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ORIGINAL

Estimation of cardiometabolic risk in 25.030 Spanish kitchen workers

Estimación del riesgo cardiometabólico en 25.030 trabajadores de cocina españoles

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Summary

Introduction: Cardiometabolic diseases have a high prevalence in the world and a large number of factors are involved in their genesis, some of them sociodemographic. The aim of this study was to determine the level of cardiometabolic risk in kitchen workers belonging to the low socioeconomic level.
Methods: Descriptive, cross-sectional study of 25030 Spanish kitchen workers with a mean age slightly over 39 years in whom different cardiometabolic risk scales were determined, such as metabolic syndrome, atherogenic risk, nonalcoholic fatty liver disease, insulin resistance, or cardiovascular risk scales such as REGICOR, SCORE, or vascular age.
Results: Almost all the cardiometabolic risk scales show high prevalences in this group of workers; these figures take on special importance taking into account that the age of the participants is not very high.
Conclusions: There is a moderate to high prevalence of elevated values of the different cardiometabolic risk scales analyzed, especially in men.

Key words: Cardiometabolic risk, metabolic syndrome, insulin resistance, nonalcoholic fatty liver disease, atherogenic risk.

Resumen

Introducción: Las enfermedades cardiometabólicas presentan una elevada prevalencia en el mundo y en su génesis están involucrados gran número de factores, algunos de ellos sociodemográficos. El objetivo de este estudio es conocer el nivel de riesgo cardiometabólico de los trabajadores de cocina que pertenecen al nivel socioeconómico bajo.
Material y métodos: Estudio descriptivo y transversal en 25030 trabajadores de cocina españoles con una edad media algo superior a los 39 años en los que se determinan diferentes escalas de riesgo cardiometabólico como síndrome metabólico, riesgo aterogénico, hígado graso no alcohólico, resistencia a la insulina o escalas de riesgo cardiovascular como REGICOR, SCORE o edad vascular.
Resultados: Casi todas las escalas de riesgo cardiometabólico muestran prevalencias elevadas en este colectivo de trabajadores, estas cifras adquieren especial importancia teniendo en cuenta que la edad de los participantes no es muy elevada.
Conclusiones: Existe una moderada-alta prevalencia de los valores elevados de las distintas escalas de riesgo cardiometabólico analizadas, especialmente en los hombres.

Palabras clave: Riesgo cardiometabólico, síndrome metabólico, resistencia a la insulina, enfermedad del hígado graso no alcohólico, riesgo aterogénico.

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Introduction

According to different international organizations, including the World Health Organization, cardiometabolic diseases (CHD) are considered to be the main cause of morbidity and mortality on the planet[1]. In the first decades of the 21st century, they represent the most probable cause of death in our country, accounting for almost 28% of the total[2]. The appearance and development of the different SCDs will be influenced by environmental[3] as well as pathophysiological and biochemical[4] factors, which will result in these diseases having a complex and multifactorial genesis.

Health inequalities associated with socioeconomic status are currently one of the greatest challenges facing public health5. It has long been known that people belonging to the lowest social strata will have very poor health indicators, both in terms of healthy habits[6], morbidity and mortality indicators[7] and accessibility to social and health services[8].

The different items that assess socioeconomic status, including income, educational level and job qualifications, are co-participants in these inequalities[9].

The so-called white-collar workers, also known as manual workers, have a higher degree of professional qualification and, in most studies, have different rates of morbidity and mortality of cardiometabolic origin compared with blue-collar or manual workers, who have a much lower level of professional qualification. These manual workers, whether men or women, have higher levels of morbidity and mortality[10].

There is abundant literature on work-related diseases, also known as occupational diseases, in workers who work in the different areas of the hotel and catering industry. The high prevalence of dermatitis[11] and musculoskeletal problems is well known, whether epicondylitis or carpal tunnel syndrome in waiters[12], or the injuries derived from overexertion and repetitive movements in housekeepers that result in a high prevalence of lumbar pathologies[13].

However, there are almost no studies that assess the level of cardiometabolic risk of these hospitality professionals, which is why the aim of this study is to determine precisely this, the level of cardiometabolic risk in a large group of 25.030 kitchen workers from different companies in different Spanish autonomous communities.

