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ORIGINAL

Cardiometabolic risk level in 1136 Spanish professional musicians

Nivel de riesgo cardiometabólico en 1136 músicos profesionales españoles

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Abstract

Introduction: Practically all the studies carried out on musicians have focused on musculoskeletal and mental injuries. The aim of this study is to determine the level of cardiometabolic risk in this group of workers.
Methodology: Descriptive and cross-sectional study in 1136 Spanish professional musicians in which the level of cardiometabolic risk (obesity, hypertension, dyslipidemia, insulin resistance, atherogenic risk, metabolic syndrome and heart age) was determined.
Results: The mean age of the musicians was 35 years and the cardiometabolic risk was moderate, with a high prevalence of obesity and especially dyslipidemia.
Conclusions: Taking into account the age of the participants and that they show a moderate level of risk, it is advisable to carry out health promotion activities in the group of musicians.

Key words: Musicians, cardiometabolic risk, obesity, dyslipidemia, metabolic syndrome, insulin resistance.

Resumen

Introducción: La práctica totalidad de los estudios realizados en el colectivo de músicos se han centrado en las lesiones musculoesqueléticas y de la esfera mental. El objetivo de este estudio es conocer cuál es el nivel de riesgo cardiometabólico de este colectivo de trabajadores.
Metodología: Estudio descriptivo y transversal en 1136 músicos profesionales españoles en los que se determina el nivel de riesgo cardiometabólico (obesidad, hipertensión, dislipemia, resistencia a la insulina, riesgo aterogénico, síndrome metabólico y edad del corazón).
Resultados: La edad media de los músicos es de 35 años y el riesgo cardiometabólico es moderado, destacando la alta prevalencia de obesidad y especialmente dislipemia.
Conclusión: Teniendo en cuenta la edad de los participantes y que muestran un nivel de riesgo moderado, es aconsejable realizar actividades de promoción de la salud en el colectivo de músicos.

Palabras clave: Músicos, riesgo cardiometabólico, obesidad, dislipemia, síndrome metabólico, resistencia a la insulina.

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Introduction

The various physical and psychological difficulties that come with being a musician have brought attention to the issue of occupational health among musicians in recent years[1,2]. The purpose of this introduction is to examine the complex field of occupational health for musicians, including the hazards they confront as well as the tactics for health promotion and preventative measures that are available.

The practice of music requires extensive use of the body and mind, whether one is a musician on stage, in a recording studio, or an instructor[3]. Long hours of rehearsal, performance, and practice can cause a variety of physical health problems in musicians. Musculoskeletal injuries resulting from incorrect posture and repetitive strain during practice and performance are among the most prevalent[4]. These ailments include tendinitis[5,6], nerve damage[7], and persistent pain[8]. Prolonged exposure to loud environments during practice sessions and performances can also cause hearing loss and other issues associated to the auditory system[9-11].

Due to the pressure to achieve musical brilliance, employment uncertainty, and the competitive character of the music industry, artists confront particular issues with regard to their mental health[12,13]. Depression[14] and performance anxiety[15] are common problems that affect musicians' general well-being and capacity to do their best work.

To address these issues, it is imperative to implement health promotion strategies and preventive measures that are tailored to the particular needs of musicians. The goal of this is to teach people about ergonomics and suitable practice techniques in order to prevent musculoskeletal problems. It also entails emphasizing the value of taking regular breaks and maintaining proper posture when working. To further safeguard the health of their ears, it is essential to make sure that musicians have access to safe listening practices and equipment.

Programs and resources for mental health assistance must be made available to musicians in order to help them manage the pressures and stress of their line of work. This could involve therapy, counseling, and wellness initiatives created especially with artists in mind. Furthermore, encouraging a collaborative and supportive culture within the music industry can aid in lessening the stigma attached to mental health problems and advance a safe and encouraging work environment[16].

