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Occupational Physical Activity and Cardiovascular Risk Factors Profile in the Adult Population of the Southern Cone of Latin America. Results from the CESCAS I Study

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Abstract

Objective: We explore the association between occupational physical activity (OPA) and cardiovascular risk factors in 4 cities of the Southern Cone.

Methods: Robust multivariable linear regression models were used to examine the associations

Results: The working population was constituted by 1,868 men and 1,672 women. Men performing high levels of OPA showed higher levels of HDL (mean adj. diff.= 2.24 mg/dL; p=0.004), lower levels of triglycerides (−24.59 mg/dL; p=0.006) and TC/HDL ratio values (−0.21; p=0.015) compared to reference. Women in the highest category of OPA had higher levels of HDL (2.85 mg/dL; p=0.006), lower TC/HDL (0.27; p=0.001) and LDL/HDL ratios (−0.18; p=0.003) compared to sedentary activities.

Conclusions: Individuals who performed high levels of OPA did not exhibit a worse cardiovascular risk profile and an improvement on selected biomarkers was observed when compared to those performing sedentary activities.

Keywords: Exercise; Apolipoproteins; Occupational; Lipoproteins; Physical activity; risk factors

Introduction

Abundant data has described the inverse associations between physical activity (PA) and cardiovascular disease (CVD) risk[1], however, occupational PA (OPA) might have different impact than leisure time physical activity (LTPA). A meta-analysis showed that those who engaged in moderate levels of LTPA reduced the CVD risk in 20-30%, while high levels of OPA increased it by 24%[2]. Nevertheless, several studies showed variable impact of OPA on CVD when accounting for LTPA. Some studies showed that high levels of OPA had: a) no effect[3], b) beneficial effect[4-7] or c) detrimental effect[8-10] on CVD risk. When this association was analyzed by strata of LTPA, high OPA increased CVD risk only in those who performed low LTPA[8, 10]. Similarly, other studies that accounted for fitness in their analyses found that high levels of OPA increased CVD risk only in those with low levels of fitness[11-14]. Furthermore, most of the aforementioned studies did not include women and have not considered important potential confounders associated to CVD risk such us working hours[15], stress, depression or type of PA at work[16-18]. Petersen et al. found that only lifting activities were associated with higher CVD risk (RR 1.52), while non-lifting activities were associated with lower risk (RR 0.50)[19]. All these studies were conducted in developed populations in which psychological, environmental and social factors may independently influence both behavioral and cardiometabolic risk factors[20, 21]. For example, in the Southern Cone of Latin America the lower income population engaged more in active transportation than in developed populations[22].

Opposing to the large evidence demonstrating the benefits provided by PA in health, the role of occupational PA on CVD, remains to be clarified. There is no published data from Latin America populations regarding this multifaceted topic. Therefore, the aim of the present study is to evaluate the association between occupational PA and behavioral and clinical risk factors by gender in a representative sample of four cities from Argentina, Chile and Uruguay using baseline data of CESCAS I study.

Material and Methods

Sample design and study population

Briefly, "The CESCAS I is a population-based prospective cohort study that used 4-stage multistage random sample to include 7,524 adults aged 35-74 years from four mid-sized cities in Argentina (Bariloche and Marcos Paz), Chile (Temuco) and Uruguay (Pando-Barros Blancos)"[23]. For the current analysis we used baseline data, excluding participants who were unemployed (n=542), retired (n=2,150), housewives (n=1,040) or had history of CVD at baseline (n=252). The final working population was constituted by 1,868 men and 1,672 women.

