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original article

Sleep quality and its associations with leisure-time exercise and excess weight among civil servants

Qualidade de sono e suas associações com a prática de exercícios físicos no lazer e o excesso de peso entre servidores públicos

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Abstract – The objective of this study was to analyze the association between sleep quality, leisure-time exercise and obesity among university employees. The sample consisted of 92 adults of both genders. Sleep quality and physical activity were assessed by questionnaires. Overweight/obesity was diagnosed based on body mass index, which was calculated from self-reported measures of body weight and height. The prevalence of sleep disorders was 53.84%. An association was observed between obesity (OR = 7.22 [$OR_{95\%CI}$: 1.65-31.5]) and poor sleep quality, and between physical activity and good sleep quality (OR = 0.19 [$OR_{95\%CI}$: 0.04-0.95]), irrespective of other confounders. In conclusion, the results showed a high prevalence of sleep disorders, which were independently associated with physical activity and obesity.

Key words: Adults; Physical activity; Obesity; Sleep.

Resumo – *O objetivo do estudo foi analisar a associação entre qualidade do sono, prática de exercícios físicos no lazer e obesidade entre servidores públicos de uma universidade. A amostra foi composta por 92 adultos de ambos os sexos. Qualidade do sono e atividade física foram coletadas por meio de questionário. O excesso de peso/obesidade foi diagnosticado pelo índice de massa corporal, o qual foi calculado com valores de peso e estatura relatados pelos avaliados. A prevalência de pessoas com sono alterado foi de 53,84%. Houve associação entre obesidade (OR= 7,22 [$OR_{IC95\%}$: 1,65-31,5]) e pior qualidade do sono, bem como, prática de atividade física e melhor qualidade do sono (OR= 0,19 [$OR_{IC95\%}$: 0,04-0,95]), independente de outros fatores de confusão. Concluiu-se que há alta ocorrência de distúrbios do sono, a qual foi associada de maneira independente com a prática de exercícios físicos e a obesidade.*

Palavras-chave: *Adultos; Atividade física; Obesidade; Sono.*

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INTRODUCTION

Sleep is a restorative neurological event that is essential for the function of the human organism[1]. Sleep deprivation or any event affecting sleep quality compromises the quality of a life of an individual[1-3]. Studies have shown a strong correlation between poor sleep quality and some health problems[4-7], demonstrating the close relationship between sleep quality and a healthy life.

Sleep disorders are an important public health problem, with an estimated prevalence of 10 to 48% in the general population[4,5,8,9]. Determinants of sleep disorders include excess weight (overweight/obesity), which has a high prevalence in the Brazilian population[10]. Recent studies have investigated this relationship and concluded that poor sleep quality and insufficient sleep are etiological factors of weight gain and obesity[1,3,11]. Although the mechanisms underlying this relationship are not fully understood, Schmid et al.[2] demonstrated that only one night of sleep deprivation can lead to endocrine alterations characterized by an increase in cortisol and ghrelin levels, reducing satiety and energy expenditure.

Within this context, physical activity contributes to improve sleep quality[6,7]. These effects can be explained by two types of factors: (i) acute factors including fatigue of the central nervous system, an increase in body temperature, alterations in heart rate, and heart rate variability and (ii) chronic factors including a reduction in body fat, improvement in physical conditioning, and altered heart rate variability[12]. Physical activity therefore represents an effective and financially accessible non-pharmacological option.

Few epidemiological studies have investigated the prevalence of and association between sleep disorders, overweight/obesity and physical activity in Brazil. Therefore, the objectives of the present study were (i) to identify the prevalence of sleep disorders among civil servants, (ii) to analyze the association of physical activity during leisure time and excess weight with the outcome variable, and (iii) to determine whether the possible associations of these two factors with sleep quality are independent.

METHODOLOGICAL PROCEDURES

Sample

A descriptive and analytical study was conducted using a cross-sectional design. Employees from a public university of the State of São Paulo (adults of both genders older than 18 years) were interviewed. A convenience sample was chosen for this pilot study. All 226 administrative staff (office assistants, engineers, system analysts, session supervisors, and accountants), general service personnel (gardeners, carpenters, painters, masons, drivers, and janitors), and security guards were entered in a list and 50% (n = 113) were randomly selected in an arbitrary manner. Ninety-one of the 113 employees (participation of 80.5%) agreed to participate in the study and signed a free informed consent form. The project was approved by the Ethics Committee on Research Involving Humans of Faculdade de Ciên-

cias e Tecnologia, Universidade Estadual Paulista, Campus de Presidente Prudente (Process No. 21960).

