

High Occupational Physical Activity and cardiovascular risk factors in employees of Fomento de Construcciones y Contratas S.A. Company: a cross-sectional study

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Abstract

Background

The impact of occupational physical activity (OPA) intensity, considering adults work many hours a day, on health is unknown. The present study aims to evaluate the association between the high intensity of OPA and cardiovascular risk factors of employees.

Methods

A cross-sectional study was carried out in the "Fomento de Construcciones y Contratas S.A. Company" (FCC S.A. Delegation) in 2017, Spain. The intensity of OPA of each employee was classified by work categories in low (≤ 3 METs) or high (> 3 METs). Health and lifestyle data of employees were collected on medical consultation in the workplace.

Results

Associations were analyzed between the high intensity of OPA and cardiovascular risk factors of employees. 751 employees, 55.5% ($n = 417$) with high intensity of OPA. An 82.2% ($n = 245$) of employees with low intensity of OPA presented overweight/obesity compared with 69.0% ($n = 171$) with high intensity of OPA employees ($p < 0.001$). In men, high intensity of OPA is negatively associated with Body Mass Index (BMI) (B: -0.042 , $p = 0.003$), waist circumference (B: -0.027 , $p < 0.001$) waist-hip ratio (B: -5.484 , $p < 0.001$), cholesterol (B: -0.007 , $p = 0.001$) and triglycerides (B: -0.003 , $p = 0.025$). In women, high intensity of OPA was positively associated with blood pressure (BP) (systolic BP: B = 0.036 , $p = 0.005$ and diastolic BP: B = 0.040 , $p = 0.021$).

Conclusions

In conclusion, the high intensity of OPA is associated with less cardiovascular risk factors in men, whereas women are associated with high levels of blood pressure, suggesting an influence of gender and work categories.

Background

Workplace has been identified as a suitable environment to promote healthy lifestyles to prevent chronic diseases [1], due to the large population involved and prolonged periods of working days [2, 3].

Lifestyles, such as leisure-time physical activity (LTPA), decrease the risk of some chronic diseases as cardiovascular disease, obesity, diabetes mellitus, hypertension and some types of cancer [4–6].

The interesting, high time of LTPA, without considering the intensity, are inversely associated with the prevalence of the cardiovascular disease in males and females [7].

However, the impact of high intensity of occupational physical activity (OPA) on health remains unknown with the evidence published up to now. The OPA intensity could have an impact on cardiovascular disease, the leading cause of death in the world [8]. Whereas low intensity of OPA is few or no-associated with poor health status, as a higher risk for stroke, specifically in women [9, 10], high levels of OPA are associated with an increased risk of mortality in men but decreased the risk of mortality in women, from a meta-analysis of prospective studies data [11]. Therefore, physical activity has paradoxical health effects depending on if this physical activity is developed over leisure (LTPA) or occupational time (OPA) [12] which could be explained due to high intensity of OPA performed over long periods with insufficient recovery time, leading can cause a sustained inflammation, one of the hypothesized pathways in the etiology of cardiovascular diseases [13, 14].

Thus, the association between high OPA intensity and cardiovascular risk factors needs to be confirmed.

Fomento de Construcciones y Contratas (FCC) S.A. is a Spanish company with a great experience delivering services to citizens all over the world. FCC S.A. has the Catalonia Delegation II (Tarragona and Lleida provinces) of the environmental area (hereafter, the FCC S.A. Delegation) with employees with different OPA intensities who could be evaluated by impact of OPA.

Methods

Aims, design and setting of the study

The present study aims to evaluate the association between the high intensity of OPA and cardiovascular risk factors of employees (18–65 years old) of the FCC S.A. Delegation.

This study is a cross-sectional study carried out from 1 January to 31 December 2017 in the FCC S.A. Delegation. All employers and employees have signed written informed consent. The study design was approved and agreed by the security and health committees of all company worksites and signed with the worksite unions, and it was included in the collective bargaining agreement and obtained a certificate of ethical approval from the Security and Health Committee of the FCC S.A. Delegation and the Catalan public administration. The present cross-sectional study follows the STROBE criteria [15] (supplementary file 1).

Inclusion and exclusion criteria

To be eligible for inclusion, participants had to 1) be an employee of the FCC S.A. Delegation company with at least one year of service, 2) be ≥ 18 years old to 65 years old, and 3) have a medical visit in 2017. The exclusion criteria were noncompliance with an inclusion criterion.

