ORIGINAL ARTICLES

Self-Reported Traffic Accidents and Sleepiness in a Professional Group of Turkish Drivers

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Sleepiness in professional drivers is widely accepted to be an important cause of traffic accidents. Despite growing knowledge of the prevalence of sleepiness in automobile and truck drivers, estimates from different countries vary on the extent to which sleepiness is a cause of motor vehicle accidents. We have performed a study assessing the sleep characteristics and symptoms of disordered sleep as well as sleep related traffic accidents in a group of professional drivers by using a self-reported sleep symptom questionnaire. A hundred drivers with a mean age of 36 years filled out the questionnaire. Respondents were asked, whether they had had an accident and whether they felt like the sleepiness was the main reason. According to the answer of this question whether positive or negative, we divided the subjects into two groups: (1) accident group and (2) no accident group. Then, we compared the characteristics of these two. All sample rate of excessive daytime sleepiness and sleep related traffic accidents were 21% (95% confidence interval, CI 13,1 to 28,9) and 17% (95% CI 10,3 to 24,0) respectively. In the accident group (n=17) only two of subjects (12%) complained of witnessed apneas, nocturnal choking, nocturnal sweating and morning headaches. 35,3% of accident group reported five hours or less of average sleep duration per night whereas only 13,3% of no accident group had five hours or less sleep ($p<0,05$). In conclusion, this is the first study that reports the rate of sleepiness related traffic accidents in a Turkish group of commercial drivers. All sleepiness related accidents cannot be explained by sleep apnea syndrome. And finally, drivers may be able to decrease their risk of accident if they get sleep more than five hours a night. **(Sleep and Hypnosis 2002;4(3):106-110)**

Key words: *sleepy driving, traffic accident, self-reported sleepiness, snoring*

INTRODUCTION

Driving is a complex form of activity involving full alertness as well as quick and accurate perception, judgement and psychomotor functions. These functions may be impaired by increased sleep propensity and/or sleepiness while driving. Sleepy drivers are at particular risk for motor vehicle crashes because they may not perceive a potential crash threat or react quickly enough to take evasive action (1). A recent study suggests that driving while sleepy should be recognized as potentially dangerous or as at least as dangerous as driving illegally under the influence of alcohol (2). Respiratory disorders during sleep, such as sleep apnea,

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are common causes of excessive sleepiness (3) and of an increased risk of automobile crashes (4-6). In these disorders, sleep is disrupted by partial or total cessation of breathing leading to sleep fragmentation. Even one night of sleep fragmentation can induce objective sleepiness and altered psychometric function (7).

Driver sleepiness is considered an important factor leading to traffic crashes which are frequent cause of serious injury and death. Each year, over 110,000 people are injured and more than 5000 are killed in the United States in motor vehicle accidents involving commercial trucks (8). Studies have estimated that between 1% and 3% of crashes may be attributed to the driver falling asleep or being drowsy in US (1). Studies from other countries have given estimates of 4%, 6%-33% and 16% for Norway (9), Australia (10) and Britain (11) respectively. No previous studies have attempted to estimate the rate of sleepiness related motor vehicle accidents among Turkish drivers.

This study addresses the following questions: (1) What is the rate of recalled traffic accidents related to sleepiness in a representative group of professional Turkish driver population? (2) Are there differences between drivers who had accident and who did not in terms of sleep characteristics and symptoms of disturbed sleep? (3) What is the rate of snoring and sleep disordered breathing symptoms in this group of drivers?

METHOD

Subjects

Subjects were 100 male, licenced commercial drivers from taxi stations and municipal bus stations. None of the subjects were long haul truck drivers. Drivers were told the purpose of the study and asked to participate. All drivers read and signed an informed consent form that detailed the study.

