ORIGINAL

Determination of scales related to cardiovascular risk and fatty liver in 5.370 spanish farmers

Determinación de escalas relacionadas con el riesgo cardiovascular y el hígado graso en 5.370 agricultores españoles

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Recibido: 1 - III - 2021
Aceptado: 26 - IV - 2021

doi: 10.3306/AJHS.2021.36.02.26

Abstract

Introduction: Cardiovascular diseases are one of the main causes of morbidity and mortality worldwide. Although these pathologies mainly affect the elderly, they also affect younger people.

Material and methods: Descriptive and cross-sectional study carried out in 5.370 Spanish farmers (3.695 men and 1.675 women) with a mean age of approximately 41 years. Different indeces of overweight and obesity, fatty liver, atherogenic indices, cardiovascular risk scores, metabolic syndrome and other indicators related to cardiovascular risk were analyzed.

Results: Approximately 20% of our workers presented obesity, hypertension and hypertriglyceridemia. Around 40% had hypercholesterolemia. We found a high prevalence of metabolic syndrome, fatty liver and high values of REGICOR and SCORE cardiovascular risk scores.

Conclusions: Despite the low mean age of our farmers, the prevalence of altered values of the different scores related to cardiovascular risk can be considered high.

Keywords: metabolic syndrome, fatty liver, hypertension, dyslipidemia, farmers.

Resumen

Introducción: Las enfermedades cardiovasculares son una de las principales causas de morbimortalidad a nivel mundial. Estas patologías aunque afectan principalmente a personas de edad avanzada, también están presentes en personas más jóvenes.

Material y métodos: Estudio descriptivo y transversal realizado en 5.370 granjeros españoles (3.695 hombres y 1.675 mujeres) con una edad media de aproximadamente 41 años. Se analizan diferentes escalas de sobrepeso y obesidad, escalas de hígado graso, índices aterogénicos, escalas de riesgo cardiovascular, síndrome metabólico y otros indicadores relacionados con riesgo cardiovascular.

Resultados: Aproximadamente un 20% de nuestros trabajadores presentan obesidad, hipertensión e hipertrigliceridemia. Un 40% hipercolesterolemia. Hemos encontrado altas prevalencias de síndrome metabólico, hígado graso y de valores elevados de las escalas de riesgo cardiovascular REGICOR y SCORE.

Conclusiones: Pese a la baja edad media de nuestros granjeros, la prevalencia de valores alterados de las diferentes escalas relacionadas con el riesgo cardiovascular se pueden considerar elevadas.

Palabras clave: Síndrome metabólico, hígado graso, hipertensión, dislipemias, agricultores.

Introduction

Among the tasks of occupational physicians we can highlight the preventive one, Considered as the set of activities aimed at reducing or eliminating occupational risks by individual or collective interventions, although in recent years, comprehensive health promotion has gained special importance, defined by the WHO in the Ottawa letter (WHO, 1986)[1] as the process that allows people to exercise control over the determinants of health, thus improving their health, and which encompasses actions to improve the health and well-being of workers.

Within the preventive activities we find a continuous Health Surveillance, which allows the occupational health personnel to have information about health problems, health indicators or unhealthy life habits of workers that may contribute to the development of diseases.

Various institutions (Public Health or Occupational Health) have begun to take action to prevent cardiovascular diseases by studying the factors related to greater cardiovascular risk and by implementing measures aimed at reducing the incidence and consequences of these diseases among the working population.

CVD is the leading cause of disability and premature death worldwide[2], with significant health care costs. In Europe they are also the leading cause of death in men and women, although preventive measures to control cardiovascular risk factors and treatments have increased the overall survival[3].

Despite the fact that Spain is the second country in the European Union with the lowest mortality rates due to cardiovascular diseases, in 2015 diseases of the circulatory system continued to be the leading cause of death in our country, with ischemic coronary heart disease standing out as the pathology responsible for the greatest number of deaths[4].

In addition to the classic factors related to cardiovascular risk (diabetes, obesity, smoking and hypertension, among others), there are others, especially sociodemographic and occupational factors, that influence the risk of the population that has not yet developed clinical signs of cardiovascular pathology and therefore, on which primary prevention can be carried out to avoid the onset of CVD, The work environment is an ideal place to put it into practice, especially in the context of health surveillance, where action is taken on active healthy workers, and where, in addition to the classic risk factors, different sociodemographic and occupational variables have to be taken into consideration, such as age, gender, level of education, social class and type of work performed.

