

Clinical symptoms and related factors of obstructive sleep apnea among overweight and obese taxi drivers

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ABSTRAK

Latar belakang: Obstructive sleep apnea (OSA) merupakan kondisi yang umum pada pengemudi kendaraan komersil dengan berat badan lebih dan obesitas, diketahui merupakan faktor risiko terpenting. Penelitian ini bertujuan untuk mengetahui gejala klinis serta faktor-faktor risiko OSA pada pengemudi taksi dengan berat badan lebih dan obesitas di Jakarta, Indonesia.

Metode: Penelitian potong-lintang ini dilakukan pada 103 pengemudi taksi di Jakarta sejak November 2011–September 2013, secara systematic random sampling di 10 pool taksi. Kriteria inklusi adalah pengemudi taksi dengan indeks massa tubuh (IMT) 23–29,9 dan terbukti OSA ringan atau sedang. Diagnosis OSA dengan pemeriksaan polisomnografi (PSG). Analisis bivariat menggunakan uji parametrik dan nonparametrik. Regresi logistik multivariabel untuk evaluasi faktor-faktor risiko.

Hasil: Sebanyak 54 (52,4%) dari 103 pengemudi terbukti OSA dan 49 (47,6%) bukan OSA. Gejala OSA yang signifikan ($p < 0,05$) adalah mendengkur, bangun tidur tidak segar, tertidur saat mengendarai mobil dan sakit kepala atau mual saat bangun tidur. Faktor yang berhubungan dengan OSA adalah peningkatan IMT ($OR = 0,60$, $95\% CI = 0,45-0,79$, $p = 0,001$), riwayat mendengkur dalam keluarga ($OR = 4,92$, $95\% CI = 1,82-13,31$, $p = 0,002$) dan lama tidur < 7 jam dalam 24 jam ($OR = 5,14$, $95\% CI = 1,37-19,23$, $p = 0,015$).

Kesimpulan: Gejala klinis OSA adalah mendengkur, bangun tidur tidak segar, tertidur saat mengendarai mobil dan sakit kepala atau mual saat bangun tidur. Faktor risiko OSA adalah peningkatan IMT, riwayat keluarga mendengkur, dan lama tidur < 7 jam dalam 24 jam.

ABSTRACT

Background: Obstructive sleep apnea (OSA) is common condition in commercial drivers while overweight and obesity as the most important risk factors. This study aimed to know the clinical symptoms and risk factors of OSA in overweight and obese taxi drivers in Jakarta, Indonesia.

Methods: A cross-sectional study was done in 103 taxi drivers in Jakarta from November 2011–September 2013, by systematic random sampling from 10 taxi stations. Inclusion criteria were taxi drivers with body mass index (BMI) which 23–29.9 and mild or moderate OSA. Portable polysomnography (PSG) test was used to diagnose OSA. Parametric and nonparametric test were used in bivariate analysis. Logistic regression multivariable was used to final evaluate risk factors of OSA.

Results: There were 54 (52.4%) of 103 drivers with OSA and 49 (47.6%) without OSA. Clinical symptoms found significantly ($p < 0.05$) were snoring, unrefreshing sleep, occasional sleep while driving, and headache or nausea on waking up in the morning. Risk factors for OSA were increased BMI ($OR = 0.60$, $95\% CI = 0.45-0.79$, $p = 0.001$), snoring history in the family ($OR = 4.92$, $95\% CI = 1.82-13.31$, $p = 0.002$) and sleep duration < 7 hours within 24 hours ($OR = 5.14$, $95\% CI = 1.37-19.23$, $p = 0.015$).

Conclusion: Clinical symptoms of OSA were snoring, unrefreshing sleep, occasional sleep while driving and headache or nausea on waking up in the morning. Risk factors of OSA were increased BMI, snoring history in the family and sleep duration < 7 hours within 24 hours.

