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Differences in cardiovascular risk levels between cleaning staff and hotel housekeepers

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Abstract

Background and objective: Cardiovascular diseases are the leading cause of morbidity and mortality worldwide, with a greater incidence in the most disadvantaged social classes. In this study, we aimed to evaluate the level of cardiovascular risk in cleaning workers.

Methods: This was a descriptive, cross-sectional study in 46.632 cleaning workers (40.169 women and 6.463 men). Thirty-one different scales related to cardiovascular risk were studied (14 assessing overweight and obesity, 5 determining the risk of nonalcoholic fatty liver disease, 5 scales of cardiovascular risk, 4 atherogenic indices, and 3 scales of metabolic syndrome, among others). The results obtained were divided between personnel who perform their cleaning tasks in the hotel and catering industry and those in other sectors.

Results: The prevalence of obesity and arterial hypertension in cleaning workers was over 20% in both sexes. A similar amount was observed in moderate or high values on the REGICOR (Registre GIroní del COR) scale. More than 15% presented metabolic syndrome according to the NCEP ATPIII (National Cholesterol Education Program-Adult Treatment Program III) criteria, while over 10% of women and 20% of men had a high risk of nonalcoholic fatty liver disease assessed with the fatty liver index.

Conclusion: Cardiovascular risk is higher, in both sexes, in the group of cleaning workers who work in companies other than hotels.

KEYWORDS

atherogenic index, cardiovascular disease, cleaning staff, hypertension, obesity

1 | INTRODUCTION

According to the WHO (World Health Organization), cardiovascular diseases (CVD) are the leading cause of morbidity and mortality worldwide. In 2019,[1] they caused 27.9% of deaths in Spain, making them the leading cause of death in our country. Its etiology is complex and multifactorial, including pathophysiological and biochemical factors, which, together with environmental factors, contribute to the appearance and development of CVD.[2]

Among these factors, we find inequality in health linked to social class, which constitutes one of the great challenges of public health.[3] Thus, the most disadvantaged social classes have worse health indicators, in terms of morbidity and mortality, lifestyles, and access to health services.[4] These inequalities are presented according to different indicators of socioeconomic position such as income, level of education, situation, and type of employment.[5] Significant differences in cardiovascular morbidity and mortality have been demonstrated between highly skilled nonmanual workers and unskilled manual workers. With higher mortality in manual workers in both men and women.[5]

Both the hotel housekeepers and cleaning staff in other places correspond to jobs that are not specialized and require little training (blue necks). The cleaning sector generated 4.1 million jobs in Europe during 2018, 154 thousand more jobs than the previous year. This produced a profit of 120 000 million euros, which makes the cleaning sector a fundamental part of the European economy. The country that generates the most employment in this industry is Germany, with more than 1.1 million workers, followed by the United Kingdom (516 783), Spain (509 748), France (460 036), and Italy (445 150).[6]

Cleaning companies in Europe are highly atomized, with a small number of contract workers. Of the 30 593 Spanish cleaning companies in 2019, 68% had between 2 and 9 people hired, 17% between 10 and 19 workers, 10% between 24 and 49, 4% between 50 and 249, and only 1% employ more than 250 people. These data are very similar to those of the rest of Europe.[6]

Among the companies that have hired the largest number of cleaning staff are hotels. The hotel industry is a very important part of the economy in Spain. Most of the workers in this industry are housekeepers. Many of these positions are low paying and have a high risk of exposure to occupational stress.[7] These stressors include high physical demands, low job security, time constraints, inadequate training, interpersonal conflicts, and low wages.[8] As a result, hotel workers have higher rates of occupational injuries and suffer more serious injuries than most other service workers.[7] The majority of injuries were reported by housekeepers with an overall injury rate of 7.9 per 100 worker-years. Housekeepers are also at higher risk of developing hypertension, linked to occupational stress and their inability to control it.[9] As a result, hotel workers have higher rates of occupational injuries and suffer more serious injuries than most other service workers. Which leads us to wonder if cardiovascular risk among cleaning staff from different companies other than hotels and housewives is also affected.

The objective is to evaluate cardiovascular risk in a group of workers that corresponds to the lowest social classes, and to see if there are differences between two subgroups such as hotel housekeepers and cleaning workers in other industries.

2 | METHODS

A descriptive, cross-sectional study was performed on 47.650 Spanish cleaning workers of different regions (Balearic Islands, Andalusia, Canary Islands, Valencian Community, Catalonia, Madrid, Castilla La Mancha, Castilla León, and Basque Country) between January 2019 and December 2019. These workers were separated into two groups, the first group of 27,014 cleaning staff (SC) (in this group, the staff worked cleaning offices, hospitals, schools, supermarkets, airports, and restaurants) and the second group of 20,636 hotel housekeepers (HH)) (in this other group, they only worked as cleaning staff in hotels).

Of these, 1648 were excluded (901 CS and 747 HH): 66 for not agreeing to participate (41 CS and 25 HH), 619 because of a history of a previous cardiovascular event (325 CS and 294 HH), and 963 due to lacking some of the parameters necessary to calculate the different cardiovascular risk scales (502 CS and 461 HH), leaving 26.113 cleaning staff (20.295 women and 5.818 men) and 19.889 hotel housekeepers (19.244 women and 645 men). All workers were full-time workers.

The workers were selected from among those who attended periodic occupational medical checkups.

2.1 | Inclusion criteria

- Giving consent to participate in the study and the use of the data for epidemiological purposes.
- Not having suffered previous cardiovascular events.

