

Relationship between physical activity levels and sleep duration among technical-administrative employees from a university in South Brazil

Relação entre o nível de atividade física e a duração do sono de servidores técnico-administrativos de uma universidade do Sul do Brasil

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ABSTRACT | Background: Sleep disorders are receiving increasing attention in the occupational medicine literature as a function of their substantial impact on the functional recovery of workers. **Objective:** To investigate the relationship of leisure-time and transportation physical activity with sleep duration among technical-administrative employees at a public university. **Method:** The sample comprised 371 participants. Data collection was performed by means of a self-report questionnaire for sociodemographic, nutritional, behavioral, health and occupational variables. We performed crude and adjusted analysis of the association between physical activity level and outcomes. **Results:** Leisure-time physical activity exhibited positive correlation with sleep time on weekdays ($\beta=22.2$; $p=0.006$) and weekends ($\beta=31.3$; $p=0.007$). Transportation physical activity exhibited negative correlation with sleep time on weekends ($\beta=-44.5$; $p<0.001$). **Conclusion:** Leisure-time physical activity was associated with longer sleep duration on weekdays and weekends. Differently, transportation physical activity was associated with shorter sleep time on weekends. More studies, especially intervention studies, are needed to achieve a better understanding of the relationship between physical activity domains and sleep duration among workers.

Keywords | sleep; occupational health; motor activity.

RESUMO | Introdução: Alterações no sono têm ganhado destaque na literatura relacionada à saúde do trabalhador por exercerem uma função fundamental na recuperação desses indivíduos. **Objetivo:** Verificar a relação entre o nível de atividade física no domínio do lazer e do deslocamento e a duração do sono de servidores técnico-administrativos de uma universidade pública. **Método:** A amostra foi composta de 371 sujeitos. A coleta de dados foi realizada por meio de um questionário (autoaplicado) contendo informações sociodemográficas, nutricionais, comportamentais, de saúde e ocupacionais. Foram realizadas análises bruta e ajustada da associação entre os níveis de atividade física e os desfechos. **Resultados:** A atividade física de lazer foi positivamente associada com o tempo de sono durante a semana ($\beta=22,2$; $p=0,006$) e no fim de semana ($\beta=31,3$; $p=0,007$) e a de deslocamento esteve correlacionada negativamente com o tempo de sono no fim de semana ($\beta=-44,5$; $p<0,001$). **Conclusão:** A atividade física de lazer esteve relacionada ao aumento na duração do sono durante a semana e nos fins de semana. Ao contrário, a atividade física de deslocamento associou-se à redução no tempo de sono no fim de semana. Mais estudos são necessários, principalmente de intervenção, para melhor compreender a relação entre os domínios da atividade física e o tempo de sono em trabalhadores.

Palavras-chave | sono; saúde do trabalhador; atividade motora.

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INTRODUCTION

Occupational health is considered a highly relevant field by the scientific community, and thus it is the focus of many studies and international debates¹. Among several topics of interest, attention is increasingly paid to sleep disorders². Sleep stands out for being a biological function crucial to the consolidation of memory, vision, maintenance of the body temperature, conservation and restoration of energy³, and restoration of the brain energy metabolism⁴. Therefore, sleep disorders might significantly impact the occupational, physical, cognitive and social performance of people and impair their quality of life⁵, in addition to representing a risk factor for depression⁶.

Abnormalities of the sleep pattern, such as insomnia, sleep breathing disorders (obstructive sleep apnea and hypopnea) and excessive sleepiness (ES) are very common complaints in modern society, especially when due to misalignment between the sleep period (endogenous factors) and the physical and social environment (exogenous factors) along the 24 hours of the day⁷. Insomnia is a sleep disorder defined as difficulty to fall and/or stay asleep, and results in an insufficient number of daily sleep hours⁸.

The recent scientific literature consistently demonstrates that adequate levels of physical activity reduce the risk of developing several chronic diseases⁹. In addition, regular exercising is relevant for the control of the body mass, reduction of the occurrence of depression and anxiety, improvement of cognitive functions (memory, attention and reasoning) and the quality and efficiency of sleep¹⁰. Exercise is currently considered a non-pharmacological intervention to improve the sleep pattern¹¹. Mello et al.¹² performed an epidemiological survey of physical activity and associated factors among the population of São Paulo, Brazil. The results evidenced association between practice of physical activity and sleep; insomnia and excessive daytime sleepiness (EDS) were more frequent among the participants who did not exercise on a regular basis.

Technical-administrative employees at universities mainly perform office tasks, in some cases involving much responsibility and demanding high levels of concentration. As a result, this population of workers might be more exposed to situations which might interfere with the duration of sleep.

