Relationship Between Sleep Quality, Obstructive Sleep Apnea and Sleepiness During Day With Related Factors in Professional Drivers

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Received: 30 Sep. 2016; Accepted: 15 Apr. 2017

Abstract- One of the important reasons for accidents is sleepiness.With this description, the sleep disorders are associated with health and mortality, and not only affect the person but also the family and the whole society. Aim of this study was assessing of relationship between Sleep Quality, Obstructive sleep Apnea and Sleepiness during day with related factors in professional drivers. This was a cross-sectional study measuring correlation between sleep quality questionnaire (Pittsburgh Sleep Quality Index or PSQI), Epworth Sleepiness Scale (ESS) and Stop Bang questionnaire (STOP BANG).the appropriate sample size to achieve a 95% confidence level was 943 people. The study population was chosen among qualified drivers using a convenience sampling method that took place over 12 months duration. Exclusion criterion consisted of the presence of a physical or mental disability. Data analyzed by software SPSS, version 15. In this study, all drivers were men with mean of age 36±9/5 year (minimum 22 year and maximum 72 year), 799 (84.7%) were married, 535 (56.7%) had high school education. Also, 96.4 % of drivers had undesirable sleep quality, 25.8% obstructive sleep apnea and 6.8% abnormal sleepiness during day. Multiple linear regression test showed, Score of STOP-Bang was correlated with smoking (OR (β)=0/2, *P*=0.006) and history of hurt disease (OR (β)=0.95, *P*=0.003), shift work (OR (β)=0.19, *P*=0.006) more probability. Moreover, PSQI was statistically significant with shift work (OR (β)=0.44, *P*=0.02), smoking (OR (β)=0.98, *P*=0.001), history of pulmonary disease (OR (β)=3.58, *P*=0.009) more probability , and ESS was statistically significant with smoking (OR (β)=0.64, *P*=0.007) and history of pulmonary disease(OR (β)=2.82, *P*=0.006), shift work (OR (β)=0.59, *P*=0.008) more probability. In our study, according to the results, it should be planning to reduce the driving time in day and night and also it are recommended short breaks during driving. It is suggested the more widespread and prospective studies, as well as informing the drivers about the benefits of proper sleep and annual checkup drivers of health.

Acta Med Iran 2017;55(11):690-695.

Keywords: Professional drivers; Sleep disorder; Sleep quality; Sleepiness

Introduction

The quality of life and activity of people during waking hours is greatly influenced by their quality of sleep (1). Many sleep disorders are considered life-threatening indirectly. A large number of industrial accidents are caused by the sleepiness (2,3). With this description, the sleep disorders are associated with health and mortality, and not only affect the person but also the family and the whole society (4). The studies that have been mainly performed in the high-income countries show that the sleepiness of driver is one of the significant factors of road accident injuries and associated with the three to six times increased the risk of the road accidents (5-8).

The ratio of accidents related to sleep problems in drivers was 1-3% in the United States, up to 10% in France and 33% in Australia. The sleep-related factors which are associated with increased rate of road accident injuries, including working for a long time, night shifts or unconventional work schedules (6,9-11). These occupational risks have increased the concern in low and middle-income countries that drivers are at risk of less control of their working conditions and social and

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economic pressures for driving for a long time with not enough rest (12). In Iran, more than 700 thousand people are chosen driving as their main career, and many of them due to the occupational requirements and economic situation are forced to work in the whole hours of the day such as sleepiness peak hours (13). Also, the increased risk of developing some sleep disorders in professional drivers such as respiratory disorders during sleep and non-observing the sleep health would increase the risk of loss of quality in this occupational group (14).

Despite many studies that emphasized the importance of appropriate sleep, many aspects of the subject have remained unknown or inconsistent. Due to the high rate of accidents in Iran and role of sleep quality in the road accidents, a comprehensive study will be important to determine the sleep quality of drivers in Iran. Hence, the present study was aimed to examine the relationship between sleep quality, obstructive sleep apnea and sleepiness during the day with related factors in professional drivers in Tehran, to provide the required background for legal planning and health recommendations to reduce the driving accidents.