Anthropometric, clinical, and analytical determinations were carried out by the health-care professionals of the different occupational health units that participated in the study, after standardizing the measurement techniques.

The following parameters were included in the assessment:

- Weight (in kg) and height (in cm) were determined with a SECA model 700 scale and a SECA 220 measuring rod.
- Abdominal waist circumference (in cm) was measured with a SECA model 200 tape measure. For the waist-to-height ratio, the cutoff point is set at 0.50.
- Blood pressure was measured in the supine position with a calibrated OMRON M3 automatic sphygmomanometer after a 10-min rest period. Three determinations are made at 1-min intervals, obtaining the mean of the three. Hypertension was considered when the values were greater than/equal to 140 mmHg systolic or 90 mmHg diastolic blood pressures, or if the worker was receiving antihypertensive treatment.
- Blood glucose, total cholesterol, and triglycerides were determined by peripheral venipuncture after fasting for at least 12 h. Glycemia, total cholesterol, and triglycerides were determined by automated enzymatic methods. HDL was determined by precipitation with dextran sulfate, and Cl2Mg and LDL were calculated using the Friedewald formula (provided that triglycerides were less than 400 mg/dl). All the above values are expressed in mg/dl.

$$\text{Friedewald formula: LDL} - \text{c} = \text{total cholesterol} - \text{HDL} - \text{c} - \text{triglycerides}/5$$

The following were considered altered values: 200 mg/dl for cholesterol, 130 mg/dl for LDL, and 150 mg/dl for triglycerides, or if they were under treatment for any of these analytical alterations.

Blood glucose figures were classified based on the recommendations of the American Diabetes Association, considering hyperglycemia from 125 mg/dl. Patients with a previous diagnosis were classified as diabetic, those who after obtaining a blood glucose level higher than 125 mg/dl had an HbA1c ≥ 6.5%, or if the person was taking hypoglycemic treatment.

BMI was calculated by dividing weight by height in meters squared. Obesity was considered to be 30 kg/m^2 or more.

Different scales were used to estimate the percentage of body fat:

- CUN BAE (Clínica Universitaria de Navarra Body Adiposity Estimator)[10]

$$-44.988 + (0.503 \times \text{age}) + (10.689 \times \text{gender}) + (3.172 \times \text{BMI}) - (0.026 \times \text{BMI}^2) + (0.181 \times \text{BMI} \times \text{gender}) - (0.02 \times \text{BMI} \times \text{age}) - (0.005 \times \text{BMI}^2 \times \text{gender}) + (0.00021 \times \text{BMI}^2 \times \text{age})$$

Male =0 Female =1.

- ECORE-BF (Equation Córdoba for Estimation of Body Fat)[11]

$$-97.102 + 0.123\,(\text{age}) + 11.9\,(\text{gender}) + 35.959\,(\text{LnBMI})$$

$$\text{Male} = 0\ \text{Female} = 1$$

- Palafolls formula.[12]

$$\text{Men} = \left[(\text{BMI}/\text{waist}) \times 10\right] + \text{BMI}.$$

$$\text{Women} = \left[(\text{BMI}/\text{waist}) \times 10\right] + \text{BMI} + 10.$$

- Deurenberg formula.[13]

$$1.2 \times (\text{BMI}) + 0.23 \times (\text{age}) - 10.8 \times (\text{gender}) - 5.4$$

$$\text{Male} = 0\ \text{Female} = 1$$

- Relative fat mass.[14]

Women: 76- (20 × (height/waist)) Men: 64- (20 × (height/waist)).

Other indicators related to overweight and obesity:

Visceral adiposity index (VAI)[15]

$$\text{Females: VAI} = \left(\frac{\text{WC}}{36.58 + (1.89 \times \text{BMI})}\right) \times \left(\frac{\text{TG}}{0.81}\right) \times \left(\frac{1.52}{\text{HDL}}\right)$$

$$\text{Males: VAI} = \left(\frac{\text{WC}}{39.68 + (1.88 \times \text{BMI})}\right) \times \left(\frac{\text{TG}}{1.03}\right) \times \left(\frac{1.31}{\text{HDL}}\right)$$

Body roundness index[16] BRI =364.2–365.5 × √1-[(waist/(2π)^2)/(0.5 × height)^2].

Body Surface Index[17] (BSI). BSA is calculated using the DuBois formula where w (weight) represents weight in kg and h (height) represents height in cm.

$$\text{BSA} = \text{w}^{0.425} \times \text{h}^{0.725} \times 0.007184$$

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

Conicity index.[18]

$$\frac{\text{waist circumference (in meters)}}{0.109} \times 1/\sqrt{\frac{\text{weight (in kilogram)}}{\text{height (in meters)}}}$$

Body shape index (ABSI).[19]

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

Normalized weight-adjusted index (NWAI)[20]:

$$\left[(\text{weight}/10) - (10 \times \text{height}) + 10\right]$$

Weight is measured in kg and height in m.

