hypertension (HTN) and glucose intolerance, it was Reaven's group the one that confirmed the association of these metabolic alterations with insulin resistance, even in apparently healthy and thin individuals.^{2,3}

There are several sets of defining criteria for MS: in 1988 the World Health Organization⁴ considers that metabolic syndrome can be diagnosed when the glycemia level in fasting conditions is 110 mg/dL and when the glycemia level after two hours of drinking a glucose solution is 140 mg/dL, or when there is a diagnosed insulin resistance, along with, at least, two of the following: Dyslipidemia (Triglycerides > 150 mg/dL and cholesterol HDL > 35 or 39 mg/dL in men and women respectively); HTN (\geq 140-90 mmHg); Obesity (waist/hip index > 0,9-0,8 in men and women respectively and body mass index (BMI) > 30 kg/m²); Microalbuminuria (short-time urine collection of 20 mg/min).

Currently, the Adult Treatment Panel III (ATP III 2001)⁵ diagnostic criteria are considered the most useful and the most commonly used to diagnose Metabolic Syndrome. It requires the existence of at least three of the following: Waist Circumference (> 102 cm for male and > 88 cm for female); Triglycerides \geq 150 mg/dL; HDL cholesterol < 40 mg/dL (male) and < 50 mg/dL (female); Blood pressure \geq 130-85 mmHg; Fasting plasma glucose \geq 110 mg/dL.

The MS and its components are related to a high risk of developing cardiovascular disease; obesity and sedentariness are underlying risk factors, therefore, the first line treatment is change of lifestyle, modifying physical activity and diet⁸⁻¹¹ in order to normalize the individual disorders that comprise the MS.

Recent research shows the important role of visceral obesity in the development of MS.²¹ Obesity and overweight tend to trigger an increase of the insulin resistance.²² It also has been noticed a relationship between

obesity and arteriosclerosis, caused by the increase of free fatty acids, the unbalance of cytosines, and the insulin resistance. Through the insulin resistance, glucose intolerance and diabetes type II are developed. But also, in association with the increase of the free fatty acids, the insulin resistance plays a role in the development of dyslipidemia, that results in a reduced amount of HDL cholesterol and raised triglycerides.²³

The aim of this article is to show the relationships between variables such as gender, age, HDL cholesterol, triglycerides, glycemia, BMI, percentage of body fat, waist circumference, blood pressure, and diet with the MS diagnose in a population of the tropical coast of Granada.

Material and methods

Subjects

This study was conducted in a sample of 119 individuals belonging to the so called tropical coast of Granada. The sampling process was carried out in a private clinic located in the geographical area object of the study, taking advantage of the voluntary attendance of these individuals with the purpose of being subjected to different routine clinical analysis.

All the subjects had previously and voluntarily signed an informed consent (according to the WMA Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Subjects) expressing their willingness to take part in this study and giving permission to collect, use and disclose their personal analytic data anonymously. All the individuals were given a control number to guarantee their anonymousness. Regarding the composition of the sample in terms of gender and age, 52% of the subjects were women and 48% were men, and their ages ranged between 15 and 90 (fig. 1).

Information collected

The individuals were subjected to several tests and measurements: Anthropometric measurements such as weight (kg), height (m), BMI (kg/m²), and waist circumference (cm). The skinfold test was used to calculate the percentage of body fat. Points of measurement: biceps, triceps, subscapular, and iliac crest and Blood pressure measurement (mmHg).

Clinical analysis of glucose, total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides were analyzed.

