JCTEI
JOURNAL OF CLINICAL TRIALS AND EXPERIMENTAL INVESTIGATIONS
Year: 2024 Volume: 3 Issue: 3

ORIGINAL ARTICLE

10.5281/zenodo13887819

Cardiometabolic risk estimation in professional firefighters

Javier Lucas Tosoratto[1], Barbara Carriedo[1], Ana Cecilia Romero[1], María Bañegil[1], Ángel Arturo López González[1], Hector Eugercios[1]

1. Multiprofessional Teaching Unit of Occupational Health, Balearic Islands, Spain

Correspondence
Ángel Arturo López González, Multiprofessional Teaching Unit of Occupational Health, Balearic Islands, Spain.

e-mail
angarturo@gmail.com

Received: 20 August 2024
Revised: 14 September 2024
Accepted: 18 September 2024
Published: 30 September 2024

Keywords
- Atherogenic risk
- cardiometabolic risk
- firefighters
- hypertension
- metabolic syndrome
- obesity

ORCID ID of the author(s):
JLT: 0000-0003-0790-4953
BC: 0000-0002-6202-9162
ACR: 0000-0002-5401-7436
MB: 0009-0005-3302-1638
AALG: 0000-0002-7439-8117
HE: 0000-0002-8088-9609

Abstract

Objective: Cardiometabolic diseases are currently the leading causes of morbidity and mortality worldwide and are highly prevalent. Firefighters, due to the nature of their work, appear to have a high prevalence of these pathologies. Our objective was to determine the prevalence of variables related to cardiometabolic risk in a group of professional firefighters.

Materials and methods: A descriptive, cross-sectional study was performed in 2155 Spanish firefighters between January 2019 and December 2019. Body mass index (BMI) and CUN BAE (Body Adiposity Estimator from the University Clinic of Navarra) were evaluated.

Results: The study evaluated cardiometabolic risk factors among 2,127 firefighters, showing that 29.71% (n=632) were smokers, 27.7% (n=589) were sedentary, and 36.06% (n=767) did not follow a Mediterranean diet. The prevalence of hypertension increased with age: 14.75% (n=96) among those under 40, 19.71% (n=176) in those aged 40-49, and 39.97% (n=233) in those over 50. Total cholesterol ≥ 200 mg/dL was found in 48.47% (n=1,030), with LDL-c ≥ 130 mg/dL in 37.09% (n=789). Metabolic syndrome according to NCEP ATPIII criteria was present in 8.65% (n=184), while atherogenic dyslipidemia was noted in 3.43% (n=73).

Conclusions: Considering that the average age of our sample is not very high, the cardiometabolic risk in our group of firefighters can be classified as elevated.

Level of evidence: Level IIb

Cite as: Tosoratto JL, Carriedo B, Alonso AC, Bañegil M, López-González AA, Eugercios H. Cardiometabolic risk estimation in professional firefighters. J Clin Trials Exp Investig. 2024;3(3):65-74.

Introduction

Cardiovascular risk (CVR) among firefighters has become a growing concern due to the high incidence of cardiovascular events during their duties. Recent studies show that firefighters face a significantly higher risk of acute cardiovascular events, such as myocardial infarctions (MIs) and sudden cardiac deaths (SCDs), compared to the general population. Approximately 45% of on-duty firefighter deaths in the United States are related to cardiovascular causes, underscoring the importance of this issue for occupational health in this group (1). This increased susceptibility is due to a unique combination of work-related factors, such as exposure to hazardous agents, extreme physical demands, and high levels of psychological stress.

Firefighters are exposed to working conditions that significantly increase their cardiovascular risk. One of the main factors is exposure to toxic substances released during combustion, such as carbon monoxide, fine particles, and volatile chemicals. These substances can induce systemic inflammation, endothelial dysfunction, and oxidative stress, all key mechanisms in the development of cardiovascular diseases (2). Repeated exposure to these toxins has been associated with a higher risk of cardiovascular events, especially in firefighters who have other risk factors such as hypertension and smoking.