The different professions can have a positive or negative influence on the levels of cardiovascular risk, so it is interesting to know what this level is in each of the occupational groups.

In this study, we set out to determine the level of cardiovascular risk in an occupational group that has been little studied in Spain, namely farmers.

Methods

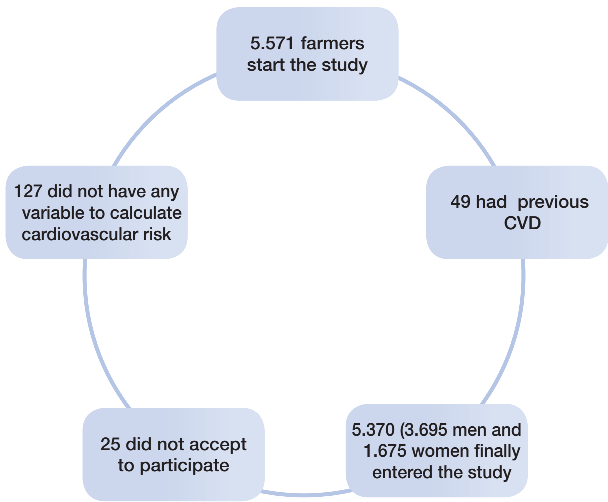
A retrospective and cross-sectional study was carried out in 5.571 farmers from different Spanish geographical areas between January 2019 and September 2020. The farmers were selected on the basis of their attendance at periodic occupational health checkups.

Inclusion criteria:

- Belongs to one of the participating companies.
- Accepts participating in the study.
- Not having suffered a serious cardiovascular disease event in the past (myocardial infarction, cerebrovascular disease...)

5.571 farmers began the study, 127 were excluded because data were not available for all the variables needed to calculate the cardiovascular risk indicators; 49 had a history of cardiovascular disease and 25 did not agree to participate in the study. The final number of workers included in the study was 5.370 farmers. See flow chart in **figure 1**.

Figure 1: Participant flow chart.



All anthropometric, clinical and analytical measurements were performed by health personnel from the occupational health units that participated in the study, after standardizing the measurement techniques. The following parameters related to cardiovascular risk were included in the assessment:

Weight, expressed in kilograms, and height in cm, were determined with a SECA 700 scale equipped with a SECA 220 telescopic height bar.

Waist circumference (in cm): was measured with a SECA model 200 tape measure. The individual stood with feet together, trunk straight and upper limbs hanging on both sides of the body. The tape measure was placed parallel to the ground at the height of the last floating rib.

Blood pressure was measured with a calibrated OMRON M3 automatic sphygmomanometer and after 10 minutes rest. Three determinations were made at one-minute intervals, obtaining the mean of the three. Hypertension was considered when the values were equal to or greater than 140 mm Hg systolic or 90 mm Hg diastolic blood pressure.

Glycemia, total cholesterol and triglycerides: These were determined by automated enzymatic methods and HDL by precipitation with dextran sulfate Cl2Mg. LDL was calculated using the Friedewald formula (provided that triglycerides were less than 400 mg/dl). All the above values are expressed in mg/dl.

Friedewald's formula: LDL = total cholesterol –HDL– triglycerides / 5

Glycemia was classified according to the recommendations of the American Diabetes Association[5], considering hyperglycemia >125 mg/dL. Cholesterol values >239 mg/dL, LDL >159 mg/dL and triglycerides >200 mg/dL were considered high.

The cut-off points for the atherogenic indexes were[6]: Cholesterol/HDL (considered as high values >5 in men and >4.5 in women), LDL/HDL and Triglycerides/HDL (high values >3).

Three models of metabolic syndrome were determined:

a) NCEP ATP III (National Cholesterol Educational Program Adult Treatment Panel III), at least three of the following factors are required: waist circumference >88 cm in women and 102 cm in men; triglycerides >150 mg/dL or under treatment ; blood pressure >130/85 mm Hg or under treatment ; HDL <40 mg/dL in women or <50 mg/dL in men or under treatment, and fasting blood glucose >100 mg/dL or under treatment.

b) The International Diabetes Federation (IDF)[7] requires central obesity, waist circumference >80 cm in women and >94 cm in men, and in addition two or more of the other factors cited above for ATP III.

c) JIS[8] criteria the same as NCEP ATPIII, except waist, which is the same as the IDF model.

