Original Article

Prevalence of risk factors for obstructive sleep apnea syndrome in interstate bus drivers*

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ABSTRACT

Objective: To determine the prevalence of risk factors for obstructive sleep apnea syndrome in interstate bus drivers. **Methods:** This study involved 262 professional interstate bus drivers employed by a Brazilian company headquartered in the Federal District. The drivers were evaluated using a questionnaire designed to assess respiratory sleep disorders, the Epworth Sleepiness Scale, test of sustained attention, test of divided attention and anthropometric measurements. **Results:** Body weight was found to be above the ideal in 68% of the drivers evaluated, 34% of which had a neck circumference = 42 cm. During the study period, the drivers reported using tobacco (27%), cola-based soft drinks (55%), alcohol (65%) and coffee (88%). The Epworth Sleepiness Scale score was = 10 points in 28%. Snoring was reported by 36%, sleep apnea by 5%, a sensation of suffocation during sleep by 12%, restless sleep by 29% and drowsiness while driving by 48%. There were 42% who had been involved in transit accidents, 7.6% of which were attributed to hypersomnolence. Those scoring higher than 10 of the Epworth Sleepiness Scale presented lower levels of sustained attention. In addition, a reduction in divided attention was found to correlate with greater daytime sleepiness and larger neck circumference. **Conclusion:** The rate of stimulant use found in the group of drivers evaluated is alarming. The high prevalence of daytime sleepiness indicates that attentiveness is reduced in this population.

Keywords: Automobile driving; Sleep apnea, obstructive; Work schedule tolerance; Psychometrics; Risk factors; Attention; Questionnaires

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Submitted: 17 May 2005. Accepted, after review: 8 September 2005.

INTRODUCTION

Road transportation in Brazil is highly predominant, generating 42 billion Brazilian reals annually and employing 1.2 million workers. More than half the population in Brazil uses paved and unpaved roads for transporting goods and passengers.[1] As a result of the preference for road transportation, there are an alarming number of traffic accidents due to poor road conditions, driver impairment and obsolete vehicles.

According to data from the National Traffic Council,[2] sleepiness was responsible for 1787 and 1844 accidents in 2001 and 2002, respectively.

However, lack of attention was the cause of 35,999 accidents in 2001 and 37,722 accidents in 2002, corresponding to 35% of all accidents in both periods. Therefore, lack of attention was the greatest isolated cause of accidents in those two consecutive years.

However, hypersomnolence is underestimated in regard to its capacity to cause work-related accidents, most of all, traffic accidents.

Nevertheless, there are studies revealing that 40% of commercial long-haul truck drivers and 21% of short-haul drivers have difficulty staying alert 20% of the time.[3-4] Another study showed that the accident rate is twice as high for truck drivers with sleep disorders as for those with no such disorders.[5]

Obstructive sleep apnea syndrome (OSAS),[6] characterized by transient cessation of breathing during sleep, excessive daytime sleepiness being one of its major symptoms, should be diagnosed using polysomnography. Among the risk factors for OSAS are increased neck circumference (NC) and obesity.[7-8] Although the influence of obesity on obstructive sleep apnea and snoring is not fully understood, it seems that obesity reduces the size of the pharynx and increases its collapsibility.

Increased NC, which is a better marker of central fat deposit than is body mass index (BMI), has proven to be an important predictor of snoring and obstructive sleep apnea.[9-10]

We believe this study is justified insofar as we aim to use it in order to describe the prevalence of risk factors for OSAS and study the correlation between excessive daytime sleepiness with attention and BMI in interstate bus drivers.

METHODS

This was a descriptive transversal study involving 1200 interstate bus drivers in the employ of a Brazilian company headquartered in Brasília (Federal District). Drivers are hired to work 44 hours per week, with one day off, in alternating sequential shifts (one morning, then one afternoon, then one evening, etc.), and are not allowed to exceed four hours of non-stop driving on each trip. Participants were interviewed at the company headquarters during the Weekly Driver Refresher Course during the period from February to May of 2004. All of the drivers participated in the study voluntarily, and there were no exclusion criteria. Therefore, none of the drivers were excluded.

