

Obstructive sleep apnea syndrome in truck drivers*

Síndrome da apneia obstrutiva do sono em motoristas de caminhão

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Abstract

Objective: To determine the prevalence of obstructive sleep apnea syndrome (OSAS), as well as to identify factors associated with a greater risk of developing OSAS, among truck drivers. **Methods:** The study population comprised 209 truck drivers (mean age, 38.8 years; 98.5% males) at two branches of a transportation company. The mean body mass index was 26.5 ± 4.4 kg/m². The participants completed questionnaires regarding sociodemographic data, physical activity and OSAS. The prevalence of OSAS was estimated using the Berlin Questionnaire, associations between OSAS and the factors studied being assessed through univariate and multivariate regression analysis. **Results:** The prevalence of OSAS in the population was 11.5%. Of the 209 truck drivers, 72 (34.5%) reported having fallen asleep while driving and 81 (38.7%) reported snoring. The following variables were found to present statistically significant associations with OSAS: informal employment (OR = 0.27; p = 0.01); body mass index ≥ 25 kg/m² (OR = 13.64; p = 0.01); and poor sleep quality (OR = 3.00; p = 0.02). **Conclusions:** The prevalence of OSAS in this study was lower than that reported in other studies of truck drivers and yet higher than that observed for the general population. In addition, our results suggest that work characteristics, such as employment status, are associated with OSAS. These data show the relevance of considering work activity in studies of factors associated with OSAS.

Keywords: Sleep apnea, obstructive; Sleep disorders; Questionnaires.

Resumo

Objetivo: Estimar a prevalência da síndrome da apneia obstrutiva do sono (SAOS) e verificar os fatores associados à chance de desenvolver SAOS em motoristas de caminhão. **Métodos:** A população desse estudo constituiu-se de motoristas de caminhão de duas filiais de uma empresa transportadora (n = 209), com idade média de 38,8 anos, sendo 98,5% do sexo masculino. O índice de massa corpórea médio foi de $26,5 \pm 4,4$ kg/m². Os participantes responderam questionários sobre dados sociodemográficos, atividade física e SAOS. A prevalência de SAOS foi estimada por meio do Questionário de Berlim e sua associação com os fatores estudados foi verificada pela análise de regressão univariada e multivariada. **Resultados:** A prevalência de SAOS na população foi de 11,5%. Dos 209 motoristas, 72 (34,5%) referiram dormir ao volante enquanto dirigiam ao menos uma vez e 81 (38,7%) referiram roncar durante o sono. As variáveis estatisticamente significativas associadas à SAOS foram vínculo empregatício informal (OR = 0,27; p = 0,01), índice de massa corpórea ≥ 25 kg/m² (OR = 13,64; p = 0,01) e qualidade do sono ruim (OR = 3,00; p = 0,02). **Conclusões:** Apesar de a prevalência de SAOS ter sido inferior à observada em outros estudos com motoristas, essa prevalência é superior à da população em geral. Os resultados ainda sugerem que as características do trabalho, entre as quais o vínculo de trabalho, estão associadas à SAOS. Esses dados evidenciam a relevância de se levar em consideração a atividade de trabalho em estudos que investiguem fatores associados à SAOS.

Descritores: Apneia do sono tipo obstrutiva; Transtornos do sono; Questionários.

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Introduction

Sleepiness impairs work, social, neuropsychological and cognitive activities, as well as increasing the risk of accidents. A study conducted in Brazil⁽¹⁾ revealed that 7.6% of the accidents involving interstate drivers occurred due to excessive sleepiness, which illustrates the association between sleepiness and accidents that is frequently observed in various professional categories.⁽²⁾

Irregular sleeping habits or sleep disorders per se, resulting from sleep deprivation, can cause excessive sleepiness. Of the sleep disorders leading to sleepiness, the most prevalent among professional drivers is obstructive sleep apnea syndrome (OSAS).⁽³⁾ In the general population, OSAS, as diagnosed by polysomnography, ranges from 1% to 5% in men and from 1.2% to 2.5% in women.⁽⁴⁾ However, OSAS is more prevalent in the population of professional drivers. There are studies in which the prevalence of moderate or severe OSAS among such drivers was found to be 46%.^(3,5) Recently, the prevalence in railway engine drivers was found to be approximately 20%.⁽⁶⁾ In Brazil, a study of bus drivers revealed that 60% present at least one sleep-related complaint or problem.⁽⁷⁾

