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Associations between Sitting Time and Musculoskeletal Pain in Different Body Regions among Workers According to Blue and White Collars

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Abstract

Objectives: To investigate the association between sitting time (daily total, and occupational and leisure-time periods) and musculoskeletal pain in different body regions among workers by blue-collar and white.

Methods: The sample comprised 205 workers. Musculoskeletal pain and related symptoms was assessed with the Nordic Questionnaire of Osteoarticular Symptoms, and the sitting time was assessed with IPAQ – Short Version. The association of sitting time and musculoskeletal pain and related symptoms was analyzed with logistic regression, adjusted for BMI, age, gender and Moderate to Vigorous Physical activity.

Results: The white collars participants had lower level of moderate to vigorous Physical Activity than Blue collars. The participants were more likely to have less musculoskeletal pain and related symptoms in the ankles/feets with higher sitting time (odds ratio [OR] = 0.995, p = .032).

Conclusion: Sitting time is negatively associated with musculoskeletal pain in the ankles/feets intensity only among white collars workers. Future studies using a prospective design with objective measures of sitting time are recommended. Our results emphasize the need of worksite interventions to prevent musculoskeletal pain and related symptoms.

Keywords: Physical Activity; Musculoskeletal Pain; Workers; Blue and White Collars; Sitting Time

Introduction

The hazards of a sedentary lifestyle are widely acknowledged. Recently, sedentary behaviour has been emerging as potential health risk behaviour for premature mortality and chronic health conditions such as cardiovascular disease and diabetes mellitus, even when physical activity is taken into account [1]. Sedentary behaviour is defined as activities that are done sitting or reclining and cost ≤1.5 times the basal metabolic rate [2].

Workplace health promotion (WHP) focuses on factors that influence the health and productivity of workers [3]. Adults generally spend as much as 6-8 hours per day or more than 45–50% of their waking hours in a sitting position [4]. Previous research has indicated that prolonged sitting may be a risk factor for developing MSD [5].

In a cross-sectional study, some authors observed a significant association between self-reported occupational sitting time (i.e. for more than 3 hours) and increased severity of Musculoskeletal disorders (MSD`s) [6]. One reason for these contrasting results may be that most studies have utilized self-reported measurements of sitting time [7].

MSD`s rates are high among employed adults and have shown a consistent increase over the past few decade [8,9]. An Osteoarticular disorder has also been shown to increase the risk of sick leave and early retirement, causing high socioeconomic costs [10]. It is also known that work-related musculoskeletal disorders are a major cause of disability in working age individuals [11]. Several studies have shown that repetitive work can contribute significantly to the increase of musculoskeletal disorders in workers and to absenteeism [9,11,12].

Workplace health programs have demonstrated improvements in the leading global risk factors for chronic disease, which has led to their increasing role in chronic disease prevention [13]. Indeed, in the last 20 years, the number of health promotion programs in workplace settings has continued to grow [14]. This growth can be attributed to the increased awareness of the advantages of having quality health promotion programs available for employees [14]. Companies believe that these programs can reduce employee health care and disability costs; staff renewal rate; aid in recruiting new workers; enhance the company image; and improve employee productivity [15]. Skilled employees who are well compensated, have pleasant work environments, and enjoy their work can still have low productivity when they are absent from work because of poor health [15].

In 2003, a comprehensive study focusing on the economic return of WHP concluded that workplace programs achieve a 25-30% reduction in medical and absenteeism costs in an average period of about 3.6 years [15].

According to recent studies, blue-collar workers such as assemblers and drivers spent as much as 50 % of the working hours being sedentary. Accordingly, these workers also have a higher prevalence of all-cause mortality and chronic diseases such as ischemic heart diseases compared to white-collar workers.

In this context, effective, well-documented initiatives for reducing weight, improving physical capacity, and reducing musculoskeletal pain among workers are, therefore, needed [9,11,12].

The aim of this study was to verify the association between objectively measured sitting time (daily total, and occupational and leisure-time periods) and musculoskeletal pain in different body regions among workers: blue-collar and white.

Materials and Methods

Study Design and Sampling

The present study derives from a research project on Physical Activity at the workplace, which is aimed to decrease physical disability, indicated by musculoskeletal pain and related symptoms, increase work ability, and decrease sickness absence among workers with high physical work demands.

