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ORIGINAL

Determination of cardiometabolic risk scales in 7.962 hotel receptionists

Determinación de escalas de riesgo cardiometabólico en 7.962 recepcionistas de hotel

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Summary

Introduction: Cardiometabolic diseases are highly prevalent and have a multifactorial etiology, with socioeconomic factors playing a role in their appearance. The aim of this study was to assess the level of cardiometabolic risk in a large group of hotel reception workers, a group included among non-manual workers.
Methods: Descriptive and cross-sectional study carried out in 7962 hotel reception workers from different Spanish regions in which different scales of cardiometabolic risk were assessed, including scales of insulin resistance, scales of nonalcoholic fatty liver disease, scales of atherogenic risk, scales of metabolic syndrome, and scales of cardiovascular risk.
Results: The highest prevalences of high cardiometabolic risk parameters in this group were found for overweight-obesity scales, atherogenic indices and nonalcoholic fatty liver disease scales. Prevalences are higher in men.
Conclusions: The prevalence of high values of the cardiometabolic risk scales in hotel reception workers can be considered moderate, but these data are especially relevant due to the low average age of this group. The variables that most increase cardiometabolic risk in these workers are age, male sex and, to a lesser extent, smoking.

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

Resumen

Introducción. Las enfermedades cardiometabólicas son altamente prevalentes y presentan una etiología multifactorial, teniendo los factores socioeconómicos algún papel en su aparición. El objetivo de este estudio es valorar el nivel de riesgo cardiometabólico de un colectivo amplio de trabajadores de recepción de hoteles, colectivo englobado dentro de los trabajadores no manuales.
Material y métodos. Estudio descriptivo y transversal realizado en 7.962 trabajadores de recepción de hoteles de distintas regiones españolas en los que se valoran diferentes escalas de riesgo cardiometabólico entre las que podemos incluir escalas de resistencia a la insulina, escalas de hígado graso no alcohólico, escalas de riesgo aterogénico, escalas de síndrome metabólico y escalas de riesgo cardiovascular.
Resultados. Las prevalencias más elevadas de parámetros de riesgo cardiometabólico alto en este colectivo las encontramos para escalas de sobrepeso-obesidad, índices aterogénicos y escalas de hígado graso no alcohólico. Las prevalencias son superiores en los hombres.
Conclusiones. Las prevalencias de valores altos de las escalas de riesgo cardiometabólico en trabajadores de recepción de hotel se pueden considerar moderadas, pero estos datos son especialmente relevantes debido a la baja edad media de este colectivo. Las variables que más incrementan el riesgo cardiometabólico en estos trabajadores son la edad, el sexo masculino y, en menor medida el consumo de tabaco.

Palabras clave: Riesgo cardiometabólico, resistencia a la insulina, hígado graso no alcohólico, riesgo aterogénico, riesgo cardiovascular.

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Introduction

Cardiovascular disease (CVD) is the leading cause of death worldwide and is estimated to cause almost 18 million deaths annually[1]. Coronary heart disease, cerebrovascular disease and rheumatic heart disease are some of the disorders that affect both the heart and blood vessels[2]. Coronary heart disease and stroke account for more than four out of five CVD deaths, and one third of these deaths occur prematurely in people under the age of 70 years[3].

Unhealthy diet[4], physical inactivity[5], tobacco use[6] and harmful alcohol consumption[7] are the most important behavioral risk factors for heart disease and stroke. Hypertension[8], hyperglycemia[9] and hyperlipidemia[10], as well as overweight and obesity[11] are some of the effects of behavioral risk factors on individuals. In primary health care centers and occupational health units, these "intermediate risk factors" that indicate an increased likelihood of heart attack, stroke, heart failure and other conditions can be assessed[12].

It has been shown that the risk of CVD can be reduced by avoiding tobacco use[13], reducing the amount of salt in the diet, eating more fruits and vegetables, exercising regularly[14] and avoiding harmful alcohol consumption[15]. Health policies that focus on making healthy choices accessible and affordable are essential to motivate people to adopt and maintain healthy behaviors[16].

Identifying people at high risk of CVD and ensuring that they receive appropriate treatment is essential to prevent premature deaths.

There are other risk factors for CVD in addition to those described above and which form part of the so-called sociodemographic factors, among which we could highlight socioeconomic level[17].