On the day of the evaluation, the drivers received a morning lecture explaining the objectives of the research and the voluntary participation therein. All of the drivers gave written informed consent. After the lecture, a self-administered, anonymous questionnaire was applied in order to evaluate sleep-related breathing disorders. In addition, the Epworth Sleepiness Scale (ESS), Test of Sustained Attention and Test of Divided Attention were administered, also on an anonymous basis. These tests comprise the Battery of Driver Mental Function tests and were therefore chosen since they are administered to drivers applying for a professional driver's license. The results are evaluated according to the percentage obtained, a higher percentage corresponding to a higher score. Both were validated with more than 400 people each and presented strong, significant correlations with the Cambraia SV[11] sustained attention test.

The weight, height and NC of all participants were then measured, always by the same examiner.

The group to be studied was divided into subgroups according to the following criteria: BMI (< 30 and > 30 kg/m^2)[12]; NC (< 42 and > 42 cm)(13); and ESS (< 10 and > 10 points).[14]

The protocol of this study was approved by the Ethics in Research Committee of the University of Brasilia School of Medicine. The obtained data are presented through descriptive statistics (mean ± standard deviation). The comparison between the variables was made using the Student's t-test, chi-square test and Pearson's correlation analysis.

Values of $p < 0.05$ were considered statistically significant.

RESULTS

This study involved 262 male drivers. The mean age was 38.1 ± 5.8 years, ranging from 25 to 55 years. Mean BMI was 26.8 ± 3.5 kg/m², with minimum and maximum values of 19.2 and 40.1 kg/m², respectively. Mean NC was 40.4 ± 2.5 cm, with minimum and maximum dimensions of 34 cm and 48 cm, respectively. Those with an NC = 42 cm presented a mean value of 43.2 ± 1.2 cm, compared with 39.0 ± 1.6 cm for those with an NC < 42 cm.

The above-mentioned subgroups presented the following results.

In relation to the BMI analysis, we observed that 32% of the individuals were of normal weight, 50% were overweight, 15% presented class I obesity, 1.5% presented class II obesity, and 0.8% presented class III obesity.[12]

We observed that 34% of the drivers presented NC = 42 cm. Comparing NC with BMI, we found that the mean NC for drivers in the BMI > 30 kg/m² group was of 43.2 ± 1.8 cm, compared with 39.8 ± 2.2 cm for those in the BMI < 30 kg/m² group ($p < 0.05$).

We found that 27.5% of the drivers evaluated presented excessive daytime sleepiness, scoring at least 10 on the ESS. When we evaluated only those drivers with a BMI > 30 kg/m², we found that the prevalence of excessive sleepiness rose to 35% (Figure 1). However, 26% of drivers in the BMI < 30 kg/m² group scored higher than 10 on the ESS ($p > 0.05$). Similarly, when comparing ESS values for the groups divided by NC, we found no statistically significant differences among them ($p > 0.05$).

There were 71 drivers (27%) who defined themselves as smokers, of which 79% started smoking before age 20. We found that 12% used medication, 55% consumed cola-based soft drinks, 65% drank alcohol and 88% drank coffee. All of these substances were used in order to maintain alertness. In relation to sleep disorders, 36% reported snoring regularly, 32% reported snoring that was annoying to their bed partner (in 5% of the cases, the snoring could be heard from behind closed doors). In addition, 29% reported restless sleep; 12% reported waking up with a sensation of suffocation during sleep, and 5% reported sleep apnea (Figure 2).

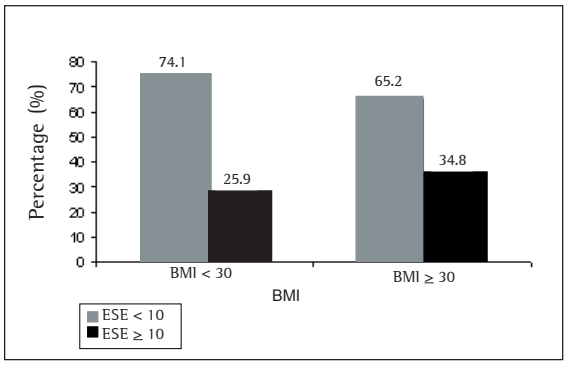

Figure 1 - Drivers divided by BMI and by ESS score, in percentage; $p > 0.05$; BMI: body mass index; ESS: Epworth Sleepiness Scale