Keywords: obstructive sleep apnea, occupational lung disease, taxi driver

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Obstructive sleep apnea (OSA) is a disorder characterized by repeated collapse of the upper airway, either as part or total that occurs during a person's sleep. Airway collapse is associated with a decrease or cessation of airflow even though there is still some effort for breathing.¹ Upper airway collapse that occurs is connected with the occurrence of fragmented sleep episode and recurrent reduction of oxyhemoglobin saturation.² The common symptoms of OSA are snoring, fatigue or excessive daytime sleepiness (EDS).³ Gold standard to confirm the diagnosis of OSA currently is using polysomnography (PSG).⁴

There are several risk factors that may lead to OSA such as gender, age, genetics, overweight or obesity, large neck, smoking, alcohol consumption, nasal obstruction, craniofacial abnormalities. However, the main risk factor is obesity.⁵ Individuals with 10% increase of body weight are associated with six-fold increased risk of moderate to severe OSA.⁶ Approximately two thirds of patients with OSA have body weight 20% above normal weight. Obesity increases the average progression of OSA and weight loss will decrease further progression.^{5,7}

Sleep apnea clearly increases EDS. This causes a tendency to sleep, decreases alertness and vigilance, slow down reaction time and decreases psychomotor coordination.⁸ These conditions in turn increase the risk of a vehicle crash accident.⁹ The risk is two to 10 times higher among drivers with OSA compared with non-OSA.¹⁰

The prevalence of OSA in commercial vehicle drivers is quite high. Epidemiological data shows OSA incidence among commercial drivers varied from 15.8% to 17.6%.¹¹ Study of Howard, et al¹² on 3,268 commercial truck drivers in Australia found that more than half (59.6%) of the drivers had sleep-disordered breathing (SDB) and as much as 15.8% are proven to have OSA. Approximately 24.0% of the truck drivers had excessive sleepiness. Pack⁷ found that the prevalence of SDB in a professional driver in Philadelphia is 28.2%. Study of Hui et al¹³ on 216 commercial bus drivers in Hong Kong found that 37.0% of them had snoring and 7.9% of them had sleep apnea. While research on the 262 bus drivers in Brazil by Viegas and de Oliveira¹⁴ found 36.0% of snoring, 32.0% snoring loudly, and 12.0% had apnea.

Obstructive sleep apnea research specifically on taxi drivers are still very limited and generally use questionnaires. Gülbay et al¹⁵ reported that 5.9% taxi drivers show symptoms of OSA and 23.7% show EDS. A total of 67.8% of taxi drivers have a history of accidents, and there is a significant relationship between traffic accidents that occurred with EDS and OSA symptoms. Firestone et al¹⁶ estimated the prevalence of moderate and severe OSA on taxi drivers in Wellington, New Zealand to be around 18.0%. Research in Indonesia by Wiadnyana et al¹⁷ reported the occurrence probability of OSA in 'X' taxi driver in Jakarta for about 25.0%. To date there are no research data of OSA on taxi drivers in Indonesia by using the gold standard examination of PSG.

This study aimed to know the clinical symptoms and related factors of mild and moderate OSA among overweight and obese taxi drivers in Jakarta, Indonesia.

METHODS

This study is part of another study examining the relationship of OSA with an accident and reaction time of taxi drivers using the cross-sectional design. Target population in this study was taxi drivers in Jakarta. While scope population of this study was taxi drivers of 'X' company in Jakarta. Inclusion criteria were active driver with less than one work year, age between 25–58 years, male, body mass index (BMI) 23 to 29.9, the value of O₂ saturation >90% before the PSG examination and they were willing to follow the study by filling out informed consent. The inclusion criteria from PSG result were mild and moderate OSA or non-OSA. The exclusion criteria were having a sleep disorder other than OSA, a history of heart disease, stroke, drugs and alcohol abuse, mental disorders, visual impairment, and hearing impairment.

This study was approved by Medical and Health Research Ethics Committee (MHREC) Faculty of Medicine Gadjah Mada University, Yogyakarta, Indonesia (No. KE/FK/386/EC). Subjects in this study were taken from 10 taxi pools of 'X' company in Jakarta. Sample size (total number of the taxi drivers) was calculated using systematic random sampling method. The research was conducted from November 1st 2011 to September 31th 2013. The study began by conducting screening interview

using questionnaires. Data were obtained from the interview, questionnaires, physical examination, and PSG done at driver's residence. The questionnaire, which had been used, was a questionnaire assessing the identity, work history, habits, health conditions and symptoms of OSA, the Berlin questionnaire¹⁸ and epworth sleepiness scale (ESS)¹⁹ were used to assess the likelihood of OSA. PSG examination was conducted at driver's residence (portable home monitoring) when the driver was off from his work hour. PSG is done by using device that consist of electroencephalogram (EEG), electrooculogram (EOG), electromyogram (EMG), nasal airflow, thoraco-abominal movement, and oximetry.