Data Collection

We used a questionnaire to record data on demographic characteristics, the average number of hours slept per day, alcohol intake, sleep symptoms related with sleep-disordered breathing. The number of automobile accidents was obtained in all participants from the subject. Respondents were asked , "Have you ever had a traffic accident and have you felt that the accident(s) were related to sleepiness?" According to the answer of this question, whether positive or negative, we divided the group into two subgroups as "accident group" and "no accident group". The questionnaires were administered by trained interviewers, usually at the subject's station during resting period. Sleep symptom questions were answered on a five-point scale, with 1=never, 2=rarely, 3=sometimes, 4=often and 5=always.
Statistical Analysis

Qualitative variables were expressed as percentages, and quantitative variables as mean ± SD. Relation between crosstabulated variables were analysed by chi- square test. Quantitative variables were compared by using Student's t test if the distribution is normal, otherwise Mann Whitney U test was used. %95 confidence intervals were calculated.

RESULTS

The investigated group consisted of mainly middle-aged men. Table 1 presents the main characteristics and the number of subjects in the accident group and no accident group. All sample rate of traffic accidents due to sleepiness in this group was 17%. There were no differences in age and BMI ratio between drivers with accident (n=17) and those not involved any accident (n=83). Accident group complained of sleep disruption due to the feeling of breathlessness (nocturnal choking), nocturnal sweating and morning headaches in higher rates. When drivers answered questions on nocturnal choking, witnessed apneas,

Table 1. Comparisons between drivers who reported car accidents due to sleepiness and drivers with no accident.

	Accident Group	No Accident Group	Chi-square value	p value
No of drivers	17	83		
Age, yr	37,2±7,7	35,9±7,9		NS
BMI, kg/m^2	28±9	26±3		NS
Average sleep duration per night, h	6,2±1,3	7,0±1,3		<0,05
Complaint of				
Snoring, %	35,3,7	24,1	0,378	NS
Witnessed apneas, %	29,4	16,9	1,443	NS
Sleep disruption due to the feeling of choking, %	58,8	16,9	13,617	<0,001
Nighttime sweating, %	82,4	61,4	2,711	NS
Morning headaches, %	70,6	39,8	5,418	<0,02
Abnormal sleep, %	82,4	50,6	5,773	<0,02
Ineffective sleep, %	64,7	67,5	0,049	NS
Weight gain at least 5 kg in last 6 months, %	29,4	38,6	0,506	NS

nocturnal sweating and morning headaches with "often" or "always," they were classified as possible sleep apnea patients. In the accident group, only four subjects complained of both witnessed apneas and sleep disruption due to the feeling of choking (95% confidence interval 0,2 to 7,8) and only two subjects complained of witnessed apneas, sleep disruption due to the feeling of choking, nocturnal sweating and morning headaches (95% CI 2,7 to 4,7). Answers of "often" or "always" to any one of the questions pertaining to "feeling sleepy during daytime," "falling asleep or drowsy during eating, watching TV, driving or talking to someone" and "irresistable napping during daytime" were sufficient to classify drivers presenting with "excessive daytime sleepiness". The rate of excessive daytime sleepiness was 21% (95% CI 13,1 to 28,9) in the whole group.

Drivers who reported five hours or less of average sleep duration for a night had significantly more traffic accidents compared with those who had more than five hours of sleep. 35,3% of accident group reported five hours or less of average sleep duration whereas only 13,3% of no accident group had the same amount of sleep (p<0,05). In other words, accident group had 6,2±1,3 hour average sleep duration per night whereas no accident group had 7,0±1,3 hour per night (p<0,05).

DISCUSSION

Before making firm conclusions about the findings, it should be noted that this study had several limitations. Our samples consisted of yellow cab drivers, bus drivers and other vehicle drivers who were driving on the urban roads and streets. These results may therefore not be generalizable to other driver populations such as long-haul truck drivers.

It should also be noted that the absence of physiological measures of sleep, wake and daytime functioning to corroborate and supplement subjects' self reports is a serious limitation of this investigation and may have led to an overestimation of differences in sleep and wake times between individuals. Nevertheless, polysomnographic criteria should not be used as the only basis of sleep quality in accordance with a recent policy statement by the Standards of Practice Committee of the American Sleep Disorders Association (12).