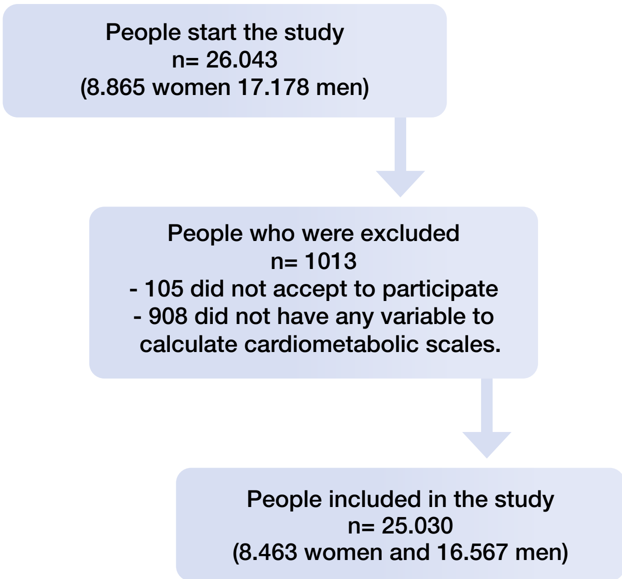
Methods

In the period from January 2019 to December 2019, this descriptive and cross-sectional study was carried out in a large group of 25.030 kitchen workers from different autonomous communities of our country, practically all the Spanish regions were represented, especially the Balearic Islands, Andalusia, Canary Islands, Valencian Community, Catalonia, Madrid, Castilla La Mancha, Castilla León and the Basque Country. The waiters included in this study were selected from among those who attended the periodic health examinations carried out in the different companies that participated.

The inclusion criteria established were:
- To be aged between 18 and 69 years.
- To have an employment contract in one of the participating companies.
- Accepting participation in the study and the transfer of the use of the data for epidemiological purposes.

The flow diagram of the study participants is shown in **figure 1**.

Figure 1: Flow chart of the study participants.



Determination of variables

The medical professionals from the different participating companies determined the anthropometric, analytical and clinical variables necessary to calculate the different cardiometabolic risk scales. The measurement techniques were standardized to minimize potential biases in obtaining the variables.

The measurement was made when the person was in an upright position and with the abdomen relaxed. A SECA model scale-measuring scale was used to measure weight and height. The abdominal waist circumference was measured in this position with a tape measure placed parallel to the floor at the level of the last rib.

An OMROM-M3 sphygmomanometer was used to measure blood pressure. After ten minutes of rest, three measurements were taken with a one-minute interval between each and the mean of the three was obtained.

After a fast of at least twelve hours, various techniques were used to measure blood glucose, triglycerides and total cholesterol, as well as precipitation methods for HDL-cholesterol. LDL-cholesterol was calculated using the Friedewald formula, which is valid for triglyceride values up to 400.

Each analysis parameter was expressed in milligrams per deciliter.

Cholesterol values of 200 mg/dL or more, LDL values of 130 mg/dL or more, and triglycerides of 150 mg/dL or more, or if they were being treated for any of these analytical alterations, were established as altered values.

The recommendations of the American Diabetes Association14 were used to classify blood glucose levels. Diabetics were those who had a previous diagnosis, had a blood glucose greater than 125 mg/dL, had an HbA1c of at least 6.5%, or were receiving treatment to reduce blood glucose.

Dividing weight (in kg) by height squared (in meters), the body mass index (BMI) was calculated. The cut-off point for obesity was 30 kg/m^2 or higher.

Scales for calculating the percentage of body fat:
- CUN BAE (Estimador de Adiposidad Corporal de la Clínica Universitaria de Navarra)[15].
$-44.988 + (0.503 \times \text{age}) + (10.689 \times \text{sex}) + (3.172 \times \text{BMI}) - (0.026 \times \text{BMI}^2) + (0.181 \times \text{BMI} \times \text{sex}) - (0.02 \times \text{BMI} \times \text{age}) - (0.005 \times \text{BMI}^2 \times \text{sex}) + (0.00021 \times \text{BMI}^2 \times \text{age})$. Male =0 Female =1.

- ECORE-BF (Equation Córdoba for Estimation of Body Fat)[16]
97.102+0.123 (age) +11.9 (sex) +35.959 (LnBMI) Man =0 Woman =1.

