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Cardiovascular risk and associated risk factors in Spanish professional drivers

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ABSTRACT

Introduction: Cardiovascular diseases are the leading cause of mortality worldwide and are related to harmful lifestyles and certain professions such as being a professional driver. The aim of this study was to determine cardiovascular risk in professional drivers and the factors that influence it, with the intention of recommending improvements in their lifestyle habits.
Material and methods: A retrospective, cross-sectional study was carried out on 24784 professional drivers (cab drivers and bus drivers) of both sexes (23,560 men and 1227 women) in different Spanish regions. Several variables and scales related to cardiovascular risk were assessed. In order to see if this type of profession produces an increase in cardiovascular risk.
Results: 27.8% of drivers were obese, 34.7% were hypertensive, and 48.7% had a high waist to height ratio. 46.5% were considered non-metabolically healthy, in that 24.9% had metabolic syndrome with the NCEP-ATPIII criteria, 19.2% with the IDF criteria, and 37.3% with JIS criteria. 26.9% had moderate or high values on the REGICOR scale and 29.5% on the SCORE scale. 32.7% had a high risk of hepatic steatosis.
Conclusions: The cardiovascular risk of our drivers was high in men and moderate in women. Significant differences were found between men and women with regard to the habits of regular physical exercise and healthy eating, which could justify the lower cardiovascular risk in women.

1. Introduction

Cardiovascular diseases have increased in the last decade to constitute the leading cause of mortality worldwide (WHO 2020). In Spain they cause about 120,000 deaths a year, which is equivalent to one in four deaths in men and one in three in women (Bueno H, Pérez-Gómez B. 2019). It has been shown to be related to different factors (Hypertension, Diabetes Mellitus, Obesity, Sedentary lifestyle, Smoking, Hyperlipidemia, etc.) that increase the probability of suffering a cardiovascular event (CVE), as well as the possibility of preventing this by modifying harmful lifestyles (Broers ER. 2020). Therefore, it necessary to develop strategies for prevention and early diagnosis in the most susceptible population groups (Somoza MI, Torresani ME. 2007).

Professions involving sedentary activity and long working days lead to an unhealthy, harmful way of life, both in themselves and

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due to other, related, inappropriate behaviors (smoking, alcohol, junk food, etc.). Thus increasing the risk of cardiovascular disease; one of these is professional driving (Ronchese F, Bovenzi M. 2012).

Different studies have shown excessive consumption of alcohol or tobacco and a diet rich in salt and fat among professional drivers (Mota Guedes H. 2010). People who sit for a long time, driving and working shifts, generally have greater difficulty eating a healthy diet, having a regular sleep cycle, or being able to carry out regular physical exercise, or even to achieve adequate control of their weight (De Padua Mansur A et al., 2015). Which makes them participants for inclusion in the group of high risk for cardiovascular disease.

The objective of this study was to evaluate the level of cardiovascular risk in a group of professional drivers (taxi drivers and bus drivers) of both sexes, with rotating shifts of 37.5 h per week. The workers come from different companies located in various autonomous communities of Spain (Balearic Islands, Canary Islands, Castilla y León, Castilla-La Mancha, Andalusia, Valencian Community, Catalonia, Madrid and the Basque Country). The aim is to describe what factors may be influencing the increased risk of cardiovascular disease and propose preventive actions by companies with the aim of improving the quality and quantity of life of their drivers.

2. Material and methods

A cross-sectional study was carried out in 25,423 professional drivers in different Spanish geographical areas and in different companies during the period between January 2019 and June 2020. Workers were selected from those who attended periodic occupational medical examinations.

2.1. Inclusion criteria

- Working at one of the participating companies.
- Driving vehicles as the main task.

