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ORIGINAL

Influence of sociodemographic variables and healthy habits on the values of cardiometabolic risk scales in 386.924 spanish workers

Influencia de variables sociodemográficas y hábitos saludables en los valores de escalas de riesgo cardiometabólico en 386.294 trabajadores españoles

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Summary

Introduction: Cardiometabolic diseases are highly prevalent pathologies throughout the world and cause great morbidity and mortality. Their genesis is influenced by different factors. The aim of this study was to determine the influence of sociodemographic variables and healthy habits on different cardiometabolic risk scales.
Material and methods: A descriptive, cross-sectional study was carried out in 386924 Spanish workers. Cardiometabolic risk was assessed on the basis of metabolic syndrome, atherogenic risk determined by atherogenic indices and atherogenic dyslipidemia, heart age, and diabesity. The sociodemographic variables analyzed were age, gender, social class, and educational level. Physical activity, Mediterranean diet and tobacco consumption were assessed as healthy habits.
Results: The mean values and the prevalence of elevated values of the different cardiometabolic risk scales were influenced by all the sociodemographic variables (especially age) and healthy habits studied (especially physical activity and Mediterranean diet).
Conclusions: The risk profile of presenting cardiometabolic alterations would be an elderly male, low socioeconomic level, sedentary, with low adherence to the Mediterranean diet and smoker.

Key words: Cardiometabolic risk, metabolic syndrome, atherogenic risk, atherogenic dyslipidemia, heart age, diabesity.

Resumen

Introducción: Las enfermedades cardiometabólicas son patologías altamente prevalentes en todo el mundo ocasionando una gran morbimortalidad. En su génesis influyen diferentes factores. El objetivo de este estudio fue conocer la influencia de variables sociodemográficas y hábitos saludables en diferentes escalas de riesgo cardiometabólico.
Material y métodos: Estudio descriptivo y transversal realizado en 386.924 trabajadores españoles. El riesgo cardiometabólico se valora a partir del síndrome metabólico, riesgo de aterogénesis determinada por los índices aterogénicos y la dislipemia aterogénica, edad del corazón y diabesidad. Las variables sociodemográficas analizadas fueron edad, género, clase social y nivel educativo. Como hábitos saludables se valoraron actividad física, dieta mediterránea y consumo de tabaco.
Resultados: Los valores medios y la prevalencia de valores elevados de las diferentes escalas de riesgo cardiometabólico se vieron influenciadas por todas las variables sociodemográficas (especialmente edad) y hábitos saludables estudiado (especialmente actividad física y dieta mediterránea).
Conclusiones: El perfil de riesgo de presentar alteraciones cardiometabólicas sería un varón de edad avanzada, nivel socioeconómico bajo, sedentario, con baja adherencia a la dieta mediterránea y fumador.

Palabras clave: Riesgo cardiometabólico, síndrome metabólico, riesgo aterogénico, dislipemia aterogénica, edad del corazón, diabesidad.

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Introduction

Cardiometabolic risk, encompassing factors predisposing individuals to cardiovascular and metabolic diseases, is a critical public health concern[1]. In this introduction, we delve into how socio-demographic variables and lifestyle habits intersect to impact this risk.

Age plays a pivotal role[2,3]. As individuals age, the likelihood of developing cardiovascular and metabolic conditions increases[4-6], Physiological changes and cumulative risk factors contribute to this association[7].

Gender differences significantly influence cardiometabolic risk8. For instance, women tend to exhibit more favorable lipid profiles before menopause[9], but afterward, their risk escalates[10,11]. Sex hormones impact fat distribution[12] and insulin resistance[13].

Socioeconomic status matters. Individuals with lower socioeconomic standing often have a higher prevalence of risk factors such as obesity[14,15], smoking[16,17] and unhealthy diets[18,19]. Access to resources and opportunities shapes lifestyle choices[20].

Diet is fundamental. Adopting a balanced eating pattern, like the Mediterranean diet rich in fruits, vegetables, fish, and olive oil, can mitigate cardiometabolic risk[21,22]. Conversely, excessive saturated fats[23], sugars[24], and ultra-processed foods[25] elevate risk.

Regular exercise is essential for preventing cardiovascular and metabolic diseases. Sedentary behavior correlates with higher risk[26]. Tailoring age-appropriate physical activity recommendations is crucial.

Smoking remains a major modifiable risk factor[27]. It raises blood pressure[28], damages blood vessels[29], and adversely affects lipid profiles[30]. Smoking cessation is vital for risk reduction[31].

In summary, the interplay of these variables significantly influences cardiometabolic risk. Understanding their impact allows us to design personalized preventive strategies and enhance cardiovascular and metabolic health in the population.

