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Prevalence of Metabolic Syndrome in the Adult Population of Yecla (Murcia). Degree of Agreement Between Three Definitions of It

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Objectives. To determine the prevalence of metabolic syndrome (MS), its components and insulin resistance (IR) in the adult population of Yecla. To study the variability between 3 definitions of the syndrome and IR. To identify the variables that predict the presence of IR and to verify the diagnostic validity of several strategies for predicting it.
Design. Descriptive, cross-sectional study.
Setting. Primary care, Yecla (Murcia), Spain.
Participants. We studied 317 persons (292 with analysis) out of 424 selected by stratified (age and sex) random sampling from 18 059 people ≥30 years old and possessing a health card.
Main measurements. We used WHO-98, NCEP III, and EGIR criteria for diagnosing MS, and WHO-99 for defining DM2, impaired basal glucose and impaired glucose tolerance. The following variables were collected: social, demographic and personal details, plasma lipid, glycosylated haemoglobin, microalbuminuria, and insulin levels. IR was defined by the HOMA method at ≥3.8 or as the highest quartile of basal insulinemia in normoglycaemic persons.
Results. MS prevalence was NCEP 20.2% (95% CI, 15.6-24.8), WHO 35.3% (95% CI, 29.8-40.8), EGIR 24% (95% CI, 19.1-28.9), and IR was 27.7% (95% CI, 22.6-32.8). The sensitivity and specificity of NCEP, WHO, and EGIR criteria for detecting IR were (46% and 90%), (78% and 81%), and (73% and 95%), respectively. Insulin resistance was associated significantly with age, basal glycaemia, triglycerides, and waist circumference.
Conclusions. Metabolic syndrome is common in Yecla (more so in men). There is disagreement between several diagnostic criteria for the syndrome, with NCEP criteria less sensitive in determining IR. A generally accepted definition is needed.

Key words. Metabolic syndrome. Prevalence. Definitions.

PREVALENCIA DEL SÍNDROME METABÓLICO EN LA POBLACIÓN ADULTA DE YECLA (MURCIA). GRADO DE ACUERDO ENTRE TRES DEFINICIONES

Objetivos. Detectar la prevalencia del síndrome metabólico (SM), sus componentes y la resistencia a la insulina (RI) en la población adulta de Yecla. Estudiar la concordancia de 3 definiciones del SM entre sí y con la RI. Identificar variables que puedan predecir la presencia de RI y comprobar la validez diagnóstica de varias estrategias para predecirla.
Diseño. Estudio descriptivo, transversal.
Emplazamiento. Población de Yecla (Murcia). Ámbito de atención primaria.
Participantes. Estudiamos a 317 personas (292 aportaron analítica) de 424 seleccionadas mediante muestreo aleatorio estratificado (edad y sexo) de 18.059 con tarjeta sanitaria y edad ≥ 30 años.
Mediciones principales. Utilizamos los criterios NCEP III, OMS-98 y EGIR (Grupo Europeo de Estudio de la Resistencia a la Insulina) para diagnosticar el SM y OMS-99 para definir la diabetes mellitus no insulinodependiente, la glucemia basal alterada y la tolerancia alterada a la glucosa.
Recogimos variables sociodemográficas y antropométricas, y determinamos la presencia de lípidos, microalbuminuria, HbA_{1c} e insulinemia; definimos RI si el índice HOMA ≥ 3,8 o como cuartil más alto de insulinemia basal en normoglucémicos.
Resultados. La prevalencia del SM fue, según los criterios NCEP, del 20,2% (intervalo de confianza [IC] del 95%, 15,6-24,8), OMS del 35,3% (IC del 95%, 29,8-40,8), EGIR del 24% (IC del 95%, 19,1-28,9) y RI del 27,7% (IC del 95%, 22,6-32,8). La sensibilidad y la especificidad de NCEP, OMS y EGIR para detectar RI fueron del 46 y el 90%, del 78 y el 81% y del 73 y el 95%, respectivamente. La edad, la glucemia basal, los triglicéridos y el perímetro de la cintura se asocian significativamente con RI.
Conclusiones. Hay una alta prevalencia de SM en el área (mayor en los varones). Hay diferencias entre los diferentes criterios diagnósticos del síndrome, y los de NCEP son menos sensible para determinar la RI. Es necesario establecer una definición universalmente aceptada del SM.

Palabras clave: Síndrome metabólico. Prevalencia. Definiciones.