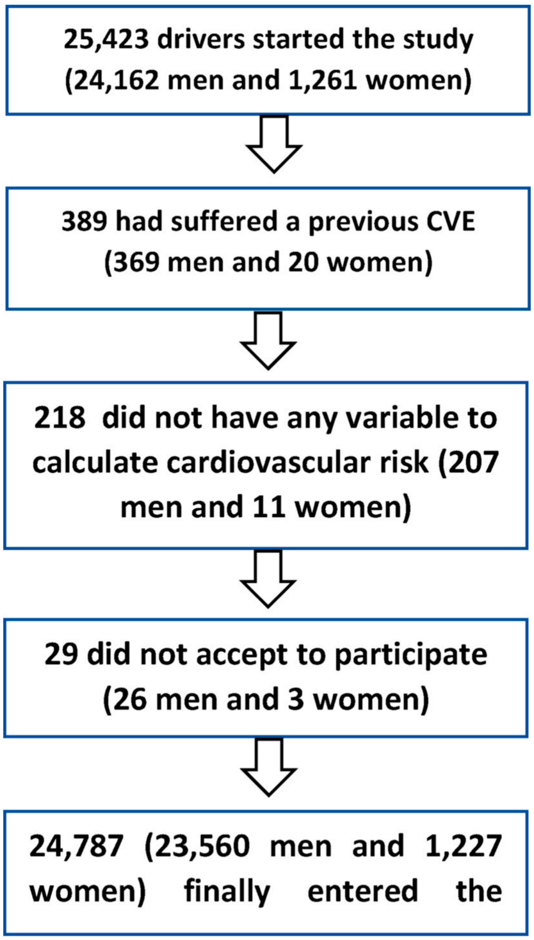

Fig. 1. Participant flow chart.

– Acceptance of participation in the study.
– Not having suffered a serious cardiovascular disease before (myocardial infarction, cerebrovascular disease ...).

Of the 25,423 drivers, 218 were excluded as they did not have all the necessary variables to calculate the cardiovascular risk indicators, 389 had suffered a previous cardiovascular event, and 29 did not accept to participate. The final number of workers included in the study was 24,787 (23,560 men and 1227 women) (see Fig. 1).

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

2.2. Parameters related to cardiovascular risk included in the assessment

To measure weight (expressed in kilograms) and height (expressed in cm), a height rod scale was used: SECA 700 model with capacity for 200 kg and 50-g divisions that had a SECA 220 telescopic height rod with millimeter division and 60–200 cm interval added to it.

Abdominal waist circumference was measured in cm with a tape measure: SECA model 200, with an interval of 1–200 cm and millimeter division. The person stood in a standing position, feet together and trunk erect, abdomen relaxed and upper extremities hanging on both sides of the body. The tape measure was placed parallel to the ground at the level of the last floating rib.

Blood pressure was measured in the supine position with a calibrated OMRON M3 automatic sphygmomanometer after 10 min of rest. Three determinations were made at 1-min intervals, obtaining the mean value of the three. Hypertension was considered to be greater than 140 mm Hg systolic or 90 mm Hg diastolic, or individuals previously diagnosed with arterial hypertension or antihypertensive treatment.

Blood tests were obtained by peripheral venipuncture after a 12-h fast. Samples were sent to the reference laboratories and processed in a maximum time of 48–72 h. Automated enzymatic methods were used for blood glucose, total cholesterol, and triglycerides. Values are expressed in mg/dl. HDL was determined by precipitation with dextran-sulfate Cl2Mg, and the values are expressed in mg/dl. LDL was calculated using the Friedewald formula (provided that triglycerides were less than 400 mg/dl). Values are expressed in mg/dl.

Friedewald Formula: LDL = total cholesterol – HDL – triglycerides/5

Blood glucose figures were classified based on the recommendations of the American Diabetes Association (American Diabetes Association. 2010), considering hyperglycemia from 125 mg/dl. Patients were classified as diabetic if they had a previous diagnosis, or after obtaining a blood glucose level higher than 125 mg/dl had an HbA1c $\geq$ 6.5%, or if the person was receiving hypoglycemic treatment.

Lipid profile values were classified according to the recommendations of the Spanish Heart Foundation (high cholesterol above 239 mg/dl, high LDL from 159 mg/dl, and high triglycerides from 200 mg/dl).

Four atherogenic indexes were calculated: Cholesterol/HDL (these are high values from 5 in men and 4.5 in women), LDL/HDL, Triglycerides/HDL (high values from 3), and HDL/LDL + VLDL (no breakpoints) (López González ÁA et al., 2015).

The metabolic syndrome was determined using three models:

a) NCEP ATP III (National Cholesterol Educational Program Adult Treatment Panel III) which establishes it when three or more of the following factors are present: waist circumference greater than 88 cm in women and 102 in men, triglycerides from 150 mg/dl or specific treatment for this lipid disorder, blood pressure from 130/85 mm Hg, HDL less than 40 mg/dl in women or less than 50 in men, specific treatment and fasting blood glucose from 100 mg/dl, or specific glycemic treatment.
b) Model of the International Diabetes Federation (IDF) that considers the presence of central obesity necessary, defined as 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 Model (Cabrera-Roe E et al., 2017) follows the same criteria as NCEP ATPIII but with waist cut-off points starting at 80 cm in women and 94 cm in men.