Data collection

The exposure to risk factors and prevalence of CVD was collected between 2011 and 2013 by trained interviewers in participant´s household. "Data was collected using cross-culturally adapted questionnaires from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL). Once the survey was completed, each participant was scheduled for a clinical exam to obtain physical measurements (blood pressure, weight and height). Information about smoking status was assessed using the Global Adult Tobacco Survey. Nutritional information was collected using a food frequency questionnaire (FFQ) adapted from the National Cancer Institute Diet History Questionnaire, which has been validated by our research team for use in Argentina, Chile and Uruguay[24]. Depression was assessed by the nine-item Patient Health Questionnaire (PHQ-9). During the clinical examination, blood pressure and anthropometric measurements were obtained by trained and certified observers using standard protocols and techniques. Overnight fasting blood specimens were obtained to measure blood glucose, total cholesterol, HDL-cholesterol, triglycerides, Apo B, Apo A1 and ultrasensitive CRP, using standard methods with commercially available reagents. LDL-cholesterol was calculated using the Friedewald equation for participants with triglycerides <400 mg/dL".[23, 25]

Physical activity assessment

"Physical activity data was assessed using the transcultural adaptation of the International Physical Activity Questionnaire long form (IPAQ) used in the HCHS/SOL study. The questionnaire asked about frequency (days/week) and duration (minutes/day) of moderate and vigorous intensity activities performed during a typical week in three different domains:

occupational, leisure time and active transportation (walking and bicycling). We estimated energy expended on the assessed PA in metabolic equivalents (MET). One MET was defined as the energy it takes to sit quietly, which is about one calorie per every kilogram (2.2 pounds) of body weight per hour for an average adult (i.e. 1 MET = 1 kcal/kg/hour). The values used in this study were 8 METs for vigorous intensity activities and 4 METs for moderate intensity activities following the IPAQ´s guidelines for data processing and analysis. Only activities performed for 10 or more minutes were included in the calculation of the PA scores. If a subject reported participating in any activity for more than 180 minutes, the value was truncated at 180 minutes".[22] Total occupational PA (OPA) per week was calculated as the sum of energy that each participant expended in moderate and vigorous intensity activities in occupational domain, and was expressed in total MET-minutes/week. Energy expended in moderate and vigorous occupational PA was calculated as the sum of energy expended in the corresponding intensity for the occupational domain. Total occupational PA was categorized separately for men and women as low (those who reported no moderate or vigorous activities at work, percentile < 50), moderate (those who reported moderate or vigorous activities at work and were classified between percentiles 50 to 74.99) and high (subjects between percentiles 75 to 100).

Type of labor was classified as sedentary labor, light/mobility or heavy according to the participant's reported occupation. Sufficient level of PA in leisure time (LTPA) and active transportation (AT) was defined as those subjects who engaged in ≥ 600 MET-minutes/week in the respective domains, according to the current "World Health Organization (WHO) guidelines for PA".[26]

Potential confounders

For the present analysis, we evaluated a comprehensive number of independent variables to determine their potential confounding role. We assessed 5 sociodemographic characteristics (age, sex, educational level, working hours and type of labor performed), 7 behavioral risk factors (smoking status, diet, alcohol consumption, sleeping hours per day, TV watching hours per day, LTPA and active transportation), obesity or overweight, major depressive episode (MDE), medical treatment for hypertension, diabetes and/or dyslipidemia. Overweight and obesity, were excluded as covariates when the dependent variable was BMI.

“Educational level was defined as primary school or lower, middle/high school or university according to the highest level reported. Hypertension was defined as a mean systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥ 90 mmHg, and/or self-reports of current use of antihypertensive medications. Body mass index was calculated as body weight divided by the square of height (kg/m^2), and WHO guidelines definitions for overweight (25.0-29.9 kg/m^2) and obesity (≥ 30.0 kg/m^2) were used. Dyslipidemia was defined as total cholesterol ≥240 mg/dL and/or LDL cholesterol ≥160 mg/dL and/or HDL-cholesterol <40 mg/dL and/or triglyceride ≥200 mg/dL and/or use of lipid-lowering medication. Diabetes was defined as fasting glucose ≥126 mg/dl or self-reported history of diabetes”.[25]. Medication for hypertension, diabetes and dyslipidemia was defined as receiving any drug for lowering blood pressure, glucose or lipids, respectively. Alcohol consumption was expressed in grams of ethanol for 2000 kilocalories. “Mayor depressive episode was defined as ≥ 8 of the PHQ-9 score, based on the calibration of this instrument by our group”.[27] We used the “Dietary Approaches to Stop Hypertension (DASH) Score” (ranged from 8 to 40) to assesses the adherence to a healthy diet. The score considered 8 different components: high intake of fruits, vegetables, nuts and legumes, whole grains, low-fat dairy products and low intake of sodium, sweetened beverages and meats (red and processed).[28]