It would have been preferable to use Epworth Sleepiness Scale (ESS) in assessing daytime sleepiness. The ESS is easy to administer and currently the most popular subjective measure of daytime sleepiness. However, translation of the ESS into Turkish needs to be better clarified. Although Turkish versions of the ESS have been used for clinical

and research purposes, the scales have not been validated.

We recognize and acknowledge that the study was limited in numbers of respondents and thus in statistical power. Nevertheless, it was undertaken as a preliminary first step investigation because, to our knowledge, this type of study had not been previously performed. These results should be better accepted as initial documentation of sleepiness and sleep related traffic accidents in Turkish urban drivers.

Sleepiness is characterized by a tendency to fall asleep and is the unavoidable consequence of the unsatisfied need to sleep (1). Benbadis et al reported that daytime sleepiness is not only common in the general population, but also among drivers. In their study, 26% of 620 drivers had ESS scores equal to or higher than 10 (13). Interviews of 1000 randomly selected automobile drivers in New York State revealed that about 23% had fallen asleep while driving at sometime in their lifetime and 5% had a crash due to sleepiness or falling asleep while driving (14). In another survey from England, Horne and Reyner (11) reported that sleep related vehicle accidents comprise about 16-23% of road accidents. In our study group, the rate of excessive daytime sleepiness was %21 which is relevant with the results from U.S. and U.K. surveys.

There have been several more studies on sleepiness among drivers. Martikainen et al found that 15% of 173 drivers had nodded off at the wheel during driving (15). Matcock et al (16) reported 29% of 4621 male drivers had felt close to falling asleep while driving. Masa et al found that 3,6% of 4002 drivers were habitually sleepy and the reported automobile crash rate in habitually sleepy drivers was approximately 10 times greater than control subjects (17). Habitual sleepiness rather than sporadic sleepiness is more likely to be a result of unrecognized sleep problems such as sleep apnea. Among the causes of sleepiness, sleep related breathing disorders appear to play a major role in accidents (18) due to their high prevalence (3). It has been shown that patients with sleep apnea had a greater probability of having a traffic accident than patients without sleep apnea (6). Furthermore, treatment of obstructive sleep apnea by means of either continuous positive airway pressure (4,19) or surgery (20) improved daytime sleepiness and decreased automobile accidents. Frequency of snoring in our driver group was 26%. Although the rate of snoring in accident group (35%) was higher than no accident group (24%), the difference was not statistically significant. In our study, 4% of all drivers reported symptoms of sleep apnea which is in accordance with previous studies. In the accident group, 12% of the subjects reported symptoms of sleep apnea syndrome i.e. witnessed apneas, nocturnal choking, morning headaches and nocturnal sweating. These results suggest that only small portion of the sleepiness related traffic accidents can be attributed to sleep apnea syndrome. Other causes such as inadequate working schedule, insomnia, late-night socializing and poor sleep habits seems more likely to be the underlying reason of sleepiness which induces traffic accidents

Undoubtedly, the average sleep duration per night plays an important role in sleep related traffic accidents. It is well-known that psychomotor performance is impaired if sleep is limited to five hours for two or more consecutive nights (21). And a person's tendency to fall asleep during normal waking hours increases if he or she has slept less than six hours (21). Our results on the average sleep duration of accident and no accident groups are not very different from more recent and well documented studies. For example, Connor et al found that drivers who reported five hours or less of sleep in the previous 24 hours were at significantly increased risk compared with those who had more than five hours (22). Powell et al demonstrated that chronic sleep deprivation, 5 hours of sleep nightly for a 7-day period impaired reaction time as much as

alcohol challenge during driving (2). In our driver group, drivers who reported five hours or less of average sleep duration for a night had significantly more traffic accidents compared with those who had more than five hours of sleep.