Data collection

In FCC S.A. Delegation Medical Examination Service, the physician did a check-up of all employees every year and recruited the information of employees in the workplace such as age, gender, anthropometric, biochemical, and lifestyle.

This medical visit consisted of the recruitment of anthropometric, biochemical and lifestyle data.

Anthropometric data

Anthropometric data were weight (kg), height (m) and waist circumference (WC) measured above the iliac crest and hip circumference (HP) (cm) using the Lohman manual [16]. Diagnoses of abdominal obesity were assessed (WC ≥ 102 cm in men and ≥ 88 cm in women) [17, 18]. The waist-hip ratio was calculated by dividing WC by HC (considered high waist-hip ratio for men > 1 and women > 0.9031) [17]. Moreover, body mass index (BMI) (kg/m^2) was calculated, and it was categorized using the World Health Organization (WHO) thresholds (BMI ≥ 25 kg/m^2 overweight or ≥ 30 kg/m^2 obesity).

Systolic and diastolic blood pressure were collected (mmHg) using the OMRON® arterial pressure monitor. The employees were sitting in at rest for about 10 minutes with the arterial pressure monitor in the arm, the physician measured three times the arterial pressure and the mean of three measurements were used. The hypertensive employees were registered in the medical record and were register for the prescribed medication for hypertension by family physicians for obtaining more information about the employee.

Biochemical data

Biochemical data were parameters related to cardiovascular diseases: cholesterol, triglycerides, and glucose collected in blood samples. Employees with hypercholesterolemia (cholesterol ≥ 200 mg/dL), hypertriglyceridemia (triglycerides ≥ 150 mg/dL), and diabetes mellitus (glucose ≥ 126 mg/dL) were derived from a family physician, to obtain better health management of the employee.

Lifestyle data

Focusing on lifestyle, alcohol risky consumption was considered if the employed referred an alcohol consumption > 28 standard drink units (SDUs) /week in males and 17 SDUs/week in females. Tobacco consumption was registered if the employee is an active smoker. Physical activity outside of work hours (named as leisure-time physical activity, LTPA) were collected by International Physical Activity Questionnaire [19] and classified by ≥ 30 minutes/day of LTPA as high LTPA or < 30 minutes/day of LTPA as low LTPA. From this questionnaire [19], it was only considered LTPA, but other variables such as transport used, household domain and working hours were dismissed.

Employees OPA and socioeconomic characteristics

Employees were classified by different work categories based on the International Labour Organization [20], and linked with socioeconomic level evaluated [21, 22], into:

1. a) Managers: administrative and commercial managers/production and specialized service managers (high socioeconomic levels: directors and managers),
2. b) Drivers and mobile plant operators (medium socioeconomic level: intermediate occupation),
3. c) Supervisor of operators and drivers (medium socioeconomic level: intermediate occupation),
4. d) Cleaners and helpers (low and very low socioeconomic level: primary qualified, half-qualified and non-qualified), and,
5. e) Plant and machine operators and assemblers (low and very low socioeconomic level: primary qualified, half-qualified and non-qualified).

Moreover, the intensity of OPA was registered from the Compendium of Physical Activities [23] and work categories by the International Labour Organization [20]. The OPA intensity was the physical activity developed in the workplace, and this is assessed by physical activity intensity done during work hours using METs, depending on the type of work. Employees who spent ≤ 3 METs in their work hours per day were categorized as the low intensity of OPA, and employees who spent > 3 METs in their work hours per day were categorized as the high intensity of OPA.

Additional data

The Metabolic Syndrome of employees has considered if they present these three factors: diabetes mellitus, hypercholesterolemia, obesity and/or hypertension and its association with OPA intensity [24].

Sample size

From 19,471 employees in Spain at 2019 (Instituto Nacional de Estadística, 2019), it was calculated a sample size to estimate with a 95% confidence interval (CI) and a precision of ± 5 percent with cardiovascular risk factors, considering in Spain around 46% of employees presented cardiovascular risk factors [26], 467 employees will suffice. It is being anticipated the replacement rate of 20%.