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A commentary follow this article (pág. 80)

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Introduction

In 1988, Reaven defined an entity called "syndrome X," characterised by the coexistence of different cardiovascular risk factors in the same person, such as obesity, glucose tolerance disturbances, dyslipidaemia, and high blood pressure.

In 1991 the strong relationship was described between these clinical disorders and resistance to the action of insulin (IR),[2,3] which constitutes the physiopathological substrate of metabolic syndrome (MS), as it is now called. Despite this long history, there is still no uniformity in the diagnostic criteria of MS, since 3 large organisations (OMS,[4] NCEP/ATPIII,[5] and EGIR[6]) have defined it with their own criteria which, although having the same philosophy, are at variance with the cut off points used for the diagnosis and clinical interpretation.[7,8]

Epidemiological studies are beginning to appear which give variable data on the prevalence of MS, particularly depending on the origin of the population and the diagnostic method used. Thus, the prevalence can vary from 13% recorded in France[9] to 33.4% recorded in Turkey,[10] both by using NCEP criteria. It should be pointed out that, in Spain, the recent data provided by DESIRE[11] study, with a prevalence which varies depending on which criteria is used, WHO (42.1%), EGIR (26.4%) or NCEP (22.6%). The results of the study in the Canary Islands[12] also has to be mentioned, with a figure of 24.4% (according to NCEP).

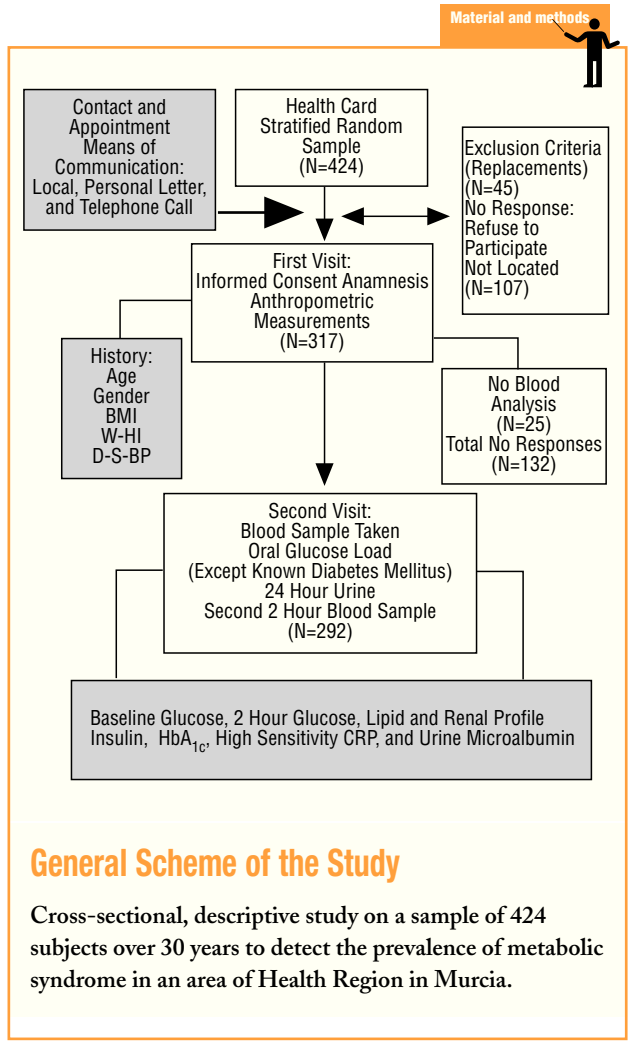
But the real importance of diagnosing MS lies in the coexistence of different cardiovascular risk factors (CVRF), such as obesity, high blood pressure (HBP), lipid disorders or diabetes mellitus,[13] and the fact that the presence of an MS per *se* brings about a higher morbidity-mortality and practically doubles the cardiovascular morbidity-mortality in the general population.[14,15]

For all these reasons, the principal objective of our study is to detect the prevalence of metabolic syndrome, its different components and insulin resistance in the adult population of Yecla, Spain. Secondly, we set out to evaluate the level of consistency between the principal definitions of MS themselves and with IR, to analyse the relationship of the different variables to predict IR, and subsequently to evaluate the diagnostic validity of different strategies to carry out this prediction.

Subjects and Methods

Design

Cross-sectional, descriptive population study carried out on adults over 30 years old, cared for in 2 Yecla Health Centres, (8901 men and 9158 women with individual health cards) with a total urban population of 32 468 inhabitants during the year 2001.



General Scheme of the Study

Cross-sectional, descriptive study on a sample of 424 subjects over 30 years to detect the prevalence of metabolic syndrome in an area of Health Region in Murcia.