Methods

We conducted a survey involving 386,924 people who operate in several autonomous communities in Spain and come from diverse work sectors. The information was taken from the occupational health examinations that these workers attend. The time frame for gathering data was January 2019 to June 2020.

Age between 18 and 69 years old was one of the inclusion criteria used to choose the sample.
- An employment contract being in place at one of the study's participating companies.
- Marking a consent form in order to take part in the research.
- Give permission for the data to be used for epidemiological research.

The flowchart of the study participants is presented in **figure 1**.

Identifying the variables

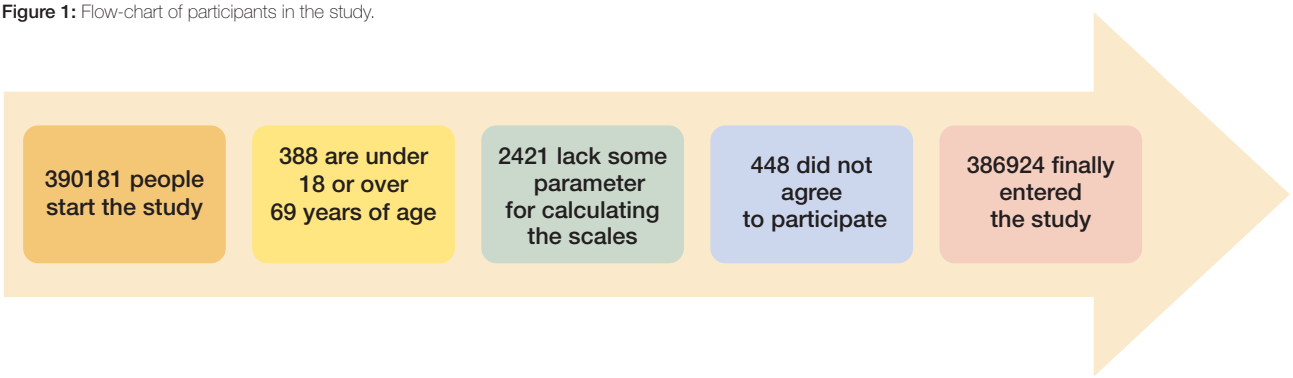
It was the responsibility of each health professional in the participating companies to gather the data needed to compute the various scales examined in this research. These methods were used to gather the data:

- Medical background. It comprises healthy behaviors (tobacco, alcohol, Mediterranean diet, and physical activity) as well as sociodemographic factors (age, sex, socioeconomic class, and degree of education).
- Clinical and anthropometric computations. includes systolic and diastolic blood pressure, height, weight, and the size of the hips and waist.
- Tests on the blood. glycemia and lipid profile included.

Standardized measurements were made for each variable to reduce the appearance of bias.

The worker is measured for height and weight while standing straight and only wearing underpants. The head needs to be facing forward, and the arms should be parallel to the thorax. A SECA model scale-measuring apparatus is used to collect measurements, and the results are reported in kilograms and millimeters.

Figure 1: Flow-chart of participants in the study.



A SECA model measuring tape, parallel to the floor and positioned at the level of the last floating rib, is used to measure the circumference of the abdominal waist. The employee has a relaxed abdomen and is standing erect. By holding the tape measure parallel to the floor at the level of the gluteal area's widest point, one can acquire the hip perimeter in the same manner.

Blood pressure is measured with the OMROM-M3 blood pressure monitor. For an accurate evaluation, the subject needs to be seated and at rest for a minimum of 10 minutes. Because they should be worn around the arm without being too tight, cuffs come in a variety of sizes. We run three different tests lasting one minute each. The average of the three statistics serves as the basis for the evaluation.

Venous punctures are used to take blood samples following a 12-hour fast. For optimal preservation, samples undergo processing and are chilled for a maximum of 48 to 72 hours. Analyzing the samples is done by reference laboratories using comparable techniques. While HDL cholesterol is measured using precipitation techniques, blood glucose, total cholesterol, and triglycerides are determined by enzymatic methods. The indirect estimation of LDL cholesterol is done using the Friedewald formula32, which is valid as long as the triglycerides do not exceed 400 mg/dL. LDL is calculated immediately if the reading is greater than 400 mg/dL. The milligrams per deciliter are used to display all analytical variables.

Three criteria were used to define metabolic syndrome: the Joint Interim Statement (JIS), the International Diabetes Federation (IDF) update, and the National Cholesterol Education Program Adult Treatment Panel III (NCEP/ATP-III)[33,34].