Statistical analyses

The principal outcome was the association of OPA intensity calculated by the physical activity of the category work of each employee and cardiovascular risk factors. The secondary outcome was considered the association of OPA intensity and cardiovascular risk factors segregated by gender.

Continuous variables were presented as the means \pm standard deviations (SD), and categorical variables are presented as percentages. ANOVA test was used to compare continuous variables and Chi-square to compare categorical variables. Analyses were conducted segregating the population by OPA intensity and gender. Logistic regression models were used to analyze the associations between OPA and cardiovascular risk factors. Logistic regression multivariate analysis was used to calculate the associations with high intensity of OPA and anthropometric or biochemical parameters, whereas for categorical variables such as lifestyle parameters (tobacco and alcohol consumption, it used binary regression logistic analysis to calculate the association with high intensity of OPA).

All data were analyzed using SPSS V.25.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The level of statistical significance was set to $p < 0.05$.

Results

All of the employees, 751 employees from the FCC S.A. Delegation were included in the present cross-sectional study.

Table 1 showed the characteristics of the FCC S.A. Delegation, consisted mainly of males (72.7% (n = 546 /751)). The age mean \pm (SD) of the total population was 45.2 ± 9.8 years. A 98.8% (n = 742) of the FCC S.A. Delegation employees had a low or very low socioeconomic level according to the work categories of employees; highlighting that a 51.7% of employees were non-qualified workers (categorized as very low socioeconomic employees).

Table 1
Characteristics of worker population of the FCC S.A. Delegation

Baseline characteristics	Total employees n = 751 % (n)
Gender	
male	72.7 (546)
female	27.3 (205)
Age (mean \pm SD)	45.2 \pm 9.8
High Socioeconomic level: Directors and managers	0.1 (1)
Medium Socioeconomic level: Intermediate occupation	1.1 (8)
Low socioeconomic level: Primary qualified employees and half qualified employees; Supervisors and technic employees	47.1 (354)
Very-low socioeconomic level: Non-qualified	51.7 (388)
The results were expressed as mean and \pm SD: Standard Deviation	

Table 2 shows the characteristics of employees depending on their intensity OPA, high OPA or low OPA. Almost half of the employees, 44.5% (n = 334) were categorized as low OPA. A 54.6% (n = 298) of males had a low OPA compared with only 17.5% (n = 36) of females.

Table 2
Categories of employees divided according to their intensity of the occupational physical activity (OPA)

		Low OPA 44.5% n =	High OPA 55.5% n =
		334	417
		% (n)	% (n)
Gender	male	89.2 (298)	59.5 (248)
	female	10.8 (36)	40.5 (169)
Age	y (mean \pm SD)	45.2 \pm 9.8	45.2 \pm 10.2
Managers: administrative and commercial managers/production and specialized service managers	male	0.7 (4)	
	female	5.4 (11)	
	total	2 (15)	
Drivers and mobile plant operators	male	32.6 (178)	
	female	2.4 (5)	
	total	24.4 (183)	
Supervisor of operators and drivers	male	21.3 (116)	
	female	9.8 (20)	
	total	18.1 (136)	
Cleaners and helpers	male		2.2 (12)
	female		49.8 (102)
	total		15.2 (114)
Plant and machine operators and assemblers	male		43.2 (236)
	female		32.7 (67)
	total		40.4 (303)
OPA: Occupational physical activity - According to Compendium of Physical Activities[23]			

Professional category: to the International Labour Organization[20]

Table 3 showed the association between the high intensity of OPA and cardiovascular risk factors. Employees of male gender with high intensity of OPA had a significant negatively association with BMI (B=-0.042, p = 0.003), WC (B: -0.027, p < 0.001), waist-hip ratio (B: -5.484, p < 0.001) and cholesterol (B: -0.007, p = 0.015); and triglycerides in blood (B: -0.003, p = 0.025). Focus on employees of female gender with high intensity of OPA, had a significant positive association with blood pressure: SBP (B: 0.036, p = 0.005) and DBP (B: 0.040, p = 0.021).

In lifestyle parameters, only tobacco consumption was significantly positively associated with the high intensity of OPA in male employees (B = 0.394, p = 0.024). Other lifestyles such as LTPA or alcohol, consumption were not associated with the intensity of OPA.

Table 3
Association between employees with high intensity OPA and cardiovascular risk factors.