- Palafolls formula[17]
Man =[(BMI/waist) ×10] +BMI.
Woman =[(BMI/waist) ×10] +BMI+10.

- Deuremberg formula[18]
1.2×(BMI) +0.23×(age) −10.8×(sex) −5.4 Man =0 Woman =1.

- Relative fat mass (RFM)[19]
Women: 76- (20 × (height/waist)) Men: 64- (20 × (height /waist)).

Other indicators related to overweight and obesity:
-Visceral adiposity index (VAI)[20]
Men: (Waist/(39,68 + (1,88 x BMI)) x (Triglycerides/1,03) x (1,31/HDL)
Women: (Waist/(36,58 + (1,89xBMI)) x (Triglycerides/0,81) x (1,52/HDL)

- Body roundness index (BRI)[21]
BRI=364.2–365.5 × √1-[(waist/ (2π) 2)/(0.5 × height)^2].

- Body Surface Index (BSI)[22]. is determined using the DuBois formula, where weight is expressed in kilograms and height in centimeters.

$$BSA = \text{weight}^{0,425} \times \text{height}^{0,725} \times 0,0007184$$

$$BSI = \text{weight}/\sqrt{BSA}$$

- Conicity index[23]

$$CI = (\text{Waist}/0,109) \times 1/\sqrt{\text{weight}/\text{height}}$$

- Body shape index (ABSI)[24]

$$ABSI = \text{Waist}/\text{BMI}^{2/3} \times \text{height}^{1/2}$$

-Normalized weight-adjusted index (NWAI)[25]

$$NWAI = (\text{weight}/10) - (10 \times \text{height}) + 10$$

Weight in kg and height in meters.

Other indicators related to cardiovascular risk:
-Triglyceride glucose index[26], Triglyceride glucose index-BMI[27], Triglyceride glucose index-waist[28]
TyGindex = LN (triglycerides [mg/dl] × glycaemia [mg/dl] /2) .
TyGindex – BMI = TyGindex × BMI
TyGindex – waist = TyGindex × waist

- Waist triglyceride index[29]

waist (cm) × triglycerides(mmol)

- Cardiometabolic index[30].

Waist/height × triglycerides/HDL

Nonalcoholic fatty liver disease risk scales:
- Fatty liver index[31].

$$FLI = \left(e^{0.953 \cdot \log_e(\text{triglycerides}) + 0.139 \cdot \text{BMI} + 0.718 \cdot \log_e(\text{GGT}) + 0.053 \cdot \text{waist circumference} - 15.745}\right) / \left(1 + e^{0.953 \cdot \log_e(\text{triglycerides}) + 0.139 \cdot \text{BMI} + 0.718 \cdot \log_e(\text{GGT}) + 0.053 \cdot \text{waist circumference} - 15.745}\right) \times 100$$

- Hepatic steatosis index (HSI)[32]
HSI = 8 × AST/ALT + BMI (+ 2 if 2 diabetes and+ 2 if female)

- Zhejiang University index (ZJU)[33]
BMI + Blood glucose (mmol L) +Triglycerides(mmol L) +3 AST/ALT+2 if female-

- Fatty liver disease index (FLD)[34]
BMI+ triglycerides +3×(AST/ALT) +2 ×Hyperglycemia (presence=1; absence=0).
If BMI ≥ 28 = 1 point, AST/ALT ≥ 0.8 = 2 points, type 2 diabetes mellitus = 1 point. Cut-off point for high risk 2 points.

- Lipid accumulation product (LAP)[35].
Men= (waist (cm) - 65) × (triglycerides (mMol)). Women: (waist (cm) - 58) × (triglycerides (mMol))

Atherogenic indices[36]
- Total cholesterol/HDL (high values from 5 in men and 4.5 in women),
- LDL/HDL and Triglycerides/HDL (high values from 3 and above)
- logTriglycerides/HDL (high values from 3)
- Total cholesterol-HDL (high values from 130)

Metabolic syndrome
- The metabolic syndrome was determined using three models[37]

a) NCEP ATP III (National Cholesterol Educational Program Adult Treatment Panel III) considers metabolic syndrome when there are three or more of the following events: blood pressure higher than 130/85 mmHg; triglycerides higher than 150 mg/dl or specific treatment for this lipid disorder; low HDL and glycemia higher than 100 mg/dl or specific treatment for this glycemic disorder.

b) The International Diabetes Federation (IDF) establishes as a requirement a waist circumference greater than 80 centimeters in women and greater than 94 centimeters in men, in addition to two of the other factors mentioned above for ATP III (triglycerides, HDL, blood pressure and glycemia).

c) The JIS (Joint Interim Statement) model establishes criteria similar to NCEP ATPIII but with abdominal waistline cut-off points similar to IDF.