Study Population

Using the Murcia Primary Care Management health card database, a sample of 425 individuals were selected for the study of carbohydrate metabolism, using simple randomisation, group by gender and four age intervals (30-42, 43-54, 55-65, and >65 years). The sample size was considered for a prevalence of glucose intolerance of 10% and a precision of 3%.

The following exclusion criteria were established; gestation or puerperium, not of Spanish nationality, on continuous treatment (more than 6 months) with glucose lowering drugs (corticoids and/or thiazides in high doses), serious cardiovascular or systemic diseases (physically or psychologically handicapped to be able to participate in the study), death or population change.

The individuals who had any of the exclusion criteria were replaced by others, again selected randomly and classified by gender and age. Finally, the prevalence of metabolic syndrome was calculated in the 292 subjects who had supporting analytical data.

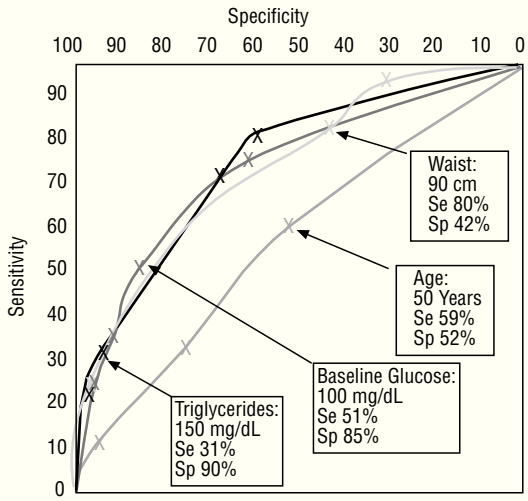


FIGURE 1 ROC curve of the 4 variables significantly associated with IR and values of the cut off points of the proposed diagnostic strategy.

Measurements

A double visit was carried out to collect the data, as shown in the general scheme of the study.
The variables were:

1. Sociodemographic: age, gender, personal history (HBP, lipid disorders, diabetes, and normal), family history of diabetes, smoking habits ("smoker"; more than 1 cigarette/day, and "non-smoker:" no cigarettes).
2. Anthropometric and physical examination: body mass index (BMI), waist circumference (WC) and waist-hips index (WHI) gathered according to that recommended by the Spanish Society for the Study of Obesity (SEEDO),[16] systolic (SBP) and diastolic (DBP) blood pressure (in mm Hg and in accordance with the WHO[17] recommendations).
3. Analytical: fasting plasma glucose and after an oral glucose load of 75 g (G2h) (hexokinase method, Hitachi 917 auto-analyser Roche Diagnostics#r with which the other biological determinations were carried out). Also quantified were, 24 h urine microalbumin, lipid profile (total cholesterol, high, and low density lipoprotein cholesterol [HDL-C and LDL-C] and triglycerides, renal profile (urea, creatinine, and uric acid), glycosylated haemoglobin (normal range, 3.5%–5.8%, HPLC method, HA-8110 Menarini Diagnostics#r analyser), high sensitivity CRP by the immunoturbidimetric method on the Roche Modular P800 analyser and fasting insulin level.
The samples were processed in the reference laboratory, except the determination of the fasting insulin, which was carried out by radioimmunoassay (Virgen de la Arrixaca University Hospital).
For the glucose metabolism disorders the WHO-1999[4] diagnostic criteria were used: non-insulin dependent diabetes if the fasting glucose is ≥126 mg/dL or the G2h≥200 mg/dL; impaired glucose tolerance: IGT if G2h≥140 mg/dL and <200 mg/dL or IFT if the fasting glucose is ≥110 mg/dL and 125 mg/dL, and normal if the fasting glucose is <110 mg/dL and G2h<140 mg/dL; previous diagnosis of diabetes was also considered.
To determine insulin resistance the HOMA index was calculated using the formula described by Matthews et al[18]: insulin (μ/mL) × [glucose (mmol/L)/22.5]. According to Ascaso et al,[19,20] IR is considered if the HOMA is ≥3.8.
The diagnostic criteria of MS are based on those proposed by 3 large study groups: OMS,[4] NCEP/ATP III,[5] and EGIR[6], and are set out in Table 1.
Data was collected during the months of February to June 2002 by 2 medical residents; the blood samples were taken first thing in the morning in the appropriate health centre by nursing professionals.
The anticipated biases were that of no response and information. To minimise the former, repeated calls were made, and non working days were made available and the final results were adjusted and standardised for age and gender according to the direct method,[21] taking the Spanish population of July 2002 as a reference. To decrease the information bias, the measurements