	Total sample n = 751		Male n = 546		Female n = 205	
	B	<i>p-value</i>	B	<i>p-value</i>	B	<i>p-value</i>
BMI[#]	-0.042	0.003	-0.046	0.008	0.029	0.423
Systolic Blood Pressure [#]	-0.005	0.167	-0.002	0.677	0.036	0.005
Diastolic Blood Pressure [#]	-0.01	0.097	-0.012	0.102	0.040	0.021
Waist circumference[#]	-0.027	< 0.001	-0.020	0.003	0.017	0.242
Waist-hip ratio[#]	-5.484	< 0.001	-2.999	0.010	4.259	0.130
Glucose mg/dL [#]	-0.002	0.377	-0.001	0.604	-0.001	0.909
Cholesterol mg/dL[#]	-0.007	0.015	-0.011	0.001	0.008	0.203
Triglycerides mg/dL[#]	-0.003	0.025	-0.002	0.10	0.001	0.865
LTPA [*]	-0.431	0.057	-0.214	0.407	-0.963	0.074
Tobacco[*]	0.210	0.163	0.394	0.024	-0.026	0.945
Alcohol[*]	0.292	0.691	0.477	0.534	19.662	1.000

These risk factors are measured as associations: [#]Logistic regression multivariate analysis and ^{*}Binary regression logistic analysis Bold $p < 0.05$

Besides, Table 4 showed the anthropometric, biochemical and lifestyle parameters of employees compared by their low or high intensity of OPA. Most of the results observed in Table 3 are reinforced in Table 4, where males carried out the high intensity of OPA presented lower levels of BMI, WC, WHR, cholesterol, and higher consumption of tobacco, compared to employees carried out the low intensity of OPA. On the other hand, females carried out the high intensity of OPA presented higher levels of SBP and DBP compared to the low intensity of OPA females (Table 4), results supported by association analysis presented in Table 3. Also, Table 4 showed lower levels of OW and OB prevalence in the high intensity of OPA (69%; $n = 171$) compared to the low intensity of OPA (82.2%; $n = 245$), $p < 0.001$. Moreover, considering females and males together, employees carried out the high intensity of OPA presented lower percentages of diabetes mellitus (3.5%, $n = 15$ vs. 7.5%, $n = 25$; $p = 0.022$) and metabolic syndrome (1.7%, $n = 7$ vs. 4.2%, $n = 14$; $p = 0.045$), compared with employees carried out the low intensity of OPA. In lifestyle parameters, specifically in high LTPA, there are no significant differences between low intensity of OPA vs high intensity of OPA (14.4%, $n = 48$ vs. 9.8%, $n = 41$; $p = 0.069$).

Table 4
Comparison of cardiovascular risk factors depending on low intensity OPA vs high intensity OPA employees

		Low OPA n = 334	High OPA n = 417	P value
Anthropometric parameters				
#BMI (kg/m ²) mean±(SD)	Male	29.0 (± 5.0)	27.8 (± 5.2)	0.008
	Female	26.5 (± 4.6)	27.3 (± 5.5)	0.425
	Total	28.7 (± 5.1)	27.6 (± 5.3)	0.003
*OW + OB ^a %(n)	Male	82.2 (245)	69.0 (171)	< 0.001
	female	55.6 (20)	59.2 (100)	0.712
	Total	79.3 (265)	65.0 (271)	< 0.001
*OB %(n)	Male	34.9 (104)	27.0 (67)	0.052
	female	25.0 (9)	29.0 (49)	0.689
	total	33.8 (113)	27.8 (116)	0.080
#Waist circumference mean±(SD)	male	99.5 (± 13.0)	96.0 (± 13.4)	0.003
	female	85.47 (± 14.6)	88.3 (± 12.9)	0.243
	total	98.0 (± 13.8)	92.9 (± 13.7)	< 0.001
#Abdominal obesity mean±(SD)	male	33.9 (101)	26.6 (66)	0.076
	female	30.6 (11)	43.2 (73)	0.193
	total	33.5 (112)	33.3 (139)	1.000
#Waist-hip rate mean±(SD)	male	0.970 (± 0.1)	0.840 (± 0.1)	0.009
	female	0.951 (± 0.1)	0.860 (± 0.1)	0.13
	total	0.956 (± 0.1)	0.914 (± 0.1)	< 0.001
*High waist-hip rate %(n)	male	23.5 (70)	21.4 (53)	0.607
	female	41.7 (15)	49.7 (84)	0.463
	total	25.4 (85)	32.9 (137)	0.030
#Systolic blood pressure mean±(SD)	male	135.7 (± 18.2)	135.1 (± 19.7)	0.678
	female	118.1 (± 12.5)	127.3 (± 18.1)	< 0.001
	total	133.8 (± 18.5)	131.9 (± 19.4)	0.167
#Diastolic blood pressure mean±(SD)	male	82.6 (± 12.1)	80.9 (± 11.3)	0.102
	female	74.3 (± 9.9)	79.3 (± 11.8)	0.019
	total	81.7 (± 12.2)	80.3 (± 11.5)	0.097
*Hypertension ^b %(n)	male	20.1 (60)	14.1 (35)	0.07
	female	5.6 (2)	14.8 (25)	0.179
	total	18.6 (62)	14.4 (60)	0.136