Materials and Methods

Study design and measurement tools

This was a cross-sectional study measuring the correlation between sleep quality questionnaire (Pittsburgh Sleep Quality Index or PSQI), Epworth Sleepiness Scale (ESS) and Stop Bang questionnaire (STOP BANG).

Using PSQI, we evaluated the subjects' attitudes about sleep quality in the last 4 weeks. This questionnaire evaluates the following seven points:

1. A general description of the sleep quality
2. The delay in falling asleep
3. The duration of effective sleep
4. Sleep efficiency (the ratio of sleep duration of total time spent in bed)
5. Sleep disorders (as defined sleep fragmentation person)
6. The amount of sleep aid used
7. The morning performance (the difficulties are experienced by the person during the days of having nightmares)

Each point has scored between 0 to 3, and score of 3 is the maximum negative. The scope of this questionnaire score between 0 and 21 And higher score of 5 indicates inappropriate Sleep quality and sleep disturbance (15) .The validity and reliability of this questionnaire in various studies have been approved (16). Also, we used Epworth Sleepiness Scale (ESS) that has eight items, and it assesses subjective sleepiness condition for individuals. Each point has scored between 0 to 3 .range of the score is between 0 to 24. Score of 0 to 8 is normal sleepiness, 9 to12 is mild sleepiness, 13 to16 is moderate sleepiness, and more than 16 is severe sleepiness. Clinically, when ESS is more than 10 shows sleepiness, and it is important (17).

Furthermore, we used Stop Bang questionnaire that has 8 items. It is a valid questionnaire for Screening of obstructive sleep apnea. The questionnaire has eight questions (criterion) is included snoring, fatigue, and Sleepiness during the day, having apnea, having high blood pressure Or taking medication for high blood pressure, body mass index More than 30, older than 50 years, around the neck more than 40 cm, and male gender. A positive response to each question has 1 score, and a negative response has zero scores. Having three or more positive answers to 8 items indicates a high risk of obstructive sleep apnea, fewer than three positive response, the questions indicate a lower risk of obstructive sleep apnea.

It must be mentioned that validity and reliability of PSQI questionnaire were confirmed by Farrahi Moghaddam and colleagues in 2012 (18). Also, validity and reliability of ESS and Stop Bang questionnaires were confirmed by Khosro Sadeghniiat-Haghighi and colleagues in 2013 and 2015 respectively in Iran (19, 20).

We performed data analysis using statistical software (Version 15) (21).

Furthermore, a checklist filled by the questioner that was subject baseline characteristics data, including the history of heart disease, history of pulmonary disease, history of surgery, history of orthodontics, smoking, shift work to gather information .

Study population

The study population was professional road drivers who were between 23 and 62 years of age currently drove with vehicles, for more than one year, and referred to take a training course of occupational health in different months from April to March 2014, in specialized center of occupational medicine of Baharlou hospital in Tehran.

The appropriate sample size to achieve a 95% confidence level was 943 people. The study population was chosen among qualified individuals using a convenience sampling method that took place over 12

months duration.Exclusion criterion consisted of the presence of a physical or mental disability.

Ethical issues

We began the study after obtaining permission from the ethical committee of the faculty medicine in Tehran University of medical science.

Results

In this study, all drivers were men with mean of age 36±9.5 year (minimum 22 year and maximum 72 year), 799 (84.7%) were married, 535 (56.7%) had high school education.

Also, 96.4 % of drivers had undesirable PSQI, 25.8% obstructive sleep apnea and 6.8% abnormal sleepiness during the day.

For assessing the relationship between some baseline characteristics and mean score of PSQI, ESS,and Stop Bang was used of Mann Whitney test because the distribution of the scores in subgroups was not normal. (Table 1).