Atherogenic dyslipidemia[38] is established when high triglyceride values (>150 mg/dL) coincide with low HDL values; if high LDL values are also added, we speak of a lipid triad[39].

Cardiovascular risk scales:
The REGICOR[40] scale, an adaptation to the Spanish population of the Framingham scale, evaluates the risk of suffering a cardiovascular event during a 10-year period. It can be used from 35 to 74 years of age. The risk is considered moderate from 5% and high from 10%.

We used the SCORE2[41] (Systematic Coronary Risk Evaluation) scale, which assesses the risk of suffering a fatal stroke within 10 years.

The Spanish cardiovascular risk equation, also known as ERICE, is based on seven studies carried out in population-based cohorts in Spain[42]. It estimates the risk of suffering a fatal or non-fatal stroke within a decade. The tables are used in individuals between thirty and eighty years of age. Age, sex, smoking, diabetes, systolic blood pressure, antihypertensive treatment, and total cholesterol are used to determine risk. The cut-off points suggested by the group responsible for the study were used to classify the level of cardiovascular risk using the ERICE tables: risk was considered moderate if it exceeded 5%; moderate-high if between 15% and 19%; high if between 20% and 39%; and very high if it exceeded 39%.

We calculate vascular age using the Framingham model[43], for which we need data such as age, sex, HDL-c, total cholesterol, systolic blood pressure values, antihypertensive treatment, smoking and diabetes. It can be calculated from the age of thirty years onwards.

We also calculated vascular age using the SCORE model[44]. To calculate it, age, sex, systolic blood pressure, smoking and total cholesterol are used. It can be calculated using a scale from 40 to 65 years.

A very important concept that applies to both vascular ages is avoidable years of life lost (ALLY)[45], which can be defined as the difference between vascular and chronological age.

We consider a person to be a smoker if he or she has smoked at least one cigarette in the last month or if he or she has stopped smoking less than a year ago.

Ethical considerations and aspects
All steps of this study were guided by the 2013 Declaration of Helsinki and the ethical standards of the institutional research committee. Data anonymity and confidentiality were guaranteed at all times. The Balearic Islands Research Ethics Committee (CEI-IB), which received IB indicator 4383/20, approved the study. Each participant had his or her data coded, so that only the person responsible for the study could identify each participant. The research team is committed to complying with Organic Law 3/2018, of December 5, which protects both digital rights and personal data. This means that they have the right to access, rectify, cancel and oppose the data collected in this study.

Statistical analysis
Student's t-test was used to calculate the mean and standard deviation for quantitative variables. For qualitative variables, the chi-square test was used. Multivariate analysis was performed using binary logistic regression. Statistical analysis was performed with the SPSS 28.0 program and a statistical significance level of $p<0.05$ was accepted.

Results

Table I shows the characteristics of the sample. The mean age was approximately 39 years, with the majority group being between 18 and 49 years of age. More than one in three workers were smokers (slightly higher in men). In general, the variables show more favorable values in women.

Table I: Characteristics of the population.