OPA: Occupational physical activity; BMI: Body Mass Index; OW: overweight; OB: obesity; DM: Diabetes mellitus; LTPA: Leisure-Time Physical Activity

^a BMI ≥ 25 kg/m²

^b Hypertension: diagnosed by a family physician

^c Diabetes mellitus: diagnosed by a family physician

^d Hypercholesterolemia: diagnosed by a family physician

^e High leisure time of physical activity: by International Physical Activity Questionnaire

^f Risky alcohol consumption: alcohol consumption > 28 SDUs/week in males and 17 SDUs/week in females.

^g Tobacco: smoke or not.

#Anova; *Chi²; Bold < 0.005 (significant results)

		Low OPA n = 334	High OPA n = 417	Pvalue
Biochemical parameters				
#Glucose g/dl mean±(SD)	male	107.8 (± 46.1)	105.2 (± 38.0)	0.604
	female	96.9 (± 27.1)	96.1 (± 30.3)	0.91
	total	106.5 (± 44.3)	102.7 (± 36.2)	0.375
*DM ^c %(n)	male	8.4 (25)	4 (10)	0.052
	female	0	3 (5)	0.589
	total	7.5 (25)	3.5 (15)	0.022
#Cholesterol g/dl mean±(SD)	male	203.1 (± 38.2)	188.8 (± 34.8)	0.001
	female	183.0 (± 35.5)	196.3 (± 43.6)	0.203
	total	200.6 (± 38.3)	190.8 (± 37.4)	0.014
*Hypercholesterolemia ^d %(n)	male	64.8 (103)	53.6 (71)	0.056
	female	47.8 (12)	68.6 (35)	0.2
	total	63.2 (115)	57.6 (106)	0.287
#Triglycerides g/dl mean±(SD)	male	152.7 (± 89.2)	135.8 (± 87.8)	0.105
	female	97.5 (± 35.7)	99.4 (± 48.0)	0.868
	total	145.7 (± 86.3)	125.8 (± 80.4)	0.022
Lifestyles parameters				
*High LTPA ^e %(n)	male	14.1 (42)	11.7 (29)	0.445
	female	16.7 (6)	7.1 (12)	0.097
	total	14.4 (48)	9.8 (41)	0.069
*Risky alcohol consumption ^f %(n)	male	1 (3)	1.6 (4)	0.707
	female	0	0.6 (1)	1
	total	0.9 (3)	1.2 (5)	0.738
Tobacco consumption ^g %(n)	male	37.6 (112)	47.2 (117)	0.029
	female	36.1 (13)	35.5 (60)	1
	total	37.4 (125)	42.4 (177)	0.178
Additionally				
*Metabolic Syndrome %(n)	male	4.7 (14)	2.4 (6)	0.177
	female	—	0.6 (1)	1.000
	total	4.2 (14)	1.7 (7)	0.045
OPA: Occupational physical activity; BMI: Body Mass Index; OW: overweight; OB: obesity; DM: Diabetes mellitus; LTPA: Leisure-Time Physical Activity				
^a BMI ≥ 25 kg/m ²				
^b Hypertension: diagnosed by a family physician				
^c Diabetes mellitus: diagnosed by a family physician				
^d Hypercholesterolemia: diagnosed by a family physician				
^e High leisure time of physical activity: by International Physical Activity Questionnaire				
^f Risky alcohol consumption: alcohol consumption > 28 SDUs/week in males and 17 SDUs/week in females.				
^g Tobacco: smoke or not.				
#Anova; *Chi ² ; Bold < 0.005 (significant results)				

