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Original Article

Factors associated with low physical activity: a cross-sectional study in workers of a Peruvian clinic

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ABSTRACT

Introduction: Low physical activity in workers is an occupational health problem that significantly increases the risk of developing chronic diseases, such as cardiovascular diseases, type 2 diabetes, hypertension, and obesity. This negatively impacts their physical well-being, productivity, and overall quality of life.

Methods: A cross-sectional study was used during the year 2019 to identify the factors associated with low physical activity in 131 health and administrative workers from a Peruvian clinic. Physical activity was evaluated with the instrument "International Physical Activity Questionnaire".

Results: The median age was 37.0 years, and 72.5% were women. The median BMI was 25.6 kg/m2, with overweight and obesity prevalences of 51.9% and 11.5%, respectively, and 13.7% presented low physical activity. The physical workload score was lower in workers with high physical activity (8.6, IQR: 6.9-13.0) compared to moderate physical activity (5.9, IQR: 3.6-9.0) and low physical activity (3.8, IQR: 3.0-4.8). The multivariate analysis showed that the physical workload score was the only variable significantly associated with physical activity.

Conclusion: Having a higher physical workload significantly decreases low physical activity in clinic workers. It is crucial that physical inactivity prevention programs at work encourage standing or walking meetings, ensure ergonomic sit-stand workstations, and allow breaks to break static posture.

Keywords: Health worker; Physical activity; Physical load at work; Risk factor; Peru

Introduction

Physical activity is an essential determinant of both physical and psychological health. Regular physical activity exerts beneficial effects on the onset and progression of various chronic diseases and well-being and has a positive effect on communities and societies. Unfortunately, over 60% of adults worldwide do not achieve the recommended physical activity.[1] Physical activity can be categorized in different ways. A widespread approach is classifying it according to the identifiable portions of daily life during which the activity occurs. The most straightforward categorization identifies physical activity while sleeping, at work, and leisure. A simple formula can be used to express the caloric contribution of each category to the total energy expenditure due.[2] The caloric contribution of each category to the total energy expenditure due to physical activity is above the basal metabolic rate. It does not include the effect of diet-induced thermogenesis (which is energy expenditure above the resting state metabolic rate). The energy expenditure from physical activity during sleep is small.[3] Leisure-time physical activity can be subdivided into categories such as sports, fitness, exercise, housework (e.g., gardening, cleaning, and home repair), and other activities.[2]

People who engage in light, moderate, or vigorous physical activity have a significantly lower risk of cardiovascular disease (CVD) mortality, regardless of their metabolic risk factors.[1] On the contrary, physical inactivity results in an increase in abdominal and visceral fat.[4] In addition, it has been associated with an increased risk of type 2 diabetes mellitus (DM2), the prevalence of which is highest in obese, overweight, and physically inactive people, and physical inactivity is independently associated with increased risk of each of these diseases.[5] Just as risk factors increase the probability of suffering from obesity,[6] there are also protective factors that reduce the risk of obesity. Among them, physical activity stands out.[4] However, it is essential to emphasize that the behavior of the epidemiological determinants of obesity is different according to age groups; for example, among adults, low physical activity (LPA) and sedentary jobs prevail, while among children and adolescents, eating habits are more important.[7]

LPA not only contributes to the appearance of obesity but is also part of metabolic risk factors, type 2 diabetes mellitus, and cardiovascular disease.[8] Physical activity is an important protective factor against obesity; however, it depends on the intensity of the activity and the obesity phenotypes the individual suffers.[9] There are obese who are metabolically healthy, while others are unhealthy; the latter are precisely those that debut with adverse events such as DM2 and CVD; and in these cases, moderate and intense physical activity can contribute to the increased risk of these outcomes, which can even be fatal.[10]

On the other hand, more is known about the working conditions that lead workers to refrain from engaging in physical activity outside of work. Among the most explored are psychosocial risks, lack of social support, and work stress associated with LPA.[11, 12] It is also evident that shift work, inflexible schedules, and work tension are associated with LPA.[13, 14] Recently, the influence of raising children has been observed as a high-risk factor for workers' free-time physical inactivity.[15]

Our study aimed to determine the prevalence of LPA and its associated factors in workers of a clinic in Peru during the year 2019. Our results will improve primary prevention strategies and risk control for diseases derived from LPA.