There are not many studies that assess the relationship between socioeconomic level and the risk of CVD and even fewer that relate the type of work with these diseases, and for this reason the aim of this study is to assess the level of cardiometabolic risk in a group of non-manual workers (white-collar workers) such as hotel receptionists.

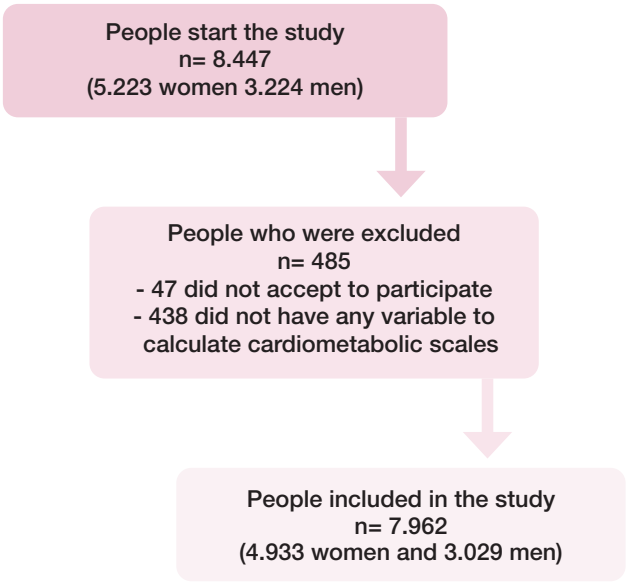
Methods

During the period January to December 2019, a descriptive, cross-sectional study was conducted on a group of 7962 hotel receptionists from various autonomous communities in Spain. These communities included Balearic Islands, Andalusia, Canary Islands, Valencian Community, Catalonia, Madrid, Castilla La Mancha, Castilla Leon and Basque Country, and almost all Spanish regions were represented. This study selected hotel receptionists who underwent regular health examinations in all participating companies.

Inclusion requirements were:
- Be between 18 and 69 years of age.
- Maintain an employment contract with one of the participating companies.
- Agree to participate in the study and allow the use of the data for epidemiological purposes.

Figure 1 shows a schematic of the study participant flowchart.

Figure 1: Flow chart of the study participants.



Determination of variables

Medical professionals from the various participating companies determined the anthropometric, analytical and clinical variables necessary to calculate the various cardiometabolic risk scales. Measurement techniques were standardized to reduce potential biases in the process of obtaining variables.

Weight and height were obtained when the individual was in an upright position and with the abdomen relaxed, using a SECA model scale and a tape measure placed parallel to the floor at the level of the last rib to measure the abdominal waist circumference in the same position.

Blood pressure was measured with an OMROM-M3 sphygmomanometer. After ten minutes of rest, three measurements were taken with a one-minute interval between each one and the mean was obtained.

After a fast of at least twelve hours, different methods were used to measure blood glucose, triglycerides and total cholesterol, as well as precipitation methods for HDL cholesterol. The Friedewald formula was used to

calculate LDL-cholesterol, which is valid for triglyceride values up to 400.

Each of the analysis parameters was represented in milligrams per deciliter.

Altered values of cholesterol ≥ 200 mg/dl, LDL ≥ 130 mg/dl and triglycerides ≥ 150 mg/dl, or if they were being treated for any of these analytical alterations, were established as altered values.

The recommendations of the American Diabetes Association[18] were used to classify glycemia figures. Diabetics were those who had been previously diagnosed, had a blood glucose greater than 125 mg/dl, had an HbA1c of at least 6.5%, or were receiving blood glucose-lowering treatment.

Body mass index (BMI) was calculated by dividing weight (in kg) by height squared (in meters). A cut-off of 30 kg/m^2 was established to consider obesity.

Scales to calculate body fat percentage:

- CUN BAE (Body Adiposity Estimator of the University Clinic of Navarra)[19].
  Navarra)[15].
-44.988 + (0.503 × age) + (10.689 × sex) + (3.172 × BMI) - (0.026 × BMI2) + (0.181 × BMI × sex) - (0.02 × BMI × age) - (0.005 × BMI2 × sex) + (0.00021 × BMI2 × age). Male =0 Female =1.

- ECORE-BF (Equation Córdoba for Estimation of Body Fat)[20]
  Palafolls formula [21]
  Man =[(BMI/waist) ×10] +BMI.
  Woman =[(BMI/waist) ×10] +BMI+10.