Statistical analyses

To examine the univariate associations among OPA categories with socio-demographic, lifestyle, and metabolic risk factors for CVD, we used χ^2 for categorical variables and non-parametric tests (Mann Whitney or Kruskal–Wallis, according to the number of groups) for continuous variables.

We used robust multivariable linear regression models to examine the associations between categories of OPA and the following dependent variables: plasma levels of Apo A1, Apo B, hs-CRP, total cholesterol (TC), HDL cholesterol, LDL cholesterol, TC/HDL ratio, LDL/HDL ratio, triglycerides, blood pressure and BMI.

All potential confounders were initially tested into bivariate analysis for each dependent variable using a p value ≤ 0.1 to determine the inclusion of a variable into the multivariate analysis. All analyses were stratified by women and men due to the different OPA pattern of each gender and the variable magnitude of association between PA and CVD demonstrated in other studies.[22, 29]

Statistical interactions were examined between OPA and overweight or obesity (categorical), age (as continuous), LTPA and active transportation PA by adding product terms to the multivariable models. “All tests were two sided. Statistical analyses were performed using STATA version 12.0 (Stata Corp., College Station, TX, USA)”[30].

Ethics

“The study protocol has been approved by IRBs in all participating institutes in Argentina, Chile, Uruguay and the US. All study participants provided written informed consent”[25].

Results

Characteristics of the study population

The baseline characteristics of the study population and physical activity features are respectively depicted in table 1 and 2. Overall, 1,868 (52.8%) men and 1,672 (47.2%) women were included in the present analysis, with a mean age of 50 and 49 years respectively.

There were noticeable differences in baseline characteristics by sex. Men, were slightly older, had lower education level, and worse risk factors profile as demonstrated by higher prevalence of overweigh or obesity, hypertension and dyslipidemia than women. Additionally, men presented lower DASH-style diet score, implying low adherence to healthy eating behaviors mostly at expenses of higher intake of sugar sweetened beverages, red meat, processed meat and lower intake of vegetables. Regarding lifestyles, men slept less hours per day, had higher prevalence of current smoking, and three-fold higher consumption of ethanol than women, but engaged in more LTPA. At work, men spent more hours per week, more energy in both moderate and vigorous intensity activities (median of energy expenditure: 8640 METs/minutes/week) and performed in similar proportions sedentary, light/ mobility and heavy labors.

Women had better risk factors profile since showed lower prevalence cardiometabolic risk factors, although presented significant higher prevalence of major depressive episode. They showed higher adherence to healthier behaviors reflected in the higher DASH-style diet score, lower prevalence of current smoking, lower ethanol consumption. Additionally, women slept more hours per day and engaged in more active transportation than men. At work, women spent less hours per week and less energy (median of energy expenditure: 5040 METs/minutes/week) in moderate intensity activities and in light or mobility labors.

Characteristics of the study population according to categories of occupational physical activity

When analyzed the characteristics of the study population by categories of OPA, we observed that men in the highest category of OPA had lower proportion of university education (10.9 vs. 26.9%; $p < 0.001$), overweight or obesity (75.5 vs. 82.9%; p 0.001), and dyslipidemia (64.2 vs. 71.4%; $p < 0.010$) while showed higher prevalence of heavy labor (58.9 vs. 19.0 %; $p < 0.001$) and active transportation (62.5 vs. 51.9%; p 0.001) compared to those who engaged in lower levels of OPA.