Hypertriglyceridemic waist[9]: waist circumference greater than 94 cm in men and greater than 80 cm in women and triglycerides greater than 150 mg/dl or treatment.

REGICOR is the Framingham scale adapted to the Spanish population[10] and is applied between 35 and 74 years of age. We speak of moderate risk >5% and high risk >10%[11]. The SCORE scale is the version recommended for Spain[12-13] It can be determined between 40 and 65 years of age and we speak of moderate risk >4% and high risk >5%.

Framingham vascular age is determined using calibrated tables[14] and assesses arterial aging. It can be calculated from the age of 30 years. Vascular age with the SCORE model[15] is also calculated using tables and in persons between 40 and 65 years of age. A concept that applies to both vascular ages is avoidable years of life lost (ALLY)[16], which can be defined as the difference between biological age and vascular age.

ALLY = vascular age –biological age.

Other different indicators are calculated using the following formulas:
Visceral adiposity index[17] (VAI)

Male:

$$VAI = \left(\frac{WC}{39{,}68 + (1{,}88 \times BMI)}\right) \times \left(\frac{TG}{1{,}03}\right) \times \left(\frac{1{,}31}{HDL}\right)$$

Female:

$$VAI = \left(\frac{WC}{39{,}58 + (1{,}89 \times BMI)}\right) \times \left(\frac{TG}{0{,}81}\right) \times \left(\frac{1{,}52}{HDL}\right)$$

Waist triglyceride index[18]
Waist circumference (cm) x triglycerides (mmol).

Body shape index (ABSI)[19].

$$ABSI = \frac{WC}{BMI^{2/3} \times height^{1/2}}$$

Normalized weight-adjusted index (NWAI)[20]

[(weight/10) – (10 x height) + 10] with weight measured in kg and height in m.

Conicity index[21]

$$\frac{\text{waist circumference (in metres)}}{0{,}109} \times 1/\sqrt{\frac{\text{weight (in kilogram)}}{\text{height (in metres)}}}$$

Cardiometabolic index[22]
Waist-to-height ratio x atherogenic index triglycerides / HDL-c.

Triglyceride glucose index[23] = LN (triglycerides [mg/dl] × glycaemia [mg/dl]/2).

Triglyceride glucose index-BMI, Triglyceride glucose index-waist[24]

TyGindex-BMI = TyGindex x BMI
TyGindex-waist = TyGindex x waist

Atherogenic dyslipidemia is defined by triglycerides >150 mg/dL, HDL<40 mg/dL in men and <50 mg/dL in women and normal LDL. If LDL is > 130 mg/dL we speak of lipid triad[25].

The overweight and obesity index analyzed include:

- Body mass index (BMI) was calculated by dividing weight by height in squared meters. Obesity was considered over 30k/m².
- The waist-to-height ratio was considered risky over 0.5026.
- The body surface index[27] (BSA) is calculated from the body surface area (BSA) where w represents weight in kg and h height in cm

$$BSA = w^{0,425} * h^{0,725} * 0,007184$$

$$BSI = \frac{WEIGHT}{\sqrt{BSA}}$$

Formulas to estimate the percentage of body fat:

- Relative fat mass[28] 76- (20 x (height/p waist)) Height and waist circumference are expressed in meters.
- CUN BAE[29] (University of Navarra Body Adiposity Estimator Clinic)
  -44.988 + (0.503 x age) + (10.689 x sex) + (3.172 x BMI) - (0.026 x BMI²) + (0.181 x BMI x sex) - (0.02 x BMI x age) - (0.005 x BMI² x sex) + (0.00021 x BMI² x age)
- ECORE-BF (Equation COrdoba Estimator Body Fat)[30]
  -97.102 + 0.123 (age) + 11.9 (gender) + 35.959 (LnBMI)

In CUN BAE and ECORE-BF male is 0 and female 1 and cut-off points for obesity are 35% in women 25% in men.