- Deuremberg formula [22]
  1.2×(BMI) +0.23×(age) –10.8×(sex) –5.4 Man =0
  Woman =1.

- Relative fat mass (RFM)[23]
  Women: 76- (20 × (height/waist)) Men: 64- (20 × (height /waist)).

Other indicators related to overweight and obesity:

- Visceral adiposity index (VAI)[24]
  Men: (Waist/(39,68 + (1,88 x BMI)) x (Triglycerides/1,03) x (1,31/HDL)
  Women: (Waist/(36,58 + (1,89 x BMI)) x (Triglycerides/0,81) x (1,52/HDL)

- Body roundness index (BRI)[25]
  BRI=364.2–365.5 × √1-[(waist/ (2π) 2)/(0.5 × height)^2].

- Body Surface Index (BSI)[26] is determined using the DuBois formula, where weight is expressed in kilograms and height in centimeters.
  BSA = weight0,425 x height 0,725 x 0,0007184
  BSI = weight/√BSA

- Conicity index[27]
  CI = (Waist/0,109) x 1/√ weight/height

- Body shape index (ABSI)[28]
  ABSI = Waist/BMI$^{2/3}$ x height$^{1/2}$

- Normalized weight-adjusted index (NWAI)[29]
  NWAI = (weight /10) - (10 x height) + 10
  Weight in kg and height in meters.

Other indicators related to cardiovascular risk:

- Triglyceride glucose index[30], Triglyceride glucose index-BMI[31], Triglyceride glucose index-waist[32].
  TyGindex = LN (triglycerides [mg⁄dl] × glycaemia [mg⁄dl]/2).
  TyGindex – BMI = TyGindex × BMI
  TyGindex – waist = TyGindex × waist

- Waist triglyceride index[33]
  waist (cm) × triglycerides (mmol)

- Cardiometabolic index[34].
  Waist to height ratio × triglycerides/HDL

Nonalcoholic fatty liver disease risk scales:

- Fatty liver index[35].

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

- Hepatic steatosis index (HSI)[36]
  HSI = 8 × AST/ALT + BMI (+ 2 if 2 diabetes and+ 2 if female)
- Zhejiang University index (ZJU)[37]
  BMI + Blood glucose (mmol L) +Triglycerides(mmol L) +3 AST/ALT+2 if female

- Fatty liver disease index (FLD)[38]
  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)[39].
  Men= (waist (cm) - 65) × (triglycerides (mMol)).
  Women: (waist (cm) - 58) × (triglycerides (mMol))

Atherogenic indices[40]

- 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

- Metabolic syndrome was determined using three models[41]

a) 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 blood glucose lower than 100 mg/dl or specific treatment for this glycemic disorder, NCEP ATP III considers metabolic syndrome.

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

c) The JIS model establishes criteria that are similar to those of NCEP ATPIII but with abdominal waist cut-off points similar to IDF.

Atherogenic dyslipidemia[42] occurs when high triglyceride values (more than 150 mg/dL) coincide with low HDL values; if high LDL values are added in these individuals, we speak of a lipid triad[43].

Cardiovascular risk scales:

The REGICOR[44] scale, adapted from the Framingham scale to the Spanish population, assesses the risk of suffering a cardiovascular event over a 10-year period. It can only be calculated in persons aged between 35 and 74 years. The risk is considered to be moderate from 5% and high from 10%.

We used the SCORE2[45] scale, a systematic coronary risk assessment, to evaluate the risk of suffering a fatal stroke within 10 years.

The Spanish cardiovascular risk equation, also known as ERICE, is based on seven investigations in population-based cohorts in Spain[46]. It estimates the risk of suffering a stroke in 10 years. The tables are used for people aged 30 to 80 years. The risk is measured on the basis of age, sex, smoking, diabetes, systolic blood pressure, antihypertensive treatment, and total cholesterol. The cut-off points suggested by the group responsible for the study were used: the risk was considered moderate if it exceeded 5%; moderate-high if it was between 15% and 19%; high if it was between 20% and very high if it exceeded 39%.

We used the Framingham model[47] to calculate vascular age. This requires information 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.

In addition, we calculated vascular age using the SCORE[48] model, which uses age, sex, systolic blood pressure, smoking and total cholesterol. The scale is valid for ages 40 to 65 years.