Women in the highest category of OPA had also lower proportion of university education (20.4% vs. 29.5%; p=0.008), higher prevalence of major depressive episode (16.9% vs. 11.5%; p=0.003), spent more time at work (≥ 35 hours/week 62.2% vs. 52.5%; p=0.005) and slept less hours per day (7.4 vs. 7.7 hours/day; p=0.021) compared to women engaged in lower levels of OPA.

Nutritional variables varied among men but no statistical differences were seen in women. Men in the highest category of OPA, had a lower mean diet DASH score (21.4 vs 22.5; p=0.002), mostly at expenses of higher sugar sweetened beverages consumption (360.1 vs 230.6 mL/2000 Kcal; p=0.015) and higher red meat consumption (95.7 vs. 83.2 g/2000 Kcal; p=0,046).

Table 3 describes the mean biomarkers and clinical values by categories of occupational physical activity and stratified by sex. Compared to those in the lowest category of OPA, men in the highest category had higher HDL plasma levels (mean adj. diff. = 2.24 mg/dL; p=0.004), lower plasma levels of triglycerides (mean adj. diff. = −24.59 mg/dL; p=0.006) and TC/HDL ratio values (mean adj. diff. = −0.21; p=0.015), while men with moderate category of OPA had lower BMI (mean adj. diff. = −0.80 kg/m^2; p=0.012). Moderate and high OPA was associated with higher plasma levels of HDL compared with those in the lowest category (mean adj. diff. = 1.89 mg/dL; p=0.012 and 2.24 mg/dL; p=0.004, respectively). Women in the highest category of OPA had higher HDL plasma levels (mean adj. diff. = 2.85 mg/dL; p=0.006), lower TC/HDL and LDL/HDL ratio values (mean adj. diff. = −0.27; p=0.001 and −0.18; p=0.003, respectively) compared to reference, with no other significant variation among the biomarkers and clinical variables.

Discussion

This is the first study that evaluated the association between OPA and cardiovascular risk factors in a representative sample of the adult population of four mid-sized cities from Argentina, Chile and Uruguay, taking into account a large array of potential confounders.

We found that men and women who performed high levels of OPA did not exhibit a worse cardiovascular risk profile, and an improvement on selected biomarkers was observed compared to those performing sedentary activities.

These results are robust given that important confounders for BMI, lipoproteins and blood pressure (dependent variables) such us diet, medical treatments, LTPA and active transportation, which is highly prevalent in this region, were taken into account in the analyses[20].

The improvements in cardiovascular risk profile were more pronounced in men. One possible explanation for this finding is that men expended more energy than women in both moderate and vigorous intensity activities and performed more mobility and heavy labors. It is important to note that heavy labor (31% of the workers) it's not a synonymous of heavy lifting activities, since PA categories included a wide array of occupational type of activities.

A large array of published studies that investigated the effect of OPA on incident CVD reported diverse results. Some showed that high levels of OPA had no effect[3] on CVD risk, others beneficial effect [4-7] and others detrimental effect[8-10]. The latest studies published on this topic found only increased CVD risk in those performing high level of OPA and low LTPA[8, 10] or that have low level of fitness[11-14].

These varieties of results could be attributed to several reasons: I) Heterogeneity of the exposure variable (OPA). Some studies used simple questions for assessing the type of activity (sitting, walking, heavy lifting-, climbing stairs, manual work)[4, 8] not accounting for the total amount of PA (frequency and duration), some used broader occupational categories as proxy of occupational PA (manual, professional, blue collar)[10, 31], others expressed in METs the total amount of physical activity in the occupational domain[3, 32] (absolute measure) without considering the type of activity and two studies used relative measures constructed with fitness level (relative aerobic workload: RAS)[13, 14]. II) The covariates used for adjustment among studies were very diverse and most of them did not included important potential confounders associated with increased CVD risk, such as dietary habits, working hours[15], stress, work environment[33], nor depression[16-18], therefore the residual confusion effect could not have been completely excluded and could affect the estimations made.