TABLE 1 **Criteria of the Different Definitions of Metabolic Syndrome***

Criteria	WHO	NCEP	EGIR
Body mass index	BMI≥30		
Waist circumference	WHI>0.9 (men) or >0.85 (women)	102 cm (men) or ≥88 cm (women)	≥94 cm (men) or ≥80 cm (women)
Blood pressure	≥140/90 mm Hg or previous treatment	≥130/85 mm Hg or previous treatment	≥140/90 mm Hg or previous treatment
Baseline glucose	DM or IGT or IFG	≥110 mg/dL or DM treatment	≥110 mg/dL or DM treatment
Insulin resistance	P75 insulin normal population		P75 insulin normal population
Triglycerides	≥150 mg/dL	≥150 mg/dL	≥180 mg/dL
HDL-C	<35 mg/dL (men) or <39 mg/dL (women)	<40 mg/dL (men) or <50 mg/dL (women)	<40 mg/dL
Urine microalbumin	EUA>20 mg/L, or albumin/creatinine >30 mg/g		

*DM indicates diabetes mellitus; HDL-C, high density lipoprotein cholesterol; IGT, impaired glucose tolerance; IFG, impaired fasting glucose.
Metabolic syndrome according to World Health Organisation (WHO): requires alteration of carbohydrate metabolism or insulin resistance and the coexistence of 2 or more criteria. Metabolic syndrome of the NCEP (National Cholesterol Education Program): requires the coexistence of 3 or more criteria.
Metabolic syndrome of the (European Group For The Study Of Insulin Resistance): requires the presence of insulin resistance and the coexistence of 2 or more criteria.

TABLE 2 **Baseline Characteristics of the Studied Population**

	Men	Women	Total
Number of subjects	155	162	317
Age, years	52.32±16.13	53.29±15.2	52.81±15.65
BMI	28.55±4.21	27.62±5.35	28.07±4.84
Waist circumference, cm	97.92±11.27	90.47±13.94	94.11±13.22
Waist/hip	0.99±0.05	0.91±0.07	0.95±0.07
SBP, mm Hg	132.7±17.6	130.3±19.7	131.47±18.72
DBP, mm Hg	80.7±10.3	79.56±10.2	80.09±10.23
Baseline glucose. mg/dL	104.36±37.03	95.2±27.6	99.68±32.83
2 hours glucose OGTT, mg/dL, excludes known DM	119.43±63.03	101.85±36.7	110.27±51.70
HbA_{1c}, %	5.01±1.32	4.75±1.13	4.88±1.23
Insulin, µU/mL	14.45±10.33	13.32±7.95	13.88±9.20
HOMA			
Total cases	3.96±5.3	3.2±2.7	3.57±4.19
Diabetics excluded	3.37±2.5	2.93±1.66	3.15±2.16
Total cholesterol, m/dL	206.23±42.3	208.8±38.1	07.55±40.16
HDL-C, mg/dL	51.64±11.78	65.6±14.57	58.77±15.0
LDL-C, mg/dL	128.38±35.56	124.5±35.07	126.41±35.31
Triglycerides, mg/dL	131.05±85.7	93.14±49.92	111.71±72.18
Creatinine, mg/dL	1.08±0.15	0.88±0.12	0.98±0.17
24 hour urine microalbumin, mg/L)	34.1±166.34	12.66±55.15	23.12±123.1
High-sensitivity CRP	0.35±0.67	0.37±0.85	0.36±0.77

*BMI indicates body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; OGTT, oral glucose tolerance test; HbA_{1c}, glycosylated haemoglobin; HOMA, homeostasis model assessment; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; CRP, C reactive protein. The values are expressed as mean ± standard deviation.

were made in the same period and with the same measurement tools for the physical examination; a pilot study with 25 cases was carried out before the study to check the concordance between the two medical residents who carried out the field work.

Statistical Analysis

A descriptive analysis of the variables was performed using frequency distribution tables for qualitative variables. The quantitative ones are summarised as their mean ± standard deviation (SD) and 95% confidence interval (CI).

The prevalence rates are given as crude and adjusted to the population of Segi and Spain (July 2002 according to the National Institute of Statistics).

In the bivariate analysis the χ^2 test was used for the relationship between qualitative variables and the Student *t* test and/or analysis of variance (ANOVA) for the quantitative ones.