	Men n=16,567	Women n=8,463	
	Mean (SD)	Mean (SD)	p-value
Age (years)	38.7 (11.4)	39.6 (11.6)	<0.0001
Height (cm)	174.0 (7.2)	160.8 (6.4)	<0.0001
Weight (kg)	80.1 (15.6)	68.5 (14.9)	<0.0001
Waist circumference (cm)	85.5 (11.8)	76.5 (11.3)	<0.0001
Systolic blood pressure (mmHg)	127.5 (15.0)	119.7 (15.4)	<0.0001
Diastolic blood pressure (mmHg)	76.9 (10.8)	73.1 (10.3)	<0.0001
Total cholesterol (mg/dl)	189.8 (39.2)	190.7 (37.5)	0.101
HDL-cholesterol (mg/dl)	50.1 (7.9)	55.6 (7.5)	<0.0001
LDL-cholesterol (mg/dl)	116.3 (37.4)	116.8 (36.1)	0.274
Triglycerides (mg/dl)	120.9 (88.9)	92.2 (52.9)	<0.0001
Glycaemia (mg/dl)	92.3 (22.9)	88.5 (17.1)	<0.0001
ALT (U/L)	31.2 (20.7)	21.3 (12.5)	<0.0001
AST (U/L)	25.3 (16.0)	19.0 (7.5)	<0.0001
GGT (U/L)	35.8 (38.6)	21.7 (17.7)	<0.0001
	%	%	p-value
18-29 years	25.6	23.8	<0.0001
30-39 years	27.3	25.9	
40-49 years	27.5	27.4	
50-59 years	16.3	19.0	
60-69 years	3.3	3.9	
Non-smokers	65.2	65.8	0.340
Smokers	34.8	34.2	

HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. AST Aspartate Aminotransferase. ALT Alanine Aminotransferase. GGT Gamma Glutamyl Transpeptidase.

Table II: Differences in mean values of the scales related with cardiovascular risk by sex using the T-Student test.

	Men n=16,567	Women n=8,463	
	Mean (SD)	Mean (SD)	p-value
Waist to height ratio (WtHR)	0.49 (0.06)	0.47 (0.07)	<0.0001
Body mass index (BMI)	26.5 (4.8)	26.5 (5.6)	0.543
CUN BAE	24.9 (7.2)	36.7 (7.5)	<0.0001
ECORE-BF	24.9 (7.2)	36.8 (7.6)	<0.0001
Relative fat mass	22.6 (5.4)	33.2 (5.7)	<0.0001
Palafolls formula	29.6 (5.1)	40.0 (5.9)	<0.0001
Deurenberg formula	24.5 (6.9)	35.5 (7.7)	<0.0001
Body fat index	21.9 (8.6)	28.4 (8.4)	<0.0001
Body surface index	57.2 (8.4)	52.0 (8.6)	<0.0001
Normalized weight adjusted index	0.62 (1.47)	0.77 (1.46)	<0.0001
Body roundness index	3.3 (1.2)	3.0 (1.3)	<0.0001
Body shape index	0.073 (0.007)	0.068 (0.006)	<0.0001
Visceral adiposity index	7.1 (6.3)	2.8 (1.8)	<0.0001
Conicity index	1.2 (0.1)	1.1 (0.1)	<0.0001
METS-VF	6.1 (0.8)	5.6 (0.9)	<0.0001
Waist triglyceride index	118.8 (93.6)	80.8 (50.6)	<0.0001
Waist weight index	9.6 (0.8)	9.3 (0.7)	<0.0001
nº factors metabolic syndrome NCEP ATPIII	1.2 (1.2)	1.0 (1.2)	<0.0001
nº factors metabolic syndrome JIS	1.7 (1.3)	1.1 (1.2)	<0.0001
Total cholesterol/HDL-c	3.9 (1.1)	3.5 (0.9)	<0.0001
Triglycerides/HDL-c	2.5 (2.1)	1.7 (1.1)	<0.0001
LDL-c/HDL-c	2.4 (1.0)	2.2 (0.8)	<0.0001
Total cholesterol-HDL-c	139.7 (41.1)	135.1 (39.1)	<0.0001
Cardiometabolic index	1.3 (1.1)	0.8 (0.6)	<0.0001
Triglyceride glucose index (TyG index)	8.4 (0.6)	8.2 (0.5)	<0.0001
TyG index-BMI	224.4 (49.4)	217.9 (51.9)	<0.0001
TyG index-waist circumference	723.1 (124.6)	627.6 (109.0)	<0.0001
TyG index-WtHR	4.2 (0.7)	3.9 (0.7)	<0.0001
METS-IR	38.9 (9.0)	37.1 (9.1)	<0.0001
ALLY vascular age SCORE	7.5 (6.9)	4.7 (5.3)	<0.0001
SCORE scale	1.8 (2.3)	0.6 (1.0)	<0.0001
ALLY vascular age Framingham	6.5 (10.3)	2.4 (12.5)	<0.0001
REGICOR scale	3.2 (2.2)	2.9 (2.2)	<0.0001
ERICE scale	4.3 (5.1)	3.1 (3.9)	<0.0001
Fatty liver index	36.6 (28.8)	22.7 (24.4)	<0.0001
Hepatic steatosis index	37.4 (7.3)	37.8 (6.9)	0.275
Zhejiang University index	37.6 (6.3)	38.4 (6.3)	0.014
Fatty liver disease	32.5 (5.9)	31.5 (6.1)	<0.0001
BARD scoring	1.7 (1.1)	1.9 (1.0)	<0.0001
Lipid accumulation product	30.1 (33.1)	20.4 (19.7)	<0.0001