III) More than half of the studies with positive results (OPA increased CVD risk) did not include women[8, 10-14].

Several published data showed the benefits of engaging in certain activities performed at work. A landmark study published in 1953 by Morris et al. found that the more active bus conductors and postman (those who go up or down stairs or walk) had lower coronary heart disease risk compared to those more inactive (sedentary activities).[34, 35] More currently, two studies clearly described that only lifting activities increased CVD risk whereas aerobic activities reduced it[19, 34].

The type of physical activity performed at work matters since it is well known that aerobic activities reduces blood pressure, cholesterol, triglycerides, glycosylated hemoglobin[35] whereas heavy lifting activities produce an acute cardiovascular strain[36].

After the abundant evidence published in relation to the benefits provided by physical activity on health[35], it is complex to hypostatize that expending energy in aerobic or mobility activities at work increases CVD risk compared to sedentary activities. A person who delivers food on bicycle, a postman, a garbage collector or a person who performs heavy lifting activities will report similar energy expenditure at work; therefore, discriminating the type of physical activity performed at work is essential to understand whether the increment of CVD risk is attributed to the activity itself or to the residual and unmeasured confounding effect. To analyze the total OPA without taking into account the type of OPA might lead us to wrong conclusions.

This study has several strengths. The sampling method and the response rate (73.4%) reduced the possibility of selection bias; therefore the results represent the characteristics of the working population of 4 cities of the Southern Cone. The assessment of physical activity was conducted by trained interviewers which improve the description of occupational physical activity patterns and reduce the potential recall bias.[22] Finally, this is the first study that provides data on several behavioral risk factors such as the level of adherence to the DASH Score, ethanol consumption, sleep hours, and TV watching time in the working population of the Southern Cone.

"Some limitations of the present study must be underscored. First, although validation studies in Latin America[37] suggested that the IPAQ had acceptable validity and reliability in comparison with accelerometers, responses to the IPAQ tend to overestimate occupation. In this context, the lack of validation of self-report using activity monitors is a major limitation of the current study. Nevertheless, this questionnaire is the most frequent tool used for assessing PA at population level because it is intended to quantify PA behaviors over a longer duration of time and thus incorporates elements of psychosocial and environmental context.[38] Second, METs are not an equivalent of fitness; thus, a moderate intensity PA based on MET may actually be vigorous for some people".[22] Third, we did not assess type of OPA, we only define type of labor according to the participant's reported occupation. Fourth, we only analyzed an absolute measure of OPA (total MET/min/week in occupational). Relative measures (fitness level) better discriminate persons who spend high levels of energy in occupation at higher risk.[13, 14] Fifth, this is a cross-sectional analysis between OPA and mediators' variables (risk factors), therefore we are not able to determine causal relationships with incident CVD events.

There is a need to discriminate the type of activity in occupational since isometric vs. dynamic movements have demonstrated different impact on CVD risk. The addition of simple questions regarding different types of activities performed in occupational is vital to answer this research question, since longitudinal studies conducted in developing populations are not able to assess fitness data due to the high cost.

Future public health campaigns and programs for CVD prevention in the Southern Cone should distinguish between occupational or leisure time physical activity. The prevention strategies for the working populations should take into account the type PA performed at work since the assessment of fitness status is too expensive for many developing countries. To provide education in the less educated working population about the importance of adhering to healthier diets and engaging in moderate intensity LTPA should be a priority to combat the significant burden of disease that crosses the region.