Table 1. Mean comparison of PSQI, ESS and Stop Bang based on baseline characteristics (n=943)

Variables		PSQI		ESS		Stop Bang	
		Mean (CI)	*P*	Mean (CI)	*P*	Mean (CI)	*P*
History of heart disease	**Have**	5.36 (5.19-5.54)	0.129	3.70 (3.51-3.90)	0.056	2.03 (1.97-2.09)	0.027*
	Have not	7.88 (4.05-11.72)		7.33 (2.67-11.99)		3.22 (1.74- 4.69)	
History of pulmonary disease	**Have**	5.37 (5.19- 5.55)	0.102	3.72 (3.53-3.92)	0.034*	2.03 (1.97- 2.09)	0.006*
	Have not	9.75 (.71-18.78)		7.50 (1.61-13.38)		3.25 (2.45-4.04)	
History of surgery	**Have**	5.37 (5.20-5.55)	0.168	3.73 (3.53-3.93)	0.624	2.04 (1.98- 2.10)	0.438
	Have not	7.16 (3.69-10.64)		4.16 (.95-7.37)		2.33 (1.24- 3.41)	
History of Orthodontics	**Have**	5.35 (5.17-5.53)	0.062	3.74 (3.54- 3.94)	0.597	2.03 (1.97- 2.10)	0.133
	Have not	6.72 (5.26-8.17)		3.72 (2.17-5.26)		2.28 (1.89- 2.66)	
Smoking	**Have**	5.14 (4.94-5.33)	0.001*	3.56 (3.35-3.78)	0.009*	1.99 (1.92- 2.05)	0.002*
	Have not	6.24 (5.83-6.66)		4.33 (3.83-4.82)		2.22 (2.08-2.36)	
Shift work	**Morning**	5.23 (5.02-5.43)	0.001*	3.54 (3.31-3.76)	0.002*	1.98 (1.91- 2.05)	0.001*
	Evening and night	5.85 (5.49-6.21)		4.28 (3.86- 4.70)		2.21 (2.09-2.33)	

*There is significant relationship

Multiple linear regression tests showed PSQI was statistically significant with shift work (β=0/44, *P*=0/02), smoking (β=0/98, *P*=0/001), history of pulmonary disease (β=3/58, *P*=0/009) more probability (Table 2).

Table 2. Multiple linear regression for modeling of PSQI score determinants

Variables	Regression coefficients (Beta)	95% CI for beta	*P*
History of heart disease	1.50	-0.281 to 3.29	0.099
History of pulmonary disease	3.58	0.911 to 6.26	0.009*
History of surgery	1.60	-0.765 to 3.97	0.184
History of Orthodontics	0.804	-0.295 to 1.90	0.151
Smoking	0.984	0.568 to 1.39	0.001*
Shift work	0.446	0.054 to 0.838	0.026*

*Statistically significant

Moreover, ESS was statistically significant with smoking (β=0/64, *P*=0/007) and history of pulmonary disease(β=2/82, *P*=0/006), shift work (β=0/59, *P*=0/008) more probability (Table 3), and Score of STOP-Bang was correlated with smoking (β=0/2, *P*=0/006) and history of hurt disease(β=0/95, *P*=0/003), shift work (β=0/19, *P*=0/006) more probability(Table 4).

There was correlation between total Stop bang score and total Epworth sleepiness scale (ESS) score (r=0.216, *P*=0.001), total Epworth sleepiness scale (ESS) score and total Pittsburg score(PSQI) (r=0.39, *P*=0.001), and total Stop bang score and total Pittsburgh score (r=0.203, *P*=0.001)

There was correlation between total Epworth sleepiness scale (ESS) score and total Pittsburgh score (r=0.39, *P*=0.001), and total Stop bang score and total Pittsburgh score (r=0.20, *P*=0.001), and total Stop bang score and total Epworth sleepiness scale (ESS) score

(r=0.21, *P*=0.001), (Table 5).