- Palafolls formula[31].
  Men = (BMI/waist]*10) + BMI. Women = (BMI/waist]*10) + BMI + 10.
- Deuremberg formula[32].
  1,2 x (BMI) + 0,23 x (age) - 10,8 x (gender) - 5,4
  Male = 0 Female = 1

Body Roundness Index[33] (BRI)

$$BRI = 364,2 - 365,5 \times \sqrt{1 - \left(\frac{(WC/(2\pi))^2}{(0,5\ height)^2}\right)}$$

Non-alcoholic fatty liver scales:

- Fatty liver index (FLI)[34]
  FLI = $(e^{0.953*\log_e(triglycerides) + 0.139*BMI + 0.718*\log_e(ggt) + 0.053*waist\ circumference - 15.745}) / (1 + e^{0.953*\log_e(triglycerides) + 0.139*BMI + 0.718*\log_e(ggt) + 0.053*waist\ circumference - 15.745}) \times 100$

Cutoff for high risk 60.

- Hepatic steatosis index (HSI)[35]
  HSI = 8 x ALT/AST + BMI (+ 2 if type 2 diabetes yes, + 2 if female)
- Zhejian University index (ZJU)[36]
  BMI + FPG mmol L + TG mmol L+ 3 ALT/AST + 2 if female
- Fatty liver disease index (FLD)[37]
  BMI + TG + 3 × (ALT/AST) + 2 × Hyperglycaemia (presence= 1; absence = 0)
  Values <28.0 or >37.0 excluded the possibility of NAFLD
  BMI ≥ 28 = 1 point, AST/ALT ≥ 0.8 = 2 points, type 2 diabetes mellitus = 1 point.
  Cut off for high risk 2 points
- Lipid accumulation product[38]
  In men: (waist circumference (cm) - 65) x (triglyceride concentration (mMol)).
  In women: (waist circumference (cm) - 58) x (triglyceride concentration (mMol))

A smoker was considered to be any person who had regularly consumed at least 1 cigarette/day (or the equivalent in other types of consumption) in the last month, or had quit smoking less than one year ago.

Statistical analysis

Frequency was calculated for categorical variables and mean and standard deviation for quantitative variables. Bivariate analysis was performed using the chi-square test (with a correction with Fisher's exact test, when conditions required it) and a Student's t test for independent samples. Multivariate analysis was performed by binary logistic regression with the Wald method, with calculation of the Odds ratio, and the Hosmer-Lemeshow goodness-of-fit test was performed. The SPSS 27.0 program was used for the statistical analysis, and it was considered statistically significant when $p<0.05$.

Considerations and ethical aspects

The Clinical Research Ethics Committee of the Illes Balears Health Area approved the study nº IB 4383/20. The procedures were performed following the ethical standards of the institutional research committee and with the 2013 Declaration of Helsinki. All patients signed written informed consent documents before participating in the study.

Results

The mean values by sex of the different anthropometric, clinical and analytical variables of the sample are shown in **table I**. The high percentage of smokers in both sexes stands out, especially in men. In all the variables the results were worse in male farmers, the differences being statistically significant in all cases.

Most of the data analyzed show more negative results in male farmers, this is true for overweight and obesity indices (waist/height, BMI, BRI, ABSI, BSI, VAI and conicity index) but not for NWAI, cardiovascular risk scales (SCORE, REGICOR and vascular age), metabolic syndrome, atherogenic indices, Triglyceride-glucose index and waist triglyceride index.

Fatty liver index and Framingham steatosis index are higher in men while hepatic steatosis index and Zhejian University index are higher in women. The formulas for estimating body fat have higher values in women, since the female sex has a higher fat content under normal conditions. The complete results can be found in **table II**.

When analyzing the prevalence of altered values of the different scales studied, we observed a trend similar to that found in the mean values, that is, most prevalences are higher in men. There are only higher prevalences in women in BMI, CUN BAE, ECORE-BF, Deuremberg formula, hepatic steatosis index and Zhejian University index. All the data can be consulted in **table III**.

Multivariate analysis using binary logistic regression showed that males (except in the metabolic syndrome with the IDF criteria) and age over 50 years (except in the waist to weight ratio, hypertriglyceridemic waist and fatty liver index) are the two factors that most influence the appearance of altered values of scales related to cardiovascular risk. Smoking affects few scales and does so on the one hand by decreasing the prevalence (ECORE-BF, CUN BAE, Palafolls formula, Deuremberg formula and Framingham liver disease index) and on the other by increasing it (total and LDL cholesterol, Atherogenic dyslipidemia, lipid triad, LDL/HDL, REGICOR and SCORE scales). To see all the results, please refer to **table IV**

Table I: Characteristics of Spanish farmers.