On these grounds, the aim of the present study was to investigate the relationship between level of leisure-time and transportation physical activity and average sleep duration on weekdays and weekends among the technical-administrative employees of a public university in the Southern region of Brazil.

METHOD

The present cross-sectional observational study was conducted in 2014–2015. Participants were 371 technical-administrative employees of Federal University of Pelotas (Universidade Federal de Pelotas–UFPel) aged 20 to 59 years old.

The inclusion criterion was:

- UFPel administrative employees selected by means of the lottery method from the university official online list of employees.

The exclusion criteria were:

- Employees on leave due to mental disorders which made them unable to respond the questionnaires or who were admitted to hospital;
- Employees away from work to participate in graduate courses (specialization, master's, doctoral programs).

All the participants signed an informed consent form. The study was approved by the research ethics committee of Superior School of Physical Education (Escola Superior de Educação Física–ESEF), UFPel, ruling no. 725,405.

STUDY VARIABLES

Exposure

The participants' level of physical activity was measured by means of the International Physical Activity Questionnaire (IPAQ)–long form, validated for use in Brazil by Matsudo et al.¹³. IPAQ measures job-related, housework, transportation and leisure-time physical activity. In the present study we only analyzed the latter two domains, because job- and housework-related physical activity seem to be overestimated¹⁴. In the calculation of domain scores, we multiplied the reported duration of vigorous physical activity (in minutes) times 2. The cutoff point to define

participants as active was the one recommended by the World Health Organization (WHO)¹⁰ for adults, to wit, 150 minutes per week.

Outcome

The outcome variables were average sleep time on weekdays (Monday through Thursday) and weekends (Friday through Sunday). Average sleep time was investigated by means of the following questions: "How many hours do you sleep Monday through Thursday, on average?" and "How many hours do you sleep Friday through Saturday, on average?" Outcomes were measured in minutes and continuously.

Control variables

Data collection was performed by means of a self-report questionnaire designed to collect information on socio-demographic (sex: male/female; age: in years; skin color: white/black/brown/mulatto; marital status: married–lives with partner/single–without partner/widowed; educational level: years of formal schooling), nutritional (body mass index–BMI, calculated as body weight in kilograms divided by height in meters squared), behavioral (smoking: never/current smoker/ex-smoker), health (sick leave due to depression: yes/no) and occupational (weekly working hours) characteristics.

Statistical procedures

The dataset was developed with software EpiData[®] 3.1; the data were entered twice, and then exported to statistical package Stata[®] 14.1. Visual histogram inspection and the Shapiro-Wilk test were used to investigate the normality of outcomes, and the Bartlett test to measure the homogeneity of variance.

Descriptive analysis include calculation of mean, standard deviation (SD) and relative frequency. Crude analysis consisted of simple linear regression analysis of the association between outcomes and levels of physical activity. Adjusted analysis was performed by means of multiple linear regression analysis. All the sociodemographic, behavioral, nutritional, health and occupational variables were simultaneously included, and the ones with $p=0.2$ were removed one by one (variables with $p<0.2$ were kept to control for confusion). The significance level was set to $p<0.05$.

RESULTS

Table 1 describes the participants' characteristics. Their average age was 45 years old (SD=11.7). Most participants were female (57.4%), white (83.6%) and married (66.0%). The mean duration of formal schooling was 18 years (SD=6.2). Most of the sample had never smoked (58.9%). About 41.0% of the participants exhibited excess weight, and almost none had ever required sick leave due to depression (91.1%). The average working time was 35 hours per week (SD=12.6). About 60.0% of the sample was considered active in the leisure-time and transportation domains. On separate analysis, the rates decreased to 43.2% and 26.2% for leisure-time and transportation physical activity, respectively. In regard to the outcomes of interest, the mean sleep time was longer on weekends, 474 minutes (almost 8 hours of sleep) compared to weekdays, 411 minutes (almost 7 hours).