Criteria for OSA is stated if it fulfills the criteria of the American Academy of Sleep Medicine (AASM) 2005.²⁰ The patient was diagnosed as OSA when apnea-hypopnea index (AHI) ≥ 15 or AHI ≥ 5 which is accompanied by one or more of the following symptoms: 1) unintentional sleep episodes during wakefulness, daytime sleepiness, unrefreshing sleep, fatigue, or insomnia; 2)

wakened from sleep by breath holding, gasping or choking, and 3) bed partner reported loud snore, breathing interruptions or both during the patient's sleep. OSA severity is classified based on the frequency of AHI during sleep. The category called mild when the AHI five to <15 events/hour and moderate when AHI of 15 to 30 events/hour.

Data were analyzed using computer programme. Parametric and non-parametric test were used in bivariate analysis. Multivariate analysis using binary logistic regression test was used to do final evaluation of OSA related factors.

RESULTS

Polysomnography characteristics

A total of 103 taxi drivers who met the inclusion criteria participated in this study. Taxi drivers who proven to have OSA (mild and moderate) consist of 54 subjects (52.4%) and non-OSA were about 49 subjects (47.6%). Polysomnography examinations

Table 1. Characteristics of polysomnography (PSG) results

Variables	OSA		Non-OSA		p*	95% CI
	Mean	SD	Mean	SD		
Apnea hypopnea index	15.66	6.26	4.92	3.46	0.001	8.78-12.70
Total in bed	412.93	63.37	421.43	67.41	0.511	-34.07-17.06
Sleep periode time	374.68	63.42	363.31	65.29	0.372	-13.79-36.55
Total sleep time	338.45	66.41	332.26	64.98	0.634	-19.54-31.92
Sleep onset	32.05	23.12	37.46	26.43	0.273	-15.15-4.32
Rapid eye movement (REM) latency	74.65	93.21	89.53	94.26	0.423	-51.56-21.79
Sleep eff	0.82	0.11	0.79	0.12	0.235	-0.02-0.07
Arousal	16.50	5.85	18.38	7.57	0.159	-4.51-0.75
Apnea	3.11	3.56	0.47	0.49	0.001	1.65-3.61
Central apnea	0.47	0.47	0.14	0.24	0.001	0.18-0.47
Obstructive apnea	2.45	3.14	0.29	0.37	0.001	1.29-3.01
Hypopnea	12.56	4.77	4.53	3.20	0.001	6.45-9.61
Oxygen saturation (SpO2) mean	0.95	0.01	0.96	0.01	0.171	-0.007-0.001
SpO2 lowest	0.86	0.05	0.90	0.05	0.001	-0.06--0.02
Desat index	11.27	6.85	4.43	6.85	0.001	4.50-9.19
Limb move	44.94	44.57	34.16	22.53	0.121	-2.89-24.44
Total desat	64.70	45.98	25.33	29.94	0.001	24.27-54.47
Heart rate	35.32	64.73	30.06	50.46	0.649	-17.59-28.11
Snoring	245.61	339.46	88.86	133.86	0.003	57.05-256.46
% Snoring	0.04	0.05	0.01	0.02	0.001	0.01-0.04

*unpaired T-test, OSA=Obstructive sleep apnea

on 103 subjects show the results that are listed in table 1. There are significant differences in the mean AHI, apnea, obstructive apnea, hypopnea and snoring between subjects with OSA and non-OSA ($p < 0.05$). There are significant differences in mean oxygen saturation, mean of the lowest oxygen saturation and total oxygen desaturation during apnea hypopnea period ($p < 0.05$).