Cases of OSAS are characterized by complete upper airway obstruction (apnea) or partial upper airway obstruction (hypopnea) during sleep.⁽⁸⁾ This obstruction is typically accompanied by decreased oxygen-hemoglobin saturation, and its principal symptoms are loud snoring, periods of apnea, fragmented sleep and frequent awakenings, resulting in daytime sleepiness.⁽⁹⁾ One of the principal risk factors for OSAS is body mass index (BMI) greater than 30 kg/m² (the cut-off value for obesity as defined by the World Health Organization).⁽¹⁰⁾ Therefore, it could be postulated that the tendency toward excessive daytime sleepiness can be predicted, to some extent, by BMI.⁽¹¹⁾ In addition, various studies have found an association between degree of OSAS severity and obesity.^(12,13) Other risk factors, such as gender, age, alcohol consumption and smoking, are well known.^(14,15)

Although polysomnography is considered the gold standard for the diagnosis of OSAS, subjective instruments have been used in population studies for the identification of individuals at higher risk of developing the disease.⁽¹⁴⁾ One such instrument is the Berlin Questionnaire,

which comprises questions related to risk factors for the syndrome, such as obesity, hypertension, snoring, daytime sleepiness and fatigue.⁽¹⁶⁾ In a PubMed search using the keywords "Berlin questionnaire" and "sleep", performed in October of 2008, 65 references were found. This result suggests that the Berlin Questionnaire is used in several countries. Among those 65 references, only the studies by Moreno et al. were found to have used this instrument in truck drivers.^(17,18) In those studies, 26.1% of the population was found to be at high risk of developing OSAS.⁽¹⁷⁾

The relevance of studies of OSAS in truck drivers is related to the inability of such individuals to maintain a satisfactory level of concentration and the necessary psychomotor coordination to drive,⁽¹⁾ which increases the risk of accidents.^(11,19-21) The decrease in the performance of drivers has been observed by various researchers.^(19,21,22)

In view of what has been presented above, the objective of the present study was to determine the prevalence of and identify factors associated with OSAS in a population of truck drivers.

Methods

This was a cross-sectional study involving truck drivers employed at two branches of a motor freight transportation company. A total of 209 drivers, accounting for 95.4% of this population, were interviewed. Of those, 123 worked at the Campinas branch (located in the state of São Paulo) and 86 worked at the Belo Horizonte branch (located in the state of Minas Gerais). The sociodemographic characteristics (gender, age, marital status and years of professional driving experience) of the drivers working at the two branches were similar. The drivers at both branches worked in one of two sectors: transfer (long hauls) or distribution/collection (short hauls within the city limits). There were no exclusion criteria; all drivers in the company were invited to participate in the study.

Most drivers were male (98.6%), and the mean age at the time of data collection was 38.8 ± 8.9 years (range, 22-62 years). A great number of drivers (58%) were informally employed. Therefore, less than half of the population consisted of hired (formally employed) drivers. Most drivers (65.7%) worked in the distribution/collection sector, and 70% worked irregular hours that included night shifts.

The drivers who participated in the study were interviewed at the transportation company between March and July of 2007. All participants gave written informed consent using a form that had been approved by the Ethics Committee of the University of São Paulo School of Public Health.

In order to collect data, the drivers completed a questionnaire consisting of questions regarding sociodemographic characteristics, a physical activity assessment scale⁽²³⁾ and an OSAS risk scale.⁽¹⁶⁾

In addition, the questionnaire included questions regarding smoking, alcohol consumption, employment status, work sector and work schedule. The physical activity assessment scale used was the International Physical Activity Questionnaire, short version, which considers the frequency and duration of vigorous, moderate and mild physical activities, classifying respondents as highly active, active or sedentary.⁽²³⁾ The prevalence of OSAS was determined using the Berlin Questionnaire,⁽¹⁶⁾ which classifies individuals based on their risk of developing the syndrome. This questionnaire consists of three categories: the first includes questions regarding frequent snoring (3-4 times per week); the second refers to frequent daytime sleepiness (3-4 times per week) or sleepiness while driving; and the third refers to a history of high blood pressure and obesity (BMI ≥ 30 kg/m²). Drivers who fell into at least two of these categories were classified as being at high risk of developing OSAS.⁽¹⁶⁾ It should be emphasized that there are suggestions for changing the interpretation of the scale, as well as for altering the scale itself, such as excluding hypertension and obesity (category 3).⁽²⁴⁾ In the present study, the classification followed the suggestion of the authors of the scale, since this is the one most commonly adopted.⁽²⁵⁾

In order to determine BMI, we used the reported body mass (kg) and height (m). We classified BMI in accordance with the proposals made by the World Health Organization.⁽¹⁰⁾

First, a descriptive statistical analysis (means and standard deviations) was carried out. We used univariate and multivariate (forward stepwise) logistic regression analysis in order to build the statistical model. In the regression analysis, the following dichotomous categories were created for the variables: BMI

Table 1 - Distribution of the number and percentage of truck drivers, by risk of developing obstructive sleep apnea syndrome.