Methods

A cross-sectional study was used and evaluated workers from a Peruvian clinic in Lima, the capital of Peru. The workers performed a range of jobs, such as mental health, surgery, and administration. The totality of workers was enrolled in this study in April 2019. Male and female included clinical and administrative workers, between 18 and 65 years of age, with a minimum seniority of 12 months, and with either full-time or part-time jobs. We excluded eight workers (two workers with disabilities, two workers with shifts in irregular periods, three workers on vacation, and one pregnant worker). We estimated the statistical power of our analysis based on data from 131 workers. A logistic regression model was employed, assuming a 95% confidence level, a 45.1% prevalence of low physical activity, and an Odds Ratio of 0.52, derived from the association between the type of health worker activity and low physical activity, according to Fransson E., et al. [14] Additionally, we considered an R^2 coefficient of 0.4, and obtained a power of 82%. The power calculation was performed using the PASS software.

A form was used aimed at collecting demographic data (age and sex), anthropometric measurements (weight, height, and body mass index), type of work activity (assistance or administrative), work shift (day or night), number of jobs and estimated basal energy requirements of the job.

Weight and height measurements were made on an adult foot scale with a stadiometer (Seca 700, Hamburg, Germany) in the clinic. The instrument was calibrated two weeks before the execution of the study.

Basal energy expenditure was calculated with the online application developed by the Endocrinology and Clinical Nutrition Research Center of the University of Valladolid in Spain (https://calcdieta.ienva.org/gasto.php). To do this, preliminarily entered the data on the participant's sex, age (years), height (m), and weight (kg). Then, the category of physical activity (activities of daily living, household chores, physical activity/sports, or work), and the levels of activity (light work [office workers, professional], active work [light industry, construction], and very active work [diggers, laborers, lumberjack] were defined. Finally, each participant's recorded average time reported (expressed in hours and minutes) when executing the work activity. The final result was expressed in Kcal and was managed as a continuous numerical variable.

Physical activity in the general population was evaluated with the short version of the IPAQ (International Physical Activity Questionnaire). This instrument is the most widely used worldwide due to its proven validity and ease of application.[16] The questionnaire in its version designed for surveillance studies is made up of 8 items, which are aimed at collecting information on physical activities (moderate to vigorous), and inactivity (time spent sitting). We used the version of the IPAQ questionnaire approved by the Ministry of Health of Peru in its technical document that develops the thematic axis of Physical Activity.[17] The final score obtained defined three levels: high (>3000 METs), moderate (600-3000 METs), and low (<600 METs). See supplementary material 1.

Also applied the Physical Workload Questionnaire (PWQ) to assess unfavorable body or limb postures, such as bending, rotating, kneeling, or squatting, and handling heavy loads required during work. The PWQ was designed to identify physical workload factors that may interact with psychosocial factors in assessing tension, as expressed through musculoskeletal symptoms. Administration of the PWQ involves recording the average frequency of the occurrence of body positions or load handling during work activity. The questionnaire is validated and comprises 19 items describing these work situations.[18] The validation involved the evaluation of nurses, service and social workers, and managing directors, and determining the total compression force over the lower lumbar spine. In a biomechanical model, they estimated the compression force over L5-S1 due to different body postures. The PWQ has high test-retest reliability and adequate convergent and discriminant validity. This questionnaire allowed the evaluation of body postures by sections such as trunk (5 items), arms (3 items), legs (5 items), weight loaded with a straight trunk (3 items), and weight loaded with an inclined trunk (3 items). Each item was evaluated on a Likert scale (0: never, 1: rarely, 2: sometimes, 3: frequent, and 4: very frequent). The instrument included pictograms for each posture to facilitate its administration by the participants. The physical load score at work was obtained from weighted scores of the 19 items. See supplementary material 2.