The REGICOR scale, adaptation of the Framingham scale to the characteristics of the Spanish population (Marrugat J et al., 2007), estimates the risk of suffering a cerebrovascular event in a period of 10 years. The tables can be applied to people between 35 and 74 years old. Risk is moderate from 5% and high from 10% (Marrugat J et al., 2003). The SCORE scale used was the version for low-risk countries, recommended for Spain (Sans S et al., 2007; Buitrago F et al., 2007). It estimates the risk of suffering a fatal cerebrovascular event in one period of 10 years. It applies to people between 40 and 65 years old. Risk is moderate from 4% and high from 5% (Zimmet P et al., 2009). For vascular age, calibrated tables were used (Ramírez M. 2010) that enable an assessment of the degree of aging of the arteries and can be calculated from the age of 30.

To calculate the visceral adiposity index (Amato MC, Giordano C. 2014) (VAI), the following formula was used.

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

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

The Conicity index (Andrade MD, 2016) was calculated using the following formula:

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

Lipid accumulation product (Chiang JK, Koo M. 2012) was calculated using the following formula.

- In men: (waist circumference (cm) - 65) x (triglyceride concentration (mMol)).
- In women: (waist circumference (cm) - 58) x (triglyceride concentration (mMol))

Cardiometabolic index (Wakabayashi I, Daimon T. 2015) was calculated by multiplying the waist to height ratio by the atherogenic triglycerides index/HDL-c.

The body mass index (BMI) was calculated by dividing weight by height in meters squared. Obesity is considered over 30.

The waist to height ratio was considered risky above 0.50 (Browning LM et al., 2010).

Two formulas were used to estimate the percentage of body fat:

- Relative fat mass (Woolcott OO, Bergman RN. 2018) was calculated using the following formula where height and waist circumference are expressed in meters.

  Women: 76- (20 x (height/p waist))
  Men: 64- (20 x (height/p waist))
  The cut-off points for obesity were from 33.9% in women and 22.8% in men.

- CUN BAE (Gómez-Ambrosi J et al., 2012) (University of Navarra Body Adiposity Estimator Clinic)

  The formula is:

$$-44.988 + (0.503 \text{ x age}) + (10.689 \text{ x sex}) + (3.172 \text{ x BMI}) - (0.026 \text{ x BMI2}) + (0.181 \text{ x BMI x sex}) - (0.02 \text{ x BMI x age}) - (0.005 \text{ x BMI }^{2}\text{x sex}) + (0.00021 \text{ x BMI}^{2} \text{ x age})$$

Where male sex is equal to 0 and female equal to 1.

The CUN BAE cut-off points for obesity are from 25% in men and 35% in women.

Body Roundness Index (Chang Y et al., 2015) (BRI) was calculated using the following formula where WC represents the waist circumference.

$$\text{BRI} = 364.2 - 365.5 \times \sqrt{1 - \frac{(\text{WC}/(2\pi))^2}{(0.5 \text{ height})^2}}$$

Fatty liver index (Bedogni G et al., 2006). Determination of the risk of suffering from non-alcoholic fatty liver was determined by the formula:

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

FLI scores of 60 and above indicate that FL is present.

Smoking, diet, and physical activity were assessed by clinical interview. Tobacco was considered a dichotomous variable, being able to have the value of yes/no. A smoker was the person who had regularly consumed at least 1 cigarette/day (or the equivalent in other types of consumption) in the previous month, or had stopped smoking less than a year before. Healthy eating included a daily consumption of vegetables and fruits; and physical activity was considered adequate when performing at least 30 min a day or 150 min a week of moderate intensity aerobic physical activity or 75 min a week of vigorous activity.

2.3. Statistical analysis

A descriptive analysis of the categorical variables was carried out, by calculating the frequency and distribution of responses for each of them. 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 χ^2 test (with correction for Fisher's exact statistic when conditions so required) 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 was performed. Statistical analysis was performed with the SPSS 27.0 program, the accepted level of statistical significance being 0.05.

2.4. Considerations and ethical aspects

The study was approved by the Clinical Research Ethics Committee of the Balearic Islands Health Area in November 2020. All procedures were performed in accordance with the ethical standards of the institutional research committee and with the 2013 Declaration of Helsinki. All patients signed written informed consent documents prior to participation in the study.

3. Results

The anthropometric, clinical, and analytical characteristics of the sample are presented in Table 1. The low percentage of drivers who did regular physical activity or ate a healthy diet stands out. Better results were obtained among women in both cases. A third of all drivers of both sexes smoked.

The mean values for cardiovascular risk factors indicate a moderate risk. Levels of all risk factors were higher in male drivers than in female drivers. The complete data are presented in Table 2.

The prevalence of elevated risk factors is shown in Table 3. The most relevant differences in risk factors between men and women were in the following areas: hypertension (35.9% in men and 13.9% in women), metabolic syndrome with NCEP ATPIII criteria (25.6% in men and 11.9% in women), fatty liver index of high risk (33.8% in men and 11.1% in women) and SCORE scale moderate-high (30.6% in men and 3.3% in women).