The new Heart Age (HA) scale is derived from the traditional Framingham Scale[35-36]. The HA measures how our heart has aged, as opposed to the conventional cardiovascular risk scales, which calculate the likelihood that a cardiovascular event will occur within the next ten years. A number of factors are needed to calculate it, including gender, age, height, weight, and circumference around the waist, as well as the presence of cardiovascular disease in the family, diabetes, smoking, lipid profile, systolic blood pressure, and antihypertensive medication[37]. You can use all of these details to get to the calculator at www.heartage.me. The period between 20 and 80 years can be used to calculate HA.

A new notion known as ALLY (avoidable years of life lost)[38] is derived from the subtraction of chronological age from cardiac age. The age thresholds for high ALLY (17 years) and moderate ALLY (11 years)[39].

Atherogenic dyslipidemia can occur when there is a combination of high triglyceride, low HDL cholesterol (less than 50 mg/dL in women and less than 40 mg/dL in men), and normal LDL cholesterol levels[40].

The total cholesterol/HDL (high values > 5 in males and > 4,5 in women) is one of the atherogenic indexes[41-43].

- High values (>3) for LDL-c/HDL-c and triglycerides/ HDL-c

The American Diabetes Association's guidelines44 were followed for classifying blood glucose levels, with 125 mg/ dL or more being deemed hyperglycemia. Individuals who had previously been diagnosed with diabetes were included in the classification, as were those on hypoglycemic medication and those whose glycated hemoglobin (HbA1c) was ≥ 6.5% following a glycemia reading more than 125 mg/dL. Patients with diabetes were classified as diabetics if their body mass index was 30 kg/m^2 or higher.

Male and female are the established genders.

By deducting the date of birth from the date of the medical examination, the age is determined.

The highest educational level out of all those taken is the one being considered. Studying at the primary, secondary, and university levels are the three recognized levels.

The Spanish Society of Epidemiology's criteria, which are based on the kinds of jobs covered by the 2011 national classification of occupations (CNO-11)[45], were applied to determine social class. There were three tiers established: - Social class I. This include university-trained professionals, artists, professional athletes, and managers. - Social class II. This covers competent independent contractors as well as intermediate-level professions. - Social class III. This also applies to unskilled laborers.

If someone has smoked for at least one day in the last thirty days or has quit smoking less than a year ago, we classify them as smokers.

A fourteen-question survey with a 0 or 1 point system is used to assess adherence to the Mediterranean diet. Nines represent high adherence[46,47].

To ascertain an individual's level of physical activity, the International Physical Activity Questionnaire (IPAQ)[48] is utilized. This self-administered questionnaire's goal is to determine how much physical activity was done during the previous seven days.

Ethical aspects

The 2013 Helsinki Declaration[50] and all other ethical guidelines governing research have been followed. Participants' privacy and anonymity have always been guaranteed. The study was approved by the Balearic Islands Research Ethics Committee (CEI-IB), which issued consent under number IB 483/20.

Since all of the data are coded, only the lead investigator is aware of the identities of the participants. The Organic Law 3/2018, which was passed on December 5, 2018, stipulates that study participants will always be able to access, correct, cancel, and object to the use of the data that has been gathered. It also safeguards digital rights.

Statistical analysis.

The Student's t test was used to examine quantitative data and determine means and standard deviations. For quantitative variables, the chi2 test was used to evaluate prevalence. The multinomial logistic regression analysis was performed and odds ratios with 95% confidence intervals were computed. The statistical analysis was carried out using the SPSS 28.0 software. For this investigation, the accepted threshold of statistical significance was $p<0.05$.

Results

The study's 386924 workers' anthropometric, clinical, analytical, sociodemographic, and healthy habit data are displayed in **table I**. The participants' average age was somewhat above 39. The other variables, with the exception of LDL cholesterol, have lower values in the female group. Men made up 60.2% of the participants, while women made up 39.8%. The population's mean age falls between 30 and 49 years old. The majority of them are from socioeconomic class III and just have an elementary education. A Mediterranean diet is followed by 41% of men and 51.4% of women, and 45.5% of men and 52.2% of women frequently exercise. Men smoked in proportions of 37% and women in percentages of 33%.

The mean values of the various cardiometabolic risk measures included in this study rise with age and as one moves down the socioeconomic or educational scale, as seen in **tables IIa** and **IIb**. Additionally, the levels are greater in smokers, inactive individuals, and people who follow the Mediterranean diet less closely.

The prevalence of elevated values of the cardiometabolic risk scales follows the same pattern as we have seen with the mean values, that is, they are more prevalent with increasing age and with decreasing socioeconomic level. Similarly, the prevalences are higher in people who do not engage in regular physical activity, in those who do not eat a Mediterranean diet, and in smokers. All the data can be consulted in **tables IIIa** and **IIIb**.