Another crucial factor is thermal stress. During firefighting operations, firefighters work in extreme heat conditions, which raises their heart rate and blood pressure, increasing the load on the cardiovascular system (3). Dehydration and electrolyte loss also contribute to greater vulnerability to acute cardiac events. Recent research suggests that thermal stress and intense physical activity can trigger cardiac events in individuals with pre-existing cardiovascular disease (4).

Extreme physical exertion is another key characteristic of firefighters' work. Activities such as firefighting and rescue operations require high physical demands, which can lead to heart rates approaching the firefighter's maximum age-predicted heart rate (5). In individuals with cardiovascular risk factors, this extreme exertion can trigger acute events, such as MI or SCD. Studies have shown that the risk of MI is 10 to 100 times higher during physically demanding firefighting activities compared to less demanding tasks (6).

Reducing cardiovascular risk in firefighters requires the implementation of effective preventive strategies. Promoting physical fitness is essential, as firefighters with better cardiorespiratory capacity have a lower risk of suffering cardiac events during their duties (7). Physical training programs that include aerobic and resistance exercises have been shown to improve overall cardiovascular health.

Additionally, fire departments should implement policies to reduce exposure to toxins and improve rehabilitation practices following intense physical activity. It is also essential to encourage healthy lifestyle habits, such as a balanced diet and smoking cessation, to reduce cardiovascular risk factors in this population (8).

This study aimed to estimate the prevalence of cardiometabolic risk factors, such as hypertension, obesity, dyslipidemia, and metabolic syndrome, among professional Spanish firefighters.

Material and methods

Patients

A descriptive, cross-sectional study was performed on 2,155 Spanish firefighters between January 2019 and December 2019. Of them, 56 were excluded (20 for not agreeing to participate and 36 for lacking any of the parameters necessary to calculate the different cardiovascular risk scales), leaving 2,127 workers (Figure 1).

Eligibility criteria

Participants who provided consent to participate in the study and allowed the use of their data for epidemiological purposes were included. Those who did not consent to participate or had incomplete data, even if they were initially included, were excluded from the study.

Determination of variables

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

Measurements were taken with the individual in an upright position and the abdomen relaxed. A SECA

scale was used to measure both weight and height. The abdominal waist circumference was measured in this position using a tape measure placed parallel to the floor at the level of the last rib.

Blood pressure was measured using an OMROM-M3 sphygmomanometer. After ten minutes of rest, three readings were taken, with a one-minute interval between each, and the average of the three was calculated. Following a fast of at least twelve hours, various techniques were used to measure blood glucose, triglycerides, and total cholesterol, along with precipitation methods for HDL-cholesterol. LDL-cholesterol was calculated using the Friedewald formula, which is valid for triglyceride values up to 400 mg/dL. Each analytical parameter was expressed in milligrams per deciliter. Cholesterol values of 200 mg/dL or higher, LDL values of 130 mg/dL or higher, and triglycerides of 150 mg/dL or higher, or if the individual was receiving treatment for any of these alterations, were considered abnormal. The American Diabetes Association's recommendations were used to classify blood glucose levels. Individuals were classified as diabetic if they had a previous diagnosis, a blood glucose level over 125 mg/dL, an HbA1c of at least 6.5%, or were receiving treatment to lower blood glucosa (9).

Scales for overweight and obesity

Body mass index (BMI) was calculated by dividing weight (in kg) by height squared (in meters). The cut-off point for obesity was a BMI of 30 kg/m^2 or higher.

Scales for calculating the percentage of body fat

- CUN BAE (Body Adiposity Estimator from the University Clinic of Navarra) (10): -44.988+(0.503×age) + (10.689×sex) + (3.172×BMI) - (0.026×BMI^2) + (0.181×BMI×sex) - (0.02×BMI×age) - (0.005×BMI^2×sex) + (0.00021×BMI^2×age). Male=0 Female=1.