Agreement between the different methods for diagnosing MS was analysed using the percentage of concordant cases and the kappa index (κ), which was considered excellent for values >0.75 and only acceptable for values between 0.75 and 0.40. Values of $P<.05$ were considered as statistically significant.

The study of the relationship between the variables that could be used to predict the presence of IR (HOMA≥3.8) was performed using multivariate stepwise logistic regression models. The statistics computer software SPSS#r (Version 11.0) was used.

Results

A total of 469 patients were contacted, of which 45 (9.6%) had one of the exclusion criteria; 317 (74.8%) came to the first interview and 292 (68.9%) gave a sample of blood. The no responses (not located, did not want to participate and individuals without analytical results) was 31.1%.

The mean age of the participants was 52.8±15.6 years and 51.1% were women. The baseline characteristics of the study population are shown in Table 2.

The crude prevalences of MS found were, according to the WHO criteria, 35.3% (95% CI, 29.8-40.8), according to NCEP 20.2% (95% CI, 15.6-24.8) and according to EGIR 24.0% (95% CI, 19.1-28.9). The prevalence of IR (HOMA≥3.8) was 27.7% (95% CI, 22.6-32.8). The distribution by age group and gender and their adjustment to the Spanish population and that of Segi are shown in Table 3. In the diabetic population, 70.8, 89.6, or 43.8% had MS criteria depending on which definition, NCEP, WHO, or EGIR, respectively.

The presence or prevalence of the different components of MS in our population, depending on the different diagnostic criteria used and their distribution by gender are shown in Table 4.

As regards the concordance between the different MS and IR diagnostic criteria (Table 5) we can see that the percentage of concordant cases varies between 77.4% and 88.7% depending on the criteria compared. The κ is low (0.39) when we compare the NECP criteria (the most used in clinical practice) with those of EGIR or HOMA. The sensitivity, specificity, the positive predictive value (PPV) and the negative predictive value (NPV) of the MS diagnostic criteria for the diagnosis of IR calculated using a HOMA≥3.8, are also shown in Table 5. It was verified that the 3 criteria have a high specificity (around 90%), but with a lower sensitivity (45.7% in the case of the NCEP).

A relationship analysis was carried out on the variables which could predict the presence of one IR (HOMA≥3.8) using multivariate regression models. The waist circumfe-

TABLE 3 **Prevalence of Metabolic Syndrome and Insulin Resistance by Gender and Age Group**

	WHO Criteria	NCEP Criteria	EGIR Criteria	IR (HOMA″3.8)
Men				
30-42 years (N=48)	14 (29.2%)	6 (12.5%)	12 (25.0%)	15 (31.3%)
43-54 years (N=33)	12 (36.4%)	9 (27.3%)	8 (24.2%)	8 (24.2%)
55-65 years (N=20)	8 (40%)	6 (30.0%)	5 (25%)	6 (30.0%)
>65 years (N=42)	28 (66.7%)	13 (31.0%)	16 (38.1%)	17 (40.5%)
Total (N=143)	62 (43.4%)	34 (23.8%)	41 (28.7%)	46 (32.2%)
Women				
30-42 years (N=45)	4 (8.9%)	1 (2.2%)	5 (11.1%)	9 (20.0%)
43-54 years (N=37)	10 (27%)	4 (10.8%)	6 (16.2%)	8 (21.6%)
55-65 years (N=25)	13 (52%)	10 (40.0%)	9 (36.0%)	7 (28.0%)
>65 years (N=42)	14 (33.2%)	10 (23.8%)	9 (21.4%)	11 (26.2%)
Total (N=149)	41 (27.5%)	25 (16.8%)	29 (19.5%)	35 (23.5%)
Totals				
Crude prevalence†	35.3% (29.8-40.8)	20.2% (15.6-24.8)	24.0% (19.1-28.9)	27.7% (22.6-32.9)
Prevalence adjusted to the Spanish population†	35.3% (29.8-40.8)	20.3% (15.7-24.9)	24.1% (19.2-29.0)	27.9% (22.7-33.0)
Prevalence adjusted to the Segi population†	32.5% (27.1-37.9)	19.0% (14.5-23.5)	22.9% (18.1-27.8)	26.7% (21.6-31.8)

*MS OMS indicates metabolic syndrome according to the World Health Organisation; MS NCEP, metabolic syndrome according to the National Cholesterol Education Program criteria; MS EGIR, metabolic syndrome according to the European Group for the study of Insulin Resistance criteria; HOMA, homeostais model assessment; IR, insulin resistance.
†The values between parenthesis are the 95% confidence interval.
The numbers of cases by age group that have metabolic syndrome are shown. The prevalence of MS in each group is in parenthesis.

rence (beta =0.27; *P*<.001), fasting glucose (beta =0.24; *P*<.001), triglycerides (beta =0.16; *P*<.01), and age (beta =–0.13; *P*<.05) have shown to have a significant role. The diagnostic values of the different cut off points of these variables and their ROC curves are set out in Table 6 and in Figure.