Table 3. Multiple linear regression for modeling of ESS score determinants

Variables	Regression coefficients (Beta)	95% CI for beta	*P*
History of heart disease	2.82	0.80 to 4.84	0.006*
History of pulmonary disease	2.86	-0.155 to 5.87	0.063
Smoking	0.648	0.179 to 1.11	0.007*
Shift work	0.596	0.153 to 1.03	0.008*

*Statistically significant

Table 4. Multiple linear regression for modeling of Stop Bang score determinants

Variables	Regression coefficients (Beta)	95% CI for beta	*P*
History of heart disease	0.950	0.333 to 1.56	0.003*
History of pulmonary disease	0.909	-0.013 to 1.83	0.053
History of orthodontics	0.057	-0.320 to 0.435	0.765
Smoking	0.200	0.057 to 0.344	0.006*
Shift work	0.190	0.055 to 0.326	0.006*

*Statistically significant

Table 5. Correlation coefficients of PSQI, ESS and Stop Bang scores

Correlation	Correlation coefficients	*P*
PSQI and ESS	0.397	0.001
PSQI and stop bang	0.203	0.001
ESS and stop bang	0.216	0.001

*. Correlation is significant at the 0.05 level (2-tailed)
**. Correlation is significant at the 0.01 level (2-tailed)

Discussion

In this study, the undesirable sleep quality and few numbers of obstructive sleep apnea and sleepiness during the day were observed in the drivers. The study performed in Darab on the drivers showed that the sleep quality of 40% of the truck drivers based on 5% cut-off point was undesirable (22). In the study performed in Turkey, almost 44% of the drivers have experienced the sleepiness (23), and in the study performed in Darab, one-quarter of drivers have mentioned the accident experience due to the sleepiness. In the study performed by Obianuju B. Ozoh *et al*., on the intercity drivers in Nigeria, it becomes clear that obstructive sleep apnea (OSA) risk was high in 244 (48.8%) drivers and 72 (14.4%) had excessive daytime sleepiness, and during this research, OSA was examined with STOP-Bang questionnaire, and excessive daytime sleepiness was examined with questionnaire (24).

In our study, there was also a significant correlation between working shifts with PSQI, ESS, and Stop Bang. Meaning that number of people in the evening and night working shifts had significant relationship with the mean scores for the three questionnaires.

In a study on 2304 professional truck drivers in Japan in 2005, 1050 answer sheet were collected and at the end, 1330 answers were examined, and their working conditions and Pittsburgh questionnaires features were analyzed. The regression analysis showed that high sleepiness during driving is mainly associated with excessive work, working hours distribution (mainly at night), and irregular working plan (25).

In the present study, the mean score of ESS and Stop Bang questionnaires had a significant relationship with the history of pulmonary disease. Examining the history of the disease in drivers have shown that they had the heart and respiratory diseases rarely, surgical history and orthopedic problems and the majority were healthy enough for occupational activity (26). The low number of subjects in each group can be a result of health plan for drivers performed throughout the Iran.

Furthermore, the mean score of Stop Bang had a significant relationship with the history of heart disease. In a study that was down by Daniel J. Gottlieb and *et al*., in Boston reported that obstructive sleep apnea is associated with an increased risk of incident heart failure in community-dwelling middle-aged and older men; its association with incident coronary heart disease in this sample is equivocal (27).

In this study, the smoking history had a significant relationship with PSQI, ESS and Stop Bang. The results of study by Kwok-Kei Mak in 2010 in China showed

that the smokers have sleep disorders and at the start of sleeping have problems in maintaining sleep and woke up early in the morning (28). The study was similar to our study, but the study population was different.