- Relative fat mass (RFM) (11): Women: 76-(20×(height/waist)) Men: 64-(20×(height /waist)).

Other indicators related to overweight and obesity

- Visceral adiposity index (VAI) (12): Men: (Waist/(39.68+(1.88xBMI)) 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) (13): BRI=364.2–365.5 × √1-[(waist/(2π)2) / (0.5 × height)2].

- Conicity index (14): CI = (Waist/0.109) x 1/√ weight/height)

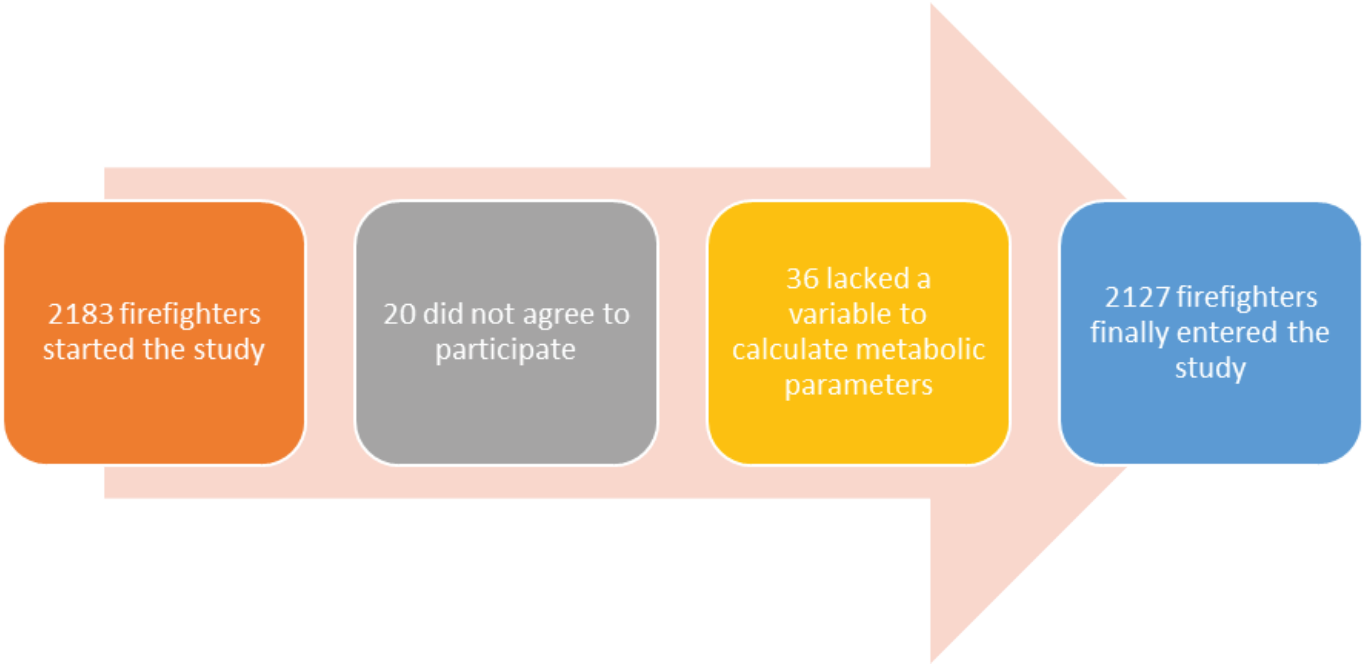

Figure 1: Flow chart of participants in this study

Other indicators related to cardiovascular risk

-Triglyceride glucose index (15): TyG index = LN (triglycerides [mg/dl]×glycaemia [mg/dl]/2).