The diagnostic validity of the various strategies to predict insulin resistance was then checked. The application of the DESIRE[11] criteria on our sample (capillary glucose >90 mg/dL waist ≥94 cm in men or ≥80 cm in women) showed a sensitivity of 63% and a specificity of 70%, while those of the "waist-high triglycerides" of Lemieux et al[22] (waist >90 cm and triglycerides ≥175 mg/dL) had a low sensitivity (19%), with a specificity of 95%. In our population, the diagnostic strategy shown to have a higher value was found in subjects with a waist >90 cm, a fasting glucose >100 mg/dL or triglycerides >150 mg/dL (67% sensitivity, 68% specificity, PPV of 53%, and an NPV of 80%).

TABLE 4 **Prevalence of the Different Components of Metabolic Syndrome According to the Different Diagnostic Criteria. Prevalence According to Gender***

	Cut Off Point, Criteria	Prevalence, 95% CI	By Gender, %
Obesity according to WHO	BMI≥30 or WHI>0.9 (men) or >0.85 (women)	90.5±3.3%	98.1-83.3†
Waist circumference	″94 cm (men) or 80 cm (women) (EGIR)	69.4±5.1%	65.8–72.8
	≥102 cm (men) or 88 cm (women) (NCEP)	48.3±5.5%	37.4-58.6†
Blood pressure	≥130/85 mm Hg or previous treatment (NCEP)	63.4±5.3%	68.4-58.6
	140/90 mm Hg or previous treatment (WHO, EGIR)	50.2±5.5%	54.2-46.3
Baseline glucose	≥110 mg/dL or DM treatment (NCEP, EGIR)	17.1±4.3%	20.3-14.1
	DM or IGT or IR (P75 insulin normal) (OMS)	45.9±5.7%	51.7-40.3†
Triglycerides	≥150 mg/dL (OMS, NCEP)	15.8±4.2%	23.8-8.1†
	≥180 mg/dL (EGIR)	10.6±3.5%	16.1-5.4†
HDL-C	<35 mg/dL (men) or 39 mg/dL (women) (WHO)	3.4±2.1%	4.9-2
	<40 mg/dL (men) or 50 mg/dL (women) (NCEP)	14.4±4%	12.6-16.1
	<40 mg/dL (EGIR)	7.2±3%	12.6-2†
Urinary albumin excretion (UAE)	UAE>20 mg/L (WHO)	11±3.6%	14-8.1

*MS WHO indicates metabolic syndrome according to the World Health Organisation criteria; MS NCEP, metabolic syndrome according to the National Cholesterol Education Program criteria; MS EGIR, metabolic syndrome according to the European Group for the study of Insulin Resistance criteria; BMI, body mass index; DM, diabetes mellitus; IGT, impaired glucose tolerance; HDL-C, high density lipoprotein cholesterol; IR, insulin resistance; CL, confidence limits.
†*P*<.05.

TABLE 5 **Concordance Between the Different Criteria for the Diagnosis of Metabolic Syndrome***

		WHO		NCEP		EGIR	
	Cases	MS	No MS	MS	Non MS	MS	Non MS
NCEP	MS	50	9				
	Non MS	53	180				
EGIR	MS	66	4	34	36		
	Non MS	37	185	25	197		
HOMA≥3.8	RI	63	18	37	44	59	22
	Non IR	40	171	22	189	11	200
Percentage of concordant cases (and κ value):							
WHO versus HOMA: 80.1% of cases (κ=0.54±0.057)							
NCEP versus HOMA: 77.4% of cases (κ=0.39±0.056)							
EGIR versus HOMA: 88.7% of cases (κ=0.71±0.052)							
OMS versus NCEP: 78.8% of cases (κ=0.49±0.057)							
OMS versus EGIR: 86.0% of cases (κ=0.67±0.054)							
NCEP versus EGIR: 79.1% of cases (κ=0.39±0.056)							

Sensitivity, Specificity, Positive (PPV), and Negative (NPV) Predictive Value of Metabolic Syndrome Criteria to Predict Insulin Resistance (Homa″3.8)

	Sensitivity	Specificity	PPV	NPV
OMS	77.7%	81%	61.2%	90.5%
NCEP	45.7%	89.6%	62.7%	81.1%
EGIR	72.8%	94.8%	84.3%	90.1%

*κ indicates kappa index ± confidence limits; PPV, positive predictive value; NPV, negative predictive value; MS WHO, metabolic syndrome according to the World Health Organisation criteria; MS NCEP, metabolic syndrome according to the National Cholesterol Education Program criteria; MS EGIR, metabolic syndrome according to the European Group for the study of Insulin Resistance criteria; HOMA, homeostasis model assessment; IR, insulin resistance, Homa≥3.8.