Table 2 describes the results of crude and adjusted analysis of the association between levels of physical activity and the outcomes of interest. Total physical activity did not exhibit association with sleep time on weekdays ($p=0.13$) or weekends ($p=0.3$). On crude analysis, leisure-time physical activity was associated with longer sleep time, 24.3 ($\beta=24.3$; $p=0.002$) and 33.8 ($\beta=33.8$; $p=0.004$) more minutes on weekdays and weekends, respectively. Transportation physical activity did not have relationship with sleep time on weekdays ($p=0.4$), and was associated with shorter sleep time on weekends, 41 minutes less ($\beta=41.1$; $p=0.001$). On adjusted analysis, leisure-time physical activity remained positively correlated with sleep time on weekdays ($p=0.006$) and weekends ($p=0.007$); transportation physical activity was negatively correlated with sleep time on weekends ($p<0.001$). Meeting the weekly exercise recommendations by means of leisure-time physical activity exhibited positive correlation with sleep time on weekdays (22 minutes) ($\beta=22.2$) and weekends (31 minutes). In turn, meeting the weekly exercise recommendations by means of transportation physical activity exhibited negative correlation with sleep time on weekends, which was 44 minutes shorter ($\beta=-44.5$).

DISCUSSION

The number of studies seeking to identify factors which influence the living and health conditions of civil

Table 1. General characteristics of technical-administrative employees of a university in the Southern region of Brazil, 2014/2015 (n=371).

Characteristics	N	% or mean and standard deviation
Control variables		
Age (years)	371	45.1±11.7
Sex (%)		
Male	158	42.6
Female	213	57.4
Skin color (%)		
White	310	83.6
Black/brown/other	61	16.4
Marital status		
Married	245	66.0
Single	76	20.5
Separated	39	10.5
Widowed	11	3.0
Schooling (years)	341	18.0±6.2
Body mass index		
Normal	130	36.0
Overweight	150	41.6
Obesity	81	22.4
Smoking (%)		
Never	218	58.9
Ex-smoker	102	27.6
Smoker	50	13.5
Alcohol consumption		
Yes	15	4.4
No	326	95.6
Sick leave due to depression		
Yes	33	8.9
No	336	91.1
Working hours (weekly)	368	35.5±12.6
Stress		
High strain job	80	22.7
Active job	79	22.4
Passive job	99	28.0
Low strain job	95	26.9
Exposures		
Total physical activity		
Yes	187	61.1
No	119	38.9
Leisure-time physical activity		
Yes	137	43.2
No	180	56.8
Transportation physical activity		
Yes	89	26.2
No	251	73.8
Outcomes		
Sleep time (minutes) on weekdays	364	411.4±69.3
Sleep time (minutes) on weekends	363	474.4±102.5

Results expressed as mean±standard deviation and relative frequency (%).

servants in Brazil has been increasing in the past decades^{15,16}. However, organizations do not seem concerned with the sleep of their employees, and despite the recent interest of investigators, there are still gaps in the literature in this regard. According to Lima et al.¹⁷ sleep disorders are often undiagnosed, and in many cases do not even represent a reason to seek treatment, although their presence is clearly noticed in everyday life.

The recommended sleep duration to ensure the recovery of the human metabolism varies as a function of age, and is estimated as 7 to 9 daily hours for adults (18 to 64 years old)¹⁸. The mean duration of sleep on weekends in the present study was rated sufficient (7.9 hours). In turn, the sleep duration on weekdays did not reach the minimum recommended, but was close (6.85 hours). On analysis of the sleep duration on weekdays and weekends according to leisure-time and transportation physical activity levels, only the participants rated active based on leisure-time physical activity met the recommended sleep duration (7.1 hours). In regard to sleep on weekends, all the participants met the recommended duration, which varied from 7.4 to 8.2 hours. The quality and amount of sleep are influenced by a variety of factors, including cultural, social, psychological, pathophysiological and environmental aspects¹⁹.

Changes underwent by modern society include longer working hours and increasing shift work. These changes are attended by a secular trend of reduction of the number of daily sleep hours in the West²⁰. This trend resulted in growing frequency of reports of fatigue, tiredness and EDS²¹. Lack of sleep has deleterious effects on several body systems; detectable abnormalities involve metabolic²², endocrine²³ and immune pathways²⁴.

Spiegel et al.²⁵ compared carbohydrate metabolism and endocrine function among 11 young men subjected to two conditions. First, the time in bed was restricted to 4 hours per night for 6 nights to induce the sleep-debt condition. In the sleep-recovery period they were allowed 12 hours in bed per night for 6 nights. Glucose tolerance was lower in the sleep-debt than in the fully rested condition. The evening cortisol and thyroid hormone concentrations exhibited significant increase in the sleep-debt condition. These findings indicate that chronic sleep debt induces effects similar to the ones of normal aging, and thus it might increase the severity of age-related chronic disorders.

Another aspect deserving of mention is the relationship between sleep duration and obesity. In a review study, Spiegel et al.²² analyzed 10 longitudinal studies on sleep duration and risk of obesity among children and adults. In nine studies shorter sleep duration was associated with higher risk of development of overweight or obesity some years later. Among the possible mechanisms involved in this relationship, reduction of the leptin and increase of ghrelin levels and increased hunger and appetite stand out, leading to weight gain in the long run²⁶.