	Men n=3.695 Mean (SD)	Women n=1.675 Mean (SD)	p-value
Age (years)	40.9 (11.2)	41.5 (10.5)	0.068
Height (cm)	173.7 (7.0)	161.6 (6.6)	<0.0001
Weight (cm)	79.8 (14.9)	69.1 (15.0)	<0.0001
Waist (cm)	84.1 (11.6)	74.5 (11.6)	<0.0001
Systolic Blood Presure (mmHg)	126.5 (16.1)	117.1 (15.9)	<0.0001
Dyastolic Blood Presure (mmHg)	76.5 (10.9)	71.3 (10.3)	<0.0001
Cholesterol (mg/dl)	195.1 (40.8)	191.3 (35.4)	0.001
HDL-c (mg/dl)	51.0 (7.8)	56.3 (6.9)	<0.0001
LDL-c (mg/dl)	119.2 (38.7)	115.6 (34.3)	0.001
Triglycerides (mg/dl)	126.3 (90.3)	97.5 (44.7)	<0.0001
Glycaemia (mg/dl)	92.5 (25.6)	86.3 (19.6)	<0.0001
ALT (U/l)	28.8 (16.6)	19.0 (11.8)	<0.0001
AST (U/l)	26.0 (12.1)	19.2 (9.2)	<0.0001
GGT (U/l)	34.5 (34.0)	20.3 (22.9)	<0.0001
	Percentage	Percentage	p-value
18-29 years	18.4	15.7	<0.0001
30-39 years	27.5	26.0	
40-49 years	29.1	34.3	
50-69 years	25.0	24.0	
Non-Smokers	63.6	65.4	<0.0001
Smokers	36.4	34.6	

Table II: Mean values of the different cardiovascular risk and fatty liver scales according to gender in Spanish farmers.

	Men n=3.695 Mean (SD)	Women n=1.675 Mean (SD)	p-value
Waist to weight ratio	0.48 (0.06)	0.46 (0.07)	<0.0001
Body mass index (BMI)	26.4 (4.6)	26.4 (5.4)	0.999
CUN BAE	25.2 (6.7)	37.0 (7.3)	<0.0001
ECORE-BF	25.2 (6.4)	36.9 (7.5)	<0.0001
Relative fat mass	22.0 (5.3)	31.7 (6.0)	<0.0001
Palafolls formula	29.6 (4.8)	40.0 (5.7)	<0.0001
Deuremberg formula	24.9 (6.5)	35.9 (7.3)	<0.0001
Body surface index	57.1 (8.0)	52.2 (8.6)	<0.0001
Normalized weight adjusted index	0.6 (1.4)	0.8 (1.4)	0.001
Body roundness index	3.1 (1.2)	2.7 (1.3)	<0.0001
Body shape index	0.072 (0.006)	0.067 (0.006)	<0.0001
Visceral adiposity index	7.2 (6.6)	2.9 (1.6)	<0.0001
Conicity index	1.1 (0.1)	1.0 (0.1)	<0.0001
Fatty liver index	35.1 (27.6)	21.8 (23.5)	<0.0001
Hepatic steatosis index	35.7 (6.9)	37.0 (7.0)	<0.0001
Zhejiang University index	36.5 (6.1)	37.5 (6.2)	<0.0001
Fatty Liver Disease index	31.4 (5.7)	30.8 (6.0)	0.010
Lipid accumulation product	29.6 (36.6)	19.3 (19.3)	<0.0001
Triglyceride glucose index	8.5 (0.6)	8.2 (0.4)	<0.0001
Triglyceride glucose index-BMI	225.6 (47.0)	218.8 (49.9)	<0.0001
Triglyceride glucose index-waist	716.0 (122.5)	615.5 (109.1)	<0.0001
Triglyceride glucose index-WtWR	4.1 (0.7)	3.8 (0.7)	<0.0001
Waist trigliceride index	122.4 (98.3)	83.1 (44.5)	<0.0001
ALLY vascular age SCORE*	7.9 (7.2)	4.1 (5.0)	<0.0001
SCORE scale*	1.9 (2.4)	0.5 (0.9)	<0.0001
ALLY vascular age Framingham**	6.6 (10.7)	2.0 (12.2)	<0.0001
REGICOR scale***	3.5 (2.4)	2.4 (2.0)	<0.0001
Nº factors of metabolic syndrome NCEP ATPIII	1.2 (1.2)	0.9 (1.1)	<0.0001
Nº factors of metabolic syndrome JIS	1.6 (1.3)	1.0 (1.1)	<0.0001
Cardiometabolic index	1.3 (1.2)	0.8 (0.5)	<0.0001
Atherogenic index total cholesterol/HDL-c	3.9 (1.2)	3.5 (0.9)	<0.0001
Atherogenic index triglycerides/HDL-c	2.6 (2.1)	1.8 (0.9)	<0.0001
Atherogenic index LDL-c/HDL-c	2.4 (1.0)	2.1 (0.8)	<0.0001