A large body of research has looked at how practicing music affects musicians' health and well-being as well as practical approaches to preventing and treating health problems that are specific to the field. For example, a study discovered that musicians who took part in a program that taught body awareness significantly reduced their discomfort in the musculoskeletal system and improved their general quality of life[17].

Additionally, the World Health Organization (WHO) has promoted programs to enhance working conditions and advance artists' health globally, realizing the significance of tackling occupational health issues in the music industry.

However, little is known about the cardiometabolic status of this group of workers, for this reason the aim of our work will be to assess it.

Material and methods

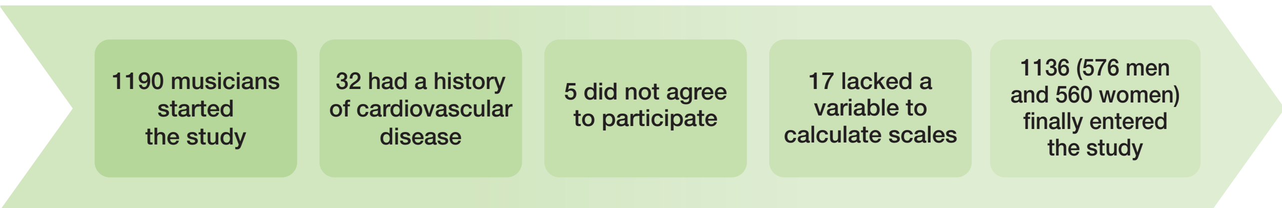
Between January 2020 and September 2022, 1136 musicians from various Spanish regions participated in a cross-sectional and retrospective study. The musicians were chosen based on how frequently they attended routine occupational health examinations.

Requirements for inclusion:

- Is employed by a collaborating company;
- Consents to take part in the research;
- Has not previously experienced a significant cardiovascular disease event (myocardial infarction, cerebrovascular illness, etc.).

32 musicians had a history of cardiovascular disease, 5 declined to participate in the study, and out of the 1190 musicians who started it, 17 were eliminated because data for all the factors required to compute the cardiovascular risk indicators were not available. 1136 musicians were the total number of workers that were included in the study. See **figure 1's** flow chart.

Figure 1: Flowchart of musicians.



After standardizing the measuring procedures, health professionals from the occupational health units that took part in the study carried out all anthropometric, clinical, and analytical measurements. The assessment comprised the following cardiovascular risk-related parameters:

Weight was measured in kilos, and height was measured in centimeters using an SECA 700 scale that had an SECA 220 telescopic height bar attached.

A SECA model 200 tape measure was used to measure the waist circumference (in centimeters). The person stood with their feet together, their upper limbs falling down on either side of their bodies, and their trunk straight. At the top of the last floating rib, the tape measure was positioned parallel to the ground.

After a 10-minute break, blood pressure was taken using an automatic sphygmomanometer (OMRON M3) that had been calibrated. The mean of the three measurements was obtained by making three assessments at intervals of one minute. When the systolic or diastolic blood pressure measurements were equal to or higher than 140 mm Hg or 90 mm Hg, hypertension was diagnosed.

Triglycerides, total cholesterol, and glucose were measured using automated enzymatic techniques, whereas HDL was measured by precipitating it with dextran sulfate Cl2Mg. The Friedewald formula was used to compute LDL (as long as the triglycerides were less than 400 mg/dl). The aforementioned values are all given in milligrams per deciliter.

Friedewald's equation: Total cholesterol - HDL+ triglycerides / 5 equals LDL.

Glycemia was classified according to the recommendations of the American Diabetes Association, considering hyperglycemia >125 mg/dL. Cholesterol values >239 mg/dL, LDL >159 mg/dL and triglycerides >200 mg/dL were considered high.

The following were the cut-off points for the atherogenic indexes: high values >3 for triglycerides/HDL, high values >5 for men and >4.5 for women, and cholesterol/ HDL.
Triglycerides >150 mg/dL, low HDL, and added LDL > 130 mg/dL are the markers of atherogenic dyslipidemia, sometimes known as the lipid triad[19].