Regarding excessive daytime sleepiness, we found that 48% of the drivers reported drowsiness while driving, and 42% had been involved in accidents, 8% of which were attributed to sleepiness. In comparing these variables between the groups subdivided by BMI, we found that those with a BMI = 30 kg/m² were more often drowsy while driving (50% versus 30%) and were more often involved in sleep-related accidents (13% versus 7%) than were those with a BMI < 30 kg/m² (Figure 3). These differences were statistically significantly ($p < 0.05$).

In comparing the results of the tests of attention, taking BMI into account, we found that mean performance on the Test of Sustained Attention was 54.4% for drivers with a BMI > 30 kg/m², compared with 52.2% for those with a BMI < 30 kg/m² ($p > 0.05$). In comparing mean performance on the Test of Divided Attention,

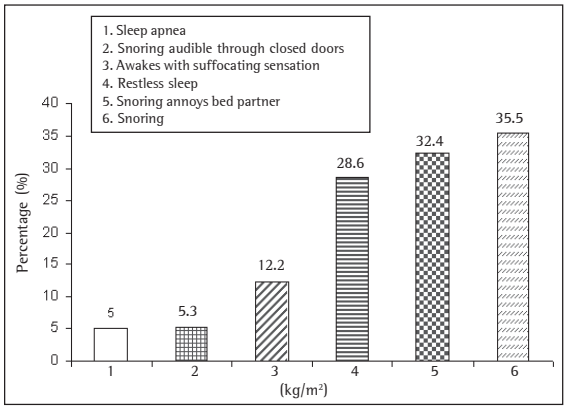

Figure 2 - Prevalence of sleep-related symptoms, in percentages

drivers with a BMI > 30 kg/m² presented a mean performance of 37.3%, whereas those with BMI < 30 kg/m² presented a mean performance of 45.6% ($p < 0.05$), the heaviest drivers presenting less divided attention.

In comparing the mean performance on the ESS with that obtained on the Test of Sustained Attention, we found that drivers with ESS scores > 10 obtained a mean performance of 51.2%, whereas those with ESS scores < 10 obtained a mean performance of 59.2% ($p = 0.07$). In comparing the results of the Test of Divided Attention among the ESS subgroups, we found statistically significant differences (37% versus 52%, $p = 0.02$), which shows that the greater the degree of excessive daytime sleepiness is, the lower the level of sustained and divided attention will be.

However, the result of the Test of Sustained Attention showed no difference between the subgroups divided by NC, whereas the divided attention was significantly lower ($p < 0.001$) in drivers with an NC > 42 cm.

The analysis of correlation of the studied variables indicated a significant correlation between BMI and ESS ($p = 0.04$ and $r = 0.30$), between ESS and the Test of Divided Attention ($p = 0.04$ and $r = -0.40$) and between the latter and NC ($p = 0.03$ and $r = -0.62$), indicating that the greater the BMI, the greater the hypersomnolence, which, in turn, correlated negatively with divided attention.

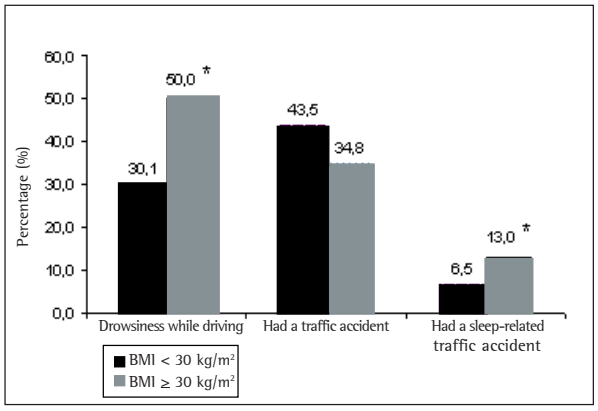

Figure 3 - Drivers divided according to sleepiness, number of accidents and BMI, in percentages
$p < 0.05$; BMI: body mass index