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Table 1. General characteristics of the study population by category of occupational physical activity

Characteristics	Men (n=1868)					Women (n=1672)					
	Overall	Low (n=873)	Moderate (n=528)	High (n=467)	p[1]	Overall	Low (n=1019)	Moderate (n=376)	High (n=277)	p[1]	p[2]
Population, %	52.8%	46.7%	28.3%	25.0%		47.2%	60.9%	22.5%	16.6%		
Age, years (SD)	50.0 (8.6)	50.2 (8.8)	50.5 (8.3)	49.0 (8.5)	**0.012**	49.0 (7.9)	48.9 (7.9)	49.5 (8.1)	48.8 (7.8)	0.337	**0.001**
Educational level, %											
Primary school or lower	37.7	29.9	37.1	53.0		32.2	30.1	36.0	34.6		
Middle or high school	41.1	43.2	42.2	36.1		41.2	40.3	40.8	45.1		
University	21.2	29.9	20.6	10.9	**<0.001**	26.6	29.5	23.2	20.4	**0.008**	**<0.001**
Risk Factors, %											
Current smoker	34.6	34.6	32.6	38.8	0.371	29.9	29.0	31.4	31.4	0.567	**0.003**
Overweight/obesity	79.2	82.9	76.3	75.5	**0.001**	68.7	68.0	69.2	70.4	0.723	**<0.001**
Diabetes	8.7	10.0	8.1	6.8	0.124	8.6	8.7	7.3	10.2	0.419	0.946
Hypertension	42.6	43.5	41.9	41.8	0.764	30.6	29.6	30.4	34.3	0.321	**<0.001**
Dyslipidemia	67.9	71.4	65.3	64.2	**0.010**	44.6	44.8	46.6	40.9	0.336	**<0.001**
Major depressive episode, %	6.7	6.1	7.1	7.5	0.566	13.8	11.5	17.8	16.9	**0.003**	**<0.001**
Work hours (≥ 35 hours/week), %	78.8	78.8	77.2	80.5	0.450	53.7	52.2	51.1	62.5	**0.005**	**<0.001**
Sleeping hours (hours/day), mean	7.4	7.4	7.5	7.4	0.748	7.6	7.7	7.6	7.4	**0.021**	**<0.001**
TV watching ≥ 2 hours/day, %	71.5	70.5	74.2	70.1	0.313	69.7	70.3	66.8	71.5	0.390	0.294
DASH-style diet adherence score, mean	22.0	22.5	21.7	21.4	**0.002**	24.1	24.1	24.2	24.1	0.989	**<0.001**
Sugar sweetened beverages (mL/2000 Kcal), median	273.5	230.6	274.9	360.1	**0.015**	245.3	271.6	217.9	227.1	0.169	**0.030**
Fruits (g/2000 Kcal),	88.9	93.1	73.8	94.3	**0.021**	126.2	126.1	135.7	121.9	0.170	0.354

median											
Vegetables (g/2000 Kcal), median	141.6	153.4	138.6	148.8	0.318	198.3	199.3	199.6	193.1	0.469	**<0.001**
Red meat (g/2000 Kcal), median	87.7	83.2	91.3	95.7	**0.046**	77.4	77.6	73.1	79.3	0.606	**<0.001**
Processed meat, median	19.7	20.4	18.9	18.2	0.622	14.9	14.7	15.1	15.5	0.646	**<0.001**
Ethanol consumption, g/2000 Kcal, mean	9.0	9.1	8.6	9.2	0.849	2.8	2.9	2.7	2.7	0.872	**<0.001**
Energy (Kilocalories per day), mean	2102	2053	2171	2112	0.131	1832	1802	1814	1963	**0.037**	**<0.001**

Current smoker: currently smoking at the time of the interview and has smoked 100 cigarettes in his or her lifetime; Overweight: body-mass index ≥25 and b30 kg/m2; obesity: body-mass index ≥30 kg/m2; diabetes: fasting glucose ≥126mg/dL or self-reported history of diabetes; hypertension: systolic blood pressure ≥140 mm Hg and/or diastolic blood pressure ≥90 mm Hg and/or use of antihypertensive medication; dyslipidemia: total cholesterol ≥240mg/dL and/or LDL-cholesterol ≥160mg/dL and/or HDL-cholesterol ≤40mg/dL and/or triglyceride ≥200mg/dL and/or use of lipid-lowering medication; Major depressive episode: Score ≥ 8 of the PHQ-9 score. DASH-style diet adherence score range: 0 -40. p^1: Comparison between each OPA groups. Kruskal–Wallis test for continuous variables and Chi^2 for categorical variables. p^2: Overall comparison men and women. Mann Whitney test for continuous variables and Chi^2 for categorical variables.