Discussion

The present cross-sectional study, conducted in the FCC S.A. Delegation, showed that the high intensity of OPA was significantly negatively associated with cardiovascular risk factors in males, such as BMI, WC, waist-hip ratio, and cholesterol and triglycerides levels in the blood, suggesting better cardiovascular health. However, in males, the high intensity of OPA was positively associated with tobacco consumption. In females, the high intensity of OPA was significantly positively associated with blood pressure levels, contrarily suggesting poorer cardiovascular health.

The hypothesis of the present cross-sectional study, about high intensity of OPA could be associated with a detrimental in health status, in particular, in cardiovascular health [13]; and it is confirmed in female employees, due to negative association with blood pressure levels. A possible explanation in females cleaners, who in present study females represented the majority of type of job, the muscle contractions during manual handling could be associated with elevated blood pressures [13].

In the same way, 419 female cleaners from five hotels evaluated during 18 h including work and leisure time, showed an increased systolic blood pressure and pulse pressure, thus room cleaners were also associated with increase blood pressure [27]. Surprisingly, cleaners presented higher levels of SBP and DBP than other professional categories and considering the exposure to chemical products as a confounder factor such as chemical exposure was proposed as a key signaling mineralocorticoid a base of blood pressure control (Huang, Ye, & Zhang, 2020).

Focus on LTPA, people have the time and frequency control of the free physical activity but the OPA intensity was difficult to control, depending on each job characteristics and working day. In a prospective cohort, lower LTPA was associated with an elevated risk of cardiovascular disease mortality events [28]. Recently, physical activity paradox has been defined as high OPA intensity increase the risk of mortality for cardiovascular events in men, whereas increasing the levels of physical activity is recommended for preventing cardiovascular events [11, 14] by LTPA as recommended to prevent cardiovascular disease [29].

Focus on WC, in our study population, low OPA intensity employees presented a high mean of WC, such as $98.0 \text{ cm} \pm 13.8$ and $92.9 \text{ cm} \pm 13.7$ in employees with high OPA intensity. Although the mean of WC, in men low OPA was $99.5 (\pm 13.0) \text{ cm}$ while high OPA intensity was $96.0 (\pm 13.4) \text{ cm}$, and in women, low OPA was $85.47 (\pm 14.6) \text{ cm}$ and $88.3 (\pm 12.9) \text{ cm}$, was not superior to defined cut-off points [17].

In a Spanish cross-sectional study, conducted with 259,014 workers, aimed to associate metabolic syndrome with occupation and gender, demonstrated that metabolic syndrome was higher in blue collars females, such as cleaners than white collars such as administrative occupation [30]. These results were aligned with our results, due to our high OPA female population, majority cleaners (blue collar), presented higher blood pressure, one of the criteria of metabolic syndrome, than low OPA female population. While cross-sectional of Sanchez-Chaparro et al associated metabolic syndrome with occupational category, our present cross-sectional had one-step further because associated with the intensity of OPA related to the occupational category. Moreover, focus on the low intensity of OPA employees, the prevalence of overweight and obesity was higher than Spanish National data (18-65y) in 2017 [31]. Spanish working population presented a prevalence of overweight plus obesity of 56% in males and 39% in females, lower than 82.2% and 55.6% showed in the present cross-sectional study, respectively. So, workplace weight management programs could increase the engagement of employees [32]. However, from all results, one important aspect to consider is to design and implement different workplace interventions depending on the OPA intensity levels and gender of employees, to achieve a significant effect.

On the other hand, focusing on lifestyles, male employees with high OPA intensity presented a significantly higher prevalence and significant association of tobacco consumption compared to low OPA intensity employees. Most of the high intensity of OPA male employees of FCC S.A. Delegation developed tasks of their work outdoors, as street cleaners probably they have more access to smoke than the low OPA intensity employees.

Thus, not only to avoid smoking, a major cardiovascular risk factor, the intensity of OPA, type of job developed by employee and gender could be considered as key indicators to contemplate in the design of workplace programs to improve the cardiovascular health of employees.