The multivariate analysis findings using multinomial logistic regression are shown in **table IV**. A consistent trend is observed across all the scales; high values on these cardiometabolic risk scales are influenced by all the variables, including sociodemographic and healthy behavior factors. This risk rises with age, falls with social status, in individuals who follow the Mediterranean diet but don't exercise regularly, and in nonsmokers. Physical activity had the highest odds ratios, followed by age and a Mediterranean diet.

Table I: Characteristics of the population.

	Men n=232.814	Women n=154.110	
	Mean (SD)	Mean (SD)	p-value
Age (years)	39.8 (10.3)	39.2 (10.2)	<0.001
Height (cm)	173.9 (7.0)	161.2 (6.6)	<0.001
Weight (kg)	81.1 (13.9)	65.3 (13.2)	<0.001
Waist circumference (cm)	87.7 (9.1)	73.9 (7.9)	<0.001
Hip circumference (cm)	100.0 (8.4)	97.2 (8.9)	<0.001
Systolic blood pressure (mmHg)	124.4 (15.1)	114.4 (14.8)	<0.001
Diastolic blood pressure (mmHg)	75.4 (10.6)	69.7 (10.3)	<0.001
Total cholesterol (mg/dl)	195.9 (38.9)	193.6 (36.4)	<0.001
HDL-c (mg/dl)	51.0 (7.0)	53.7 (7.6)	<0.001
LDL-c (mg/dl)	120.5 (37.6)	122.3 (37.0)	<0.001
Triglycerides (mg/dl)	123.8 (88.0)	88.1 (46.2)	<0.001
Glycaemia (mg/dl)	88.1 (12.9)	84.1 (11.5)	<0.001
	%	%	p-value
20-29 years	17.9	19.5	<0.001
30-39 years	33.1	33.3	
40-49 years	29.7	29.4	
50-59 years	16.3	15.3	
60-69 years	3.0	2.5	
Elementary school	61.2	51.8	<0.001
High school	34.0	40.7	
University	4.8	7.5	
Social class I	5.3	7.2	<0.001
Social class II	17.4	33.2	
Social class III	77.3	59.8	
Non physical activity	54.5	47.8	<0.001
Yes physical activity	45.5	52.2	
Non Mediterranean diet	59.0	48.6	<0.001
Yes Mediterranean diet	41.0	51.4	
Non smokers	62.9	67.0	<0.001
Smokers	37.1	33.0	

HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol

Table IIa: Mean values of the different cardiometabolic risk scales according to sociodemographic variables and healthy habits in men.

		nº factors MS ATPIII	nº factors MS JIS	ALLY HA	TC/HDL-c	LDL-c/HDL-c	TG/HDL-c
Men	**n**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
20-29 years	41742	0.5 (0.8)	0.7 (0.9)	1.2 (4.9)	3.2 (0.8)	1.8 (0.7)	1.8 (1.4)
30-39 years	76960	0.8 (0.9)	0.9 (1.0)	4.1 (6.7)	3.8 (1.0)	2.3 (0.9)	2.4 (2.1)
40-49 years	69068	1.1 (1.1)	1.3 (1.2)	7.6 (8.0)	4.2 (1.1)	2.7 (0.9)	2.9 (2.5)
50-59 years	38028	1.3 (1.2)	1.5 (1.2)	11.3 (7.9)	4.6 (1.2)	2.9 (1.0)	3.1 (2.4)
60-69 years	7016	1.5 (1.1)	1.7 (1.2)	11.5 (7.5)	4.7 (1.2)	3.0 (1.0)	3.1 (2.0)
Elementary school	142494	1.0 (1.1)	1.1 (1.1)	6.5 (7.9)	4.0 (1.2)	2.5 (0.9)	2.6 (2.3)
High school	79226	0.9 (1.0)	1.0 (1.1)	5.3 (7.8)	3.9 (1.1)	2.4 (1.0)	2.5 (2.1)
University	11094	0.8 (1.0)	0.9 (1.1)	4.7 (7.6)	3.9 (1.1)	2.4 (1.0)	2.5 (2.3)
Social class I	12262	0.8 (1.0)	0.9 (1.1)	4.7 (7.6)	3.9 (1.1)	2.4 (1.0)	2.5 (2.2)
Social class II	40650	0.9 (1.0)	1.0 (1.1)	4.9 (7.3)	3.9 (1.1)	2.4 (0.9)	2.5 (2.1)
Social class III	179902	1.0 (1.1)	1.1 (1.1)	6.3 (7.9)	4.0 (1.2)	2.5 (0.9)	2.6 (2.2)
Non physical activity	126808	1.4 (1.1)	1.6 (1.1)	8.6 (7.7)	4.4 (1.3)	2.8 (1.1)	3.4 (2.7)
Yes physical activity	106006	0.4 (0.6)	0.4 (0.6)	2.9 (6.8)	3.4 (0.7)	2.1 (0.7)	1.6 (0.6)
Non Mediterranean diet	137464	1.3 (1.1)	1.5 (1.2)	8.3 (7.8)	4.4 (1.2)	2.7 (1.1)	3.3 (2.6)
Yes Mediterranean diet	95350	0.4 (0.6)	0.5 (0.6)	2.7 (6.7)	3.3 (0.7)	2.0 (0.6)	1.6 (0.6)
Non smokers	146480	0.9 (1.0)	1.1 (1.1)	3.1 (6.7)	3.9 (1.1)	2.4 (0.9)	2.4 (1.8)
Smokers	86334	1.0 (1.1)	1.2 (1.2)	10.9 (7.1)	4.0 (1.3)	2.5 (1.1)	2.9 (2.7)

HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. TC Total cholesterol. TG Triglycerides. MS Metabolic syndrome. NCEP ATP III National cholesterol Education Program Adult Treatment Panel III. JIS Joint Interim Statement. ALLY Avoidable lost life years. HA Heart age

Table IIb: Mean values of the different cardiometabolic risk scales according to sociodemographic variables and healthy habits in women.

		nº factors MS ATPIII	nº factors MS JIS	ALLY HA	TC/HDL-c	LDL-c/HDL-c	TG/HDL-c
Women	**n**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
20-29 years	29978	0.3 (0.6)	0.4 (0.7)	-2.0 (5.0)	3.2 (0.8)	1.9 (0.7)	1.4 (0.8)
30-39 years	51392	0.4 (0.7)	0.6 (0.8)	-2.0 (7.7)	3.5 (0.9)	2.2 (0.9)	1.5 (0.9)
40-49 years	45296	0.7 (0.9)	0.9 (1.0)	2.5 (10.1)	3.9 (1.0)	2.5 (0.9)	1.8 (1.0)
50-59 years	23516	1.1 (1.0)	1.3 (1.1)	7.9 (10.4)	4.4 (1.1)	3.0 (1.0)	2.1 (1.3)
60-69 years	3928	1.4 (1.1)	1.5 (1.1)	9.1 (9.7)	4.5 (1.0)	3.1 (0.9)	2.2 (1.1)
Elementary school	79810	0.7 (0.9)	0.9 (1.0)	2.7 (9.6)	3.8 (1.1)	2.4 (1.0)	1.7 (1.0)
High school	62690	0.5 (0.8)	0.7 (0.9)	-0.3 (8.8)	3.6 (1.0)	2.3 (0.9)	1.6 (1.0)
University	11610	0.4 (0.7)	0.6 (0.8)	-1.9 (8.3)	3.6 (1.0)	2.3 (0.9)	1.6 (0.8)
Social class I	10744	0.4 (0.8)	0.5 (0.8)	-2.0 (8.3)	3.6 (0.9)	2.3 (0.9)	1.6 (0.8)
Social class II	51230	0.5 (0.8)	0.7 (0.9)	-0.5 (8.7)	3.7 (1.0)	2.3 (0.9)	1.6 (1.0)
Social class III	92136	0.7 (0.9)	0.9 (1.0)	2.4 (9.6)	3.8 (1.1)	2.4 (1.0)	1.7 (1.0)
Non physical activity	73684	1.0 (1.0)	1.3 (1.0)	4.8 (9.5)	4.2 (1.1)	2.8 (1.1)	2.2 (1.2)
Yes physical activity	80426	0.3 (0.5)	0.3 (0.6)	-2.3 (7.8)	3.2 (0.7)	2.0 (0.6)	1.3 (0.4)
Non Mediterranean diet	74828	1.0 (1.0)	1.2 (1.0)	4.5 (9.6)	4.2 (1.1)	2.8 (1.0)	2.1 (1.2)
Yes Mediterranean diet	79282	0.3 (0.5)	0.3 (0.6)	-2.2 (7.9)	3.3 (0.7)	2.0 (0.7)	1.3 (0.5)
Non smokers	103300	0.6 (0.9)	0.7 (0.9)	-1.3 (8.6)	3.7 (1.1)	2.3 (0.9)	1.7 (1.0)
Smokers	50810	0.6 (0.8)	0.7 (1.0)	6.0 (8.9)	3.7 (1.0)	2.4 (1.0)	1.8 (1.1)

HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. TC Total cholesterol. TG Triglycerides. MS Metabolic syndrome. NCEP ATP III National cholesterol Education Program Adult Treatment Panel III. JIS Joint Interim Statement. ALLY Avoidable lost life years. HA Heart age

Table IIIa: Prevalence of high values of the different cardiometabolic risk scales according to sociodemographic variables and healthy habits in men.