Sleep quality

Sleep quality was analyzed using the Mini-Sleep Questionnaire[13] validated for the Portuguese language[14]. The instrument consists of 10 questions with seven response possibilities (1 = never; 2 = very rarely; 3 = rarely; 4 = sometimes; 5 = frequently; 6 = very frequently, and 7 = always) and provides a dimensionless score, with the highest score indicating poor sleep quality. The final score generated by the instrument is classified as follows: good sleep (score of 10 to 24 points), slightly disturbed sleep (score of 25 to 27 points), moderately disturbed sleep (score of 20 to 30 points), and very disturbed sleep (score higher than 30). In the present study, "disturbed sleep" characterized by a score ≥ 25 points was used.

Leisure-time physical exercise

Habitual physical activity during leisure time and at work was evaluated using the questionnaire developed by Baecke et al.[15] and validated for the Brazilian population by Florindo et al.[16]. Leisure-time physical activity was assessed using the second session of the instrument which refers to sports activities during leisure time. Other non-sports activities (weight training, gymnastics, fight disciplines, and walking) were also computed. Three constructs of these leisure-time activities were analyzed: intensity (low, moderate, and vigorous); weekly physical activity (< 1 h/week; 1-2 h/week; 2-3 h/week; 3-4 h/week; > 4 h/week), and length of engagement (< 1 month; 1-3 months; 4-6 months; 7-9 months; > 9 months). Thus, subjects were classified as physically active when they reported a minimum of 180 minutes per week (3-4 h/week) of moderate or vigorous physical activity in the last 4 months (4-6 months). The participants were divided into three groups: (i) subjects performing no physical activity; (ii) subjects reporting less than 180 minutes per week or an intensity below the established or a length of engagement shorter than the established; (iii) subjects that achieved the cut-off established[17,18].

Excess weight

Body weight (kg) and height (m) were self-reported by the interviewed subjects and were used for the calculation of body mass index (BMI), dividing body weight by the square of the height (kg/m^2). Overweight (BMI 25 to 29.99 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) were identified in the sample studied.

Adjustment variables

Some variables that could be determinants of sleep, excess weight or physical activity were entered into the model as possible confounding factors: (i) gender (male/female); (ii) chronological age (used as a numerical variable in all analyses); (iii) ethnicity (white, black, and other); (iv) smoking (self-reported by the subject); (v) alcohol consumption (no [on any day]/yes [at least on one day per week]), and (vii) occupational physical activity score[15].

Statistical analysis

Categorical variables are expressed as prevalence and their respective confidence intervals were calculated. The chi-squared test was used to analyze the existence of associations, with the application of Yates correction in 2 x 2 contingency tables. Binary logistic regression was used for the construction of a multivariate model in which significant associations with sleep quality (physical activity and excess weight) were adjusted for the effect of confounders (gender, age, ethnicity, smoking, occupational physical activity, and alcohol consumption [simultaneous entry]). This process generated odds ratios (OR) and 95% confidence intervals ($OR_{95\%CI}$). A p value ≤ 0.05 was considered to be statistically significant. All analyses were performed using the BioEstat 5.0 software.

RESULTS

The sample consisted of 50% (n = 46) men and 50% (n = 46) women. Most subjects of the sample (78.2%, 95%CI: 69.8; 86.6) reported to be white. The frequency of subjects reporting to be smokers and those not consuming any alcohol per week was 14.1% (95%CI: 7.01; 21.2) and 34.7% (95%CI: 25.1; 44.5), respectively. Comparison of genders revealed differences in the non-consumption of alcohol (men: 28.3% and women: 41.3%; p = 0.018) and in occupational physical activity score (men: 2.6 ± 0.5 and women: 2.2 ± 0.3; p = 0.001).

Table 1. General characteristics of the civil servants stratified according to sleep quality (Presidente Prudente, SP. Brazil, 2012).

	Good sleep (n= 42)	Disturbed sleep (n= 50)	Chi-squared *p*-value
Variable	n (%)	n (%)	
Categorical			
Gender			0.143
Male	25 (54.3)	21 (45.7)	
Female	17 (37)	29 (63)	
Ethnicity			0.401
White	31 (43.1)	41 (56.9)	
Black	3 (60)	2 (40)	
Other	8 (53.3)	7 (46.7)	
Smoking			0.734
Yes	35 (44.3)	44 (55.7)	
No	7 (53.8)	6 (46.2)	
Alcohol consumption			0.930
Yes	27 (45)	33 (55)	
No	15 (46.9)	17 (53.1)	
Numerical *			
Age (years)	42.7 ± 11.1	45.1 ± 9.4	0.293
Occupational activity (score)	2.4 ± 0.4	2.4 ± 0.6	0.774

* Numerical variables are reported as the mean ± standard deviation.