Table 2. Physical activity features of the study population by category of occupational physical activity

Features	Men (n=1868)					Women (n=1672)					
	Overall	Low (n=873)	Moderate (n=528)	High (n=467)	p[1]	Overall	Low (n=1019)	Moderate (n=376)	High (n=277)	p[1]	p[2]
Energy spent in occupational, METs/minutes/week											
Total per week, median	1440	0	3600	8640	**<0.001**	0	0	3360	5040	**<0.001**	**<0.001**
Vigorous intensity, median	0	0	0	8640	**<0.001**	0	0	0	0	**<0.001**	**<0.001**
Moderate intensity, median	0	0	3600	0	**<0.001**	0	0	3360	4320	**<0.001**	0.988
Participation in leisure time PA											
Prevalence, %	29.6	30.0	31.4	26.6	0.222	21.8	20.0	26.9	21.3	**0.022**	**<0.001**
≥ 600 METs/min/week in leisure, %	23.5	24.2	24.1	21.6	0.544	16.2	14.8	20.5	15.5	**0.037**	**<0.001**
Active transportation											
Prevalence, %	55.6	51.9	55.5	62.5	**0.001**	66.5	66.2	70.2	62.5	0.111	**<0.001**
≥ 600 METs in active transportation, %	39.9	35.6	39.2	48.8	**<0.001**	44.8	46.4	42.0	42.6	0.247	**0.003**
Type of labor											
Sedentary, %	33.1	47.3	25.6	15.3		26.3	31.8	20.1	14.6		
Light/ mobility, %	35.5	33.7	47.1	25.8		70.7	65.9	76.7	79.8		
Heavy, %	31.4	19.0	27.3	58.9	**<0.001**	3.0	2.3	3.2	5.5	**<0.001**	**<0.001**

OPA categories: Low (no moderate or vigorous activities at work; (percentile < 50); moderate (those who reported moderate or vigorous activities at work and were classified between percentiles 50 to 74.99) and high (subjects between percentiles 75 to 100). Energy spent in occupational: median of the total METs/min/week in occupational. Vigorous intensity: median of the total METs/min/week spent in vigorous activities in occupational. Moderate intensity: median of the total METs/min/week spent in moderate activities in occupational. p[1]: Comparison between each OPA groups. Kruskal–Wallis test for continuous variables and Chi[2] for categorical variables. p^2: Overall comparison men and women. Mann Whitney test for continuous variables and Chi^2 for categorical variables.

Table 3. Mean biomarkers and clinical values by categories of occupational physical activity