Three metabolic syndrome models were identified[20]: At least three of the following elements must be met for NCEP ATP III (National Cholesterol Educational Program Adult Treatment Panel III) to be completed. Blood pressure >130/85 mm Hg or under treatment; waist circumference >88 cm in women and 102 cm in men; triglycerides >150 mg/dL or under therapy; HDL 100 mg/dL or under treatment. b) Central obesity, a waist circumference that is greater than 80 cm for women and >94 cm for males, as well as two or more of the additional criteria listed above for ATP III are required by the International Diabetes Federation (IDF). c) With the exception of waist, which is identical to the IDF model, JIS requirements are the same as NCEP ATPIII.

Insulin resistance scales

Triglyceride glucose index = LN (triglycerides [mg/dl] × glycaemia [mg/dl]/2)[21].
Triglyceride glucose index-BMI[22], TyGindex-BMI = TyGindex x BMI
The Metabolic Score for Insulin Resistance (METS-IR)[23] is a metabolic score that measures an individual's resistance to insulin by reversing the sum of their insulin and glucose logarithmic scores: 1/(log(ayunas' insulina μU/mL) + log(ayunas' glucose mg/dL)

SPISE = (=600 × HDL0.185/triglycerides0.2 × BMI1.338)

SPISE-IR = 10/SPISE[24]

Risk of diabetes type 2

The type 2 diabetes risk scales calculated are:

Finrisk[25]. Age, sex, waist circumference, Body Mass Index (BMI), physical activity, consumption of fruits and vegetables, use of antihypertensive medications, history of hyperglycemia in the self, and family history of diabetes are all required for its computation. A value of more than 15 points is regarded as high.

- QDiabetes score[26]. Age, sex, race, height, weight, blood sugar, smoking, antihypertensive medication usage, family history of diabetes, history of stroke, presence of depression or schizophrenia, use of statins or steroids, history of polycystic ovary disease, and gestational diabetes are all taken into account in its calculation. We regarded values of three or above for the relative risk as high as there are no cut-off marks.

The new Heart Age (HA) scale is derived from the traditional Framingham Scale. The HA measures how our heart has aged, as opposed to the conventional cardiovascular risk scales, which calculate the likelihood that a cardiovascular event will occur within the next ten years. A number of factors, including gender, age, height, weight, and circumference around the abdomen, are needed to calculate it. These factors also include the existence of cardiovascular diseases in family members, smoking, diabetes, lipid profile, systolic blood pressure, and antihypertensive medication. You can use all of these details to get to the calculator at www.heartage.me. It is possible to calculate HA within the 20-80 year timeframe.

A concept that is derived by deducting CAD from chronological age is known as ALLY[27] (avoidable years of life lost). Our group established the cut-off criteria for high ALLY (17 years) and moderate ALLY (11 years) in an earlier article[28].

The overweight and obesity index analyzed include:

• Body mass index (BMI) was computed by dividing the weight in square meters by the height in meters. Over 30k/m^2 was deemed obese.
By dividing the waist circumference by the respective hip and height circumferences, the waist/hip and waist/height indices are calculated. For the former, the cutoff value is 0.50; for the latter, it is 0.85 for women and 0.95 for men.
The abdominal volume index, or AVI[29], is calculated using the formula: AVI = [2 x (waist)^2+0,7 (hip)^2]./1.00015.
The Body Adiposity Index, or BAI, is an indicator of body obesity. Make use of the formula[30]:
BAI = (hip/height)$^{1.5}$)-18)

- Body shape index (ABSI) ABSI = Waist/BMI$^{2/3}$ x height$^{1/2}$
VAI and DAI are calculated using[31]:
VAI = (Waist (cm)/(39.68 + (1.88*BMI)))*(triglycerides/1.03)*(1.31/ HDL) for men and (Waist (cm) / (36.58+(1.89*BMI)))*(triglycerides /0.81)*(1.52/HDL) for women. DAI=[Waist/ [22.79+[2.68*BMI]]]*[triglycerides (mmol/L)/1.37]*[1.19/ (HDL, mmol/L)], for men and [Waist/ [24.02+[2.37*BMI]]]*[triglycerides (mmol/L)/1.32]*[1.43/ HDL(mmol/L)], for women.