(*) Women n=974 Men n= 1987 (**) Women n= 1412 Men n=3016 (***) Women n=1246 Men n=2584

Table III: Prevalence of altered values of the different cardiovascular risk and fatty liver scales by gender in Spanish farmers.

	Men n=3.695	Women n=1.675	
Waist to weight ratio > 0.50	35.3	23.1	<0.0001
Body mass index obesity	19.3	23.3	<0.0001
CUN BAE obesity	51.2	61.0	<0.0001
ECORE-BF obesity	51.2	60.2	<0.0001
Relative fat mass obesity	44.2	34.7	<0.0001
Palafolls formula obesity	83.9	80.1	<0.0001
Deuremberg formula obesity	48.6	77.0	<0.0001
Hypertension	24.8	11.8	<0.0001
Total cholesterol ≥ 200 mg/dl	42.1	38.1	0.005
LDL-c ≥ 130 mg/dl	36.8	32.0	0.001
Triglycerides ≥ 150 mg/dl	24.8	9.1	<0.0001
Glycaemia 100-125 mg/dl	16.2	8.7	<0.0001
Glycaemia ≥ 126 mg/dl	4.3	1.9	<0.0001
Metabolic syndrome NCEP ATPIII	14.5	9.6	<0.0001
Metabolic syndrome IDF	9.6	8.1	0.035
Metabolic syndrome JIS	23.2	10.8	<0.0001
Atherogenic dyslipidemia	5.7	3.6	0.001
Lipid triad	2.1	1.2	0.020
Hipertrigliceridemic waist	7.2	1.3	<0.0001
Atherogenic index total cholesterol/HDL-c moderate-high	16.8	11.1	<0.0001
Atherogenic index triglycerides/HDL-c high	26.1	7.1	<0.0001
Atherogenic index LDL-c/HDL-c high	25.0	12.0	<0.0001
SCORE scale moderate-high*	27.6	3.9	<0.0001
REGICOR scale moderate-high**	23.5	12.5	<0.0001
Fatty liver index high risk	21.3	10.0	<0.0001
Hepatic steatosis index high risk	42.6	51.3	<0.0001
ZJU index high	34.2	43.2	<0.0001
Framingham liver disease index high	55.2	49.9	<0.0001

(*) Women n=974 Men n= 1987 (**) Women n=1246 Men n=2584

Table IV: Logistic regression análisis.