Other indicators related to cardiovascular risk:

Triglyceride glucose index, Triglyceride glucose index-IBMI, Triglyceride glucose index-waist[21]

$$\text{TyGindex} = \text{LN}\left(\text{TG}\left[\text{mg/dl}\right] \times \text{glycemia}\left[\text{mg/dl}\right]/2\right).$$

$$\text{TyGindex} - \text{IMC} = \text{TyGindex} \times \text{BMI}$$

$$\text{TyGindex} - \text{waist circumference} = \text{TyGindex} \times \text{waist}$$

Waist Triglyceride index.[22]

$$\text{waist (cm)} \times \text{triglycerides (mmol)}$$

Cardiometabolic index.[23]

$$\text{WtHR} \times \text{Triglycerides/HDL} - \text{c}$$

Fatty liver scales include:

- Fatty liver index.[24]

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

- Hepatic steatosis index (HSI)[25]

$$\text{HSI} = 8 \times \text{ALT/AST} + \text{BMI}\,(+\ 2 \text{ if type 2 diabetes yes}, +\ 2 \text{ if female})$$

- Zhejiang University index (ZJU)[26]

$$\text{BMI} + \text{Glycemia (mmol L)} + \text{Triglycerides (mmol L)} + 3\text{ALT/AST} + 2 \text{ if female}$$

- Fatty liver disease index (FLD)[27]

$$\text{BMI} + \text{Triglycerides} + 3 \times (\text{ALT/AST}) + 2 \times \text{Hyperglycemia (presence} = 1;\ \text{absence} = 0)$$

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.

Cutoff for high risk 2 points.

- Lipid accumulation product.[28]
  - Men: (waist (cm) – 65) × (triglycerides (mMol))
  - Women: (waist (cm) – 58) × (triglycerides (mMol))

The atherogenic indexes determined were:

- Total cholesterol/HDL (considered as high values >5 in men and >4.5 in women),
- LDL/HDL and Triglycerides/HDL (high values >3)
- Triglycerides/HDL (high values >3)
- Total cholesterol-HDL (high values >130)

Cardiometabolic indicators:

- Metabolic syndrome was determined using three models[29]:

a) NCEP ATP III (National Cholesterol Educational Program Adult Treatment Panel III) which considers metabolic syndrome when three or more of the following factors are present: waist circumference is greater than 88 cm in women and 102 in men; triglycerides >150 mg/dl or specific treatment for this lipid disorder; blood pressure >130/85 mmHg; HDL <40 mg/dl in women or <50 mg/dl in men or specific treatment is being followed; and fasting blood glucose >100 mg/dl or specific glycemic treatment.

b) The International Diabetes Federation (IDF) model, which considers the presence of central obesity necessary, defined a waist circumference of >80 cm in women and >94 cm 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, which follows the same criteria as the NCEP ATP III but with the waist circumference cutoff points starting at 80 cm in women and 94 cm in men.

Atherogenic dyslipidemia[30] is characterized by high triglyceride concentrations (>150 mg/dl), low HDL (<40 mg/dl in men and <50 mg/dl in women), and normal or slightly elevated LDL. If LDL values are high (>160 mg/dl), we speak of the lipid triad.

The cardiovascular risk scales used were:

REGICOR (REgistre GIroni del COR) scale is an adaptation of the Framingham scale to the Spanish population[31] and assesses the risk of suffering a cardiovascular event over a 10-year period. It can be applied between 35

and 74 years of age. The risk is considered moderate at 5% or above and high at 10% or above.[32]

The SCORE (Systematic COronary Risk Evaluation) scale for low-risk countries is used in Spain[32] and determines the risk of suffering a fatal cerebrovascular event in a 10-year period. It can be calculated between 40 and 65 years of age. Moderate risk is defined at 4% and high risk at 5% or above.

ERICE (Spanish Cardiovascular Risk Equation) is based on seven population-based cohort studies conducted in different geographical areas of Spain.[33] It estimates the risk of suffering a fatal or nonfatal cerebrovascular event over a 10-year period. The tables are used in people between 30 and 80 years of age. To calculate the risk, age, sex, smoking, diabetes, systolic blood pressure, antihypertensive treatment and total cholesterol are assessed. To classify the level of cardiovascular risk with the ERICE tables, the cutoff points recommended by the group responsible for the study were used: moderate risk is considered if it exceeds 5%, moderate-high if it is between 15% and 19%, high if it is between 20% and 39%, and very high if it exceeds 39%.

Vascular age with the Framingham model.[34] To calculate this, we need age, sex, HDL-c, total cholesterol, systolic blood pressure values, antihypertensive treatment, smoking, and diabetes. It can be calculated from the age of 30 years.

Vascular age with the SCORE model.[35] For its calculation, age, sex, systolic blood pressure, smoking, and total cholesterol are used. As with the scale from which it is derived, it can be calculated in people between 40 and 65 years of age.

An interesting concept applicable to both vascular ages is avoidable lost life years (ALLY) which can be defined as the difference between biological age and vascular age.

A smoker is considered to be any person who has regularly consumed at least 1 cigarette/day (or the equivalent in other types of consumption) in the previous month or has quit smoking less than 12 months before.

2.2 | Statistical analysis

A descriptive analysis of the categorical variables was performed, by calculating the frequency and distribution of responses for each one. For quantitative variables, the mean and standard deviation were calculated, whereas for qualitative variables, the percentage was calculated. The bivariate association analysis was performed using the X^2 test (with correction of Fisher's exact statistic when conditions required so) and Student's *t*-test for independent samples. For the multivariate analysis, binary logistic regression was used with the Wald method, with the calculation of the odds ratio and the Hosmer-Lemeshow goodness-of-fit test. The statistical analysis was performed with the SPSS 27.0 program, with an accepted statistical significance level of 0.05.

3 | RESULTS

The mean values of anthropometric, clinical, and analytical variables were almost always more unfavorable in the cleaning staff group, for both sexes. The prevalence of smoking did not show statistically significant differences in either sex (Table 1).