If we assess the prevalence of altered values of the different cardiovascular risk parameters according to age, we observe that in women in practically all cases, except in the prevalence of obesity using the BMI, this prevalence worsens with age. In men, this worsening is observed in all the parameters included in the study. The complete data can be consulted in Tables 4a and 4b.

In the multivariate analysis using binary logistic regression, aged 50 years and older, tobacco use, non-heart-healthy eating, and not performing regular physical activity are established as covariates, and it is observed that sex, age, and physical exercise are the variables that affect all the parameters related to cardiovascular risk, the effect of physical activity being more powerful in general. The increased risk for sex ranges from 1.3 for cholesterol above 200 mg/dl to 13.1 for moderately high SCORE. Age also ranges from 1.3 for cholesterol to 14.6 for moderate SCORE and above, while physical exercise has an increased risk ranging from 1.5 for moderate or high SCORE to 13.8 for high LDL/HDL atherogenic index. Smoking increases the risk in some parameters, does not affect others and even decreases the risk of obesity with the CUN BAE scale. The complete data are presented in Table 5.

4. Discussion

The overall cardiovascular risk level of the drivers included in our study is considered high for the group of men but moderate for women. Most of the parameters analyzed present a prevalence of altered values with a significant difference between genders.

Table 1
Characteristics of professional drivers according to sex.

	women n = 1227	men n = 23560	total n = 24787	p-value
	mean ± SD	mean ± SD	mean ± SD	
Age	41.1 ± 9.5	43.7 ± 10.2	43.6 ± 10.2	<0.0001
Height	162.6 ± 6.6	174.3 ± 6.7	173.7 ± 7.2	<0.0001
Weight	69.3 ± 15.1	85.1 ± 15.3	84.3 ± 15.6	<0.0001
Waist	75.6 ± 11.6	88.1 ± 11.4	87.5 ± 11.7	<0.0001
Systolic Blood Pressure	117.3 ± 15.7	130.4 ± 16.0	129.7 ± 16.3	<0.0001
Diastolic Blood Pressure	72.8 ± 10.5	79.6 ± 11.1	79.3 ± 11.1	<0.0001
Total Cholesterol	193.1 ± 36.8	197.8 ± 38.6	197.5 ± 38.5	<0.0001
HDL-c	56.1 ± 7.6	48.5 ± 8.3	48.9 ± 8.4	<0.0001
LDL-c	117.8 ± 35.0	122.8 ± 36.8	122.5 ± 36.7	<0.0001
Triglycerides	96.3 ± 48.2	135.8 ± 92.7	133.8 ± 91.4	<0.0001
Glycemia	89.2 ± 14.0	97.1 ± 24.2	96.8 ± 23.9	<0.0001
ALT	20.3 ± 11.2	32.4 ± 19.6	31.8 ± 19.4	<0.0001
AST	20.2 ± 8.3	24.6 ± 14.9	24.3 ± 14.6	<0.0001
GGT	19.3 ± 12.5	38.6 ± 42.2	37.7 ± 41.4	<0.0001
	Percentage	**Percentage**	**Percentage**	**p-value**
18–29 years	13.3	9.9	10.1	<0.0001
30–39 years	29.2	24.6	24.9	
40–49 years	36.6	34.2	34.3	
50–70 years	20.9	31.3	30.7	
Tobacco consumption	32.8	33.2	33.2	0.416
Yes Physical activity	45.8	34.9	35.4	<0.0001
Yes cardiovascular healthy food	47.2	32.4	33.1	<0.0001

Table 2
Mean values of the different CVR scales according to sex.