The intervention study was conducted between November 2010 and September 2011, in a multinational manufacturing company with offices in Portugal. The 11 months of the study included preliminary evaluation, selection of the intervention group (TOI) and the control group (TOR), and executing the intervention program that lasted six months. Evaluations were performed at baseline and at the end of the intervention.

This study began by carrying out several introductory meetings regarding the project with the administration board, the medical department, the production department, the human resources department, and the workers. The total number of employees in the company is around 1000; however, only 220 were allowed by the administration board to participate in this study for the production flow to not be adversely affected. These employees are characterized by having repetitive work with moderate force demanding tasks and a large amount of standing. Moreover, all the participants were full-time workers (40h/week) and had been employed in the company for at least six months.

Thus, at the beginning of this intervention, 220 employees were invited (93 men; 128 women) to participate. From those, 212 agreed to participate (88 men; 124 women) in baseline evaluations.

Anthropometric Measures

Body height was measured to the nearest millimetre in bare or stocking feet with the participant standing upright against a stadiometer (Holtain Ltd., Crymmych, Pembrokeshire, UK). Weight was measured to the nearest 0.10 kg, lightly dressed using a portable electronic weight scale (Tanita Inner Scan BC 532, Tokyo, Japan). BMI was calculated from the ratio between body weight (kg) and body height (m2). Participants were categorized as non-overweight, overweight and obese, applying the cut-off points suggested by the World Health Organization [16].

Percentage of body fat (%BF) was measured using a bio impedance scale (Tanita Inner Scan BC 532, Tokyo, Japan), which was set to 'standard' while body frame and the participant's age, height and gender were entered. Waist circumference was measured twice, with a non-elastic metal anthropometric tape, midway between the lower rib margin and the iliac crest at the end of normal expiration [17]. The average of the two measures was used for analysis. If the two measurements differed by more than one cm, a third measurement was taken and the two closest measurements were averaged.

Blood Pressure

Blood pressure was measured in a seated position after 10 minutes of rest with an electronic blood pressure monitoring device (OSZ 5 Easy Welch Allyn) on the left arm. Three measurements were done one minute apart and an average calculated.

Socio-Demographic Variables

Participants answered a questionnaire that assessed several socio-demographic variables (age, marital status, etc.).

Physical Activity

Physical activity was assessed using the short version of the International Physical Activity Questionnaire (IPAQ) [18]. Validity and reliability data from 12 countries (including Portugal) show IPAQ has comparable validity and reliability to CSA (Computer Sciences and Applications) monitor that assess physical activity and to other self-reported measures of PA [19]. According to the Guidelines for data Processing and Analysis of the IPAQ, total PA was expressed as metabolic equivalent (MET) minutes/week by weighting the reported minutes per week in each activity category by the metabolic equivalent specific to each activity (Total PA = 3.3 MET x walking minutes x walking days + 4.0 MET x moderate-intensity activity minutes x moderate days + 8.0 MET x vigorous-intensity activity minutes x vigorous-intensity days). Physical activity was expressed as minutes per week by summing the time spent in moderate physical activity and vigorous physical activity (MVPA).

Musculoskeletal Disorders and Related Symptoms

Musculoskeletal pain and related symptoms was assessed by the standardized Nordic Questionnaires for the Analysis of Musculoskeletal Symptoms. (NMQ) [20], supplemented with questions about localized pain intensity. This questionnaire has been validated to the Portuguese population [21]. The NMQ consists of 27 binary choice questions (yes or no). The questionnaire has three questions correlating to nine anatomic regions (neck, shoulders, wrists/hands, lumbar region, dorsal region, hips/thighs, knees, and ankles/feet). The first is "had some troubles or pain in the last 12 months," the second is "in the last 12 months felt some limitation caused by work in the daily activities," and the third is "had some troubles or pain in the last 7 days." In the sense of facilitating the identification of the corporal areas, the questionnaire also includes a corporal diagram detaching all of the involved corporal areas [20]. The pain intensity in the "last 7 days," included the numeric pain scale (scale 0-10).

Results

Descriptive Characteristics of the Participants, by workplace position: blue or white collars are shown in Table 1.