Moreover, the mean score of ESS, PSQI and Stop Bang questionnaires had a significant relationship with Also, in the drivers who had a history of pulmonary diseaseand smoking and had evening and night shift work, lower sleep qualitywas more probability and in the drivers, who had a history of heart disease and smoking, and had evening and night shift work, sleepiness during the day was more probability. Furthermore, sleep apnea was in the drivers who had history of heart disease, smoking, evening a night shift work and sleep apnea wasmore probability.

Our study also showed that there was a significant correlation between total score of ESS, PSQI, and Stop Bang. This result was similar to the study of Mohsen Dehghani *et al*., They examined 312 subjects among the professional drivers of Shahrud Terminal Association and showed that there was a significant correlation between ESS, PSQI and Stop Bang. The drivers with the respiratory disorder(Stop Bang>3), don't also have an appropriate PSQI sleep quality (overall score greater than 5) and were also sleepy throughout the day (ESS>10) (30). Theseresults were also similar to the study of Obianuju B. Ozoh on the intercity drivers in Nigeria. They showed that ESS score had a significant positive correlation with Stop Bang score (24).

The limitations of this plan are examining the sleep disorder as questionnaire. The difficulty of accessing all the drivers in the country and no-cooperation of some drivers and their concern of misusing private data and its impact on occupational activities was another limitation of this study.

In our study, according to the results, it should be planning to reduce the driving time in day and night and also it is recommended short breaks during driving . It is suggested the more widespread and prospective studies, as well as informing the drivers about the benefits of proper sleep and annual checkup drivers of health.

References

1. Gooneratne NS, Weaver TE, Cater JR, Pack FM, Arner HM, Greenberg AS, et al. Functional outcomes of excessive daytime sleepiness in older adults. J Am Geriatr Soc 2003;51:642-9.
2. Kingshott RN, Cowan JO, Jones DR, Flannery EM, Smith AD, Herbison GP, et al. The role of sleep-disordered breathing, daytime sleepiness, and impaired performance in motor vehicle crashes-a case control study. Sleep Breath 2004;8:61-72.
3. Melamed S, Oksenberg A. Excessive daytime sleepiness and risk of occupational injuries in non-shift daytime workers. Sleep 2002;25:315-22.
4. Amagai Y, Ishikawa S, Gotoh T, Doi Y, Kayaba K, Nakamura Y, et al. Sleep duration and mortality in Japan: the Jichi medical school cohort study. J Epidemiol 2004;14:124-8.
5. Amagai Y, Ishikawa S, Gotoh T, Kayaba K, Nakamura Y, Kajii E. Sleep duration and incidence of cardiovascular events in a Japanese population: the Jichi Medical School cohort study. J Epidemiol 2010;20:106-10.
6. Lyznicki, J.M., et al., Sleepiness, driving, and motor vehicle crashes. JAMA 1998;279:1908-13.
7. Peden M. World report on road traffic injury prevention. World Health Organization. (Accessed April 2017, 29, at http://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/en.(/
8. Philip P, Sagaspe P, Lagarde E, Leger D, Ohayon MM, Bioulac B, et al. Sleep disorders and accidental risk in a large group of regular registered highway drivers. Sleep Med 2010;11:973-9.
9. Akerstedt T. Consensus statement: fatigue and accidents in transport operations. J Sleep Res 2000;9:395.
10. Williamson A, Lombardi DA, Folkard S, Stutts J, Courtney TK, Connor JL. The link between fatigue and safety. Accid Anal Prev 2011;43:498-515.
11. Vanlaar W, Simpson H, Mayhew D, Robertson R. Fatigued and drowsy driving: A survey of attitudes, opinions and behaviors. J Saf Res 2008;39:303-9.
12. Nantulya VM, Muli-Musiime F. Kenya: Uncovering the social determinants of road traffic accidents. (Accessed April 2017, 25, at http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780195137408.001.0001/acprof-9780195137408-chapter-15.(
13. Sadeghniiat K, Labbafinejad Y. Sleepiness among Iranian lorry drivers. Acta Med Iran 2007;45:149-52.
14. Akkoyunlu ME, Altın R, Kart L, Atalay F, Ornek T, Bayram M, et al., Investigation of obstructive sleep apnoea syndrome prevalence among long-distance drivers from Zonguldak, Turkey. Multidiscip Respir Med 2013;8:10.
15. Ghaljaei F, Naderifar M, Ghaljeh M. Comparison of general health status and sleep quality between nurses with fixed working shifts and nurses with rotating working shifts. Zahedan J Res Med Sci 2011;13:47-50.
16. Mahdizadeh S, Salari MM, Ebadi A, Aslani j, Naderi Z, Avazeh A, et al. Relationship between sleep quality of life in chemical warfare victims with bronchiolitis