	women n = 1227	men n = 23560	total n = 24787	p-value
	mean ± SD	mean ± SD	mean ± SD	
BMI	26.2 ± 5.4	28.0 ± 4.6	27.9 ± 4.7	<0.0001
waist to height ratio	0.46 ± 0.07	0.51 ± 0.06	0.50 ± 0.06	<0.0001
CUN BAE	36.6 ± 7.0	27.7 ± 6.4	28.1 ± 6.7	<0.0001
Relative fat mass	32.1 ± 6.0	23.8 ± 4.9	24.2 ± 5.3	<0.0001
Body roundness index	2.8 ± 1.3	3.5 ± 1.2	3.5 ± 1.2	<0.0001
Conicity index	1.1 ± 0.1	1.2 ± 0.1	1.2 ± 0.1	<0.0001
Visceral adiposity index	2.9 ± 1.7	8.6 ± 7.2	8.3 ± 7.1	<0.0001
Fatty liver index	21.8 ± 24.4	45.3 ± 28.4	44.2 ± 28.6	<0.0001
Lipid accumulation product	20.9 ± 21.5	37.7 ± 37.0	36.8 ± 36.6	<0.0001
ALLY vascular age*	4.0 ± 5.1	8.4 ± 7.0	8.2 ± 7.0	<0.0001
SCORE scale*	0.4 ± 0.8	2.0 ± 2.5	2.0 ± 2.4	<0.0001
REGICOR scale**	2.2 ± 1.8	3.7 ± 2.5	3.7 ± 2.5	<0.0001
Cardiometabolic index	0.9 ± 0.6	1.5 ± 1.3	1.5 ± 1.3	<0.0001
AI Cholesterol/HDL-c	3.5 ± 0.9	4.2 ± 1.2	4.2 ± 1.2	<0.0001
AI Triglyceride/HDL-c	1.8 ± 1.0	3.0 ± 2.3	2.9 ± 2.3	<0.0001
AI LDL-c/HDL-c	2.2 ± 0.8	2.6 ± 1.0	2.6 ± 1.0	<0.0001
AI HDL-c/LDL-c + VLDL-c	0.5 ± 0.2	0.4 ± 0.2	0.4 ± 0.2	<0.0001

(*) SCORE scale and ALLY vascular age n = 705 (women) n = 15380 (men) 16085 (total) (**) REGICOR scale n = 920 (women) n = 18766 (men) 19686 (total) AI Atherogenic index.

Table 3
Prevalence of altered values of the different CVR scales by sex.

	women n = 1227	men n = 23560	total n = 24787	p-value
	Percentage	Percentage	Percentage	
Hypertension	13.9	35.9	34.7	<0.0001
Total cholesterol ≥ 200 mg/dl	39.0	45.5	45.1	<0.0001
LDL-c ≥ 130 mg/dl	33.9	41.2	40.9	<0.0001
Triglycerides > 150 mg/dl	11.8	30.2	29.3	<0.0001
Glycemia ≥ 100 mg/dl	14.1	30.3	29.5	<0.0001
Metabolic syndrome NCEP ATPIII	11.9	25.6	24.9	<0.0001
Metabolic syndrome IDF	11.4	19.6	19.2	<0.0001
Metabolic syndrome JIS	12.9	38.5	37.3	<0.0001
AI Cholesterol/HDL-c moderately high	12.2	23.0	22.5	<0.0001
AI Triglyceride/HDL-c high	10.5	34.9	33.7	<0.0001
AI LDL-c/HDL-c high	13.0	32.9	31.9	<0.0001
Waist to height ratio > 0.50	24.9	49.9	48.7	<0.0001
BMI obesity (≥ 30 kg/m^2)	20.2	28.2	27.8	<0.0001
CUN BAE obesity (> 25% men,35% women)	57.7	65.1	64.7	<0.0001
RFM obesity (> 22,8% men, 33,9% women)	38.5	60.0	58.9	<0.0001
Fatty liver index high risk (> 60)	11.1	33.8	32.7	<0.0001
SCORE scale* moderate	2.6	16.9	16.4	<0.0001
SCORE scale high	0.7	13.7	13.1	
REGICOR scale moderate**	7.3	24.8	24.0	<0.0001
REGICOR scale high-very high	0.5	3.0	2.9	

(*) SCORE scale n = 705 (women) n = 15380 (men) 16085 (total) (**) REGICOR scale n = 920 (women) n = 18766 (men) 19686 (total) AI Atherogenic index.

Our study covers a very large sample of drivers, 25,000, of whom 1247 are women. We have only found in the literature a previous study of our group with 3000 drivers (López-González AA et al., 2018), but without as many variables studied in it.

Although the number of professional female driver participants in this study is high, it is far below the participation of men, which may in some cases make it difficult to compare the results between the sexes.

It is worth noting in the comparison of our results that, with respect to obesity, this was present in 27.8% of drivers in our sample according to BMI. This is in agreement with studies carried out in India (Eshwaran Udayar S et al., 2015) and Brazil (Sangaleti CT et al., 2014) and with a previous work by our group on drivers in the Spanish Mediterranean area (López-González AA et al., 2018). However, it is higher than that found in a study on Korean drivers (Shin SY et al., 2013) 29 and the data obtained in the Spanish National Health Survey for the year 2011–12 (Sagües MJ et al., 2015). Specify that in the Korean study, the cut-off point for BMI was greater than 27, while we have assessed a BMI equal to or greater than 30. On the other hand, a study carried out in Hong Kong (Siu SC et al., 2012) found a prevalence of obesity greater than 50%, although the number of drivers who participated was very small and, therefore, their results are not comparable with those in this paper.