	Total n=205	**Blue collar n=137**	**White collar n=68**	**P value**
Age	37.0 (12.0)	37.0 (13.0)	37,00 (9.0)	0.842
Weight	71.0 (17.30)	69.7 (17.7)	75.4 (19.97)	0.883
Height	1.65 (0.15)	1.6 (0.14)	1.7 (0.13)	<0.001
BMI	26.3 (6.09)	26.3 (6.45)	26.3 (5.34)	0.296
Weight status				
Non-overweight	72 (35.1)	48 (35.0)	24 (35.3)	0.971
Overweight/obese	133 (64.9)	89 (65.0)	44 (64.7)	
Sex				
Female	**122 (59.5)**	**97 (70.8)**	**25 (36.8)**	**<0.001**
Male	83 (40.5)	40 (29.2)	43 (63.2)	
Moderate to vigorous Physical activity, min/day	**360.0 (630.0)**	**480.0 (675.0)**	**180.0 (300.0)**	**<0.001**

Sitting time, min/day	150.0 (255.0)	**120.0 (120.0)**	**360.0 (352.50)**	**<0.001**
Pain, %yes				
Shoulder	**77 (37.6)**	**64 (46.7)**	**13 (19.1)**	**<0.001**
Elbow	**44 (21.5)**	**35.5 (25.5)**	**9 (13.2)**	**0.043**
Knee	54 (26.3)	35 (25.5)	19 (27.9)	0.714
Wrist/Hand	**80 (39.0)**	**64 (46.7)**	**16 (23.5)**	**0.001**
Ankle/feet	**55 (26.8)**	**43 (31.49**	**12 (17.6)**	**0.037**
Dorsal region	**34 (16.6)**	**30 (21.9)**	**4 (5.9)**	**0.004**
Lumbar region	**98 (47.8)**	**79 (57.7)**	**19 (27.7)**	**<0.001**
Thigh/Hip	46 (22.4)	34 (24.8)	12 (17.6)	0.247
Neck	**73 (35.6)**	**60 (43.8)**	**13 (19,1)**	**0.001**

Table 1: Descriptive Characteristics of the Participants, by workplace position: blue or white collars.

In this table we can see that employees denominated Blues collars report a level of moderate physical activity vigorous higher than employees white collars. The Blues collars report less time sitting compared with collaborators Blue collars. Overall the blue collars report higher prevalence of pain in various body regions assessed.

In Table 2 we can verify the participants were more likely to have less musculoskeletal pain and related symptoms in the ankles/feets with higher sitting time (odds ratio [OR] = 0.995, p = .032).

The results showed that the Blue Collars felt more musculoskeletal pain caused by lower sitting time at work in labour daily activities in the ankles/feets (odds ratio [OR] = 0.995, p = .032). If we compared the differences between the two groups we can verify that the white collars felt less musculoskeletal caused by sitting time.

	Blue Collars			**White Collars**		
	OR	**95% CI**	**P**	**OR**	**95% CI**	**P**
Shoulder	1.000	0.997-1.003	0.847	1.002	0.999-1.006	0.254
Elbow	1.000	0.997-1.003	0.949	0.998	0.994-1.002	0.411
Knee	1.001	0.998-1.004	0.544	0.997	0.994-1.004	0.054
Wrist/Hand	1.000	0.997-1.002	0.856	0.997	0.994-1.001	0.129
Ankle/feet	**1.000**	**0.997-1.003**	**0.094**	**0.995**	**0.991-0.999**	**0.032**
Dorsal region	1.000	0.997-1.004	0.761	0.993	0.984-1.002	0.131
Lumbar region	0.999	0.996-1.002	0.359	0.999	0.996-1.002	0.669
Thigh/Hip	1.001	0.998-1.004	0.692	0.998	0.994-1.002	0.305
Neck	0.999	0.996-1.001	0.359	1.002	0.998-1.005	0.362

Table 2: Results adjusted OR.

There did exist some results that should be examined, because there is a tendency to felt more musculoskeletal pain caused by lower sitting time at work in labour daily activities in some body regions, like Shoulder; Elbow; Wrist/Hand; Neck; Lumbar region; Dorsal region.