No differences or association with gender were observed for the other variables (age, smoking, ethnicity, leisure-time physical activity, excess

weight, and percentage of sleep disorders). The occurrence of disturbed sleep was not associated with ethnicity, gender, smoking or alcohol consumption, and there was no difference in age or occupational physical activity (Table 1).

On the other hand, an association was observed between disturbed sleep and overweight (OR = 2.69 [$OR_{95\%CI}$: 1.05-6.89]) and obesity (OR = 5.57 [$OR_{95\%CI}$: 1.51-20.4]). Disturbed sleep was also significantly associated with physical activity (OR = 0.20 [$OR_{95\%CI}$: 0.04-0.82]) (Table 2). When these associations were adjusted for different confounders, subjects who were physically active during leisure time had an 81% lower chance of reporting sleep disorders than inactive subjects (OR = 0.19 [$OR_{95\%CI}$: 0.04-0.95]). Similarly, comparison showed that obese subjects were more likely to report sleep disorders than normal weight subjects (OR = 7.22 [$OR_{95\%CI}$: 1.65-31.5]) (Table 3).

Table 2. Association between physical activity, obesity and sleep quality among civil servants (Presidente Prudente, SP. Brazil, 2012).

Independent variable	Disturbed sleep n (%)	Chi- squared *p*-value	Binary logistic regression OR_{crude} (95%CI)
Leisure-time activity		0.018	
No activity reported	35 (62.5)		1.00
< 180 min/week	12 (50)		0.60 (0.22 – 1.57)
≥ 180 min/week	3 (25)		0.20 (0.04 – 0.82)
Excess weight		0.004	
Normal	14 (36.8)		1.00
Overweight	22 (61.1)		2.69 (1.05 – 6.89)
Obesity	13 (76.5)		5.57 (1.51 – 20.4)

OR: odds ratio; 95%: 95% confidence interval.

Finally, an independent association was observed between the two variables and sleep quality. Furthermore, 76.9% of the variation in sleep quality could be explained by the multivariate model.

Table 3. Multivariate models expressing the association between leisure-time physical activity, excess weight and disturbed sleep (Presidente Prudente, SP. Brazil, 2012).

	Binary logistic regression (outcome: disturbed sleep)		
Independent variable	Model 1	Model 2	Model 3*
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Leisure-time activity			
No activity reported	1.00	1.00	1.00
< 180 min/week	0.80 (0.27 – 2.31)	0.80 (0.27 – 2.40)	0.79 (0.26 – 2.35)
≥ 180 min/week	0.27 (0.06 – 1.24)	0.20 (0.04 – 0.98)	0.19 (0.04 – 0.95)
Excess weight			
Normal	1.00	1.00	1.00
Overweight	2.34 (0.85 – 6.41)	2.53 (0.90 – 7.11)	2.45 (0.86 – 6.95)
Obesity	6.50 (1.61 – 26.2)	7.24 (1.65 – 31.6)	7.22 (1.65 – 31.5)

* Hosmer-Lemeshow test with p = 0.167. OR: odds ratio. 95%CI: 95% confidence interval.
Model 1: Leisure-time physical activity and obesity entered simultaneously into the model and adjusted for gender and age. Model 2: Leisure-time physical activity and obesity entered simultaneously into the model and adjusted for gender, age, ethnicity, smoking, and alcohol consumption. Model 3: Leisure-time physical activity and obesity entered simultaneously into the model and adjusted for gender, age, ethnicity, smoking, alcohol consumption, and occupational activity.

DISCUSSION

The percentage of subjects reporting to be smokers (14.1%) was similar to that observed for the Brazilian population (14.8%) in a study conducted in Brazilian capitals and Distrito Federal[10], and lower than that reported by Antunes et al.[19] (16.7%) for university employees from Porto Alegre (RS). An association between smoking and sleep disorders has been reported in the literature[9,20,21]. The hypothesis is that nicotine excitation in the central nervous system causes disturbances in the sleep-wake cycle[21]. With respect to alcohol consumption, only 34.7% of the subjects reported not to drink any alcohol, a number lower than that reported by Bortoluzzi et al.[22] (54.5%) in the municipality of Joaçaba (SC) and by the National Anti-Drug Secretariat (SENAD) (48%) for the Brazilian population[23]. In a cohort study conducted in Finland involving 8,960 workers aged 40 to 60 years, Haario et al.[24] identified an association between alcohol consumption and insomnia symptoms, which the authors attributed to delayed sleep onset and subsequent sleep interruptions in heavy drinkers.