		MS ATPIII	MS IDF	MS JIS	ALLY HA high	AD	TC/HDL -c high	LDL-c/HDL -c high	TG/HDL -c high	diabesity
Men	**n**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
20-29 years	41742	2.8	4.1	3.8	4.2	1.6	0.1	5.2	10.4	1.3
30-39 years	76960	6.3	8.3	8.2	17.6	3.5	0.2	16.2	20.0	2.8
40-49 years	69068	11.5	14.7	14.9	36.4	5.9	0.3	30.8	30.3	6.0
50-59 years	38028	14.7	19.0	20.2	55.3	8.2	0.4	44.0	36.1	8.9
60-69 years	7016	14.5	21.4	24.1	56.0	9.1	0.5	46.8	36.3	11.4
Elementary school	142494	9.4	12.2	12.5	30.4	5.1	0.3	24.0	25.0	5.0
High school	79226	8.1	10.9	10.9	24.7	4.4	0.2	23.5	23.8	4.4
University	11094	6.9	9.0	9.8	22.1	4.1	0.1	23.0	21.5	2.9
Social class I	12262	6.9	9.1	9.7	22.5	4.2	0.1	22.5	21.4	3.0
Social class II	40650	8.0	10.9	10.8	23.0	4.4	0.2	23.4	23.8	4.4
Social class III	179902	9.2	11.9	12.2	29.6	5.0	0.3	23.9	24.8	4.9
Non physical activity	126808	16.2	20.7	21.4	39.6	8.9	0.5	37.4	43.8	8.7
Yes physical activity	106006	0.5	0.7	0.3	23.5	1.3	0.1	8.0	1.3	0.6
Non Mediterranean diet	137464	14.9	19.1	19.7	38.2	8.2	0.4	35.7	40.0	8.9
Yes Mediterranean diet	95350	0.7	0.8	0.5	13.4	1.9	0.1	7.1	2.0	1.2
Non smokers	146480	7.3	10.7	10.2	13.8	2.1	0.7	23.6	22.4	5.2
Smokers	86334	11.4	13.0	14.6	52.3	9.4	4.1	24.7	27.9	5.8

HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. TC Total cholesterol. TG Triglycerides. MS Metabolic syndrome. NCEP ATP III National cholesterol Education Program Adult Treatment Panel III. IDF International Diabetes Federation. JIS Joint Interim Statement. ALLY Avoidable lost life years. HA Heart age. AD Atherogenic dyslipidemia.

Table IIIb: Prevalence of high values of the different cardiometabolic risk scales according to sociodemographic variables and healthy habits in women.

		MS ATPIII	MS IDF	MS JIS	ALLY HA high	AD	TC/HDL -c high	LDL-c/HDL -c high	TG/HDL -c high	diabesity
Women	**n**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
20-29 years	29978	0.9	1.4	1.8	2.1	0.9	0.4	7.5	4.7	0.6
30-39 years	51392	2.0	2.7	3.1	6.8	1.5	0.6	15.1	5.7	1.4
40-49 years	45296	4.2	5.4	7.0	23.7	2.4	1.3	25.9	8.8	2.6
50-59 years	23516	9.2	7.9	13.1	43.8	5.7	3.7	45.6	15.8	4.8
60-69 years	3928	12.6	10.0	18.3	49.5	8.2	4.3	48.9	18.9	7.7
Elementary school	79810	4.6	5.2	7.4	22.6	2.8	1.6	24.8	9.2	3.0
High school	62690	3.0	3.4	4.6	12.8	2.0	1.1	19.8	7.5	1.5
University	11610	2.3	2.3	3.1	9.1	1.9	1.0	18.7	5.9	1.2
Social class I	10744	2.5	2.4	3.2	9.0	1.9	0.9	18.1	6.0	1.5
Social class II	51230	3.0	3.4	4.6	12.3	2.0	1.1	20.6	7.4	1.6
Social class III	92136	4.4	4.9	7.0	21.5	2.7	1.5	23.8	9.0	2.8
Non physical activity	73684	7.7	8.5	12.0	29.2	5.0	2.8	39.4	17.2	4.7
Yes physical activity	80426	0.2	0.2	0.4	7.0	0.2	0.3	6.7	1.3	0.2
Non Mediterranean diet	74828	7.2	8.5	11.8	28.4	5.0	2.7	37.8	16.4	4.7
Yes Mediterranean diet	79282	0.2	0.2	0.4	7.4	0.3	0.4	7.7	1.6	0.2
Non smokers	103300	3.7	4.1	5.8	10.9	2.5	1.3	23.5	7.9	1.6
Smokers	50810	3.8	4.4	6.2	31.2	2.6	1.4	19.8	9.1	2.1

HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. TC Total cholesterol. TG Triglycerides. MS Metabolic syndrome. NCEP ATP III National cholesterol Education Program Adult Treatment Panel III. IDF International Diabetes Federation. JIS Joint Interim Statement. ALLY Avoidable lost life years. HA Heart age. AD Atherogenic dyslipidemia.