TABLE 6 **Diagnostic Validity of the Variables Which Had a Significant Value on Insulin Resistance***

	Sensitivity	Specificity
Waist, cm		
>80	96%	32%
>90	80%	42%
>100	61%	72%
>110	22%	96%
Baseline glucose, mg/dL		
>90	74%	61%
>100	51%	85%
>110	35%	92%
>125	24%	94%
Triglycerides, mg/dL		
>90	80%	58%
>100	70%	67%
>150	31%	90%
>175	22%	94%
Age, years		
>50	59%	52%
>65	33%	74%
>75	10%	92%

Discussion

Despite the participation achieved in the study (68.9% of the selected population), it was slightly higher than that of other studies carried out in our country, such as that in the Canary Islands[12] and the Spanish Insulin Resistance Study (SIRS) by Lorenzo et al,[23] and an acceptable response was not achieved in the women >65 years group, therefore an attempt was made to correct for this bias, which could underestimate the prevalence of MS, by adjusting the results to the 2002 Spanish population and the population of Segi.

The prevalence of the syndrome is high, more in men and increases with age, independent of the criteria used for its definition:

– If the NECP criteria are used, it is 20.2%, similar to that obtained in the Canary Isles (24.4%),[23] and that of NHANES 1999-2000 in the United States population (27%).[24] Of the different components of MS, high triglycerides, high BP and hyperglycaemia occur more frequently in men, while increase in waist circumference and low HDL-C concentrations predominate in women, similar to that in the previously mentioned studies. The frequency of MS (NCEP) among diabetics (70.8%) is less than that detected by Lorenzo et al[23] (64.6% in men, 92% in women) and in Finland[25] (87,1%).

– If the WHO criteria are used, in our population we classify 35.3% of our population to have MS, a higher prevalence than that of Ford et al[8] (25.1%) and Meigs et al[26] (26.6%) in the United States population, and similar to those of the DESIRE[11] study (42.1%) and those of Finland[25] (38.8% in men, 22.2% in women), for the same age group. The prevalence among diabetics (89.6%) is slightly higher than that obtained in the study by Botnia[14] (80%).

The principal component of MS (WHO criteria) is obesity (90.5%), more frequent, especially in women, than in the previously mentioned studies (67.5% in that of Ford et al[8] and 86% men and 38.2% in women in the study by Meigs et al[26]), consistent with the high prevalence of obesity of our population.[27]

As regards the level of concordance between definitions (WHO and NCEP), 78.8% of the participants in our study were similarly classified by both definitions (percentage <86.6 obtained by Ford et al[8]), while the level of concordance was moderate (κ of 0.49), similar to that of other studies,[26,28] with values between 0.45 and 0.56 depending on the population group analysed.

Discussion
Key points

What Is Known About the Subject

- Obesity is one of the most important determining factors of metabolic syndrome.
- The increase in the prevalence of metabolic syndrome is associated with the rise in the population obesity indicators.

What This Study Contributes

- Metabolic syndrome is very common in our population, with a similar prevalence to that already known in the Canary Islands.
- A strategy that is easy to implement in daily clinical practice to detect insulin resistance with a good sensitivity and specificity.
- A universally accepted definition of the syndrome is needed given the level of disagreement between the current definitions.

As regards the predictive capability of the different criteria of MS regarding the IR quantified by HOMA, we should point out that most clinical criteria of the NCEP have shown similar values of sensitivity (46%), specificity (90%) and PPV (63%) to those of Cheal et al.[7] The level of disagreement between the different definitions of the syndrome suggest the need for a definition which may be universally accepted, with a good predictive capability of IR and cardiovascular complications. In the multivariate analysis, the 4 variables that showed a significant association with the presence of IR were waist circumference, fasting glucose, triglycerides and age; therefore these have to be taken into account in any MS detection and prevention programme.

Lastly, using the results from the study we designed a screening strategy which enables subjects who have IR to be identified, with a sensitivity of 67% and a specificity of 69%, without having to use the HOMA.