Table 2 shows that all variables related to cardiovascular risk (overweight and obesity scales, cardiometabolic indicators, atherogenic indices, fatty liver scales, and cardiovascular risk scales) had higher mean values in the cleaning staff group compared to the hotel housekeepers. This situation was similar in both sexes.

When assessing the prevalence of elevated values on the different scales related to cardiovascular risk, the highest were found in the cleaning staff group (Table 3).

In the multivariate analysis using binary logistic regression, the covariates established were aged 50 years or older, male sex, smoking, and belonging to the cleaning staff group. The explanatory variables are gender, age, tobacco consumption, and type of cleaning work. The outcome variables are the elevated values of different scales related to cardiovascular risk. The variable with the greatest correlation with increased risk on the cardiovascular risk scales was age, followed by male sex. In our results, the simple fact of belonging to the cleaning staff group increased the risk in almost all the scales related to the evaluation of cardiovascular risk except FLD and glycemia greater than 125 mg/dl (Table 4).

4 | DISCUSSION

In the bibliography found in our review, chronic pathologies are very common among hotel housekeepers. These conditions include chronic back pain, migraine, arthritis, and hypertension.[8] When studying high blood pressure in this group of workers, a link between it and occupational stress has been found.[9] High blood pressure and hypertension are the main risk factors for cardiovascular diseases (CVD) such as strokes and coronary heart disease and also chronic kidney disease.

In an American study on hotel housekeepers, 21% of them met the criteria for high blood pressure,[36] with values close to the ones obtained in our study. A Brazilian study[37] carried out on 45 cleaning workers to evaluate musculoskeletal disorders found a prevalence of arterial hypertension of 23%, also very similar to our results.

TABLE 1 Characteristics of people

	Women			Men		
	n = 19 244	*n* = 20 925		*n* = 645	*n* = 5818	
	Hotel housekeeper	Cleaning staff		Hotel housekeeper	Cleaning staff	
	Mean (SD)	Mean (SD)	*p*-value	Mean (SD)	Mean (SD)	*p*-value
Age	43.2 (10.6)	45.1 (10.5)	<.0001	35.9 (11.3)	39.4 (11.9)	<.0001
Height	160.0 (6.4)	159.3 (6.4)	<.0001	173.1 (7.6)	173.4 (7.1)	.347
Weight	66.5 (13.3)	68.1 (14.5)	<.0001	76.6 (14.6)	79.7 (15.4)	<.0001
Waist	74.2 (10.5)	76.2 (10.6)	<.0001	82.7 (11.6)	85.6 (11.5)	<.0001
SBP	121.1 (15.9)	121.7 (17.3)	<.0001	124.7 (14.4)	127.9 (15.5)	<.0001
DBP	74.2 (10.3)	74.6 (11.0)	<.0001	75.7 (10.4)	77.1 (10.9)	.002
Total cholesterol	195.6 (36.6)	199.9 (37.6)	<.0001	183.2 (40.1)	189.4 (40.6)	<.0001
HDL-c	55.8 (7.4)	54.2 (8.2)	<.0001	52.0 (8.9)	49.7 (8.5)	<.0001
LDL-c	122.7 (35.7)	126.2 (36.4)	<.0001	110.4 (37.1)	115.4 (37.7)	.001
Triglycerides	85.8 (45.3)	98.3 (54.8)	<.0001	106.9 (88.4)	125.0 (97.7)	<.0001
Glucose	90.8 (15.7)	90.8 (18.8)	.989	90.7 (21.0)	92.9 (21.7)	.016
AST	22.3 (12.7)	22.1 (13.9)	.135	29.1 (15.4)	31.6 (23.1)	.007
ALT	19.9 (9.0)	19.7 (8.5)	.370	23.7 (9.8)	25.6 (14.0)	.009
GGT	21.9 (22.5)	23.3 (22.6)	<.0001	28.5 (21.9)	36.8 (48.9)	<.0001
	Percentage	Percentage	*p*-value	Percentage	Percentage	*p*-value
< 30 years	12.3	9.4	<.0001	34.6	25.5	<.0001
30–39 years	24.6	19.8		27.1	24.7	
40–49 years	32.1	33.1		24.2	26.6	
50–59 years	25.7	30.2		12.4	19.3	
60–69 years	5.3	7.5		1.7	3.9	
Nonsmokers	66.7	67.2	.341	65.9	65.0	.634
Smokers	33.3	32.8		34.1	35.0	

Abbreviations: ALT, Alanine Aminotransferase; AST, Aspartate Aminotransferase; DBP, Diastolic blood pressure; GGT, Gamma-glutamyl Transpeptidase; HDL-c, High-density lipoprotein cholesterol; LDL, Low-density lipoprotein cholesterol; SBP, Systolic blood pressure.

Continued stress in the workplace produces a high allostatic load index associated with all-cause mortality, cardiovascular disease, mental illness, migraine, periodontitis, and other health-related conditions.[38]

At the end of the last century, Mamelle et al[39] studied 594 female workers in a hospital in Lyon in which the prevalence of overweight and obesity (56%) was higher in the group of female cleaning workers, results that coincide with ours in which we obtained a prevalence of obesity of more than 20% and overweight of more than 30% in the group of women.

Multivariate analysis showed a negative effect on cardiovascular risk, especially of age and male sex, and a slightly smaller effect of cleaning work outside the hospitality sector.