obliterans referred to Baqiyatallah hospital of Tehran, Iran. Payesh 2011;10:265-77.

17. Bloch KE, Schoch OD, Zhang JN, Russi EW. German version of the Epworth sleepiness scale. Respiration 1999;66:440-7.
18. Farrahi Moghaddam J, Nakhaee N, Sheibani V, Garrusi B, Amirkafi A. Reliability and validity of the Persian version of the Pittsburgh Sleep Quality Index (PSQI-P). Sleep Breath 2011;16:79-82.
19. Sadeghniiat Haghighi K, Montazeri A, Khajeh Mehrizi A, Aminian O, Rahimi Golkhandan A, et al. The Epworth Sleepiness Scale: translation and validation study of the Iranian version. Sleep Breath 2012;17:419-26.
20. Sadeghniiat-Haghighi K, Montazeri A, Khajeh-Mehrizi A, Ghajarzadeh M, Alemohammad ZB, Aminian O, et al. The STOP-BANG questionnaire: reliability and validity of the Persian version in sleep clinic population. Qual Life Res 2015;24:2025-30.
21. Silva GE, Vana KD, Goodwin JL, Sherrill DL, Quan SF. Identification of patients with sleep disordered breathing: comparing the four-variable screening tool, STOP, STOP-Bang, and Epworth Sleepiness Scales. J Clin Sleep Med 2011;7:467-42.
22. Malek M, Halvani G, Fallah H. A study of the relationship between the Pittsburgh sleep quality index and road accidents among truck drivers. Occup Med Q J 2011;3:14-20.
23. Pérez-Chada D, Videla AJ, O'Flaherty ME, Palermo P, Meoni J, Sarchi MI, et al. Sleep habits and accident risk among truck drivers: a cross-sectional study in Argentina. SLEEP 2005;28:1103.
24. Ozoh OB, Okubadejo NU, Akanbi MO, Dania MG. High-risk of obstructive sleep apnea and excessive daytime sleepiness among commercial intra-city drivers in Lagos metropolis. Niger Med J 2013;54:224-9.
25. Kanazawa H, Suzuki M, Onoda T, Yokozowa M. Excess workload and sleep-related symptoms among commercial long-haul truck drivers. Sleep Biol Rhythms 2006;4:121-8.
26. kakooei H, Akhlaghi A, Panahi D. Investigation of sleep quality professional drivers inter-city terminals (Case study: Tehran). Traffic Manag Stud 2010;5:1-10.
27. Gottlieb DJ, Yenokyan G, Newman AB, O'Connor GT, Punjabi NM, Quan SF, et al. Prospective study of obstructive sleep apnea and incident coronary heart disease and heart failure the sleep heart health study. Circulation 2010;122:352-60.
28. MakKK, Ho SY, Thomas GN, Lo WS, Cheuk DK, Lai YK, et al. Smoking and sleep disorders in Chinese adolescents. Sleep Med 2010;11:268-73.
29. Dehghani M, Niat S, Ebrahimi M. Relationship between Epworth Sleepiness Scale and obstructive sleep apnea with road accidents. IOH 2015;12:87-96.