	Men					Women				
Dependent variables	**Low**	**Moderate**	**High**	**p_1**	**p_2**	**Low**	**Moderate**	**High**	**p_1**	**p_2**
BMI (kg/m²), mean	**28.9**	**28.1**	**28.3**	0.005	0.003	**28.4**	**28.7**	**28.2**	0.687	0.930
Mean adjusted diff.	Ref.	-0.80	-0.58	**0.012**	0.120	Ref.	0.18	-0.10	0.658	0.839
SBP (mmHg), mean	**129.7**	**128.1**	**128.7**	0.581	0.407	**122.1**	**122.6**	**123.0**	0.951	0.352
Mean adjusted diff.	Ref.	-1.23	0.43	0.224	0.698	Ref.	0.30	1.71	0.781	0.192
DBP(mmHg), mean	**85.0**	**84.7**	**84.3**	0.554	0.650	**79.6**	**80.3**	**80.9**	0.197	0.044
Mean adjusted diff.	Ref.	0.44	0.20	0.522	0.781	Ref.	1.06	1.33	0.089	0.093
Glucose (mg/dL), mean	**100.2**	**97.0**	**98.5**	0.108	0.977	**92.7**	**92.9**	**91.7**	0.685	0.016
Mean adjusted diff.	Ref.	-2.01	-1.53	0.179	0.348	Ref.	0.70	-0.20	0.619	0.910
Total Cholesterol (mg/dL), mean	**203.8**	**203.4**	**204.0**	0.713	0.795	**202.2**	**203.5**	**201.5**	0.665	0.821
Mean adjusted diff.	Ref.	1.15	2.35	0.672	0.426	Ref.	-0.36	-1.07	0.898	0.732
LDL (mg/dL), mean[a]	**128.1**	**129.4**	**130.5**	0.886	0.874	**126.7**	**127.0**	**126.5**	0.796	0.916
Mean adjusted diff.	Ref.	1.98	4.69	0.387	0.069	Ref.	-1.51	-0.84	0.513	0.751
HDL(mg/dL), mean	**41.2**	**43.3**	**43.8**	0.007	0.000	**49.0**	**49.4**	**51.7**	0.864	0.022
Mean adjusted diff.	Ref.	1.89	2.24	**0.012**	**0.004**	Ref.	-0.55	2.85	0.539	**0.006**
TC/HDL ratio, mean	**5.2**	**5.0**	**4.9**	0.008	0.002	**4.2**	**4.3**	**4.1**	0.189	0.026
Mean adjusted diff.	Ref.	-0.15	-0.21	0.097	**0.015**	Ref.	0.07	-0.27	0.403	**0.001**

LDL/HDL ratio, mean	**3.2**	**3.1**	**3.1**	0.184	0.049	**2.7**	**2.7**	**2.5**	0.689	0.031
Mean adjusted diff.	Ref.	-0.51	-0.21	0.411	0.751	Ref.	-0.01	-0.18	0.826	**0.003**
Triglycerides(mg/dL), mean	**190.0**	**166.9**	**166.2**	0.026	0.001	**130.0**	**137.4**	**122.2**	0.831	0.132
Mean adjusted diff.	Ref.	-14.91	-24.59	0.106	**0.006**	Ref.	9.44	-11.58	0.260	0.086
Apo A(mg/L), mean[b]	**106.4**	**115.7**	**109.4**	0.047	0.360	**125.5**	**125.1**	**132.4**	0.685	0.099
Mean adjusted diff.	Ref.	8.97	2.47	0.108	0.405	Ref.	-0.40	7.57	0.919	0.088
Apo B(mg/L), mean[b]	**91.2**	**85.0**	**90.0**	0.132	0.928	**81.2**	**84.6**	**86.8**	0.262	0.369
Mean adjusted diff.	Ref.	-4.73	-0.77	0.196	0.854	Ref.	2.48	4.45	0.474	0.337
Hs-CRP(mg/L), mean[b]	**3.4**	**3.0**	**4.0**	0.658	0.249	**3.2**	**3.4**	**2.4**	0.937	0.376
Mean adjusted diff.	Ref.	-0.59	0.47	0.492	0.627	Ref.	0.22	-1.21	0.766	0.069

BMI: Body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; TC: total cholesterol; HDL: high-density lipoprotein; LDL: low-density lipoprotein. a: calculated for participants who fasted > 9 hr and triglyceride concentrations ≤400 mg/dL according to Friedwald's equation. b: Assessed in 539 participants. Robust multivariable linear models showing the mean adjusted difference (β coefficients) of the outcome variables. All models adjusted for age; educational level; overweight (BMI 25.0-29.9 kg/m^2) or obesity (BMI ≥ 30.0 kg/m^2); current smoking; alcohol consumption; DASH diet score; treatment for diabetes, hypertension or dyslipidemia, active transportation (≥600 METs/min/week) and leisure time physical activity (≥600 METs/min/week). BMI additionally adjusted for total daily energy intake in both men and women. p1: t-test comparing moderate vs. low occupational PA. p2: t-test comparing high vs. low occupational PA.