When comparing the two subgroups of cleaning workers that are supposed to present the same cardiovascular risk, we found that it is higher for cleaning workers compared to housekeepers in all the formulas used with high statistical significance. What should make us think that this group has a higher allostatic load that would produce a high risk of developing clinical conditions such as hypertension and diabetes. So, it would be necessary to develop and test interventions aimed at reducing stress, promoting worker health and safety, and addressing occupational health disparities.

In our literature search, we found very few studies assessing the level of cardiovascular risk in cleaning workers, which makes it difficult to compare our results with those of other authors.

In the existing literature, it has not been shown that one formula for calculating cardiovascular risk is better than another. It is essential to assess the applicability of risk models to each population, as risk scores may perform worse in a different setting than they were originally obtained. For this reason, we wanted to assess cardiovascular risk using different scales.[40]

TABLE 2 Differences in mean values of the scales related to cardiovascular risk according to the profession by sex using the T-Student test

	Women			Men		
	n = 19 244	*n* = 20 925		*n* = 645	*n* = 5818	
	Hotel housekeeper	Cleaning staff		Hotel housekeeper	Cleaning staff	
	Mean (SD)	Mean (SD)	*p*-value	Mean (SD)	Mean (SD)	*p*-value
Waist-to-height ratio (WtHR)	0.46 (0.06)	0.48 (0.06)	<.0001	0.48 (0.1)	0.49 (0.1)	<.0001
Body mass index (BMI)	26.0 (4.9)	26.8 (5.4)	<.0001	25.5 (4.4)	26.5 (4.8)	<.0001
CUN BAE	36.7 (6.6)	38.0 (6.9)	<.0001	23.2 (7.1)	25.0 (7.2)	<.0001
ECORE-BF	36.6 (6.9)	38.0 (7.2)	<.0001	23.3 (6.6)	25.0 (6.8)	<.0001
Relative fat mass	32.2 (5.5)	33.5 (5.4)	<.0001	21.4 (5.5)	22.8 (5.3)	<.0001
Palafolls formula	39.5 (5.2)	40.3 (5.7)	<.0001	28.6 (4.6)	29.6 (5.0)	<.0001
Deurenberg formula	35.7 (6.6)	37.2 (7.2)	<.0001	22.7 (6.3)	24.6 (6.9)	<.0001
Body fat index	26.6 (7.8)	28.1 (7.9)	<.0001	20.10 (8.4)	22.0 (8.4)	<.0001
Body surface index	50.9 (7.7)	52.0 (8.4)	<.0001	55.3 (8.0)	57.0 (8.4)	<.0001
Normalized weight-adjusted index	0.6 (1.3)	0.9 (1.4)	<.0001	0.3 (1.3)	0.6 (1.5)	<.0001
Body roundness index	2.8 (1.2)	3.0 (1.2)	<.0001	3.0 (1.1)	3.3 (1.2)	<.0001
Body shape index	0.067 (0.01)	0.068 (0.01)	<.0001	0.073 (0.01)	0.074 (0.01)	.003
Visceral adiposity index	2.6 (1.5)	3.1 (2.0)	<.0001	5.8 (5.3)	7.5 (7.0)	<.0001
Conicity index	1.06 (0.1)	1.07 (0.1)	<.0001	1.14 (0.1)	1.16 (0.1)	<.0001
No factors metabolic syndrome NCEP ATPIII	1.0 (1.1)	1.3 (1.2)	<.0001	1.0 (1.0)	1.3 (1.2)	<.0001
No factors metabolic syndrome JIS	1.1 (1.2)	1.4 (1.3)	<.0001	1.4 (1.2)	1.7 (1.3)	<.0001
Total cholesterol/HDL-c	3.6 (0.8)	3.8 (1.0)	<.0001	2.2 (2.0)	2.7 (2.4)	<.0001
log triglycerides/HDL-c	0.15 (0.2)	0.22 (0.2)	<.0001	0.24 (0.23)	0.33 (0.3)	<.0001
LDL-c/HDL-c	2.3 (0.8)	2.4 (0.9)	<.0001	2.2 (0.9)	2.4 (1.0)	<.0001
Total cholesterol-HDL-c	139.8 (37.8)	145.8 (39.1)	<.0001	131.3 (41.5)	139.7 (42.5)	<.0001
Cardiometabolic index	0.7 (0.5)	0.9 (0.7)	<.0001	1.1 (1.0)	1.4 (1.3)	<.0001
Triglyceride glucose index (TyG index)	8.1 (0.5)	8.3 (0.5)	<.0001	8.3 (0.6)	8.5 (0.6)	<.0001
TyG index-BMI	212.5 (45.8)	223.0 (51.8)	<.0001	212.4 (44.1)	225.3 (49.3)	<.0001
TyG index-waist circumference	606.4 (99.9)	632.4 (106.6)	<.0001	686.9 (116.5)	726.8 (124.5)	<.0001
TyG index-WtHR	3.8 (0.6)	4.0 (0.7)	<.0001	4.0 (0.6)	4.2 (0.7)	<.0001
Waist triglyceride index	72.7 (42.0)	86.0 (53.4)	<.0001	100.8 (84.1)	123.2 (99.8)	<.0001
Waist weight index	9.1 (0.7)	9.3 (0.7)	<.0001	9.5 (0.7)	9.6 (0.8)	<.0001
ALLY vascular age SCORE	5.1 (5.3)	5.2 (5.2)	.044	6.9 (6.5)	7.9 (6.9)	.030
SCORE scale	0.66 (1,1)	0.68 (1.1)	.062	1.44 (2.0)	1.82 (2.3)	.011
ALLY vascular age Framingham	2.9 (12.8)	5.0 (13.7)	<.0001	4.6 (9.4)	7.3 (10.4)	<.0001
REGICOR scale	2.7 (2.2)	3.1 (2.3)	<.0001	2.9 (2.0)	3.5 (2.3)	<.0001
ERICE scale	3.4 (3.8)	3.9 (4.1)	<.0001	3.5 (4.0)	4.8 (5.2)	<.0001
Fatty liver index	18.8 (21.0)	24.3 (24.3)	<.0001	29.0 (25.4)	36.9 (28.4)	<.0001
Hepatic steatosis index	37.2 (7.1)	38.3 (6.9)	<.0001	37.7 (6.9)	37.2 (7.3)	.530
Zhejiang University index	37.6 (5.7)	38.9 (6.4)	<.0001	37.6 (6.0)	37.3 (5.8)	.711
Fatty liver disease	30.7 (5.5)	31.8 (6.1)	<.0001	32.4 (5.6)	32.2 (5.6)	.738
Lipid accumulation product	16.5 (15.9)	21.6 (21.12)	<.0001	22.3 (24.8)	31.3 (34.6)	<.0001