CUN BAE Clinica Universitaria Navarra Body Adiposity Estimator; ECORE-BF Equation Córdoba for Estimation of Body Fat; METS-VF Metabolic score- visceral fat. ALLY Avoidable lost life years. SCORE Systematic COronary Risk Evaluation. REGICOR REgistre GIroni del COR. HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. METS-IR Metabolic score for Insulin Resistance. TyG Triglyceride glucose index

Table III: Differences in the prevalence of altered values of different scales related with cardiovascular risk by sex using the chi-square test.

	Men n=16.567	Women n=8.463	
	%	%	p-value
Waist to height ratio > 0.50	40.9	28.6	<0.0001
Body mass index obesity	20.2	22.7	<0.0001
CUN BAE obesity	48.9	57.7	<0.0001
ECORE-BF obesity	48.6	56.7	<0.0001
Relative fat mass obesity	34.6	56.4	<0.0001
Palafolls formula obesity	82.9	80.1	<0.0001
Deuremberg formula obesity	44.5	74.3	<0.0001
METS-VF high	8.3	2.1	<0.0001
Diabesity	3.1	2.0	<0.0001
Hypertension	25.8	14.8	<0.0001
Total cholesterol ≥ 200 mg/dl	37.6	38.1	0.416
LDL-c ≥ 130 mg/dl	34.7	33.7	0.115
Triglycerides ≥ 150 mg/dl	22.6	9.3	<0.0001
Glycaemia 100-125 mg/dl	16.4	11.9	<0.0001
Glycaemia ≥ 126 mg/dl	3.9	2.0	<0.0001
Metabolic syndrome NCEP ATPIII	14.9	13.1	<0.0001
Metabolic syndrome IDF	12.2	12.4	0.569
Metabolic syndrome JIS	25.9	15.0	<0.0001
Atherogenic dyslipidemia	6.7	4.6	<0.0001
Lipid triad	2.0	1.3	<0.0001
Hipertriglyceridemic waist	7.4	2.0	<0.0001
Total cholesterol/HDL-c moderate-high	15.4	13.1	<0.0001
Triglycerides/HDL-c high	24.9	8.5	<0.0001
LDL-c/HDL-c high	25.0	14.9	<0.0001
Total cholesterol-HDL-c high	57.5	52.8	<0.0001
METS-IR high	11.6	9.7	<0.0001
TyG index high	25.1	14.9	<0.0001
SCORE scale moderate-high	25.4	5.8	<0.0001
REGICOR scale moderate-high	20.0	17.8	0.004
ERICE scale moderate-high	11.9	4.0	<0.0001
Fatty liver index high risk	23.5	11.2	<0.0001

CUN BAE Clinica Universitaria Navarra Body Adiposity Estimator; ECORE-BF Equation Córdoba for Estimation of Body Fat; METS-VF Metabolic score- visceral fat. ALLY Avoidable lost life years. SCORE Systematic COronary Risk Evaluation. REGICOR REgistre GIroni del COR. HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. METS-IR Metabolic score for Insulin Resistance. TyG Triglyceride glucose index

Table II shows the mean values of all the cardiometabolic risk scales studied, separated by sex. Both the scales that assess overweight-obesity (except those that estimate body fat) and those that determine the risk of insulin resistance, nonalcoholic fatty liver disease, cardiovascular risk or atherogenic risk show significantly higher values in men working in the kitchen. In all cases except BMI and HSI, the differences found between men and women were statistically significant.

Table III shows the prevalence of high values for the different cardiometabolic risk scales considered in this study in both sexes. A situation similar to that previously mentioned for the means is observed, that is, the prevalences are significantly higher in the group of male kitchen workers, in all cases except for hypercholesterolemia, elevated LDL and metabolic syndrome with the IDF criteria.