The prevalence of hypertension found was 34.7%, a figure lower than that reported in other studies carried out in Colombian

Table 4a
Prevalence of altered values of the different CVR scales in women according to age groups.

women	18–29 years	30–39 years	40–49 years	50–70 years	p-value
	n = 163	n = 358	n = 449	n = 257	
	Percentage	Percentage	Percentage	Percentage	
Hypertension	3.7	7.3	13.1	30.7	<0.0001
Total cholesterol ≥ 200 mg/dl	16.0	26.8	45.4	59.1	<0.0001
LDL-c ≥ 130 mg/dl	12.3	23.7	38.8	53.3	<0.0001
Triglycerides > 150 mg/dl	9.2	7.0	14.3	16.0	<0.0001
Glycemia ≥ 100 mg/dl	7.4	8.9	17.1	23.7	<0.0001
Metabolic syndrome NCEP ATPIII	6.1	6.4	13.6	20.2	<0.0001
Metabolic syndrome IDF	6.7	7.5	13.8	15.6	0.001
Metabolic syndrome JIS	6.1	7.0	14.9	21.8	<0.0001
AI Cholesterol/HDL-c moderately high	4.3	5.9	13.1	24.5	<0.0001
AI Triglyceride/HDL-c high	6.1	5.3	13.1	16.0	<0.0001
AI LDL-c/HDL-c high	4.3	7.3	13.6	25.7	<0.0001
Waist to height ratio > 0.50	25.8	19.6	27.6	27.2	<0.0001
BMI obesity (≥ 30 kg/m^2)	22.1	17.0	21.8	20.6	<0.0001
CUN BAE obesity (> 25% men,35% women)	39.3	44.1	64.8	75.9	<0.0001
RFM obesity (> 22,8% men, 33,9% women)	35.6	34.9	42.3	48.5	0.152
Fatty liver index high risk (> 60)	11.2	8.8	11.6	12.8	0.002
SCORE* moderate	nc	nc	0.0	7.0	<0.0001
SCORE high	nc	nc	0.0	2.0	<0.0001
REGICOR* moderate	nc	0.0	2.4	21.8	<0.0001
REGICOR high-very high	nc	0.0	0.0	1.9	<0.0001

nc Under 40 years this can't be calculated. (*)50–70 years (n = 256) (**) 30–39 years (n = 214) AI Atherogenic index.

Table 4b
Prevalence of altered values of the different CVR scales in men according to age groups.

men	18–29 years	30–39 years	40–49 years	50–70 years	p-value
	n = 2333	n = 5804	n = 8061	n = 7362	
	Percentage	Percentage	Percentage	Percentage	
Hypertension	16.0	21.1	36.0	53.8	<0.0001
Total cholesterol ≥ 200 mg/dl	17.7	35.1	53.1	54.1	<0.0001
LDL-c ≥ 130 mg/dl	15.4	30.8	47.8	50.6	<0.0001
Triglycerides > 150 mg/dl	12.6	23.8	33.7	37.0	<0.0001
Glycemia ≥ 100 mg/dl	12.2	19.1	32.5	53.6	<0.0001
Metabolic syndrome NCEP ATPIII	5.9	12.1	25.3	42.7	<0.0001
Metabolic syndrome IDF	6.3	12.9	21.8	26.7	<0.0001
Metabolic syndrome JIS	14.2	22.5	38.8	58.6	<0.0001
AI Cholesterol/HDL-c moderately high	4.2	12.6	25.7	34.4	<0.0001
AI Triglyceride/HDL-c high	12.9	25.4	37.9	46.0	<0.0001
AI LDL-c/HDL-c high	9.0	20.2	36.1	46.9	<0.0001
Waist to height ratio > 0.50	34.9	44.0	52.2	56.8	<0.0001
BMI obesity (≥ 30 kg/m^2)	14.3	20.3	29.6	37.2	<0.0001
CUN BAE obesity (> 25% men,35% women)	29.8	49.0	68.6	85.1	<0.0001
RFM obesity (> 22,8% men, 33,9% women)	44.7	55.2	61.8	66.5	<0.0001
Fatty liver index high risk (> 60)	16.0	25.0	36.8	42.5	<0.0001
SCORE* moderate	nc	nc	3.8	31.4	<0.0001
SCORE high	nc	nc	0.2	28.5	<0.0001
REGICOR* moderate	nc	0.0	14.3	46.9	<0.0001
REGICOR high-very high	nc	0.0	0.4	6.3	<0.0001

nc Under 40 years this can't be calculated (*). 50–70 years (n = 7319) (**) 30–39 years (n = 3343) AI Atherogenic index.