Discussion

This study assessed the associations between sitting time and musculoskeletal pain in different body regions among workers according to blue and white collars. When the physical work demands exceeds the safety margin of the individual physical capacities, this environment is generally considered to enhance the risk for physical deterioration and is revealed as musculoskeletal disorders, poor work ability, and sickness absence [4]. However, effective interventions for preventing physical deterioration in job groups at high risk still need to be established. This feature of the program enhances the probability for enabling evidence-based information for public health policy and health promotion strategies among employees in job groups (Blue and White Collars) with high risk for physical deterioration.

These results show us that it is extremely important to the categorization of workers in white and blue collars. This separation is important, in that the executions of the two categories are totally different task. They are different at various levels: with regard to the amount of time sitting, the task of routine breaks and the number and duration of breaks. The level of physical activity in the Blue Collars is higher due to the implementation of labour market activity and not properly organized physical activity, unlike the white collars that have a labour physical activity more sedentary (spend more time sitting in execution the work task) and the practice of physical activity organized within leisure.

Improving workers' daily physical activity may prevent weight gain and subsequently improve workers' health, increase productivity, and reduce absenteeism [22]. In this vein, a randomized, controlled trial included 16 school worksites (eight of intervention and eight of control). Intervention schools formed committees to develop and implement health promotion activities for employees. Anthropometric measures and PA self-report data were collected at baseline and at the end of the intervention (two years later). The primary outcome measure was physical activity. This participatory intervention resulted in a modest improvement in health status and possible unmeasured secondary gains, such as improved morale and increased productivity [23].

Upper extremity musculoskeletal disorders (UEMSDs) are painful conditions affecting soft tissues of the hands, arms, shoulders, and neck on the white collars workers. The prevalence of work related upper extremity musculoskeletal disorders reported in the United States has increased dramatically during the past two decades. In 1982, they accounted for 18% of all reported occupational illness in the USA; in 2002, they accounted for two thirds of all reported occupational illness in the US [24].

Work which included plenty of twisting movements of the trunk, working with the trunk forward flexed or the hands above shoulder level were important work-related risk factors. Musculoskeletal pain of a working-age population has many risk factors of which age, stress, and work-related physical loading seem to play an important role. By affecting the latter factors, it may be possible to decrease the prevalence of musculoskeletal symptoms and maintain a good ability to work. Due to high morbidity rates, the importance of preventive measures must be emphasized. When studying the associations between physical exercise and musculoskeletal pain among the working-age population, researchers should pay attention to the factors which are strongly related to pain, such as stress and work-related physical loading. More research with prospective design is needed in order to achieve more reliable information of the true effects of physical exercise on musculoskeletal health. The risk factors for musculoskeletal pain form a complex mesh, many factors of which (such as the amount of exercise practiced) are difficult to measure in epidemiological research [9,13].

The results presented here are also in agreement with those reported by Sethi, et al. [25], conducted among 301 workers with different jobs and shifts in an engineering plant, in which they found a significant association between high PA and a decrease in scores of musculoskeletal dis Sitting time is negatively associated with musculoskeletal pain in the ankles/feets intensity only among white collars workers.

Limitations of the Study

A limitation of the program is that only simple measures of process evaluation such as the proportion of workers in uptake, the actual start of the program, and the actual completion of the intervention program are collected. Moreover, no economical cost-effectiveness evaluations are included. Another limitation is that the intervention among factory workers is an exploratory study that is not well controlled.

Conclusion

The study population of the program (i.e., employees in job groups with high physical demands) is well documented to have a high risk for physical deterioration. The association between sitting time, assessed objectively for several days, and Low Back Pain (LBP) intensity indicates that sitting time is positively associated with LBP intensity among blue-collar workers. If proven effective, the specific tailored interventions to the different job groups can provide meaningful scientifically based information for public health policy and health promotion strategies for employees in these job groups at high risk for physical deterioration. In conclusion, sitting time is negatively associated with musculoskeletal pain in the ankles/feets intensity only among white collars workers. Future studies using prospective designs with larger sample sizes and objective measurements of sitting time are needed to confirm these findings. Our results emphasize the need of worksite interventions to prevent musculoskeletal pain and related symptoms concern vast workers populations.

Competing Interests

The authors declare that they have no competing interests.

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