	≥ 50 years OR (95% CI)	Men OR (95% CI)	Smokers OR (95% CI)
Waist to weight ratio > 0.50	ns	1.82 (1.59-2.07)	ns
Body mass index obesity	1.33 (1.15-1.55)	0.78 (0.68-0.90)	ns
CUN BAE obesity	3.45 (3.00-3.97)	0.65 (0.58-0.73)	0.86 (0.76-0.96)
ECORE-BF obesity	3.26 (2.84-3.74)	0.67 (0.60-0.76)	0.85 (0.76-0.96)
Relative fat mass obesity	1.19 (1.05-1.35)	1.49 (1.32-1.68)	ns
Palafolls formula obesity	1.91 (1.58-2.30)	1.30 (1.12-1.51)	0.80 (0.69-0.93)
Deuremberg formula obesity	6.57 (5.56-7.75)	0.25 (0.21-0.28)	0.83 (0.73-0.94)
Hypertension	3.46 (3.00-3.99)	2.55(2.15-3.02)	ns
Total cholesterol ≥ 200 mg/dl	2.51 (2.21-2.84)	1.18 (1.04-1.33)	1.18 (1.05-1.33)
LDL-c ≥ 130 mg/dl	2.60 (2.29-2.96)	1.23 (1.09-1.40)	1.19 (1.06-1.34)
Triglycerides ≥ 150 mg/dl	1.45 (1.24-1.68)	3.31 (2.75-3.97)	ns
Glycaemia ≥ 126 mg/dl	4.14 (3.08-5.56)	2.36 (1.60-3.50)	ns
Metabolic syndrome NCEP ATPIII	3.56 (3.02-4.19)	1.62 (1.34-1.96)	ns
Metabolic syndrome IDF	1.59 (1.30-1.94)	ns	ns
Metabolic syndrome JIS	3.23 (2.79-3.73)	2.57 (2.15-3.06)	ns
Atherogenic dyslipidemia	2.20 (1.71-2.83)	1.62 (1.21-2.17)	1.38 (1.08-1.78)
Lipid triad	1.91 (1.26-2.89)	1.76 (1.07-2.89)	1.99 (1.33-2.97)
Hipertrigliceridemic waist	ns	6,11 (3,90-9,56)	ns
Atherogenic index total cholesterol/HDL-c moderate-high	2.85 (2.43-3.33)	1.62 (1.36-1.94)	ns
Atherogenic index triglycerides/HDL-c high	1.64 (1.41-1.90)	4.65 (3.80-5.68)	ns
Atherogenic index LDL-c/HDL-c high	2.79 (2.41-3.21)	2.46 (2.08-2.91)	1.25 (1.08-1.43)
SCORE scale moderate-high	56.26 (38.64-81.91)	19.37 (13.06-28.73)	6.85 (5.15-9.10)
REGICOR scale moderate-high	12.46 (10.17-15.26)	2.46 (1.98-3.06)	4.17 (3.43-5.07)
Fatty liver index high risk	ns	2.42 (1.99-2.95)	ns
Hepatic steatosis index high risk	1.44 (1.20-1.71)	0.70 (0.59-0.81)	ns
ZJU index high	1.59 (1.33-1.90)	0.68 (0.58-0.80)	ns
Framingham liver disease index high	1.53 (1.28-1.83)	1.23 (1.05-1.44)	0.83 (0.70-0.98)

Discussion

The first thing that is striking about the results obtained in this study is that the prevalence of altered values of parameters related to cardiovascular risk is high despite the fact that the mean age of the workers is low, 41 years, and the work also involves a high physical workload. In our sample we found, despite the relative youth of the sample, more than 20% obesity, arterial hypertension and hypertriglyceridemia, almost 40% hypercholesterolememia, high prevalence of metabolic syndrome and high values of cardiovascular risk scales such as SCORE or REGICOR, and also a high percentage of people at high risk of suffering from fatty liver disease according to the different scales.

These data are much higher than those found in a study carried out in Ireland[39] in 310 farmers in which the prevalence of smoking was much lower (9.3%) but much lower than those presented in 502 farmers in Crete[40] (52.7%).

As we have said, almost 20% of our workers present obesity values using BMI, these figures are lower than those found by other authors, thus the Irish study[39] presented a prevalence of 35% and a study carried out in 27 farmers in Minnesota[41] found that 40.7% were obese. Other studies found figures similar to ours, 21.8% of the 1792 Australian farmers included in a study[42] presented figures compatible with obesity. Approximately 35% of our farmers had abdominal obesity, a figure lower than that found in the Australian study[42] which was 38.4%, much lower than that found in the Irish study (80.5%)[39].

The prevalence of hypertension in 20% of our workers is much lower than that found among Irish (46%)[39] and Australian (54%)[42] farmers.

Hypercholesterolemia was found in 40% of our farmers, lower than among the Irish39 (46%), in Crete (73.6%)[40] and in Minnesota[41] (76.9%). Elevated triglyceride levels in our study represent 20%, a much lower prevalence than that found in Irish farmers (49.4%)[39].

We have not found studies in farmers that have assessed the other parameters that we have included in our study (atherogenic indices, cardiovascular risk scales, fatty liver scales, etc.) and therefore we cannot compare them.

As strong points of our study, we can highlight the large sample size, more than 5000, and the large number of variables analyzed.

The main limitation of our study is that it was carried out in a specific country, which prevents us from extrapolating our results to other countries.

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