(Camargo-Escobar FL et al., 2013), Indian (Eshwaran Udayar S et al., 2015), and Brazilian drivers (Sangaleti CT et al., 2014), although the sample sizes were much smaller, as was the one obtained in our previous study (López-González AA et al., 2018). However, data from the Spanish health survey for the year 2011–12 (Sagües MJ et al., 2015) showed a higher prevalence.

The hypercholesterolemia figures found in our study were very high, specifically 45.1%. These data are considerably lower than those obtained in our previous study (López-González AA et al., 2018) but higher than those found in Colombian (Camargo-Escobar FL et al., 2013), and Hong Kong (Siu SC et al., 2012) drivers and in the Spanish national health survey (Sagües MJ et al., 2015).

High blood glucose values were present in 29.5% of our drivers; these values are clearly higher than those found in a Brazilian study (Sangaleti CT et al., 2014) and in our previous study (López-González AA et al., 2018).

The prevalence of the metabolic syndrome using the NCEP ATP III model was 24.9% whereas with the IDF model it was down to 19.2%; these figures are much higher than those found in Hong Kong (Siu SC et al., 2012) and in our previous work (López-González

Table 5
Logistic regression.

	Men	Age ≥ 50 years	Tobacco consumption	No Physical activity	No fruit or vegetables	OR PhA/ORFV* (95% CI)
	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	
Hypertension	3.5 (3.0–4.1)	2.9 (2.4–3.5)	ns	2.5 (2.0–3.1)	ns	
Total cholesterol ≥ 200 mg/dl	1.3 (1.2–1.5)	1.3 (1.0–1.6)*	ns	12.7 (6.4–28.8)	11.0 (6.7–16.0)	1.2 (1.1–1.3)
LDL-c ≥ 130 mg/dl	1.4 (1.2–1.5)	1.4 (1.1–1.8)	ns	3.4 (1.8–6.2)	14.3 (5.8–35.6)	0.2 (0,2-0.3)
Triglycerides > 150 mg/dl	3.2 (2.7–3.9)	1.6 (1.3–2.0)	ns	11.3 (5.9–25.2)	3.0 (1.2–7.5)	3.8 (3,6-4.0)
Glycemia ≥ 100 mg/dl	2.6 (2.2–3.1)	3.9 (3.0–5.2)	ns	2.1 (1.5–3.0)	2.7 (2.2–3.3)	0.8 (0.7–0.8)
Metabolic syndrome NCEP ATPIII	2.3 (1.9–2.8)	3.3 (2.7–4.0)	1.5 (1.2–1.9)	10.0 (4.4–22.5)	4.1 (1.8–9.3)	2.4 (2.3–2.5)
Metabolic syndrome IDF	1.8 (1.5–2.1)	2.2 (1.8–2.7)	ns	8.8 (5.7–12.4)	3.9 (2.8–5.3)	2.3 (2.2–2.4)
Metabolic syndrome JIS	4.0 (3.4–4.8)	2.5 (2.1–2.9)	1.4 (1.2–1.6)	7.8 (6.2–9.7)	4.0 (3.2–4.9)	2.0 (2.0–2.1)
AI Cholesterol/HDL-c moderately high	2.1 (1.8–2.6)	2.1 (1.7–2.5)	1.2 (1.0–1.5)	12.5 (4.2–25.9)	1.8 (1.5–2.2)	6.9 (6.7–7.1)
AI Triglyceride/HDL-c high	4.6 (3.8–5.5)	1.4 (1.1–1.7)	1.6 (1.3–1.9)	9.7 (6.0–13.6)	2.0 (1.2–3.5)	4.9 (4.8–5.0)
AI LDL-c/HDL-c high	3.3 (2.8–3.9)	2.0 (1.6–2.4)	ns	13.8 (9.1–21.0)	3.5 (3.0–4.1)	3.9 (3.8–4.0)
Waist to height ratio > 0.50	3.0 (2.6–3.4)	1.7 (1.4–2.1)	ns	3.4 (2.5–4.6)	1.9 (1.4–2.6)	1.8 (1.7–1.8)
BMI obesity	1.5 (1.3–1.8)	2.1 (1.6–2.6)	ns	3.1 (2.2–4.0)	2.1 (1.5–2.7)	1.5 (1.4–1.6)
CUN BAE obesity	1.4 (1.2–1.5)	5.5 (4.2–7.3)	0.7 (0.6–0.8)	9.6 (6.8–13.5)	1.7 (1.2–2.5)	5.6 (5.4–5.7)
RFM obesity	2.4 (2.1–2.7)	1.7 (1.4–2.1)	ns	2.9 (2.1–4.0)	2.1 (1.5–2.8)	1.4 (1.3–1.5)
Fatty liver index high risk	3.9 (3.2–4.8)	1.7 (1.6–1.8)	ns	1.9 (1.3–2.5)	1.5 (1.2–1.9)	1.3 (1.3–1.4)
SCORE moderately high	13.1 (8.6–19.9)	10.7 (5.1–23.5)	3.0 (2.7–3.3)	1.5 (1.1–1.9)	ns	
REGICOR moderately high-very high	4.5 (3.6–5.8)	14.6 (11.2–19.1)	3.1 (2.9–3.3)	3.5 (1.8–6.7)	ns	