The characteristics of the participants were presented descriptively, using relative frequencies, 95% confidence intervals, median, and interquartile range (IQR) for categorical and numerical variables, respectively. We compared the outcome (LPA) using Pearson's chi-square test, with a p-value less than 0.05 as a “statistically significant difference.” Identifying the factors associated with LPA was estimated in a generalized linear model, with calculation of Odds Ratio, 95% confidence interval, and p-value in a Poisson family and Log link. We selected the variables in the multivariate model according to the construction of a directed acyclic graph,[19] and on the theoretical bases that allow us to explain the occurrence of LPA. Statistical calculations were performed using the Stata v.17 program (StataCorp. LCC College Station, TX, USA).

The research had the approval of the Ethics Committee of the Alas Peruanas University and the authorization of the Clinic of Medical Specialties of Lima, Peru, with Registration

CEM031-2019/GG. The information generated (consent, completed questionnaires and forms, database, among others) was handled with strict confidentiality and access restricted to the research team. The electronic files were encrypted to guarantee the protection of the information.

Results

We evaluated 131 workers from a clinic in Lima, Peru, of whom 72.5% were women. The median age was 37 years. Weight and height had medians of 64.5 kg (IQR: 59.4-72.4) and 1.59 m (IQR: 1.54-1.65), respectively. The BMI had a median of 25.6 (IQR: 24.2-27.7), and 15 (11.5%) were overweight or obese. 83 (63.4%) of those evaluated were health workers and the remaining administrative ones. All evaluated workers reported having only one job. There was only one person with night work activity. Regarding the results of the PWQ, only 10 (7.7%) had physical workload classified as frequent and very frequent. On the other hand, 18 (13.7%) presented LPA (Table 1).

None of the independent variables was associated with PA in the participants, except for physical workload, whose score was lower in workers with high PA (8.6, IQR: 6.9-13.0) compared to moderate PA (5.9, IQR: 3.6-9.0) and low PA (3.8, IQR: 3.0-4.8) (Table 2).

Table 1: Descriptive characteristics of study participants (n=131)

Characteristic	N [%]	CI 95%
Sex		
Male	36 [27.5]	20.5-35.8
Female	95 [72.5]	64.2-79.5
Age (years) [a]	37 (29-42); mín.: 20, máx.: 62	
BMI categorized		
Normal weight	48 [36.6]	28.8-45.3
Overweight	68 [51.9]	43.3-60.4
Obesity	15 [11.5]	7.0-18.2
Type of work activity		
Assistance	83 [63.4]	54.7-71.2
Administrative	48 [36.6]	28.8-45.3
Workshift		
Day	130 [99.2]	94.7-99.9
Night	1 [0.8]	0.1-5.3
Physical workload Index	6.94 (4.32-10.74); mín.: 0.30, máx.: 26.55	
Physical Activity[b]		
High	59 [45.1]	36.7-53.7
Moderate	54 [41.2]	33.0-49.9
Low	18 [13.7]	8.8-20.8

CI 95%: confidence interval at 95%

Table 2: Factors associated with physical activity in workers in bivariate analysis

Independent variable	Physical activity, n (%)			p-value
	High [n=59]	Moderate [n=54]	Low [n=18]	
Sex				
Male	19 [52.8]	14 [38.9]	3 [8.3]	0.410 [a]
Female	40 [42.1]	40 [42.1]	15 [15.8]	
Age (years)	38.0 [31.0-42.0]	35.5 [29.0-42.0]	37.5 [31.0-42.0]	0.610 [b]
BMI (kg/m^2)	25.4 [23.8-27.5]	25.6 [24.7-27.1]	26.3 [23.4-28.1]	0.763 [b]
Daily energy expenditure (Kcal)	1413.9 [1328.6-1572.5]	1412.8 [1350.6-1350.2]	1572.5 [1536.2-1460.2]	0.479 [b]
Type of work activity				
Assistance	46 [55.4]	29 [34.9]	8 [9.6]	0.006 [a]
Administrative	13 [27.1]	25 [52.1]	10 [20.8]	

Independent variable	Physical activity, n (%)			p-value
	High [n=59]	Moderate [n=54]	Low [n=18]	
Workshift				
Day	58 [44.6]	54 [41.5]	18 [13.9]	0.541 [a]
Night	1 [100.0]	0 [0.0]	0 [0.0]	
Physical Workload Index	8.6 [6.9-13.0]	5.9 [3.6-9.0]	3.8 [3.0-4.8]	<0.001 [b]

[a] Pearson's Chi-square test; [b] Kruskal-Wallis non-parametric test

The multivariate analysis showed that the physical workload score was the only variable significantly associated with PA. We also calculated the marginal effects in the probit model and found that for every change in one unit of the Physical workload Index, there is a probability of an increase of 4.7% (0.047) in high physical activity, a decrease of 2.6% in Moderate physical activity, and a 2.1% decrease in low physical activity (Table 3).