Table IV shows the results of the multivariate study using the binary logistic regression technique. We can see that the variable that most increases the risk of presenting elevated values of the cardiometabolic scales is age, which also shows statistically significant differences in all cases. Male sex also had an influence on most of the cardiometabolic risk parameters analyzed (all except hypercholesterolemia and metabolic syndrome with IDF criteria). Tobacco consumption affected a limited number of parameters. The highest odds ratios were found for SCORE and Deuremberg for age and for SCORE for the male sex.

Discussion

Male kitchen workers can be classified as having moderate cardiometabolic risk and women as moderate-low. Since the mean age of the workers is low, we should consider the prevalence of high values on the scales estimating body fat, dyslipidemia, atherogenic risk and cardiovascular risk to be high.

After an exhaustive analysis of the existing literature, it has not been possible to find any study that specifically assesses the level of cardiometabolic risk in this group of workers; therefore, we should establish comparisons between our results and those obtained in groups of manual workers.

A South African study[46] carried out in more than 600 manual and nonmanual workers with an average age of 38 years (similar to ours) showed somewhat different

Table IV: Binary logistic regression.

	≥ 50 years	Male	Smokers
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
WtHR < 0.50	1	1	1
WtHR ≥0.50	1.50 (1.41-1.60)	1.76 (1.66-1.86)	ns
BMI non obesity	1	1	1
BMI obesity	1.66 (1.55-1.78)	0.88 (0.82-0.94)	0.92 (0.86-0.98)
CUN BAE non obesity	1	1	1
CUN BAE obesity	4.67 (4.34-5.03)	0.72 (0.68-0.76)	0.91 (0.86-0.96)
RFM non obesity	1	1	1
RFM obesity	4.36 (4.06-4.68)	0.74 (0.70-0.78)	0.91 (0.86-0.96)
Deurenberg formula non obesity	1	1	1
Deurenberg formula obesity	10.46 (9.53-11.48)	0.25 (0.24-0.27)	0.89 (0.84-0.94)
METS-VF normal	1	1	1
METS-VF high	3.64 (3.27-4.06)	4.59 (3.91-5.39)	ns
Non hypertension	1	1	1
Hypertension	3.68 (3.44-3.94)	2.21 (2.05-2.37)	ns
Total cholesterol < 200 mg/dl	1	1	1
Total cholesterol ≥ 200 mg/dl	2.77 (2.60-2.95)	ns	ns
LDL-c < 130 mg/dl	1	1	1
LDL-c ≥ 130 mg/dl	2.78 (2.61-2.96)	1.09 (1.03-1.15)	ns
Triglycerides < 150 mg/dl	1	1	1
Triglycerides ≥ 150 mg/dl	1.89 (1.75-2.04)	2.97 (2.74-3.23)	ns
Glycaemia < 126 mg/dl	1	1	1
Glycaemia ≥ 126 mg/dl	6.59 (5.94-7.31)	1.85 (1.64-2.08)	ns
Non metabolic syndrome NCEP ATPIII	1	1	1
Metabolic syndrome NCEP ATPIII	3.89 (3.61-4.19)	1.25 (1.15-1.35)	ns
Non metabolic syndrome IDF	1	1	1
Metabolic syndrome IDF	2.23 (2.06-2.42)	ns	ns
Non atherogenic dyslipidemia	1	1	1
Atherogenic dyslipidemia	2.66 (2.38-2.96)	1.57 (1.39-1.77)	ns
Non lipid triad	1	1	1
Lipid triad	2.92 (2.41-3.54)	1.65 (1.32-2.05)	1.27 (1.05-1.54)
Total cholesterol/HDL-c normal	1	1	1
Total cholesterol/HDL-c high	3.50 (3.24-3.77)	1.29 (1.19-1.39)	ns
Triglycerides/HDL-c normal	1	1	1
Triglycerides/HDL-c high	2.16 (2.01-2.32)	3.76 (3.45-4.09)	ns
LDL-c/HDL-c normal	1	1	1
LDL-c/HDL-c high	3.23 (3.02-3.46)	2.06 (1.92-2.22)	ns
SCORE scale low	1	1	1
SCORE scale moderate-high	67.27 (55.39-81.71)	13.64 (11.51-16.16)	7.13 (6.17-8.23)
REGICOR scale low	1	1	1
REGICOR scale moderate-high	2.22 (2.06-2.40)	1.20 (1.10-1.30)	1.43 (1.33-1.55)
Fatty liver index low-moderate risk	1	1	1
Fatty liver index high risk	1.58 (1.46-1.71)	2.48 (2.29-2.70)	ns
LAP low	1	1	1
LAP high	1.61 (1.51-1.72)	1.20 (1.14-1.27)	ns
BARD score low	1	1	1
BARD score high	1.33 (1.06-1.67)	0.55 (0.44-0.69)	ns
Non diabesity	1	1	1
Diabesity	5.72 (4.90-6.68)	1.71 (1.44-2.04)	ns
METS-IR bajo	1	1	1
METS-IR alto	1.74 (1.59-1.90)	1.26 (1.15-1.37)	ns
TyG index low	1	1	1
TyG index high	2.46 (2.30-2.64)	2.02 (1.88-2.16)	ns