Risk of OSAS	Drivers, n	%
Low	185	88.5
High	24	11.5
Total	209	100

(< 25 kg/m² or ≥ 25 kg/m²); sleep quality (good or poor); work sector (transfer or distribution/ collection); work schedule (daytime or irregular); professional driving experience (< 20 years or ≥ 20 years); smoking status (current smoker or not); alcohol consumption (yes or no); length of time driving per workday (≤ 10 h or > 10 h); and age (≤ 40 years or > 40 years). The level of significance was set at 5%. Data analysis was carried out using the STATA program, version 9.0 (Stata Corp.; College Station, TX, USA).

Results

The results of the present study revealed that the prevalence of OSAS in the population studied was 11.5% (Table 1).

Regarding sleep-related symptoms, the Berlin Questionnaire revealed that 38.7% of the drivers reported habitual snoring and 20% reported snoring that bothers other people, with a frequency of more than twice a week. In addition, 21.5% reported waking up feeling tired, 17% reported difficulty in falling asleep after going to bed, and 34.5% reported having

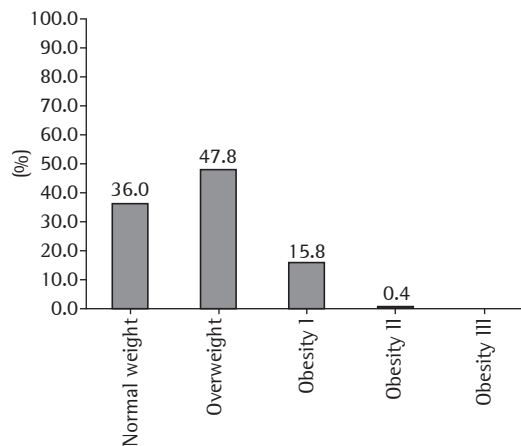


Figure 1 - Percentage distribution, by body mass index, of the drivers studied.

fallen asleep while driving. The majority (65.1%) reported having good-quality sleep.

Of the drivers who reported having fallen asleep while driving, 25% are at high risk of developing OSAS. Of those who reported having suffered truck accidents within the preceding 12 months, 15.9% were at high risk of developing OSAS. Of the sample as a whole, 47.8% were overweight and 15.8% were obese.

Most drivers were sedentary (70%) and drank alcohol on weekends (74%), which might have contributed to the rate of overweight observed (mean BMI of 25.7 ± 6.3 kg/m²).

Of the sample as a whole, 47.8% were overweight and 15.8% were obese. Figure 1 shows the distribution of BMI in the population studied, revealing that most drivers were

in the overweight range. However, only 9.6% of the drivers reported hypertension and 80.1% reported never smoking. The variables associated with OSAS were employment status, BMI and sleep quality. Table 2 shows the results of the univariate analysis of the variables for risk of OSAS.

The variables with $p < 0.20$ (employment status, BMI, sleep quality, work sector and work shift) were tested in the multivariate regression model. In addition, the model was adjusted for age (Table 3).

Informal employment was a protective factor against OSAS (OR = 0.29; $p = 0.032$), which demonstrates that the way in which work is organized can influence the health of workers. Poor sleep quality was significant as an

Table 2 - Variables analyzed for risk of obstructive sleep apnea syndrome (univariate analysis), with the respective OR, 95% CI and level of significance.

Variable	Low risk, n	High risk, n	OR	95% CI	p
Employment status (n = 202)					
Formal	71	14	1.00	0.10-0.75	0.011
Informal	109	08	0.27		
Body mass index (n = 206)					
< 25 kg/m ²	74	02	1.00	1.79-103.80	0.012
≥ 25 kg/m ²	108	22	13.64		
Sleep quality (n = 206)					
Adequate	123	9	1.00	1.17-7.72	0.023
Inadequate	60	14	3.00		
Work sector (n = 207)					
Distribution/collection	124	12	1.00	0.93-5.74	0.071
Transfer	59	12	2.31		
Work schedule (n = 200)					
Daytime	56	4	1.00	0.79-9.90	0.109
Irregular	120	20	2.80		
Professional driving experience (n = 196)					
< 20 years	155	22	1.00	0.81-1.57	0.468
≥ 20 years	17	2	1.13		
Smoking (n = 201)					
No	142	21	1.00	0.19-2.48	0.570
Yes	35	3	0.69		
Alcohol consumption (n = 201)					
No	44	8	1.00	0.31-2.34	0.765
Yes	133	16	0.86		
Length of time driving per day (n = 193)					
≤ 10 h	103	14	1.00	0.33-2.37	0.812
> 10 h	68	8	0.89		
Age (n = 209)					
≤ 40 years	110	14	1.00	0.44-2.75	0.830
> 40years	75	10	1.01		

Table 3 – Model of factors associated with risk of obstructive sleep apnea syndrome, controlled for age.