Table IV: Multinomial logistic regression.

	MS NCEP ATPIII	MS IDF	MS JIS	ALLY HA high	AD	TC/HDL -c high	LDL-c/HDL -c high	TG/HDL -c high	Diabesity
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Female	1	1	1	1	1	1	1	1	1
Male	2.08 (2.01-2.14)	2.63 (2.55-2.71)	1.83 (1.78-1.88)	1.98 (1.70-3.27)	1.11 (1.07-1.15)	0.89 (0.80-0.98)	0.90 (0.81-0.97)	2.21 (2.07-2.35)	2.19 (2.01-2.38)
20-29 years	1	1	1	1	1	1	1	1	1
30-39 years	1.11 (1.04-1.18)	1.18 (1.11-1.25)	1.34 (1.27-1.41)	3.12 (2.80-3.44)	1.06 (1.03-1.10)	1.16 (1.11-1.21)	1.15 (1.07-1.23)	1.20 (1.13-1.28)	1.22 (1.15-1.29)
40-49 years	1.43 (1.35-1.52)	1.38 (1.31-1.46)	1.80 (1.71-1.90)	6.10 (5.30-6.90)	1.09 (1.05-1.13)	1.30 (1.20-1.41)	1.30 (1.21-1.39)	1.59 (1.41-1.77)	1.40 (1.30-1.51)
50-59 years	2.13 (2.00-2.27)	2.03 (1.92-2.15)	2.82 (2.68-2.98)	8.15 (7.05-9.25)	1.21 (1.16-1.26)	1.79 (1.65-1.93)	1.80 (1.59-2.01)	1.99 (1.70-2.29)	1.89 (1.65-2.13)
60-69 years	3.50 (3.24-3.79)	3.00 (2.80-3.22)	4.32 (4.04-4.62)	11.33 (10.01-12.65)	1.30 (1.16-1.45)	2.45 (2.20-2.7.)	2.10 (1.98-2.23)	2.75 (2.41-3.09)	2.31 (2.05-2.57)
Social class I	1	1	1	1	1	1	1	1	1
Social class II	1.07 (1.02-1.11)	1.08 (1.04-1.11)	1.07 (1.04-1.11)	1.15 (1.10-1.21)	1.12 (1.05-1.19)	1.36 (1.23-1.40)	1.18 (1.12-1.24)	1.23 (1.18-1.28)	1.33 (1.21-1.45)
Social class III	1.18 (1.10-1.26)	1.26 (1.19-1.34)	1.20 (1.13-1.27)	1.45 (1.37-1.54)	1.28 (1.21-1.36)	1.88 (1.71-2.05)	1.39 (1.27-1.51)	1.56 (1.40-1.72)	1.57 (1.40-1.74)
Yes physical activity	1	1	1	1	1	1	1	1	1
Non physical activity	46.37 (38.58-55.74)	13.81 (12.58-15.15)	18.43 (16.69-20.34)	4.12 (3.50-4.75)	1.89 (1.75-2.03)	8.13 (7.83-8.44)	6.38 (5.98-6.79)	8.52 (8.13-8.91)	6.25 (6.01-6.49)
Yes Mediterranean diet	1	1	1	1	1	1	1	1	1
Non Mediterranean diet	5.38 (4.66-6.21)	3.26 (2.97-3.57)	3.73 (3.40-4.09)	2.28 (1.70-2.86)	1.71 (1.60-1.82)	5.25 (4.95-5.56)	5.29 (4.99-5.60)	5.32 (4.97-5.67)	5.03 (4.74-5.32)
Non smokers	1	1	1	1	1	1	1	1	1
Smokers	1.73 (1.69-1.78)	1.39 (1.36-1.43)	1.69 (1.65-1.73)	4.29 (3.80-4.79)	1.19 (1.11-1.27)	1.21 (1.13-1.29)	1.19 (1.08-1.30)	1.28 (1.21-1.36)	1.23 (1.08-1.39)

HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. TC Total cholesterol. TG Triglycerides. MS Metabolic syndrome. NCEP ATP III National cholesterol Education Program Adult Treatment Panel III. IDF International Diabetes Federation. JIS Joint Interim Statement. ALLY Avoidable lost life years. HA Heart age. AD Atherogenic dyslipidemia.

Discussion

All sociodemographic variables (age, sex, social class and educational level) and all health habits (physical activity, Mediterranean diet and smoking) influence the values of all the cardiometabolic risk scales analyzed, whether metabolic syndrome, atherogenic risk, diabesity or heart age.