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

• Body Roundness Index (BRI)[32]
BRI = 364.2 – 365.5 x √ 1- (waist/(2∏))/(0.5 height)^2)

• The body surface index (BSI)[33] is calculated from the body surface area (BSA) where w represents weight in kg and h height in cm
BSA = w0,425 h0,725 0,007184
BSI = WEIGHT/√ BSA

Formulas to estimate the percentage of body fat:

• Relative fat mass 76- (20 x (height/p waist)) Height and waist circumference are expressed in meters.

• CUN BAE[34] (University of Navarra Body Adiposity Estimator Clinic)-44.988 + (0.503 x age) + (10.689 x sex) + (3.172 x BMI) - (0.026 x BMI2) + (0.181 x BMI x sex) - (0.02 x BMI x age) - (0.005 x BMI2 x sex) + (0.00021 x BMI2 x age)

• ECORE-BF[35] (Equation COrdoba Estimator Body Fat) -97.102 + 0.123 (age) + 11.9 (gender) + 35.959 (LnBMI)
In CUN BAE and ECORE-BF male is 0 and female 1 and cut-off points for obesity are 35% in women 25% in men.

• Deuremberg formula[36]. 1,2 x (BMI) + 0,23 x (age) - 10,8 x (gender) - 5,4 Male = 0 Female = 1

- Metabolic score for visceral fat (METS-VF)[37] METS-VF = 4.466 + 0.011*(Ln(METS-IR))3 + 3.239*(Ln(WHtr))3 + 0.319*(Sex) + 0.594*(Ln(Age))

A person is considered a smoker if they haven't smoked for less than a year, or if they have smoked at least one cigarette per day for the past month (or a comparable amount in other consumption modalities).

We determined that adherence to the Mediterranean[38] diet was high when we used the questionnaire (which

Table I: Characteristics of the Spanish musicians.

	Men n=576	Women n= 560	
	Mean (SD)	Mean (SD)	p-value
Age	34.3 (6.7)	36.6 (10.3)	<0.001
Height	176.8 (5.7)	163.3 (6.7)	<0.001
Weight	76.0 (17.5)	66.2 (12.0)	<0.001
Systolic blood pressure	121.3 (9.8)	111.1 (11.5)	<0.001
Diastolic blood pressure	68.3 (10.7)	67.4 (9.1)	<0.001
Total cholesterol	196.5 (34.6)	188.1 (30.0)	<0.001
HDL-cholesterol	55.2 (6.2)	56.8 (4.5)	<0.001
LDL-cholesterol	121.7 (33.6)	105.4 (35.7)	<0.001
Triglycerides	128.7 (72.7)	96.8 (42.4)	<0.001
Glucose	83.1 (9.0)	81.9 (9.9)	<0.001
	(%)	(%)	p-value
< 30 years	24.2	32.9	<0.001
30-39 years	40.3	38.6	
40-49 years	15.8	17.1	
≥ 50 years	19.7	11.4	
Physical activity	51.4	58.3	<0.001
Mediterranean diet	43.8	45.8	<0.001
Smokers	31.7	26.4	<0.001

Table II: Mean values and prevalence of elevated values of different scales of obesity in Spanish musicians by gender.