- Cardiometabolic index (16): Waist/height × triglycerides/HDL

- Lipid accumulation product (LAP) (17): Men= (waist (cm) - 65) × (triglycerides (mMol)). Women: (waist (cm) - 58) × (triglycerides (mMol))

Atherogenic indices (18):

- 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).

- Atherogenic dyslipidemia (19) is established when high triglyceride values (>150 mg/dL) coincide with low HDL values; if high LDL values are also added, we speak of a lipid triad (20).

Metabolic Syndrome

Metabolic syndrome was determined using three models (21):

a) NCEP ATP III (National Cholesterol Education Program Adult Treatment Panel III) defines metabolic syndrome as the presence of three or more of the following: blood pressure higher than 130/85 mmHg; triglycerides higher than 150 mg/dL or specific treatment for this lipid disorder; low HDL; and glycemia higher than 100 mg/dL or specific treatment for this glycemic disorder.

b) The International Diabetes Federation (IDF) requires a waist circumference greater than 80 cm in women and greater than 94 cm in men, along with two of the other factors mentioned for ATP III. c) The Joint Interim Statement (JIS) model uses similar criteria to NCEP ATP III but adopts the IDF's waist circumference cut-offs.

Cardiovascular risk scales

- The REGICOR scale (22), an adaptation of the Framingham scale for the Spanish population, evaluates the risk of a cardiovascular event over 10 years in individuals aged 35 to 74. Moderate risk is considered from 5%, and high risk from 10%.

- The SCORE2 scale evaluates the risk of a fatal stroke within 10 years (23).

- The Spanish Cardiovascular Risk Equation (ERICE) (24) estimates the risk of a fatal or non-fatal stroke over a decade, using data from Spanish population-based cohort studies. The risk was classified as moderate if it exceeded 5%, moderately high if between 15% and 19%, high if between 20% and 39%, and very high if over 39%.

- We calculate vascular age using the Framingham model (25), for which we need data such as age, sex, HDL-c, total cholesterol, systolic blood pressure values, antihypertensive treatment, smoking and diabetes. It can be calculated from the age of thirty years onwards. A very important concept that applies to both vascular ages is avoidable years of life lost (ALLY) (26), which can be defined as the difference between vascular and chronological age.

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

The level of physical activity was measured using the International Physical Activity Questionnaire (IPAQ). This self-administered questionnaire quantifies physical activity performed over the past seven days (27).

Adherence to the Mediterranean diet was assessed using a questionnaire consisting of 14 questions, each scored with either 0 or 1 point. A score of 9 or higher indicates high adherence (28).

Ethical considerations

All aspects of the study were conducted in accordance with the 2013 Declaration of Helsinki and the ethical standards of the institutional research committee. The Balearic Islands Research Ethics Committee (CEI-IB) approved the study (IB indicator 4383/20). Data anonymity and confidentiality were ensured at all times. The research team adhered to Spain's Organic Law 3/2018, guaranteeing participants' rights to access, rectify, cancel, and oppose their data.

Statistical analysis

Student's t-test was used to calculate the mean and standard deviation for quantitative variables, while the chi-square test was applied for qualitative

Table 1: Characteristics of the professional firefighter

n=2127	Mean (SD)	CI 95%
Age	44.05 (7.89)	43.71-44.39
Height	176.79 (6.69)	176.50-177.08
Weight	80.28 (10.78)	79.82-80.74
Waist	85.57 (8.46)	85.19-85.93
Systolic Blood Pressure	126.97 (13.99)	126.37-127.57
Diastolic Blood Pressure	76.98 (9.79)	76.56-77.40
Total Cholesterol	57.65 (11.64)	57.15-58.15
HDL-c	200.00 (34.88)	198.49-201.51
LDL-c	121.56 (32.84)	120.13-122.99
Triglycerides	104.25 (56.88)	101.79-106.71
Glycaemia	89.52 (13.40)	88.94-90.10
	%	
< 40 years	30.61	
40-49 years	41.98	
≥ 50 years	27.41	
No tobacco	70.29	
Yes tobacco	29.71	
No Physical activity	27.70	
Yes physical activity	72.30	
No Mediterranean diet	36.06	
Yes Mediterranean diet	63.94	

HDL High density lipoprotein. LDL Low density lipoprotein.