The prevalence of workers with disturbed sleep was 53.84%. Higher rates ranging from 10 to 48% have been reported in the literature for the general population[5,6,9,25]. This difference might be explained by the specificity of the sample, i.e., university employees, whereas the general population includes students, housewives, and retired people. The prevalence was similar to that reported in a study involving Mexican workers, which detected a prevalence of sleep disorders of 59%[26]. This high rate of sleep disorders might be related to the more stressful lifestyle of workers. Poor sleep quality is associated with different disorders that affect quality of life, such as excessive weight gain. One hypothesis raised to explain this association is an increase in the levels of ghrelin and cortisol even after a single night of sleep deprivation[2]. These hormone changes reduce energy expenditure and increase dietary intake, especially the intake of hypercaloric foods rich in fats and carbohydrates, events that eventually contribute to the development of insulin resistance and metabolic syndrome[2,3,11]. Another hypothesis is that leptin resistance of specific receptors in the hypothalamus increases circulating levels of this hormone and this increase is related to sleep disorders and excessive weight gain, shedding light on the pathogenesis of obesity[27].

Within this context, Olds et al.[28] found that young people with poor sleep quality were more likely to be obese, indicating that the association between sleep quality and obesity can occur throughout life and not only in adulthood as observed here. Alarming trends are observed among Brazilian adolescents, with a prevalence of overweight and obesity of 16.8% and 6.1%, respectively. In addition, two of 10 obese adolescents have metabolic syndrome[17,18].

The prevalence of obesity among the subjects interviewed was 18.6%. This rate is similar to the mean reported for the Brazilian popu-

lation which ranges from 12.5 to 21.4%[10]. In the present study, this high prevalence was associated with sleep disorders, with OR of 2.69 [$OR_{95\%CI}$: 1.05-6.89] and 5.57 [$OR_{95\%CI}$: 1.51-20.4] for overweight and obesity, respectively. In addition, obese individuals presented an 87% lower chance of reporting good sleep quality (OR = 0.13 [$OR_{95\%CI}$: 0.03-0.60]). Similarly, obese individuals were more likely to report sleep disorders than normal weight subjects (OR = 7.22 [$OR_{95\%CI}$: 1.65-31.5]), irrespective of confounding factors. These results agree with the literature and show that an association exists between higher BMI and poor sleep quality[7,28,29]. One explanation for this association is the occurrence of respiratory problems during sleep[12]. In this respect, a BMI > 30 is considered to be a risk factor for obstructive sleep apnea-hypopnea, with 70% of patients with this syndrome being obese[27].

Physical activity was associated with good sleep quality in the present study, with 75% of physically active subjects reporting good sleep quality versus 37.5% of inactive subjects. When these associations were adjusted for different confounders, subjects physically active during leisure time had an 81% lower chance of reporting sleep disorders than inactive subject (OR = 0.19 [$OR_{95\%CI}$: 0.04-0.95]). These findings agree with other investigators who indicate physical activity as a promising treatment option for sleep disorders[6,7]. Although the pathway underlying the effect of physical activity on sleep quality is unclear, it is known that chronic exercise affects sleep more positively than acute exercise sessions[12]. Since a minimum duration of physical activity of 4 months was required, the present findings agree with this observation. Furthermore, physical exercise positively affects mood and quality of life through different pathways and mechanisms, factors that contribute to improve sleep quality.

Another line of reasoning indicates that regular physical exercise exerts beneficial effects on sleep by acting on factors that can compromise sleep quality, such as obesity[12]. This effect could not be confirmed in the present study since both factors (obesity and physical exercise) were independently associated with sleep quality.

Some limitations of the study should be mentioned, such as the bias of reverse causality due to its cross-sectional design and recall bias seen in retrospective studies. Furthermore, only employees from a single institution were interviewed. However, the sample was homogenous in terms of gender and an expressive number of university employees were included.

CONCLUSIONS

The results showed a high prevalence of disturbed sleep among civil servants. In addition, obesity and leisure-time physical activity were independently associated with sleep quality.

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