In a randomized crossover study by Spiegel et al.²⁶, the participants were subjected to 2 days of sleep restriction (4 hours in bed) and 2 days of sleep extension (10 hours in bed). The daytime levels of the satiety

hormone leptin and the orexigenic hormone ghrelin were measured, and the participants responded a validated hunger and appetite scale for various food categories. The mean leptin levels decreased by 18%, and the ghrelin levels increased by 28%. The ghrelin-to-leptin ratio increased by more than 70%. The appetite ratings increased by 23%, and the appetite for food with high carbohydrate content by more than 30% in the sleep-restriction condition. These findings show that reduction of the total sleep time has considerable impact on several health parameters.

Physical activity has been associated with better sleep quality^{27,28}. In a study conducted with employees of a university in São Paulo, Brazil, Zanuto et al.²⁷ found that

Table 2. Simple and multiple linear regression analysis of outcomes according to level of physical activity corresponding to technical-administrative employees of a university in the Southern region of Brazil, 2014/2015 (n=371).

Outcomes	Predictors	Crude			Adjusted		
		β 95%CI	P	R ²	β 95%CI	P	R ²
Sleep during weekdays	Total physical activity		0.13	0.004	-	-	
	Inactive	-			-		
	Active	12.3 (-3.8; 28.3)			-		
Sleep during weekdays	Leisure time physical activity		0.002*	0.03		0.006*	0.10
	Inactive	-			-		
	Active	24.3 (8.7; 39.8)			22.2 (6.4; 38.1)		
Sleep during weekdays	Transportation physical activity		0.4	0.002		-	-
	Inactive	-			-		
	Active	6.8 (-9.9; 23.5)			-		
Sleep during weekends	Total physical activity		0.3	0.003		-	-
	Inactive	-			-		
	Active	11.1 (-12.5; 34.8)			-		
Sleep during weekends	Leisure time physical activity		0.004*	0.03		0.007*	0.07
	Inactive	-			-		
	Active	33.8 (11.2; 56.4)			31.3 (8.6; 54.0)		
Sleep during weekends	Transportation physical activity		0.001*	0.03		<0.001*	0.11
	Inactive	-			-		
	Active	-41.1 (-65.5; -16.7)			-44.5 (-69.4; -19.6)		

Control variables: sex, age, skin color, marital status, educational level, body mass index, smoking, alcohol consumption, sick leave due to depression, weekly working hours, and stress; *p<0.05.

the odds for individuals rated active in regard to leisure-time physical activity to report sleep disorders was 81% lower²⁹. In the present study, leisure-time physical activity was associated with longer sleep time on weekdays and weekends, 22 ($\beta=22,2$; $p=0.006$) and 31 minutes ($\beta=31,3$; $p=0.007$), respectively. Only the participants rated active based on leisure-time physical activity met the recommendations for sleep duration (7.1 hours per day). These findings corroborate the results of the study by King et al.²⁹, in which intervention consisted of exercise for 16 weeks. In the group which received intervention, the total sleep time increased 42 minutes, while no difference was detected in the control group.

The sleep duration on weekends of the participants rated active on the transportation domain was shorter compared to the ones rated inactive ($\beta=-44,5$; $p<0.001$). Nevertheless, both groups (active and inactive) met the recommendations on number of sleep hours to ensure body recovery. In turn, analysis of job-related physical activity showed that it was not related with sleep improvement².

The present study has some limitations. First, it had a cross-sectional design, which might be influenced by the temporality of events. A second limitation concerns data collection relative to the outcome, as we did not use a validated questionnaire specific for this purpose.

Sleep duration is a relevant variable associated with several health outcomes, and is also correlated with higher odds of development of noncommunicable diseases³⁰. The present is the first study that in addition to total physical activity, also analyzed its leisure-time and transportation domains separately, finding mutually opposite results. Therefore, the effects of total physical activity might not be significantly associated with other outcome variables when its domains are analyzed jointly.

CONCLUSION

Leisure-time physical activity was associated with longer total sleep time on weekdays and weekends. Differently, transportation physical activity was associated with shorter sleep time on weekends. Only the individuals rated active based on leisure-time physical activity met the recommendations for sleep duration. Although transportation physical activity was associated with shorter mean sleep time on weekends, all the corresponding participants met the recommendations for weekly rest time. Other studies might attempt a more thorough understanding of the contexts which account for the length of transportation and its influence on the rest time on weekends.

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