Table 2: Mean values of the different cardiovascular risk scales according to age

		mean (SD)		mean (SD)		mean (SD)			
	n	< 40 years	n	40-49 years	n	≥ 50 years	n	total	p-value
Body mass index	651	24.79 (2.18)	893	25.40 (2.83)	583	27.06 (3.35)	2127	25.67 (2.95)	<0.0001
Waist-to-height ratio	651	0.48 (0.04)	893	0.48 (0.05)	583	0.50 (0.05)	2127	0.48 (0.05)	<0.0001
CUN BAE	651	22.32 (3.36)	893	24.44 (4.02)	583	27.86 (4.30)	2127	24.73 (4.45)	<0.0001
Relative fat mass	651	21.66 (3.43)	893	22.10 (3.98)	583	23.41 (4.11)	2127	22.32 (3.92)	<0.0001
Body roundness index	651	2.94 (0.73)	893	3.07 (0.89)	583	3.37 (1.01)	2127	3.11 (0.90)	<0.0001
Visceral adiposity index	651	4.09 (2.60)	893	5.38 (4.32)	583	7.39 (5.86)	2127	5.54 (4.57)	<0.0001
Conicity index	651	1.17 (0.08)	893	1.17 (0.08)	583	1.16 (0.06)	2127	1.17 (0.08)	0.096
SCORE scale		Not applicable	893	0.37 (0.66)	583	1.87 (2.11)	1476	0.96 (1.60)	<0.0001
ALLY vascular age SCORE		Not applicable	893	4.30 (5.56)	583	10.31 (6.12)	1476	6.68 (6.49)	<0.0001
REGICOR scale	394	1.63 (0.80)	893	2.21 (1.26)	583	3.94 (0.80)	1870	2.63 (1.91)	<0.0001
Triglyceride glucose index	651	8.10 (0.44)	893	8.33 (0.47)	583	8.57 (0.50)	2127	8.32 (0.50)	<0.0001
AI Cholesterol/HDL-c	651	3.25 (0.77)	893	3.62 (0.99)	583	4.04 (1.25)	2127	3.62 (1.05)	<0.0001
AI Triglyceride/HDL-c	651	1.19 (0.85)	893	1.93 (1.47)	583	2.61 (2.01)	2127	1.98 (1.55)	<0.0001
AI LDL-c/HDL-c	651	1.95 (0.70)	893	2.23 (0.80)	583	2.51 (0.98)	2127	2.22 (0.85)	<0.0001

Lipid accumulation product	651	19.70 (15.71)	893	25.26 (21.40)	583	33.24 (26.20)	2127	25.74 (21.96)	<0.0001

CUN BAE Clinica Universitaria de Navarra Body adiposity estimator. SCORE Systematic Coronary Risk Evaluation. ALLY Avoidable lost life years. REGICOR Registre Gironi del Cor. AI Atherogenic index. HDL High density lipoprotein. LDL Low density lipoprotein. SD Standard deviation

Table 3: Prevalence of altered values of the different cardiovascular risk scales by age