CUN BAE Clinica Universitaria Navarra Body Adiposity Estimator; ECORE-BF Equation Córdoba for Estimation of Body Fat; METS-VF Metabolic score- visceral fat. ALLY Avoidable lost life years. SCORE Systematic COronary Risk Evaluation. REGICOR REgistre GIroni del COR. HDL-c High density lipoprotein cholesterol. LDL Low density lipoprotein cholesterol. METS-IR Metabolic score for Insulin Resistance. TyG Triglyceride glucose index. LAP Lipid accumulation product

results to those found by us, since the manual workers did have a higher prevalence of arterial hypertension but not of hypercholesterolemia or excess weight. On the other hand, a study carried out in Indonesia in a very large sample of more than 137,000 workers did observe that blue-collar or manual workers had a higher prevalence of cardiovascular disease[47].

Two studies carried out by the same group, one in more than 5000 farmers[48] and the other in almost 1100 Bolivian miners[49], showed that these groups of manual workers had high values on scales related to cardiometabolic risk such as metabolic syndrome, nonalcoholic fatty liver disease, insulin resistance and even on cardiovascular risk scales such as REGICOR and SCORE; these data are similar to those obtained by us in this study.

A study in Japan[50] that included more than 1.1 million people found that nonmanual workers had a higher risk of coronary heart disease but a lower risk of stroke.

An Australian investigation[51] that included half a million workers found a higher prevalence of type 2 diabetes and higher levels of cardiometabolic risk among manual workers.

In a study of Danes aged 18 to 25 years, the relationship between low socioeconomic status and the prevalence of cardiometabolic risk was assessed, and the relationship was found to be inverse, meaning that the risk was higher in people from the most disadvantaged socioeconomic strata[52].

In the poorest socioeconomic groups, a higher prevalence of cardiometabolic disorders, especially metabolic syndrome, is observed, according to a study carried out in 2650 Chinese adults[53]. Another study carried out in young people in Iran[54] found the same correlation between metabolic syndrome and low socioeconomic status.

Our group has carried out several studies[55-58] in different groups of workers and has found a correlation between belonging to the most disadvantaged social classes and the high prevalence of various cardiometabolic risk scales, such as nonalcoholic fatty liver disease, obesity, vascular age and metabolic syndrome, among others.

A meta-analysis[59] that included 22 studies assessed the need for interventions to reduce the high prevalence of cardiometabolic risk factors such as arterial hypertension, hypercholesterolemia and obesity in manual workers. Something similar was found in another publication carried out in Korea[60].

Strengths and limitations

The large number of cardiometabolic risk scales analyzed and the sample size in both sexes are two of the advantages of the study. This study is certainly the first to specifically evaluate cardiometabolic levels in waiters, which makes it a model for future research on this group of workers.

The main limitation is that most of the cardiometabolic risk parameters were not calculated using objective methods, but rather using risk scales.

Conclusions

The kitchen workers analyzed in this study, despite having a low mean age, have high prevalence of the different cardiometabolic risk scales.

The variables that most increase the risk of presenting high values of all the cardiometabolic risk scales are age, followed by sex (male), while smoking has no influence in most cases.

Conflict of Interest

The authors declared that there is no conflict of interest.

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