A survey of the the subjects' diet 24 hours prior to the blood extraction. Once the analytic parameters were taken, the individuals were divided into a control group and a group with MS according to the diagnose criteria of the ATP III 2001.⁵

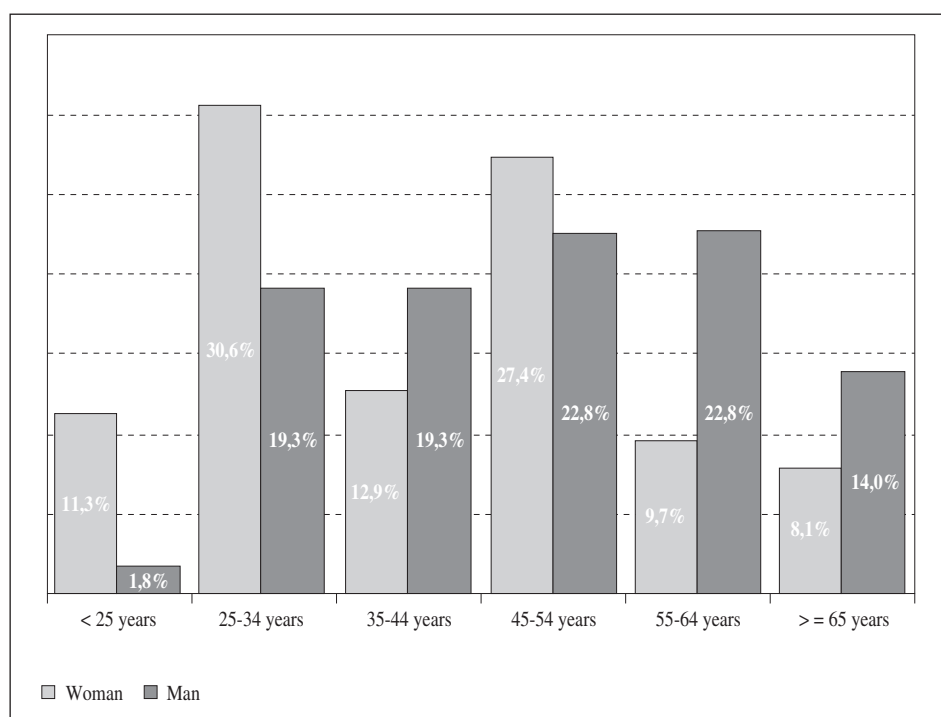


Fig. 1.—Percentage of individuals by age and sex.

Methods

The equipment used for the anthropometric measurements was: electronic scales model OMRN HN283, stadiometer BAME, fiberglass tape GULICK to measure waist circumference, caliper HOLTAIN. The BMI was calculated following the World Health Organization (WHO) criterion: $BMI = \text{Weight (kg)} / \text{Height (m)}^2$. The percentage of body fat was calculated using the Siri Equation.²⁰ Blood pressure was measured with a sphygmomanometer model OMRON wrist R6/HEM 6001-E.

The blood samples for the measurement of glucose, total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides were taken in fasting conditions between 8:30 and 9:30 in the morning. Venojet® tubes were used for the biochemical analysis, where 6 ml of blood with EDTA were introduced for the collect of blood serum or plasma. All the determinations were performed at 37° C by the biochemical analyser Technicon RA-1000. The reagents used were make QCA (Química Clínica Aplicada S.A.), and they were:

liquid glucose GOD-POD method for the measurement of glucose, liquid cholesterol colorimetric CHOD-PAP method for total cholesterol, direct HDL cholesterol calorimetric method for HDL cholesterol, and liquid triglycerides GPO method for triglycerides.

Statistical analysis

The statistical analysis was performed with Microsoft Excel 2000 and Statistical Analysis System, SAS® version 9.1 for Windows. The statistical techniques used were the Wilcoxon Test, descriptive analysis, and ANOVA.

Results

This research shows that 20,2% of the sample was diagnosed with MS. Significant statistical differences were found between the individuals with MS and the control group. When analyzing table I, it is possible to

Table I
Values and differences among the studied parameters

Analysis	Normal value ^a	Average the individuals with MS	Average in individuals control value
Total Cholesterol (mg/dL)*	< 220	224.4 ± 60.5	201.8 ± 63.8
Triglycerides (mg/dL)**	< 150	172.3 ± 42.6	92.5 ± 34.7
Max-min Blood pressure (mmHg)**	< 130-85	145.8 ± 28.2-94 ± 10.6	127.5 ± 22.6-79.9 ± 8.9
Glycaemia (mg/dL)*	< 110	104 ± 12.4	94.1 ± 9.8

^aNormal value according to the WHO and ATP III 2001. $p < 0.01^*$, $p < 0.001^{**}$.