We should suspect this disease in those subjects (men or women) who, having a waist circumference >90 cm, may have a fasting glucose level >100 mg/dL or triglycerides >150 mg/dL.

To summarise, metabolic syndrome is very common in our population, with a considerable variability in the prevalence of its component parts. The tendency for its frequency to increase in the next few decades (associated to the continuing increase in obesity in our population) it could result in an increase in non-insulin dependent diabetes and cardiovascular morbidity and mortality in the area. To achieve changes in lifestyle aimed at reducing weight, waist circumference and an increase in physical activity, mainstays of the treatment of MS, as also described by other authors,[29] should be priority objectives in health programmes of the area.

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COMMENTARY

Matebolic Syndrome: Another Chance to Make an Integrated Health Intervention

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Metabolic syndrome is a clinical entity defined as group of metabolic changes due to insulin resistance. This situation produces disorders of glucose metabolism, increases in blood pressure levels, lipid disorders, and obesity.[1]
A, still unclear, predisposing genetic component has been identified in its aetiology, along with a series of environmental factors, including those which are found in "classic" cardiovascular risk, such as central obesity, sedentary lifestyle, high calorie diet and smoking tobacco, and "emerging" factors, such as an increase in C reactive protein, increased fibrinogen and plasminogen activator inhibitor, high uric acid, leptin resistance, and high plasma cysteine.
The importance of metabolic syndrome lies in the increased probability of having cardiovascular complications in the long term. Its components are independent cardiovascular risk factors, and some—in particular obesity and insulin resistance—are factors which predispose the development of other risk factors, such as type 2 diabetes mellitus.
Although the absolute risk of cardiovascular complications in patients with metabolic syndrome has not been determined, there is data on the prevalence of coronary disease of approximately 14%[2] in patients with metabolic syndrome, and there are studies that have shown morbidity and mortality figures considerably higher than the general population.[3]
Depending on the studies and the diagnostic method employed, the prevalence of metabolic syndrome in Spain varies between 24% and 30%, although more studies are required to be able to establish these figures with confidence. In this sense, the present study contributes by giving us more data by estimating the prevalence in its population.
Since we currently know not only the risk of cardiovascular complications of each of the separate components of metabolic syndrome, but also the efficacy of the interventions made on each of them,[4] the need for timely detection of this entity and the design of appropriate interventions on the patients who present with it, with the aim of reducing the overall cardiovascular risk.

Key Points

- Metabolic syndrome is an entity which causes an increase in cardiovascular morbidity and mortality in those patients who present with it.
- The diagnostic criteria of metabolic syndrome are not homogeneous.
- Physicians have to evaluate the different diagnostic tools at their disposal to establish it true usefulness in the population. Only in this way can effective interventions be designed.

On this point, this study makes two very interesting contributions: on the one hand, it demonstrates the need to homogenise the diagnostic criteria of metabolic syndrome, by verifying the lack of concordance between those used by the different scientific groups. This fact has also been verified by other studies.
On the other hand, it studies the association of the variables which can predict insulin resistance—a metabolic anomaly involved in metabolic syndrome, in obesity, type 2 diabetes, and arteriosclerotic vascular disease—and verifies the diagnostic validity of these variables to be able to design future interventions on their population. Metabolic syndrome presents a good opportunity to fundamentally design specific interventions of lifestyle habits and drugs where necessary and personalised for each patient depending on their cardiovascular risk.
The fact that the prevention of cardiovascular complications still has a long way to go has to be reflected upon. And not just on the theoretical aspects, but also on the diagnostic and therapeutic applicability.

The abundance of guides and protocols—metabolic syndrome is a good example, but it also occurs to a lesser extent, in the case of hypertension or lipid disorders— all completely rigorous and with the same aim, but with variations in diagnostic criteria and cut off points, it sometimes makes the daily task difficult in the clinical consultations, particularly in overburdened care situations.

The quality achieved, as regards scientific education and technical training in the last few years has to be accompanied by suitable performance and interventions that really serve to improve the health of the population in our care. In this sense, it is worth remembering the fact that, despite having the knowledge and means necessary to control cardiovascular risk factors, the patients are not always diagnosed or suitably controlled.[5,6]

It is good that the initiative to evaluate the diagnostic and therapeutic usefulness of the different tools that evidence based medicine puts within our reach should come from the clinics themselves, to be able to design interventions suitable for the real population, with specific and real characteristics and needs.

Only then can the final objective of our work be accomplished, which is to improve the health of the people in our care.

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