		%		%		%			
	n	**< 40 years**	**n**	**40-49 years**	**n**	**≥ 50 years**	**n**	**total**	**p-value**
Hypertension	651	14.75	893	19.71	583	39.97	2127	23.74	<0.0001
Total cholesterol ≥ 200 mg/dl	651	32.57	893	52.74	583	59.69	2127	48.47	<0.0001
LDL-c ≥ 130 mg/dl	651	24.73	893	39.31	583	47.51	2127	37.09	<0.0001
Triglycerides > 150 mg/dl	651	6.14	893	14.56	583	26.76	2127	15.33	<0.0001
Glycaemia ≥ 100 mg/dl	651	7.22	893	12.88	583	23.84	2127	14.15	<0.0001
Waist-to-height ratio >0,50	651	23.20	893	30.80	583	44.08	2127	32.11	<0.0001
Body mass index obesity	651	1.38	893	7.73	583	19.38	2127	8.98	<0.0001
CUN BAE obesity	651	20.43	893	38.86	583	75.99	2127	43.39	<0.0001
Relative fat mass obesity	651	34.41	893	42.89	583	53.34	2127	43.16	<0.0001
Metabolic syndrome NCEP ATPIII	651	2.00	893	6.05	583	20.07	2127	8.65	<0.0001
Metabolic syndrome IDF	651	2.30	893	6.72	583	16.12	2127	7.95	<0.0001
Metabolic syndrome JIS	651	3.53	893	11.53	583	31.39	2127	14.53	<0.0001
Atherogenic dyslipidemia	651	0.31	893	2.46	583	8.40	2127	3.43	<0.0001
Lipid triad	651	0.00	893	0.56	583	3.43	2127	1.18	<0.0001
AI Cholesterol/HDL-c moderate-high	651	2.15	893	8.17	583	17.32	2127	8.84	<0.0001
AI Triglyceride/HDL-c high	651	5.38	893	12.99	583	25.90	2127	14.20	<0.0001
AI LDL-c/HDL-c high	651	8.60	893	15.45	583	24.87	2127	15.94	<0.0001
SCORE scale* moderate-high			893	1.90	583	35.85	2127	10.63	<0.0001
REGICOR moderate-high	394	0.51	893	5.15	583	31.22	2127	10.81	<0.0001

LDL Low density lipoprotein. CUN BAE Clinica Universitaria de Navarra Body adiposity estimator. NCEP ATP III National Cholesterol Education Program. Adult Treatment Panel III, IDF International Diabetes Federation. JIS Joint Interim Statement. SCORE Systematic Coronary Risk Evaluation. REGICOR Registre Gironi del Cor. AI Atherogenic index. AI Atherogenic index. HDL High density lipoprotein. LDL Low density lipoprotein.

Table 4: Logistic regression analysis.