Abbreviations: ALLY, Avoidable lost life years; CUN BAE, Clinica Universitaria Navarra Body Adiposity Estimator; ECORE-BF, Equation Córdoba for Estimation of Body Fat; HDL-c, High-density lipoprotein cholesterol; LDL, Low-density lipoprotein cholesterol; REGICOR, REgistre GIroni del COR; SCORE, Systematic COronary Risk Evaluation.

TABLE 3 Differences in the prevalence of altered values of different scales related with cardiovascular risk according to the profession by sex using the chi-square test

	Women			Men		
	n = 19 244	*n* = 20 925		*n* = 645	*n* = 5818	
	Hotel housekeeper	Cleaning staff		Hotel housekeeper	Cleaning staff	
	% (CI 95%)	% (CI 95%)	*p*-value	% (CI 95%)	% (CI 95%)	*p*-value
Waist-to-height ratio >0.50	23.4 (23.2–23.6)	29.6 (29.4–29.8)	<.0001	32.7 (32.0–33.4)	42.2 (41.4–43.1)	<.0001
Body mass index obesity	18.9 (18.7–19.1)	24.0 (23.8–24.2)	<.0001	13.8 (13.2–14.4)	20.8 (20.1–21.5)	<.0001
CUN BAE obesity	58.8 (58.5–59.2)	65.7 (65.3–66.1)	<.0001	40.6 (39.6–41.6)	49.3 (48.2–50.4)	<.0001
ECORE-BF obesity	57.4 (57.1–57.7)	64.1 (63.8–64.4)	<.0001	40.5 (39.6–41.5)	49.0 (48.0–50.0)	<.0001
Relative fat mass obesity	36.0 (35.8–36.2)	45.7 (45.5–45.9)	<.0001	40.2 (39.3–41.2)	51.6 (50.5–52.7)	<.0001
Palafolls formula obesity	80.7 (80.4–81.1)	83.9 (83.5–84.3)	<.0001	76.1 (74.0–78.2)	82.5 (80.0–85.0)	<.0001
Deurenberg formula obesity	80.3 (80.0–80.6)	84.9 (84.5–85.5)	<.0001	35.3 (34.4–36.2)	45.9 (44.9–46.9)	<.0001
Hypertension	17.0 (16.8–17.2)	23.2 (23.0–23.4)	<.0001	19.1 (18.3–19.9)	28.4 (27.4–29.4)	<.0001
Total cholesterol ≥200 mg/dl	43.1 (42.7–43.5)	48.3 (48.0–48.7)	<.0001	31.8 (30.7–33.0)	37.2 (36.2–38.4)	.007
LDL-c ≥ 130 mg/dl	39.4 (39.1–39.7)	44.2 (43.8–44.6)	<.0001	28.4 (27.4–29.5)	34.1 (33.0–35.2)	.003
Triglycerides ≥150 mg/dl	7.1 (7.0–7.3)	11.8 (11.6–12.0)	<.0001	17.8 (16.9–18.7)	23.9 (22.9–24.9)	.001
Glycemia 100–125 mg/dl	15.7 (15.5–15.9)	15.0 (14.8–15.2)	<.0001	14.1 (13.4–14.8)	18.4 (17.6–19.2)	<.0001
Glycemia ≥126 mg/dl	2.1 (1.9–2.2)	2.6 (2.5–2.7)	<.0001	2.2 (1.9–2.5)	3.6 (3.3–3.9)	<.0001
Metabolic syndrome NCEP ATPIII	11.9 (11.7–12.1)	17.0 (16.8–17.2)	<.0001	9.3 (8.6–10.0)	17.6 (16.8–18.5)	<.0001
Metabolic syndrome IDF	11.1 (10.9–11.3)	15.5 (15.3–15.7)	<.0001	5.6 (5.3–5.9)	14.1 (13.7–14.5)	<.0001
Metabolic syndrome JIS	14.0 (13.8–14.2)	19.6 (19.4–19.8)	<.0001	16.4 (15.9–16.9)	28.5 (27.8–29.3)	<.0001
Atherogenic dyslipidemia	3.5 (3.4–3.6)	7.1 (7.0–7.2)	<.0001	4.8 (4.4–5.2)	8.3 (7.6–9.0)	<.0001
Lipid triad	0.9 (0.8–0.9)	2.1 (2.0–2.2)	<.0001	1.1 (1.0–1.2)	2.3 (2.1–2.5)	<.0001
Hypertriglyceridemic waist	1.1 (1.0–1.1)	2.5 (2.2.4–2.6)	<.0001	3.9 (3.6–4.2)	8.3 (7.9–8.7)	<.0001
Total cholesterol/HDL-c moderate-high	13.7 (13.6–13.8)	20.5 (20.4–20.6)	<.0001	11.6 (11.0–12.2)	17.3 (16.6–18.0)	.001
log triglycerides/HDL-c high	6.5 (6.4–6.6)	11.6 (11.5–11.7)	<.0001	19.5 (18.8–20.2)	27.0 (26.5–27.5)	<.0001
LDL-c/HDL-c high	16.4 (16.3–16.5)	21.7 (21.6–21.8)	<.0001	18.6 (18.2–19.0)	26.3 (25.7–26.9)	<.0001
Total cholesterol-HDL-c high	58.9 (58.7–59.2)	65.2 (65.0–65.5)	<.0001	48.8 (47.7–49.9)	57.2 (56.0–58.4)	<.0001
SCORE scale moderate-high	6.7 (6.6–6.8)	7.1 (7.0–7.2)	<.0001	15.5 (14.9–16.1)	23.8 (23.0–24.6)	<.0001
REGICOR scale moderate-high	17.3 (17.1–17.5)	20.6 (20.4–20.8)	<.0001	21.1 (20.4–21.8)	28.5 (27.6–29.4)	<.0001
ERICE scale moderate-high	4.6 (4.5–4.7)	6.1 (6.0–6.2)	<.0001	7.3 (6.9–7.7)	14.9 (14.4–15.4)	<.0001
Fatty liver index high risk	7.2 (7.1–7.3)	11.7 (11.6–11.8)	<.0001	15.8 (15.3–16.3)	24.0 (23.4–24.6)	<.0001
Hepatic steatosis index high risk	50.2 (50.0–50.4)	58.1 (57.9–58.3)	<.0001	52.3 (51.1–53.5)	55.9 (54.6–57.3)	.034
Zhejiang University index high risk	41.3 (41.0–41.5)	48.8 (48.6–49.0)	<.0001	38.4 (37.5–39.3)	39.5 (38.5–40.5)	.127
Fatty liver disease high risk	51.7 (51.4–52.1)	52.0 (51.7–52.3)	<.0001	53.1 (51.8–54.4)	58.4 (57.0–59.8)	.001