Variable	Category	OR	95% CI	p
Employment status (n = 202)	Formal	1.00	0.09-0.90	0.032
	Informal	0.29		
Body mass index (n = 199)	< 25 kg/m ²	1.00	1.23-75.84	0.031
	≥ 25 kg/m ²	9.68		
Sleep quality (n = 196)	Adequate	1.00	0.90-6.76	0.079
	Inadequate	2.47		

OSAS: obstructive sleep apnea syndrome.

adjustment variable in the model (OR = 2.46; p = 0.079), which means that individuals with OSAS have poor quality sleep due to the symptoms characteristic of the syndrome, such as daytime sleepiness. In the final model, the factors associated with OSAS were employment status (OR = 0.29; p = 0.032) and BMI (OR = 9.68; p = 0.03). Although sleep quality was not associated with OSAS, the model showed better adjustment after the inclusion of this variable (OR = 2.47; p = 0.079).

Discussion

As previously mentioned, various studies have shown the prevalence of OSAS to be higher among professional drivers than in the general population.^(3,5,7,17,18) In such studies, the prevalence of OSAS has been determined by subjective instruments^(17,18) or by polysomnography.^(3,5,7)

The prevalence of OSAS in the present study was lower than that reported in other studies and yet higher than that observed for the general population. It is estimated that objective evaluations would confirm a diagnosis of OSAS in 60% of individuals who are at high risk of developing the syndrome.⁽²⁶⁾ In addition, those who are at higher risk of developing OSAS complain about poor sleep quality. Consequently, there is an association between high OSAS risk and reported sleep quality; drivers who are at high risk of developing OSAS classify their sleep quality as poor. Probably, the fragmentation resulting from the increase in awakenings leads them to perceive their sleep quality as poor.

The relationship between OSAS and employment status, revealed in the present study, needs to be investigated more fully, especially in terms of the implications of the types of employment of this professional category. This is particularly relevant, since contemporary socioeconomic changes have led to alterations in the way in which work is organized. The number of precar-

ious and temporary employment contracts have been increasing worldwide.⁽²⁷⁾ These new ways of organizing work have an impact on the health of workers that is different from that observed in workers who are formally employed. An example of this is a survey using data from fifteen European countries. This survey revealed that workers submitted to precarious employment had higher rates of work dissatisfaction, fatigue and muscle pain than did those who were formally employed. However, the rates of absenteeism and stress symptoms are higher among workers with permanent full-time employment than among those with precarious employment.⁽²⁷⁾

In the present study, formal employment, in which workers are formally hired by the company, was the principal factor increasing the risk of developing OSAS. This result can be interpreted in the following way: although being regularly employed is an important factor in determining work conditions and lifestyle, the autonomy resulting from outsourced work is a protective factor against the risk of developing OSAS in this study population.

The way the work schedule is organized affects the health of drivers also in terms of eating habits, since irregular shifts can lead to poor timing and poor-quality meals,⁽¹⁷⁾ which can result in weight gain and, consequently, increase the incidence of OSAS.⁽²⁸⁾ It seems plausible that irregular meal times contributed to the high prevalence of overweight observed in this study. For decades, there has been a consensus that the periodicity of meals can affect body weight, since the metabolic efficiency of foods differs according to the time of their ingestion.⁽²⁰⁾

According to a family budget study, 40.6% of Brazilian individuals over 20 years of age are overweight.⁽²⁹⁾ Although these data⁽²⁹⁾ show a high prevalence of overweight in the general population, the prevalence was even higher (47.8%) among the drivers evaluated in

the present study. Although the proportion of sedentary drivers was high (70.0%) in our study, it was lower than that observed for the general population (80.1%).⁽³⁰⁾ In the present study, the relationship between being overweight and having a sedentary lifestyle was not sufficiently clear, since other factors related to the lifestyle of professional drivers, such as the previously mentioned eating habits, seem to be risk factors for being overweight.

However, the results obtained suggest that work characteristics, such as employment status, are associated with OSAS. These data show the relevance of considering such characteristics in future studies.

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