Understanding the intricate relationship between age, gender, socioeconomic status (SES), education level, physical activity, adherence to the Mediterranean diet, and tobacco use is essential for comprehensively addressing various metabolic disorders. This discussion

aims to delve into the multifaceted influences of these factors on conditions such as metabolic syndrome, atherogenesis, diabesity, and heart age, to provide a holistic understanding.

Age plays a pivotal role in the onset and progression of metabolic disorders. Advancing age is associated with an increased risk of developing metabolic syndrome, atherogenesis, and diabesity, as physiological changes occur, leading to alterations in lipid metabolism, insulin sensitivity, and cardiovascular function[51]. Gender differences also influence the prevalence and presentation of these disorders, with men generally exhibiting higher rates of metabolic syndrome and atherogenesis, while women may experience increased risks post-menopause due to hormonal changes[52].

SES and education level significantly impact the development and management of metabolic disorders. Individuals from lower SES backgrounds often face barriers to accessing healthcare, nutritious foods, and opportunities for physical activity, leading to a higher prevalence of metabolic syndrome, atherogenesis, and diabesity[53]. Additionally, lower educational attainment is associated with poorer health outcomes and limited health literacy, contributing to disparities in disease prevalence and management[54].

Regular physical activity is a cornerstone in the prevention and management of metabolic disorders. Engaging in exercise improves insulin sensitivity, lipid profiles, and cardiovascular health, thereby reducing the risk of metabolic syndrome, atherogenesis, and diabesity[55]. Conversely, sedentary behavior exacerbates these conditions, leading to metabolic dysfunction and increased cardiovascular risk.

Adherence to the Mediterranean diet has been consistently associated with a reduced risk of metabolic disorders. This dietary pattern, rich in fruits, vegetables, whole grains, fish, and olive oil, exerts cardioprotective effects, improving lipid profiles, insulin sensitivity, and endothelial function[56]. Furthermore, the Mediterranean diet may mitigate the progression of atherogenesis and diabesity, thereby promoting overall cardiovascular health.

Tobacco use is a modifiable risk factor that significantly influences the development and progression of metabolic disorders. Smoking is associated with insulin resistance, dyslipidemia, and systemic inflammation, contributing to the pathogenesis of metabolic syndrome, atherogenesis, and diabesity[57]. Smoking cessation interventions are crucial for reducing the burden of these conditions and improving overall health outcomes.

Metabolic syndrome, characterized by a cluster of metabolic abnormalities including central obesity, hypertension, dyslipidemia, and insulin resistance, is influenced by various demographic and lifestyle factors. Age, gender, SES, education level, physical activity, adherence to a healthy diet, and tobacco use collectively contribute to the development and progression of metabolic syndrome[58].

Atherogenesis, the process of plaque formation in arterial walls, is closely linked to metabolic syndrome and its associated risk factors. Age, gender, SES, education level, physical inactivity, poor dietary habits, and tobacco use promote atherogenesis by exacerbating inflammation, oxidative stress, and endothelial dysfunction[59]. Lifestyle modifications targeting these factors are essential for preventing this process.

Diabesity, the intertwined occurrence of diabetes and obesity, represents a major public health challenge. Age, gender, SES, education level, physical inactivity, unhealthy dietary patterns, and tobacco use contribute to the rising prevalence of diabesity[60,61]. Addressing these factors through lifestyle interventions and population-level strategies is critical for stemming the diabesity epidemic and reducing its associated.

Heart age, an estimate of cardiovascular risk based on multiple risk factors, is influenced by age, gender, socioeconomic factors, lifestyle behaviors, and comorbidities. Age, gender, SES, education level, physical inactivity, poor diet quality, and tobacco use contribute to accelerated aging of the heart, increasing the risk of cardiovascular events and mortality[62]. Strategies aimed at optimizing cardiovascular health across the lifespan are essential for reducing heart age and improving overall cardiovascular outcomes.

As strengths we can highlight the enormous size of the sample, which exceeds 132,000 people, and the wide variety of cardiometabolic risk scales analyzed.

The main limitation is that the study was carried out in the working population (aged 18 to 69 years), so it is not possible to extrapolate our results to those of the general population.

Conclusion

The relationship between age, gender, SES, education level, physical activity, adherence to a Mediterranean diet, tobacco use, and various metabolic disorders including metabolic syndrome, atherogenesis, diabesity, and heart age is complex and multifaceted. Addressing these factors through targeted interventions and population-level strategies is paramount for reducing the burden of these disorders and improving overall cardiovascular health outcomes

Conflict of interest

The authors declare that they have no competing interests.

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