Abbreviations: CUN BAE, Clinica Universitaria Navarra Body Adiposity Estimator; ECORE-BF, Equation Córdoba for Estimation of Body Fat; HDL-c, High-density lipoprotein cholesterol; LDL, Low-density lipoprotein cholesterol; REGICOR, REgistre GIroni del COR; SCORE, Systematic COronary Risk Evaluation.

4.1 | Strengths and limitations

By way of strengths of the study, we would highlight the large sample size, that is over 46,000 cleaning staff; a large number of scales included, specifically 14 scales that assess overweight and obesity, five for fatty liver, five for CVR, four atherogenic indices, and three for metabolic syndrome; and the fact that it is the first study, to our knowledge, to address the level of CVR in cleaning staff, which could make it a reference for subsequent studies in this group.

The most important limitation is that it was carried out in a specific geographical area, which makes it difficult

TABLE 4 Logistic regression analysis to examine the relationship between covariates (≥50 years, male, cleaning staff, and smoker) and different cardiometabolic scales

	≥ 50 years	Male	Cleaning staff	Smoker
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
WtHR <0.50	1	1	1	1
WtHR ≥0.50	1.12 (1.07–1.17)	1.75 (1.66–1.86)	1.38 (1.32–1.44)	0.93 (0.89–0.97)
BMI nonobesity	1	1	1	1
BMI obesity	1.22 (1.16–1.28)	0.84 (0.79–0.90)	1.35 (1.28–1.41)	0.92 (0.88–0.96)
CUN BAE nonobesity	1	1	1	1
CUN BAE obesity	3.46 (3.31–3.62)	0.58 (0.55–0.61)	1.27 (1.21–1.32)	0.94 (0.90–0.98)
RFM nonobesity	1	1	1	1
RFM obesity	1.17 (1.13–1.22)	1.29 (1.22–1.36)	1.49 (1.43–1.55)	0.93 (0.89–0.96)
Deurenberg formula nonobesity	1	1	1	1
Deurenberg formula obesity	12.20 (11.16–13.34)	0.15 (0.14–0.16)	1.27 (1.21–1.34)	0.94 (0.89–0.99)
Nonhypertension	1	1	1	1
Hypertension	3.67 (3.50–3.85)	1.65 (1.55–1.77)	1.38 (1.31–1.45)	ns
Total cholesterol <200 mg/dl	1	1	1	1
Total cholesterol ≥200 mg/dl	3.47 (3.33–3.61)	0.74 (0.70–0.79)	1.15 (1.11–1.20)	ns
LDL-c < 130 mg/dl	1	1	1	1
LDL-c ≥ 130 mg/dl	3.36 (3.22–3.50)	0.76 (0.72–0.81)	1.14 (1.09–1.18)	ns
Triglycerides <150 mg/dl	1	1	1	1
Triglycerides ≥150 mg/dl	2.03 (1.91–2.16)	2.72 (2.53–2.92)	1.63 (1.53–1.74)	ns
Glycemia <126 mg/dl	1	1	1	1
Glycemia ≥126 mg/dl	3.03 (2.90–3.18)	1.38 (1.30–1.48)	ns	ns
Nonmetabolic syndrome NCEP ATPIII	1	1	1	1
Metabolic syndrome NCEP ATPIII	3.06 (2.90–3.22)	1.23 (1.14–1.33)	1.44 (1.36–1.52)	ns
Nonmetabolic syndrome IDF	1	1	1	1
Metabolic syndrome IDF	2.01 (1.91–2.12)	ns	1.42 (1.34–1.50)	ns
Nonmetabolic syndrome JIS	1	1	1	1
Metabolic syndrome JIS	3.09 (2.94–3.25)	1.97 (1.85–2.11)	1.43 (1.35–1.50)	ns
Nonatherogenic dyslipidemia	1	1	1	1
Atherogenic dyslipidemia	2.33 (2.15–2.52)	1.38 (1.24–1.53)	1.98 (1.81–2.17)	ns
Nonlipid triad	1	1	1	1
Lipid triad	3.31 (2.84–3.84)	1.34 (1.11–1.63)	2.11 (1.77–2.50)	ns
Total cholesterol/HDL-c normal	1	1	1	1
Total cholesterol/HDL-c high	3.37 (3.21–3.54)	ns	1.52 (1.45–1.60)	0.94 (0.89–0.99)
log Triglycerides/HDL-c normal	1	1	1	1
log Triglycerides/HDL-c high	2.20 (2.07–2.33)	3.36 (3.13–3.60)	1.75 (1.64–1.88)	ns
LDL-c/HDL-c normal	1	1	1	1
LDL-c/HDL-c high	3.36 (3.20–3.52)	1.56 (1.46–1.67)	1.35 (1.28–1.41)	ns
SCORE scale low	1	1	1	1
SCORE scale moderate-high	110.00 (84.07–143.91)	13.01 (11.38–14.86)	1.11 (1.06–1.17)	7.12 (6.45–7.87)
REGICOR scale low	1	1	1	1
REGICOR scale moderate-high	19.32 (17.84–20.92)	1.65 (1.50–1.82)	1.14 (1.07–1.21)	1.89 (1.78–2.02)
Fatty liver index low-moderate risk	1	1	1	1