DISCUSSION

As previously mentioned, greater NC and obesity are significant risk factors for the development of OSAS. However, OSAS has innumerable consequences, such as morning headaches, decreased intellectual performance, depressive symptoms, sexual impotence and excessive daytime sleepiness.[14] It is of note that sleepiness plays a causative role in numerous work-related accidents and traffic accidents, as well as in reducing productivity and provoking mood disorders, including depression. According to the United States Department of Transportation, approximately 200,000 automobile accidents are attributed to sleepiness every year. Statistics from 1988 indicate that the annual cost related to hypersomnolence-related accidents in the USA is between 43 and 56 billion US dollars.[19]

In Brazil, according to the National Traffic Department Annual Statistics, there were 394,596 accidents in 2001. Of this total, 307,287 caused injuries, of which 20,039 were fatal.[20] Until recently, most fatal traffic accidents were attributed to the use of alcohol or other drugs. We believe that sleep disorders, mainly OSAS and the consequent excessive daytime sleepiness, have greatly contributed to worsening this problem and should therefore be treated as a public health issue.[20] Obesity, on the other hand, is usually considered the result of a sedentary lifestyle and poor eating habits. Obesity is one of the major factors contributing to the development of OSAS and the consequent excessive daytime sleepiness, especially among professional drivers.[21] In addition, the majority of these professionals present sleep deficits due to their rotating work shifts,[22] daytime sleep (compared with nighttime sleep) being of shorter duration, more fragmented and often accompanied by hypersomnolence.[23]

Therefore, OSAS and excessive daytime sleepiness are factors that can cause traffic accidents.[24-27] In addition, OSAS causes neural-cognitive deficits and psychological problems, including loss of memory, concentration and executive function.[28] The above examples illustrate the fact that, during excessive daytime sleepiness, attention levels are reduced and psychomotor coordination is altered, as demonstrated in the present study.

Our results confirm the findings of previous studies since, among the drivers evaluated, excessive

daytime sleepiness was found to be responsible for the great prevalence of the use of drugs in order to maintain alertness during working hours. We also found that overweight drivers presenting excessive daytime sleepiness performed more poorly on the test of divided attention than did drivers of normal weight and presenting no excessive daytime sleepiness. It is clear that reduced attention impairs the performance of professional activities, such as driving, thereby risking the lives of the driver and the passengers due to the delayed reaction time, which impairs judgment.[29]

Despite the limitations of the ESS,[30] drivers were divided according to their scores on the ESS, and we observed that 27.5% scored at least 10. In addition, we suppose that these data were underestimated, taking into account the subjectivity of the ESS and the fact that drivers were on company premises when taking the test. Therefore, the actual number of drivers experiencing excessive daytime sleepiness may be higher than that found herein. The fact that excessive daytime sleepiness was found in approximately one-third of the drivers is alarming since it results in cognitive deficit and impaired perception, mainly in terms of attention, creating a higher risk of traffic accidents.

In the population studied, we found that a significant proportion (42%) of the drivers had been involved in at least one traffic accident. In addition, although only 7.6% reported having been involved in accidents caused by sleepiness, 47.7% reported sleepiness while driving. We found a close proximity between the percentage of drivers who had been involved in accidents (42%) and the percentage who reported drowsiness while driving (47.7%).

In comparing BMI with sleep disorders and the occurrence of accidents, we found that, in the BMI >30 kg/m^2 group, there was more than 50% more drowsiness while driving than in the BMI < 30 kg/m^2 group. In addition, the number of sleep-related accidents was is twice as high in the BMI > 30 kg/m^2 group as in the BMI < 30 kg/m^2 group.

This study was designed to draw attention to the serious problem of hypersomnolence and the use of drugs among professional drivers. We believe that, through simple means, such as proper collection of histories and guided physical examinations, together with the application of the ESS, we can have a clearer idea of which applicants for new driver's licenses or for driver's license renewals might present sleep disorders. In conclusion, we suggest that questionable applicants should be more thoroughly investigated with respect to sleep disorders prior to receiving authorization to operate motor vehicles.

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