Avoidable years of life lost (ALLY)[49], which can be defined as the difference between vascular and chronological age, is a crucial concept that applies to both vascular ages.

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

Table I: Characteristics of the population.

	Men n=3.029	Women n=4.933	
	Mean (SD)	Mean (SD)	p-value
Age (years)	38.5 (11.5)	36.6 (10.8)	<0.0001
Height (cm)	176.6 (7.1)	164.1 (6.5)	<0.0001
Weight (kg)	80.9 (14.8)	64.1 (13.1)	<0.0001
Waist circumference (cm)	86.0 (11.0)	73.6 (9.4)	<0.0001
Systolic blood pressure (mmHg)	126.8 (14.8)	115.6 (14.7)	<0.0001
Diastolic blood pressure (mmHg)	77.5 (10.7)	71.9 (10.1)	<0.0001
Total cholesterol (mg/dl)	188.6 (37.8)	187.3 (34.0)	0.101
HDL-cholesterol (mg/dl)	50.9 (7.9)	56.9 (7.9)	<0.0001
LDL-cholesterol (mg/dl)	113.9 (35.9)	113.0 (33.7)	0.249
Triglycerides (mg/dl)	120.5 (76.7)	87.2 (44.1)	<0.0001
Glycaemia (mg/dl)	89.7 (18.8)	84.7 (11.4)	<0.0001
ALT (U/L)	28.7 (18.0)	19.0 (10.5)	<0.0001
AST (U/L)	25.1 (11.8)	17.7 (6.4)	<0.0001
GGT (U/L)	31.2 (29.3)	19.3 (16.3)	<0.0001
	%	%	p-value
18-29 years	27.5	30.5	<0.0001
30-39 years	27.7	32.5	
40-49 years	23.8	22.6	
50-59 years	17.5	11.6	
60-69 years	3.5	2.8	
Non-smokers	68.2	66.6	0.071
Smokers	31.8	33.4	

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

Ethical considerations and aspects.

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

Statistical analysis

The mean and standard deviation of quantitative variables were calculated using Student's t test. The chi-square test was used for qualitative variables. Binary logistic regression was used to perform the multivariate analysis. SPSS 28.0 software was used to perform the statistical analysis, 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 37 years, with the majority group being between 18 and 39 years of age. Slightly less than one third of the receptionists were smokers (slightly higher in women). The variables show healthier values in women.

Table II shows the means of the different cardiometabolic risk scales studied, separated by sex. Except for the scales assessing body fat, the rest show significantly higher values in the men working at the hotel reception desk.

Table III shows the prevalence of elevated values for the different cardiometabolic risk scales considered in this study in both sexes. It can be seen that in all cases (except in relative fat mass), the prevalences are significantly higher in the group of male reception staff.

Table IV shows the results of the multivariate study using binary logistic regression. The variable that most