		Age > 50 years			tobacco			Seden-tarism			Non MD	
	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value	OR	CI 95%	p-value
Hypertension	2.73	2.20-3.40	<0.0001	1.33	1.08-1.65	0.008	1.57	1.27-1.94	<0.0001			ns
Total cholesterol ≥ 200 mg/dl	1.31	1.03-1.65	0.028	0.74	0.59-0.91	0.005	5.02	1.83-9.07	<0.0001	2.57	2.01-3.04	<0.0001
LDL-c ≥ 130 mg/dl			ns	1.59	1.28-1.97	<0.0001	4	1.26-7.39	<0.0001	2.19	1.87-2.51	<0.0001
Triglycerides > 150 mg/dl	1.64	1.20-2.24	0.002	4.22	3.08-5.77	<0.0001	3.25	1.38-7.11	<0.0001	2.88	2.61-3.15	<0.0001
Glycaemia ≥ 100 mg/dl	2.29	1.77-2.96	<0.0001			ns	1.79	1.39-2.31	<0.0001	1.68	1.33-2.04	<0.0001
Waist-to-height ratio >0,50	1.74	1.42-2.14	<0.0001	1.61	1.33-1.94	<0.0001	1.65	1.36-2.00	<0.0001	1.23	1.07-1.39	0.002
Body mass index obesity	3.11	2.25-4.29	<0.0001	3.31	2.33-4.68	<0.0001	3.64	2.59-5.12	<0.0001	2.78	2.11-3.56	<0.0001
CUN BAE obesity	5.95	4.75-7.46	<0.0001	2.05	1.68-2.49	<0.0001	2.54	2.08-3.11	<0.0001	2.01	1.70-2.35	<0.0001
Relative fat mass obesity	1.49	1.22-1.82	<0.0001	1.7	1.42-2.03	<0.0001	1.52	1.26-1.83	<0.0001	1.33	1.12-1.55	<0.0001
Metabolic syndrome NCEP ATPIII	3.7	2.63-5.21	<0.0001	3.13	2.17-4.50	<0.0001	4.89	1.83-8.67	<0.0001	1.57	1.10-2.24	<0.0001
Metabolic syndrome IDF	2.47	1.76-3.46	<0.0001	3.03	2.10-4.36	<0.0001	4.77	3.28-6.94	<0.0001	2.54	2.11-2.97	<0.0001
Metabolic syndrome JIS	3.67	2.77-4.85	<0.0001	4.68	3.46-6.34	<0.0001	6.34	4.70-8.56	<0.0001	3.13	2.63-3.63	<0.0001
Atherogenic dyslipidemia	2.93	1.71-5.03	<0.0001			ns	1.86	1.08-3.20	0.024	1.48	1.25-1.71	<0.0001
Lipid triad	5.27	1.93-14.14	0.001			ns	2.51	1.09-5.77	0.031	1.91	1.50-2.32	<0.0001
AI Cholesterol/HDL-c moderate-high	1.89	1.60-2.74	<0.0001	7.13	1.52-13.24	<0.0001	5.36	2.13-10.13	<0.0001	1.89	1.27-2.82	0.002
AI Triglyceride/HDL-c high	1.82	1.31-2.54	<0.0001	5.14	2.21-8.45	<0.0001	4.93	2.01-9.17	<0.0001	3.05	2.70-3.41	<0.0001
AI LDL-c/HDL-c high			ns	2.25	1.29-3.64	<0.0001	2.88	1.99-4.90	<0.0001	1.44	1.05-1.99	0.024
SCORE scale* moderate-high	55.27	30.19-101.16	<0.0001	7.9	4.99-12.50	<0.0001	2.34	1.58-3.45	<0.0001	12.75	7.96-20.41	<0.0001
REGICOR moderate-high	16.32	10.66-25.00	<0.0001	7.17	4.74-10.86	<0.0001	6.2	4.17-9.23	<0.0001	11	7.24-16.70	<0.0001

LDL Low density lipoprotein. CUN BAE Clinica Universitaria de Navarra Body adiposity estimator. NCEP ATP III National Cholesterol Education Program. Adult Treatment Panel III, IDF International Diabetes Federation. JIS Joint Interim Statement. SCORE Systematic Coronary Risk Evaluation. REGICOR Registre Gironi del Cor. AI Atherogenic index. AI Atherogenic index. HDL High density lipoprotein. LDL Low density lipoprotein. OR Odss ratio . CI Confidence Interval. MD Mediterranean diet

variables. Multivariate analysis was conducted using binary logistic regression. All statistical analyses were performed with SPSS 28.0, with a significance level of $p<0.05$.

Results

The mean values for age and the different anthropometric, clinical and analytical variables are presented in **Table 1**. This table shows that most firefighters are between 40 and 49 years old, more than 29% smoke, 27.7% are sedentary and just over 36% do not eat a Mediterranean diet.

Table 2 shows that the mean values of all variables estimating cardiometabolic risk (overweight and obesity scales, cardiovascular risk scales, and atherogenic indices, among others) increase with age.

Table 3 shows a similar trend to that observed for the mean values, i.e. the prevalence of altered values for the different cardiometabolic risk scales in this group of firefighters increases with age, being highest in those over 50 years of age.

Multinomial logistic regression analysis (**Table 4**) shows that age, smoking, sedentary lifestyle and low adherence to the Mediterranean diet all increase the risk of presenting variables related to cardiometabolic risk.