	Men n=576	Women n= 560	
	Mean (SD)	Mean (SD)	p-value
Body mass index	24.2 (5.0)	24.8 (4.2)	<0.001
Waist to height-ratio	0.49 (0.04)	0.45 (0.05)	<0.001
Waist to hip-ratio	0.87 (0.07)	0.75 (0.08)	<0.001
Abdominal volume index	15.2 (3.3)	11.4 (2.4)	<0.001
Body adiposity index	24.4 (3.3)	29.1 (4.8)	<0.001
Body roundness index	3.2 (0.9)	2.5 (0.9)	<0.001
Body shape index	0.079 (0.004)	0.068 (0.007)	<0.001
Body surface index	54.4 (9.4)	50.3 (6.9)	<0.001
Visceral adiposity index	7.0 (4.8)	3.0 (1.7)	<0.001
Dysfunctional adiposity index	0.86 (0.48)	0.77 (0.41)	<0.001
Conicity index	1.2 (0.1)	1.0 (0.1)	<0.001
CUN-BAE	20.9 (7.3)	34.2 (6.6)	<0.001
ECORE-BF	21.0 (6.6)	34.0 (6.4)	<0.001
Deuremberg formula	20.7 (6.1)	32.5 (6.1)	<0.001
Relative fat mass	22.7 (3.6)	30.9 (5.4)	<0.001
METS-VF	6.1 (0.5)	5.2 (0.9)	<0.001
	%	%	p-value
Body mass index obesity	16.7	12.9	<0.001
Waist to height-ratio high	15.7	17.4	<0.001
Waist to hip-ratio high	17.1	4.3	<0.001
Abdominal volume index high	15.3	10.2	<0.001
Body adiposity index obesity	33.3	4.9	<0.001
Body roundness index high	14.9	22.9	<0.001
Body shape index high	23.9	15.8	<0.001
Body surface index high	15.8	18.6	<0.001
CUN-BAE obesity	40.3	47.2	<0.001
ECORE-BF obesity	39.2	44.3	<0.001
Deuremberg formula obesity	39.8	48.6	<0.001
Relative fat mass obesity	41.7	30.0	<0.001
METS-VF high	14.7	8.3	<0.001

Table III: Mean values and prevalence of elevated values of different scales of cardiometabolic risk in Spanish musicians by gender.

	Men n=576	Women n= 560	
	Mean (SD)	Mean (SD)	p-value
Nº factor MS NCEP ATPIII	0.8 (0.8)	0.4 (0.7)	<0.001
Nº factor MS JIS	0.8 (0.9)	0,7 (0.9)	0.003
ALLY heart age	-0.3 (6.4)	-1.2 (8.3)	0.040
QD score relative risk	1.4 (2.4)	1.2 (2.0)	0.127
Finrisk	3.3 (4.3)	3.6 (4.0)	0.255
TyG index	8.4 (0.5)	8.2 (0.5)	<0.001
TyG-BMI	206.3 (55.2)	203.1 (39.1)	0.273
METS-IR	34.9 (8.9)	34.4 (6.7)	0.692
SPISE-IR	1.5 (0.6)	1.4 (0.4)	0.115
Total cholesterol/HDL cholesterol	3.7 (0.8)	3.2 (1.0)	<0.001
LDL cholesterol/HDL cholesterol	2.8 (0.8)	2.3 (0.8)	<0.001
Triglycerides/HDL cholesterol	2.3 (1.4)	1.8 (0.9)	<0.001
	%	%	p-value
Hypertension	8.3	5.2	<0.001
Dyslipidemia	31.9	25.7	<0.001
Glucose ≥100 mg/dL	7.9	4.3	<0.001
MS NCEP ATPIII	7.8	5.8	<0.001
MS IDF	8.1	6.9	<0.001
Nº factor MS JIS	10.6	8.1	<0.001
ALLY heart age high	10.0	8.3	<0.001
Qdscore ≥3	20.0	7.5	<0.001
Finrisk high	8.3	5.8	<0.001
TyG index high	33.3	12.9	<0.001
TyG-BMI high	16.7	12.9	<0.001
METS-IR high	17.3	11.8	<0.001
SPISE-IR high	16.8	10.7	<0.001
Total cholesterol/HDL cholesterol high	15.9	10.3	<0.001
LDL cholesterol/HDL cholesterol high	24.8	11.4	<0.001
Triglycerides/HDL cholesterol high	15.7	7.6	<0.001
Atherogenic dyslipidemia	6.8	4.1	<0.001
Lipid triad	4.2	2.3	<0.001

consisted of 14 questions with ratings ranging from 0 to 1). A score of 9 or higher indicated adherence to the diet.