ns no statistical significance ($p > 0.05$) AI Atherogenic index OR PhA/ORFV OR Physical activity/OR fruit or vegetables. (*) statistical significance in all cases.

AA et al., 2018).

The level of cardiovascular risk when the SCORE model was used in our drivers was considered moderately high, 29.5%, a figure higher than was found in our previous study (López-González AA et al., 2018) and also than a group of Colombian bus drivers (Camargo-Escobar FL et al., 2013). When the model of risk used was REGICOR, the prevalence of moderate or high values was 26.9%; these values are clearly higher than those of our previous work (López-González AA et al., 2018).

The prevalence of smokers among our drivers was 33.2%, a figure somewhat lower than was found in our previous study (López-González AA et al., 2018) and in the data of the Spanish health survey (Sagües MJ et al., 2015), as with the results of a study carried out in Korea (Shin SY et al., 2013). However, this is higher than was found in Brazilian drivers (Sangaleti CT et al., 2014), Colombians (Camargo-Escobar FL et al., 2013), and in another group of Korean drivers (Yook JH et al., 2018).

Of our drivers, 35.4% performed physical exercise on a regular basis, this figure is very similar to that found in our previous study (López-González AA et al., 2018) and in an investigation carried out in the United States (Elshatarat RA et al., 2016). In contrast, these figures are lower than that found in the Spanish health survey (Sagües MJ et al., 2015) and in other studies (Hinestroza JF, Giraldo JC. 2008). Meanwhile, a Korean study showed lower figures (Yook JH et al., 2018).

A diet rich in fruits and vegetables appeared in 33.1% of our drivers, this consumption is similar to that of our previous study (López-González AA et al., 2018) but much lower than that found in the Spanish health survey (Sagües MJ et al., 2015).

Smoking prevalence was equal between the conductors of both sexes, while regular exercise and a healthy diet rich in fruits and vegetables was significantly more common in women. Which could explain the lower cardiovascular risk in females, with these variables influencing other cardiovascular risk factors. Although we must consider that our sample consists mainly of young pre-menopausal women. In which there is a demonstrated protective effect of estrogens against cardiovascular risk. What certainly you can also influence the results (Gajardo-Navarrete J et al., 2020).

4.1. Relevance of the study

From the results, there is a clear need to implement prevention and health promotion in this group of professional drivers; as the cardiovascular risk factors are elevated, with notably greater risk among men than among women.

Although this had been suggested in previous studies, the large sample size of professional drivers and the calculation of more than twenty CV risk variables, highlights the strong relationship between this type of work and the increase Cardiovascular risk.

4.2. Strengths and limitations

Importantly, to highlight the strengths of this work: having included almost twenty variables in the CV risk calculation carried out in professional drivers, the fact of including a significant group of women, and the large sample size (25,000 drivers). Another strength is having included almost twenty variables in the CV risk calculation carried out in professional drivers, the fact of including a significant group of women, and the large sample.

As limitations, it should be noted that our data are based on the Spanish population, so they cannot be extrapolated to other countries. In addition to the fact that the cardiovascular risk scale used (REGICOR) has been validated exclusively for the Spanish population. And only those patients who have attended the company's medical check-ups are included.

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

5. Conclusions

The level of cardiovascular risk in drivers is high in men and moderate in women, so it is essential to intervene on the risk factors that influence it, reduce morbidity and mortality and years of life lost.

Smoking is the same for both sexes, but female drivers have a healthier diet and exercise more than their male counterparts; which could justify its lower cardiovascular risk. Without forgetting the protection factor that hormones produce on them and that disappears in menopause.

Cardiovascular risk increases in both sexes as age increases, so it is very important to be able to change unhealthy habits for healthy lifestyles to reduce cardiovascular risk.

It is essential to carry out health education in this group to reduce smoking, increase regular physical exercise to at least the minimum healthy and promote a diet rich in vegetables and low in fat and salt. In order to reduce cardiovascular risk, reduce morbidity and mortality, and increase the quantity and quality of life of our drivers.

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