REFERENCES

1. *Lyznicki JM, Doege TC, Davis RM, Williams MA, for the Council on Scientific Affairs, American Medical Association. Sleepiness, driving, and motor vehicle crashes. JAMA 1998;279:1908-1913.*

2. *Powell NB, Schechtman KB, Riley RW, Li K, Troell R, Guilleminault C. The road to danger: The comparative risks of driving while sleepy. Laryngoscope 2001;111:887-893.*

3. *Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurence of sleep-disordered breathing among middle-aged adults. N Eng J Med 1993;328:1230-1235.*

4. *Krieger J, Meslier N, Lebrun T, Levy P, Phillip-Joet F, Sailly J, Racineux J. Accidents in obstructive sleep apnea patients treated with nasal continuous positive airway pressure. Chest 1997;112:1561-1566.*

5. *Barbe F, Pericas J, Munoz A, Findley L, Anto JM, Agusti A. Automobile accidents in patients with sleep apnea syndrome: An epidemiological and mechanistic study. Am J Respir Crit Care Med 1998;158:18-22.*

6. *Teran-Santos J, Jimenez-Gomez J, Cordero-Guevara J. The association between sleep apnea and the risk of traffic accidents. N Engl J Med 1999;340:847-851.*

7. *Martin SE, Engleman HM, Deary IJ, Douglas NJ. The effect of sleep fragmentation on daytime function. Am J Respir Crit Care Med 1996;153:1328-1332.*

8. *Mitler MM, Miller JC, Lipsitz JJ, Walsh JK, Wylie CD. The sleep of long-haul truck drivers. N Engl J Med 1997;337:755-761.*

9. *Sagberg F. Road accidents caused by drivers falling asleep. Accid Anal Prev 1999;31:639-649.*

10. *Pierce RJ. Driver sleepiness: occupational screening and the physician's role. Aust N Z J Med 1999;29:658-661.*

11. *Horne JA, Reyner LA. Sleep related vehicle accidents. BMJ 1995;310:565-567.*

12. *Standards of Practice Committee of the American Sleep Disorders Association. Practice parameters for the use of polysomnography in the evaluation of insomnia. Sleep 1995;18:55-57.*

13. *Benbadis SR, Perry MC, Sunstad LS, Wolgamuth BR. Prevalence of daytime sleepiness in a population of drivers. Neurology 1999;52:209-210.*

14. *McCartt AT, Ribner SA, Pack AI, Hammer MC. The scope and nature of the drowsy driving problem in New York State. Accid Anal Prev 1996;28:511-517.*

15. *Martikainen K, Urponen H, Partinen M, Hasan J, Vuori I. Dayitme sleepiness: a risk factor in community life. Acta Neurol Scand 1992;86:337-341.*

16. *Maycock G. Sleepiness and driving: the experience of UK car drivers. J Sleep Res 1996;5:229-237.*

17. *Masa JF, Rubio M, Findley LJ. Habitually sleepy drivers have a high frequency of automobile crashes associated with respiratory disorders during sleep. Am J Respir Crit Care Med 2000;162:1407-1412.*

18. *Stoohs RA, Bingham L, Itoi A, Guilleminault C, Dement WC. Sleep and sleep-disordered breathing in commercial long-haul truck drivers. Chest 1995;107:1275-1282.*

19. *Findley L, Smith C, Hooper J, Dineen M, Suratt PM. Treatment with nasal CPAP decreases automobile accidents in patients with sleep apnea. Am J Respir Crit Care Med 2000;161:857-859.*

20. *Haraldsson P, Carenflt C, Lysdahl M, Törnros J. Long-term effect of uvulopalatopharyngoplasty on driving performance. Arch Otolaryngol Head Neck Surg 1995;121:90-94.*

21. *Carskadon MA, Dement WC. Cumulative effects of sleep restriction on daytime sleepiness. Psychophysiology 1981;18:107-113.*

22. *Connor J, Norton R, Ameratunga S, Robinson E, Civil I, Dunn R, Bailey J, Jackson R. Driver sleepiness and risk of serious injury to car occupants: population based case control study. BMJ 2002;324:1125-1129.*