Table 3: Factors associated with physical activity in workers in multivariate analysis.

Independent variable	Bivariate model [a]		Multivariate model [a]	
	Coef. [CI 95%]	p-value	Coef. [CI 95%]	p-value
Sex				
Male	Ref.	Ref.	Ref.	Ref.
Female	0.30 [-0.14 to 0.74]	0.185	0.44 [-0.44 to 0.92]	0.075
Age (years)	-0.01 [-0.03 to 0.02]	0.594	0.01 [-0.02 to 0.03]	0.633
BMI (kg/m^2)	0.01 [-0.05 to 0.07]	0.699	0.04 [-0.03 to 0.10]	0.246
Physical Workload Index	-0.11 [-0.15 to -0.07]	<0.001	-0.12 [-0.17 to -0.07]	<0.001
Moderate PA			0.44 [-1.46 to 2.33]	
Low PA			1.86 [-0.05 to 3.77]	

[a] Ordinal probit regression; CI95%: confidence interval at 95%

Discussion

Low physical activity (LPA) in workers is a latent concern due to its association with overweight, obesity, and chronic diseases such as cardiovascular diseases.[20] The factors that promote LPA at work can be very different, depending on the work activity and job position, as well as extra-work aspects. However, occupational factors are the most important to identify to implement workplace risk prevention and control strategies. We have found that physical workload is the only occupational factor that significantly influences (OR: 0.20, CI95: 0.06-0.62) LPA in workers in a health facility. Previous studies have found a linear relationship between the increase in occupational physical activity and physical fitness, mainly in young workers;[21] however, this relationship could be reversed with increasing age, and not necessarily be reflected in an improvement in functional or motor capacity.[22] In our study, age was not associated with physical activity in workers.

The physical workload generates changes at the physiological level in workers, mainly at the level of cardiorespiratory capacity. The maximum volume of oxygen (VO_2) or aerobic capacity varies according to work activity. However, it is necessary to consider the actual demands of physical work and the differences attributed to the sex of the workers.[23] Our study revealed a low physical workload score, as evidenced by the high frequency of responses indicating "never" and "rarely" for this variable. This finding is worrisome because we have found a high rate of overweight and obesity, the confluence of which can be associated with cardiovascular diseases.[24]

Physical activity at work does not generate the same effects as general physical activity because the former lacks programming and recovery time, and this aspect can affect the cardiovascular health of the worker, mainly when there is excess physical activity at work.[25] Our study shows that 45.1% of the participants had high physical activity, but less than 8% had a frequent physical workload. Although the intense physical workload can cause musculoskeletal pain, it is also a paradox since workers with more physical activity in free time and a lower BMI register less pain intensity.[26] For this reason, it is important not to generalize the idea that the lower the physical load, the lower the risk. This idea can be harmful for workers whose activities are sedentary.[27] On the other hand, the excessive physical load at work can generate musculoskeletal disorders and different degrees of work disability,[28] the risk of which has been reduced in workers who switched to occupations with less physical load.[29]

Low physical activity is linked to sedentary work. It is the cause of many chronic metabolic diseases and musculoskeletal disorders,[30] that are not identified promptly in occupational evaluations. In this sense, employers must guarantee the implementation of programs aimed at improving physical activity.[31] The identification and implementation of these programs must be based on consistent scientific evidence and with successful results,[32-34] not to invest unnecessary time and resources that do not fulfill their objective. These actions are critical to guarantee a safe and healthy work environment, which, in 2022, ILO defined as a fundamental principle and right at work.[35]