The International Physical Activity Questionnaire was used to measure physical activity (IPAQ)[39]. This self-administered questionnaire's goal is to determine how much physical activity was done during the previous seven days.

Statistical analysis

For categorical variables, frequency was computed, and for quantitative variables, mean and standard deviation. The Student's t test was used for independent samples in bivariate analysis, along with the chi-square test (with a correction using Fisher's exact test when necessary). The statistical analysis was performed using the SPSS 29.0 software, and a value of $p<0.05$ was deemed statistically significant.

Considerations and ethical aspects

The study n° IB 4383/20 was authorized by the Illes Balears Health Area's Clinical Research Ethics Committee. The 2013 Declaration of Helsinki and the institutional research committee's ethical guidelines were followed during the procedures. Written informed consent forms were signed by each patient before to their involvement in the research.

Results

Table I shows the characteristics of the sample. The mean age was approximately 35 years, the majority group being between 30 and 39 years of age. More than 30% were smokers (slightly higher in women). More than 50% engage in regular physical activity (slightly more in women) and 44% have a high adherence to the Mediterranean diet. All the variables presented more favorable values in women.

Table II shows the mean values and the prevalence of high values of the different overweight-obesity scales analyzed, separated by gender.
All scales except those estimating body fat show higher values in males.

Table III shows the mean values and the prevalence of high values for the different cardiometabolic risk scales analyzed, separated by gender.

All the scales also show higher values in men.

Discussion

The prevalence of high values of the different cardiometabolic risk scales analyzed in this study can be considered moderate, although the figures are particularly relevant considering that the mean age of the musicians is very low, around 35 years.

Unfortunately, we have not come across any study that values the cardiometabólic risk among musicians as a group in the literature we have reviewed, thus we are unable to compare our results with those obtained by other authors.
We will evaluate the results by comparing them to those discovered by other researchers in various work groups.
As strong points, we would highlight the large sample size, more than 1100 musicians, and the large number of cardiometabolic risk scales analyzed. In addition, we should highlight the fact that this is the first study, to our knowledge, that assesses cardiometabolic risk in this work group, making it the reference study for future research.

A study conducted in Brazil analysed the risk of astroturgy using asterogenous indexes and insulin resistance using the TyG index, finding values higher than ours, but this may have been due to the fact that the population was older than[40].

A study conducted in Germany with 414 participants and a mean age of 29.5 years found a 27.8% prevalence of arterial hypertension—much higher than the study's findings[41].

In a study done on Turkish healthcare workers, only 43% of the subjects had an IMC that was normal, whereas 33,1% and 21,1%, respectively, were classified as overweight and obese—numbers that are higher than ours[42].

Two studies with a methodology similar to ours carried out in two different groups, 5372 Spanish farmers[43] and 1094 Bolivian miners[44], showed prevalences of the different cardiometabolic scales somewhat higher than those obtained in the musicians, a situation that could be explained by the fact that the age of the participants was higher.

The main limitation is that objective methods have not always been used to assess cardiometabolic pathologies, such as insulin resistance or atherogenesis, but rather risk scales.

Conclusion

The cardiometabólic risk level of Spanish musicians is moderate, however higher than expected in a young population like the one examined in this study. In this group, it is necessary to implement programs for the prevention of cardiometabolic pathologies due to the situation.

Conflict of interest

The authors declare that they have no competing interests.

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