Whereas for employees with low intensity of OPA, taking into account this activity could be considered as a sedentary lifestyle, acting as a major modifiable risk factor for cardiovascular disease [7, 33]. The interventions to improve cardiovascular risk factors for males with high intensity of OPA should be tested because the evidence suggests that high OPA employees may not be a benefit for LTPA supporting caution should be in recommending exercise in the high intensity of OPA employees [34]. However, in workplace interventions directed to females with high intensity of OPA, it is suggested the effectiveness of lowering SBP by a single session per day in cleaners' females [35].

Therefore, from the evidence of the cardiovascular risk factors of employees, it could carry on actions to prevent cardiovascular disease at the workplace. Supporting the interventions, the workplace is a good environment to improve physical activity behaviors [36–38].

The present cross-sectional study had some limitations. Firstly, the study population included only one Delegation of one company, the FCC workers in Tarragona, whereas more participants of other FCC Delegations around all Spain could provide more information. Secondly, physical activity during the working time was assessed by International Physical Activity Questionnaire [19], and it was not calculated by an Actical accelerometer considered as the gold standard tool to evaluate physical activity [19, 39, 40] due to implying higher costs for the company. Thirdly, disease variables such as percentage of employees with hypertension and cholesterol were based on the diagnosis of the family physician, and workers were medicated, for this reason, the mean of variables related to medicated employees (mean of blood pressure and mean of blood cholesterol) was misleading. Fourthly, OW and OB prevalence could act as a confounder because it is associated with high cardiovascular risk factors, and males with high OPA intensity levels showed a low percentage of OW and OB and less cardiovascular risk factors than males with low intensity of OPA. Fifthly, although this study had the appropriate sample size, it would be more interesting to include different companies to obtain a sample size with a higher diversity of employees, to be possible to improve the generalizability of the results obtained. Besides, males represented the huge part, the generalizability of our findings to female is limited, and it should include a higher percentage of females in future researches.

Furthermore, the study had some strengths, it included a huge sample size of employees with different OPA intensity categories. Moreover, the data obtained related to cardiovascular risk factors assessed in the workplace, are based on blood analysis, anthropometric measures, and validated questionnaires. The present cross-sectional study is the first study that investigated the workplace population categorizing the intensity levels of the OPA in Spain.

Conclusion

High intensity of OPA is associated with less cardiovascular risk factors in men, whereas women are associated with high levels of blood pressure, suggesting an influence of gender and work categories.

List Of Abbreviations

Occupational Physical Activity (OPA)

Fomento de Construcciones y Contratas S.A. (FCC S.A. Delegation)

Waist Circumference (WC)

Hip Circumference (HC)

Body Mass Index (BMI)

World Health Organization (WHO)

Leisure-Time Physical Activity (LTPA)

Standard Drink Units (SDU)

Standard Deviation (SD)

Declarations

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All employers and employees (n=751) have signed written informed consent. The program obtained the approval of the security and health committees of all company worksites and agreed and signed with the worksite unions, and the program is included in the collective bargaining agreement. The program design was approved and obtained a certificate of ethical approval from the Security and Health Committee of the FCC S.A. Delegation and the Catalan public administration (Subdirecció General de Drogodependències de la Agència de Salut Pública de Catalunya, Servicios Territoriales de Tarragona del Departamento de Trabajo). The clinical information was strictly confidential, following the organic law 17/1999, of 13 December about personal data protection L.O.P.D. All of the reference data for detection controls are collected in the medical service of the FCC S.A. Delegation.

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIAL

The technical appendix, statistical code, and dataset are available from the corresponding authors upon request: elisabet.laurado@urv.cat and lucia.tarro@urv.cat.

DECLARATIONS OF INTEREST

The authors declare that they have no competing interests

FUNDING DETAILS

No funding was received for this study.

AUTHOR CONTRIBUTIONS STATEMENT

MG-R, SA-B designed the study.

MG-R, SA-B conducted research (data collection).

MG-R, SA-B, EL, LT, RS provided essential materials.

MG-R, EL, LT analyzed data or performed statistical analysis.

MG-R, SA-B, EL, LT, RS drafted and revised the manuscript.

MG-R, SA-B, EL, LT, RS take primary responsibility for the study and the manuscript content.

MG-R, SA-B, EL, LT, RS read and approved the final draft of the manuscript.

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