In Peru, the Occupational Health and Safety Law,[36] defines the employer's responsibilities, among them the creation of occupational health and safety services. These services have multiple functions, among which the health surveillance of workers and the development of risk prevention and control programs at work stand out. However, the regulations on occupational surveillance have yet to be approved by the Ministry of Health, and there are no guides to help implement programs focused on reducing and controlling sedentary lifestyles. On the other hand, the level of implementation of occupational health and safety management systems in the health sector needs to be improved, especially at the local and regional level, compared to central government entities.[37]

Various studies have reported the usefulness of different strategies to promote physical activity in the workplace. These include active travel, information on physical activity outside the workplace, facilities and opportunities, sedentary behavior, and information on physical activity within the workplace.[38] On the other hand, these strategies must accompany healthy nutrition programs aimed at reducing overweight and obesity,[39] and considering their adaptation according to work activity and number of workers.[40]

Implementing strategies for the control and prevention of a sedentary lifestyle and the promotion of physical activity at work could be effective to the extent that they are auditable by the responsible national authority. In Peru, it is essential that the National Council for Safety and Health at Work,[41] within the framework of its functions and the ratification of conventions 155 and 187 with the International Labor Organization, promotes the safety and health of workers. On the other hand, it is also critical that the regulations that define the implementation of occupational health and safety services be prepared and approved in compliance with Convention 161, a pending task in Peru.

Considering that there are no official guidelines to promote physical activity in Peru, it is vital to consider the recommendations of leading global institutions such as the National Institute for Occupational Safety and Health of the United States. NIOSH proposes implementing a Total Worker Health (TWH) approach, which includes policies, programs, and practices that integrate protection against work-related safety and health risks with the promotion of injury prevention efforts and diseases to improve employee well-being. This approach prioritizes the flexibility of having meetings standing or walking, ensuring ergonomic sit-stand workstations, and allowing breaks to break static posture if a job involves standing for a long time.[42] On the other hand, the worker must know about the negative impact of sedentary behaviors on their health. In order to achieve an effective change in the worker's lifestyle, it is important to consider age since risk and risk perceptions often change throughout life. Consequently, interventions must adjust according to the characteristics of each worker.[43] Therefore, we consider that these strategies can promote health, healthy jobs, and health-related quality of life.[44]

Although our findings focus on a group of health and administrative workers in a clinic, it is vital to assess our results, which suggest that the physical load at work is associated with LPA in workers. Above all, in a context where the COVID-19 pandemic and lifestyles have become more sedentary, employers must promptly identify the risks associated with LPA to take preventive and corrective actions.

The study's main limitations were the non-measurement of variables such as psychosocial conditions at work and general state of health, which could explain the LPA in workers. However, the workplace is a determining factor in the physical activity of every individual in such a way that we prioritize the measurement of the physical workload, a characteristic that few investigations include in their evaluation. The calculator used to estimate basal energy expenditure does not include job types in healthcare workers, so a limited classification for the final calculation could occur. On the other hand, the PWQ was validated in people with anthropometric characteristics different from Latin Americans, so there could be a risk of selection bias. It would have been interesting to use waist accelerometers to estimate physical activity at work in real-time [45] and reaching more consistent conclusions.

Conclusions

According to our results, monitoring workers with LPA and physical workload is crucial, considering they are at high risk of chronic diseases such as obesity, cardiovascular problems,[24] and even health disorders such as burnout syndrome [46]. We recommend implementing physical activity programs to improve physical fitness associated with health and reduce sedentary lifestyles in the workplace.[47, 48]

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Supplementary Material 1: IPAQ Questionnaire - Physical Activity Assessment

1. During the past 7 days, on how many days did you do vigorous physical activity such as heavy lifting, digging, aerobics, or fast bicycling?
   - Days per week (indicate number)
   - No vigorous physical activity (go to question 3)
2. How much total time did you usually spend in vigorous physical activity on one of those days?
   - Indicate how many hours per day
   - Indicate how many minutes per day
   - Don't know/not sure
3. During the last 7 days, on how many days did you do moderate physical activities such as carrying light weights or riding a bicycle at a regular speed? Do not include walking
   - Days per week (indicate the number)
   - No moderate physical activity (go to question 5)
4. Typically, how much total time did you spend in moderate physical activity on one of those days?
   - Indicate how many hours per day
   - Indicate how many minutes per day
   - Don't know/not sure
5. During the past 7 days, on how many days did you walk for at least 10 minutes at a time?
   - Days per week (indicate number)
   - No walking (go to question 7)
6. How much total time did you usually spend walking on one of those days?
   - Indicate how many hours per day
   - Indicate how many minutes per day
   - Don't know/not sure
7. During the last 7 days, how much time did you spend sitting during a business day?
   - Indicate how many hours per day
   - Indicate how many minutes per day
   - Don't know/not sure