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

	Men n=3.029	Women n=4.933	
	Mean (SD)	Mean (SD)	p-value
Waist to height ratio (WtHR)	0.49 (0.06)	0.45 (0.06)	<0.0001
Body mass index (BMI)	25.9 (4.4)	23.8 (4.6)	<0.0001
CUN BAE	24.1 (6.7)	32.7 (6.9)	<0.0001
ECORE-BF	24.2 (6.3)	32.6 (6.9)	<0.0001
Relative fat mass	22.3 (4.9)	30.8 (5.1)	<0.0001
Palafolls formula	29.0 (4.6)	37.0 (4.9)	<0.0001
Deurenberg formula	23.8 (6.6)	31.6 (6.6)	<0.0001
Body fat index	21.9 (7.9)	25.8 (7.0)	<0.0001
Body surface index	57.4 (7.8)	49.0 (7.6)	<0.0001
Normalized weight adjusted index	0.44 (1.4)	0.0 (1.3)	<0.0001
Body roundness index	3.2 (1.1)	2.5 (1.0)	<0.0001
Body shape index	0.074 (0.006)	0.070 (0.006)	<0.0001
Visceral adiposity index	7.1 (5.8)	2.7 (1.6)	<0.0001
Conicity index	1.2 (0.1)	1.1 (0.1)	<0.0001
METS-VF	6.1 (0.8)	5.2 (0.8)	<0.0001
Waist triglyceride index	119.3 (82.6)	73.5 (42.7)	<0.0001
Waist weight index	9.6 (0.7)	9.2 (0.7)	<0.0001
nº factors metabolic syndrome NCEP ATPIII	1.1 (1.2)	0.7 (0.9)	<0.0001
nº factors metabolic syndrome JIS	1.6 (1.3)	0.7 (1.0)	<0.0001
Total cholesterol/HDL-c	3.8 (1.1)	3.4 (0.9)	<0.0001
Triglycerides/HDL-c	2.5 (1.9)	1.6 (0.9)	<0.0001
LDL-c/HDL-c	2.3 (0.9)	2.1 (0.8)	<0.0001
Total cholesterol-HDL-c	137.7 (40.1)	130.3 (36.1)	<0.0001
Cardiometabolic index	1.3 (1.0)	0.7 (0.5)	<0.0001
Triglyceride glucose index (TyG index)	8.4 (0.6)	8.1 (0.5)	<0.0001
TyG index-BMI	219.7 (45.7)	193.6 (43.8)	<0.0001
TyG index-waist circumference	726.8 (118.3)	598.0 (93.2)	<0.0001
TyG index-WtHR	4.1 (0.7)	3.6 (0.6)	<0.0001
METS-IR	37.8 (8.3)	32.8 (7.5)	<0.0001
ALLY vascular age SCORE	7.3 (6.7)	3.9 (5.0)	<0.0001
SCORE scale	1.8 (2.1)	0.5 (1.0)	<0.0001
ALLY vascular age Framingham	6.0 (10.4)	-0.5 (10.6)	<0.0001
REGICOR scale	3.2 (2.1)	2.8 (2.3)	<0.0001
ERICE scale	4.5 (5.1)	2.4 (3.1)	<0.0001
Fatty liver index	33.6 (26.8)	13.5 (17.9)	<0.0001
Hepatic steatosis index	37.6 (7.2)	35.1 (6.6)	<0.0001
Zhejiang University index	37.8 (6.0)	35.6 (5.6)	<0.0001
Fatty liver disease	32.7 (5.8)	28.9 (5.5)	<0.0001
BARD scoring	1.8 (1.1)	1.8 (0.9)	0.854
Lipid accumulation product	30.7 (30.4)	16.4 (16.9)	<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

increased the risk of presenting high values for all the cardiometabolic scales was age, with statistically significant differences in all cases. Being male also influenced most of the cardiometabolic risk parameters analyzed (all except hypercholesterolemia, high LDL values, and high REGICOR values). Smoking increased risk in less than half of the scales.

The highest odds ratios were found for SCORE and Deuremberg in the case of age and for SCORE and hypertriglyceridemic waist in men.

Discussion

Men working in hotel reception may be considered at moderate cardiometabolic risk while women could be classified as moderate-low. We should consider the prevalence of high values on the scales estimating body fat, dyslipidemia, atherogenic risk and cardiovascular risk to be of concern, since the average age of the workers is low.

The relationship between cardiometabolic risk and the type of work, whether manual or non-manual, yields contradictory results and in some cases not very comparable due to the different classification of the type of work in the different countries.

After a thorough review of the existing literature, no study has been found that accurately determines the level of cardiometabolic risk in this group of workers. Therefore, we will have to make a comparison between our results and those obtained in research carried out in non-manual workers.

A study based on the Korean National Health and Nutrition Examination Survey (2010-2018) conducted in 4447 premenopausal married women50 showed that the prevalence of metabolic syndrome was higher among women with manual jobs (15.3%) than among women with non-manual jobs (10.5%), these data agree with those obtained by us, although our prevalence are lower, perhaps due to the lower mean age of the sample.

A Swedish study that included 72,855 workers (41% women) who attended occupational health examinations between the years 2014-2019 concluded that manual workers had a higher level of health risks (OR: 1.80; 95% CI 1.71-1.90) compared to non-manual workers who were taken as a reference51.