Table II Difference in variables, BMI and % of body fat		
Variables	Average in individuals with MS	Average in individuals control value
BMI**	32.5 ± 1.25	26.8 ± 1.02
% of Body fat **	34.8 ± 0.98	28.9 ± 0.67

*p < 0.01; **p < 0.001.

appreciate the figures for each parameter that was measured as well as its level of statistical significance.

According to the data, the prevalence of MS in the sample is 20,2%, 58,3% of which were women. Comparing our figure for prevalence (20,2%) with that of other researchers in the United States⁶ (22%) it is noticeable how similar they are. If also compared the sample of this research with the Spanish population as a whole⁷ (MESYAS) in terms of prevalence, it can be noticed that our figure is higher, but it has to be taken into consideration that the prevalence of MS in the Spanish population is not homogeneous, on the contrary the prevalence in the south of Spain is higher than in the north, in agreement with our results. In the developed countries there is an estimated prevalence of 24% in adults, whereas the figure exceeds 40% in the elderly.²³

Obesity is a condition characterised by the excess of body fat. According to the quantity of body fat, a person could be defined as obese when his or her percentage of body fat exceeds the figures considered as normal: 12 to 20% in men and 20 to 30% in women.²⁴

The BMI, in spite of not being an excellent indicator of adiposity in muscular or elderly people, is the parameter most used in the majority of epidemiologic studies and the most recommended one by medical societies and international health organizations for medical use, due to its reproducibility, easy use, and capability to show the adiposity of the majority of the population.

When we talk about obesity in our research, it is referred to BMI and body fat percentage. In our study there are differences between the individuals with MS and the control ones (table II). The individuals with MS of our sample have an average BMI of 32,5 kg/m² (falling into the "Obese grade I" category according to the WHO) and an average body fat percentage of 34,8% (falling into the "Obese" category according to scientists and doctors).¹⁹

Diet is the main exogenous factor that influences the concentration and composition of blood lipids. The total calorie content in the diet has an effect on the blood lipids. Diets with excess calories (hypercaloric) stimulate the production of triglycerides by the liver and increase the level of LDL cholesterol. When studying the diet⁸⁻¹¹ of the individuals in our sample (data obtained through dietetic survey) no significant differences can be appreciated in terms of percentage of lipids,

Table III Dietary variables and their statistical differences		
Dietary variables	Average in individuals with MS	Average in individuals control value
% lipids	38.5 ± 0.52	39.5 ± 0.48
% Carbohydrates	43.2 ± 1.02	42.1 ± 1.12
% Protein	13.3 ± 0.65	14.60 ± 0.48
Energy (kcal/day)	1.599.4 ± 150.1	1,612.8 ± 162.3

*p < 0.01; **p < 0.001.

carbohydrates and proteins, and kcal/day between the subjects with MS and the control ones (table III).

Discussion

The prevalence of MS in the tropical coast of Granada is similar to that of other national (MESYAS) and international studies. This prevalence is high, but it is important to know that corrective and preventive measures can be taken involving diet and physical activity. The BMI and the body fat percentage are relevant factors to consider when talking about MS since significant differences have been found between individuals with and without MS. Regarding diet, our results (obtained through dietetic survey) do not agree with those of other studies related to MS, reaching the conclusion that this method may not be the most suitable to obtain this kind of information. More controlled conditions should be applied to obtain the data related to the individuals food intake. We would suggest conducting the research among guests of some kind of canteen, where the menu is perfectly known. MS is related to variables, apart from diet, such as physical activity and genotype that were not taken into account in this research and therefore may have altered the results in one direction or the other.

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