Fatty liver index high risk	1.24 (1.15–1.32)	2.47 (2.28–2.67)	1.69 (1.58–1.82)	ns

(Continues)

TABLE 4 (Continued)

	≥ 50 years	Male	Cleaning staff	Smoker
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Hepatic steatosis index low-moderate risk	1	1	1	1
Hepatic steatosis index high risk	1.54 (1.39–1.72)	0.86 (0.76–0.97)	1.30 (1.16–1.47)	ns
Zhejiang University index low risk	1	1	1	1
Zhejiang University index high risk	1.64 (1.47–1.82)	0.76 (0.67–0.86)	1.28 (1.14–1.45)	ns
Fatty liver disease normal risk	1	1	1	1
Fatty liver disease high risk	1.32 (1.18–1.47)	1.36 (1.20–1.54)	ns	ns

Abbreviations: BMI, body mass index; CUN BAE, Clinica Universitaria Navarra Body Adiposity Estimator; REGICOR, REgistre GIroni del COR. ns nonsignificance; RFM, relative fat mass; SCORE, Systematic COronary Risk Evaluation; WtHR, Waist-to-Height ratio.

to extrapolate the results to other countries. Another limitation is that the race of the workers and their level of education and income were not known. In addition, only those patients who have attended the company's medical checkups are included.

Another limitation of our study is that we have not analyzed the psychosocial and physical work environment of the workers. As it is a descriptive cross-sectional study, we lack data that could influence cardiovascular risk factors. Such as shift work, job strain, job control, and psychological demands on and off the job.

We could also think that those people with greater stress in the workplace would leave said occupation before becoming ill. We can neither affirm nor deny this premise. However, after a very large sample, 46,632 cleaning workers, it is acceptable that statistically the number and characteristics of workers who would leave their job would be similar in both groups.

Finally, as it is a cross-sectional study, it does not allow establishing causal relationships between the assessed factors.

5 | CONCLUSIONS

The group of cleaning workers has a high cardiovascular risk regardless of the cardiovascular risk scale used.

Cardiovascular risk is higher, for both sexes, in the group of cleaning workers in sectors other than the hotel and catering industry than in the group of hotel and catering workers.

It is important to bear in mind the high cardiovascular risk in cleaning workers, in order to develop specific interventions in this group that reduce their morbidity and increase their quality of life.

DISCLOSURE

Approval of the research protocol: N/A. *Informed consent*: All patients signed written informed consent documents prior to their participation in the study. *Registry and the registration no. of the study/trial*: N/A. *Animal studies*: N/A. *Conflict of interest*: N/A.

AUTHORS' CONTRIBUTIONS

Conceptualization: AALG, HMGSM, ZM; Data collection and analysis: SAB, PRS; Methodology: JIRM, MMRV; Draft: JIRM, AALG, ZM; Review: HMGSM, SAB, PRS.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions. The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions. The database was approved by the Research Ethics Committee.

ETHICAL APPROVAL

The study was approved by the Clinical Research Ethics Committee of the Balearic Islands Health Area nº IB 4383/20. All procedures were performed in accordance with the ethical standards of the institutional research committee and with the 2013 Declaration of Helsinki.

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