Another study[52] of this same group that included a total of 304,702 participants (mean age 42.5 years, 47% female) and conducted between 1982 and 2019 found that manual and low-skilled workers had a significantly

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=3.029	Women n=4.933	
	%	%	p-value
Waist to height ratio > 0.50	36.6	13.2	<0.0001
Body mass index obesity	14.8	9.4	<0.0001
CUN BAE obesity	42.1	32.5	<0.0001
ECORE-BF obesity	41.9	31.7	<0.0001
Relative fat mass obesity	29.7	39.1	<0.0001
Palafolls formula obesity	82.5	60.2	<0.0001
Deuremberg formula obesity	39.1	52.3	<0.0001
METS-VF high	6.7	0.8	<0.0001
Diabesity	2.0	0.6	<0.0001
Hypertension	25.6	10.4	<0.0001
Total cholesterol ≥ 200 mg/dl	36.7	32.9	<0.0001
LDL-c ≥ 130 mg/dl	32.3	28.5	<0.0001
Triglycerides ≥ 150 mg/dl	22.7	7.2	<0.0001
Glycaemia 100-125 mg/dl	12.7	6.3	<0.0001
Glycaemia ≥ 126 mg/dl	2.2	0.5	<0.0001
Metabolic syndrome NCEP ATPIII	13.9	5.7	<0.0001
Metabolic syndrome IDF	10.7	6.4	<0.0001
Metabolic syndrome JIS	23.5	7.0	<0.0001
Atherogenic dyslipidemia	7.7	3.1	<0.0001
Lipid triad	2.2	0.7	<0.0001
Hipertriglyceridemic waist	7.9	1.0	<0.0001
Total cholesterol/HDL-c moderate-high	13.2	10.1	<0.0001
Triglycerides/HDL-c high	24.1	5.9	<0.0001
LDL-c/HDL-c high	21.6	11.6	<0.0001
Total cholesterol-HDL-c high	55.5	48.0	<0.0001
METS-IR high	8.1	3.8	<0.0001
TyG index high	24.4	10.0	<0.0001
LAP high	34.6	20.5	<0.0001
Fatty liver index high risk	20.2	4.1	<0.0001
SCORE scale moderate-high	26.9	4.5	<0.0001
REGICOR scale moderate-high	20.0	17.5	<0.0001
ERICE scale moderate-high	13.9	2.2	<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 IV: Binary logistic regression.