Discussion

The global cardiometabolic risk of the group of firefighters included in this study can be considered high, as elevated figures are observed in some variables such as obesity, hypertension, dyslipidemia, metabolic syndrome, or atherogenic risk, among others.

We did not find many studies that assess cardiometabolic risk in firefighters, but nearly all the ones we reviewed align with our results. A USA study found that professional firefighters showed high waist circumference measurements along with elevated lipid levels (29). Research conducted on 219 South African firefighters in the Western Cape province (30) showed that nearly 60% were overweight: 17.4% were classified as overweight and 45.5% as obese, 14.2% were hypertensive, 39.3% were prediabetic, and 18.3% diabetic; 54.3% had dyslipidemia, and over 51% did not engage in regular physical activity.

Data from the 2015-16 National Health and Nutrition Examination Survey (31) on 4,279 male firefighters showed that obesity ranged from 22% in the younger age group to over 45% in those over 40 years of age. The prevalence of metabolic syndrome according to NCEP ATPIII criteria ranged from 4% in the younger group to 16% in the older group. Elevated blood glucose reached up to 11% in the higher age groups. Another study, also on U.S. firefighters, this time on 413 subjects (32), found that the average BMI was 30 kg/m^2 and the average body fat percentage was 28.1%. The body composition of a group of Spanish firefighters33 showed an average BMI of 27.83 kg/m^2, while the average visceral fat percentage was 9%.

One of the strengths of this study is the large sample size, with more than 2,000 firefighters, and the use of various cardiometabolic risk scales, which allows us to have a comprehensive understanding of the actual cardiometabolic risk in this group.

Limitations

The limitations of this study include its cross-sectional design, which does not allow for establishing causal relationships between cardiometabolic risk factors and outcomes. Additionally, only male firefighters were included, as the number of female participants was too small for meaningful analysis, limiting the generalizability of the findings to female firefighters. Another limitation is the reliance on self-reported data for lifestyle factors, such as smoking and physical activity, which may introduce bias. Lastly, the study only considers Spanish firefighters, making it difficult to generalize the results to firefighters in other countries or regions with different occupational environments.

Conclusions

This study highlights the elevated cardiometabolic risk among Spanish firefighters, with significant rates of hypertension, obesity, dyslipidemia, and metabolic syndrome. The prevalence of these risk factors increases with age and is influenced by lifestyle factors such as smoking, sedentary behavior, and low adherence to the Mediterranean diet. The findings suggest the need for targeted interventions to reduce these risks, including promoting physical activity, dietary improvements, and smoking cessation. Further research is recommended to explore preventive

strategies and assess their effectiveness in mitigating the cardiometabolic burden in this occupational group.

Conflict of interest: The authors report no conflict of interest.

Funding source: No funding was required.

Ethical approval: All aspects of the study were conducted in accordance with the 2013 Declaration of Helsinki and the ethical standards of the institutional research committee. The Balearic Islands Research Ethics Committee (CEI-IB) approved the study (IB indicator 4383/20). Data anonymity and confidentiality were ensured at all times. The research team adhered to Spain's Organic Law 3/2018, guaranteeing participants' rights to access, rectify, cancel, and oppose their data.

Informed consent: Written informed consent was obtained from all individual participants and/or their gaurdians.

Acknowledgments: None

Peer-review: Externally. Evaluated by independent reviewers working in at least two different institutions appointed by the field editor.

Data availability: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Contributions

Research concept and design: JLT, BC, ACR, MB, AALG, HE

Data analysis and interpretation: JLT, BC, ACR, MB, AALG, HE

Collection and/or assembly of data: JLT, BC, ACR, MB, AALG, HE

Writing the article: JLT, BC, ACR, MB, AALG, HE

Critical revision of the article: JLT, BC, ACR, MB, AALG, HE

Final approval of the article: JLT, BC, ACR, MB, AALG, HE

All authors read and approved the final version of the manuscript.

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