Test value:

1. Walks: 3.3 METs x walking minutes x days per week (Ex. 3.3 x 30 minutes x 5 days = 495 METs)
2. Moderate Physical Activity: 4 MET* X minutes x days per week
3. Vigorous Physical Activity: 8 MET* X minutes x days per week

Next, add the three values obtained:

Total = walking + moderate physical activity + vigorous physical activity

*** Unit of test measure**

Classification criteria:

Moderate Physical Activity:

1. 3 or more days of vigorous physical activity for at least 20 minutes per day.
2. 5 or more days of moderate physical activity and/or walking at least 30 minutes per day.
3. 5 or more days of any combination of walking, moderate or vigorous physical activity achieving at least a total of 600 METs*.

Vigorous Physical Activity:

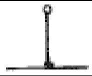
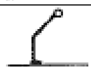
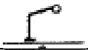
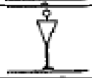
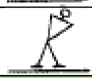
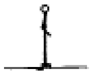
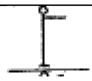
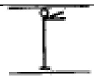
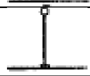
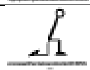
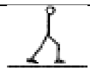
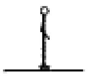
1. Vigorous Physical Activity at least 3 days per week achieving a total of at least 1500 METs*.
2. 7 days of any combination of walking, moderate physical activity, and/or vigorous physical activity, achieving a total of at least 3,000 METs*.

Results

Physical activity level	
High level (0)	>3000 MET
Moderate level (1)	600-3000 MET
Low level (2)	**<600 MET**

Supplementary material 2: questionnaire for the evaluation of physical load at work

Please indicate with a cross (X) the frequency when performing the body postures shown and how much weight you carry in your work. Complete all the lines

Trunk	Code	Motion	Never (0)	Rarely (1)	Sometimes (2)	Frequently (3)	Very frequently (4)
	T1	Straight					
	T2	Slightly Inclined					
	T3	Very inclined					
	T4	Distorted					
	T5	Laterally bent					
Arms	**Code**	**Motion**	**Never (0)**	**Rarely (1)**	**Sometimes (2)**	**Frequently (3)**	**Very frequently (4)**
	B1	Both arms below shoulder height					
	B2	One arm above shoulder height					
	B3	Both arms above shoulder height					
Legs	**Code**	**Motion**	**Never (0)**	**Rarely (1)**	**Sometimes (2)**	**Frequently (3)**	**Very frequently (4)**
	P1	Sitting					
	P2	Stopped					
	P3	Squatting					
	P4	Kneeling with one knee or both.					
	P5	Walking or moving					
Weight loaded with straight trunk	**Code**	**Motion**	**Never (0)**	**Rarely (1)**	**Sometimes (2)**	**Frequently (3)**	**Very frequently (4)**
	WR1	Light (up to 10 kg)					
	WR2	Medium (between 10-20 kg)					
	WR3	Heavy (more than 20 kg)					

Weight loaded with inclined trunk	Code	Motion	Never (0)	Rarely (1)	Sometimes (2)	Frequently (3)	Very frequently (4)
	WI1	Light (up to 10 kg)					
	WI2	Medium (between 10-20 kg)					
	WI3	Heavy (more than 20 kg)					

Index of physical load at work = 0.974xT2 + 1.104xT3 + 0.068xT4 + 0.173xT5 + 0.157xB2 + 0.314xB3 + 0.405xP3 + 0.152xP4 + 0.152xP5 + 0.549xWR1 + 1.098xWR2 + 1.647xWR3 + 1.777xWI1 + 2.416xWI2 + 3.056xWI3