	≥ 50 years	Male	Smokers
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Waist to height ratio (WtHR) < 0.50	1	1	1
WtHR ≥0.50	1.78 (1.56-2.04)	3.71 (3.32-4.15)	ns
Body mass index (BMI) non obesity	1	1	1
BMI obesity	1.84 (1.59-2.19)	1.61 (1.40-1.85)	ns
CUN BAE non obesity	1	1	1
CUN BAE obesity	5.93 (5.20-6.75)	1.39 (1.26-1.54)	ns
ECORE non obesity	1	1	1
ECORE obesity	5.36 (4.72-6.09)	1.45 (1.31-1.60)	ns
Relative fat mass non obesity	1	1	1
Relative fat mass obesity	1.77 (1.57-2.00)	0.63 (0.57-0.70)	ns
Palafolls formula non obesity	1	1	1
Palafolls formula obesity	3.10 (2.63-3.66)	3.02 (2.70-3.38)	ns
Deurenberg formula non obesity	1	1	1
Deurenberg formula obesity	19.61 (16.09-23.90)	0.43 (0.39-0.48)	ns
METS-VF normal	1	1	1
METS-VF high	0.19 (0.15-0.25)	0.12 (0.08-0.17)	ns
Non hypertension	1	1	1
Hypertension	4.72 (4.12-5.41)	2.83 (2.49-3.22)	ns
Total cholesterol < 200 mg/dl	1	1	1
Total cholesterol ≥ 200 mg/dl	3.82 (3.38-4.32)	ns	ns
LDL-c < 130 mg/dl	1	1	1
LDL-c ≥ 130 mg/dl	3.81 (3.37-4.30)	ns	ns
Triglycerides < 150 mg/dl	1	1	1
Triglycerides ≥ 150 mg/dl	2.35 (2.02-2.73)	3.65 (3.17-4.19)	1.27 (1.10-1.46)
Glycaemia < 126 mg/dl	1	1	1
Glycaemia ≥ 126 mg/dl	5.50 (3.62-8.35)	4.05 (2.53-6.48)	ns
Non metabolic syndrome NCEP ATPIII	1	1	1
Metabolic syndrome NCEP ATPIII	5.12 (4.35-6.04)	2.44 (2.08-2.88)	ns
Non metabolic syndrome IDF	1	1	1
Metabolic syndrome IDF	3.11 (2.61-3.70)	1.61 (1.36-1.90)	ns
Non metabolic syndrome JIS	1	1	1
Metabolic syndrome JIS	5.11 (4.41-5.92)	3.92 (3.40-4.52)	ns
Non atherogenic dyslipidemia	1	1	1
Atherogenic dyslipidemia	3.43 (2.77-4.25)	2.37 (1.92-2.93)	1.40 (1.13-1.73)
Non lipid triad	1	1	1
Lipid triad	3.39 (2.28-5.04)	2.87 (1.90-4.32)	2.03 (1.37-3.00)
Non Hipertriglyceridemic waist	1	1	1
Hipertriglyceridemic waist	1.97 (1.52-2.56)	8.00 (5.87-10.90)	ns
Total cholesterol/HDL-c normal	1	1	1
Total cholesterol/HDL-c high	4.65 (4.00-5.40)	1.21 (1.05-1.40)	1.27 (1.09-1.47)
Triglycerides/HDL-c normal	1	1	1
Triglycerides/HDL-c high	3.06 (2.63-3.57)	4.85 (4.19-5.61)	1.22 (1.06-1.41)
LDL-c/HDL-c normal	1	1	1
LDL-c/HDL-c high	4.04 (3.52-4.63)	1.96 (1.73-2.23)	1.17 (1.02-1.34)
SCORE scale low	1	1	1
SCORE scale moderate-high	90.09 (54.35-149.33)	15.80 (11.33-22.04)	8.06 (5.84-11.13)
REGICOR scale low	1	1	1
REGICOR scale moderate-high	1.73 (1.49-2.01)	ns	1.30 (1.12-1.50)
Fatty liver index low-moderate risk	1	1	1
Fatty liver index high risk	2.22 (1.83-2.68)	5.65 (4.66-6.84)	ns
LAP low	1	1	1
LAP high	2.11 (1.86-2.39)	1.98 (1.79-2.20)	ns
BARD score low	1	1	1
BARD score high	1.94 (1.20-3.14)	0.57 (0.40-0.81)	ns
Non diabesity	1	1	1
Diabesity	6.06 (3.99-9.21)	2.82 (1.82-4.37)	ns
METS-IR bajo	1	1	1
METS-IR alto	2.15 (1.74-2.67)	2.09 (1.72-2.54)	ns
TyG index low	1	1	1
TyG index high	2.94 (2.56-3.38)	2.79 (2.46-3.16)	1.24 (1.09-1.41)

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.

higher risk of incident CVD compared to high-skilled white-collar workers, with the association mediated primarily by variation in lifestyle-associated variables.

Data from the 2011 South Asia Cardiometabolic Risk Reduction Center survey of 16,288 Indian adults saw that risks related to excess weight (BMI >25 kg/m^2 and waist-to-height ratio ≥0.5) were more common in non-manual workers. The same was true for metabolic risks, with a higher prevalence of diabetes, hypertension and dyslipidemias observed in these workers[53].

In two investigations carried out by the same group, one in more than 5000 farmers[54] and the other in almost 1100 Bolivian miners[55], it was found that these groups of manual workers had elevated values in cardiovascular risk scales such as REGICOR and SCORE, as well as in metabolic syndrome, nonalcoholic fatty liver disease and insulin resistance. These data are similar to those obtained by us in this study.

In Japan, more than 1.1 million people participated in a study[56] that found that manual workers had a higher risk of coronary heart disease but a lower risk of stroke.

Manual workers have more type 2 diabetes and higher levels of cardiometabolic risk, according to Australian research[57] that included half a million workers.

Our research group has carried out several investigations[58-61] in different work groups 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, excess weight, vascular age, and metabolic syndrome, among others.

Strengths and limitations

Two of the advantages of the study are the large number of cardiometabolic risk scales analyzed and the sample size in both sexes. Surely, this study is 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 calculated using risk scales rather than objective methods.

Conclusions

The reception workers in this study, despite having a low mean age, have moderate prevalence of the different cardiometabolic risk scales, with higher values in men.

Age and sex (male) are the variables that most increase the risk of presenting high values in all the cardiometabolic risk scales, whereas smoking does not have an impact in most cases.

Conflict of Interest

The authors declared that there is no conflict of interest.

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