Clinical symptoms

Table 2 shows clinical symptoms of taxi drivers

with OSA and non-OSA. Some of the symptoms in the two groups that did not significantly different are choking during sleep, frequent awakening during sleep, stop breathing during sleep, sleepiness, impaired concentration and insomnia. Symptoms of OSA which are significantly different among the OSA and non-OSA groups are snoring ($p = 0.003$), not feel refresh when waking ($p = 0.001$), falling asleep while driving ($p = 0.009$) and headache or nausea when waking ($p = 0.048$).

Table 2. Clinical symptoms of taxi drivers with OSA and non-OSA

Variables	OSA		non-OSA		OR (95% CI)	p
	n	%	n	%		
Snoring					3.77 (1.65–8.59)	0.003*
Yes	39	66.1	20	33.9		
No	15	34.1	29	65.9		
Choking during sleep					2.25 (0.65–7.84)	0.317**
Yes	9	69.2	4	30.8		
No	45	50.0	45	50.0		
Frequent awakening during sleep					1.25 (0.40–3.89)	0.927*
Yes	8	57.1	6	42.9		
No	46	51.7	43	48.3		
Not feel refresh when waking					5.12 (2.03–12.94)	0.001*
Yes	27	77.1	8	22.9		
No	27	39.7	41	60.3		
Stop breathing during sleep						
Yes	1	100	0	0		
No	53	52.0	49	48.0		
Fatigue					2.56 (0.99–6.59)	0.079*
Yes	18	69.2	8	30.8		
No	36	46.8	41	53.2		
Falling a sleep while driving					3,52 (1.39–8.95)	0.009*
Yes	22	73.3	8	26.7		
No	32	43.8	41	56.2		
Sleepiness					2.40 (0.44–12.97)	0.441*
Yes	5	71.4	2	28.6		
No	49	51.0	47	49.0		
Impared concentration					1.92 (0.45–8.12)	0.493**
Yes	6	66.7	3	33.3		
No	48	51.1	46	48.9		
Headache or nausea when waking					5.34 (1.11–25.75)	0.048**
Yes	10	83.3	2	16.7		
No	44	48.4	47	51.6		
Insomnia					2.00 (0.88–4.54)	0.143*
Yes	24	63.2	14	36.8		
No	30	46.2	35	53.8		

*Chi-square test; **Fisher test; OSA=Obstructive sleep apnea

Association between variables and OSA

Association between independent variables and OSA is shown in tables 3, 4, and 5. Physical examination showed that body weight, BMI, neck circumference and abdominal circumference were significantly different between subjects with OSA and non-OSA (Table 3). But there were no significant differences for parameters of tonsil size and high blood pressure (hypertension) in subjects with OSA and non-OSA. History of snoring in family variables had a significant relationship with OSA, with OR=3.46 (95% CI=1.51-7.94) and p=0.005 (Table 4).

Age and the overall life habits of subjects in two groups were not significantly different, which consists of smoking, drink coffee, water drink, and exercise. OSA subjects were increased in the age range of 31-40 years and 41-50 years The only habit that had a meaningful relationship with OSA was the sleep duration in 24 hours with OR=3.2 (95% CI=1.12-9.15) and p=0.047. Job characteristics such as years of work, work schedules, duration of day work, shift work, and the average kilometers travelled in one day were not significantly different between subjects with OSA and non-OSA (Table 5).

Multivariate analysis for OSA

Multivariate analysis was performed on variables that have significant relationship with OSA, and these included BMI, body weight, neck circumference, abdominal circumference, family history of snoring and the number of sleep hours. Considering that BMI variable and body weight variable interplay each other and also neck circumference and abdominal

Table 3. Association between body mass index (BMI), body weight, neck circumference and abdominal circumference with OSA

Variables	OSA	non-OSA	p
	Mean (SD)	Mean (SD)	
BMI	25.18 (2.17)	24.24 (1.32)	0.001
Body weight	71.44 (8.57)	65.82 (5.74)	0.001
Neck circumference	38.50 (2.56)	37.24 (2.05)	0.007
Abdominal circumference	91.59 (7.99)	86.51 (5.52)	0.001

*SD=Standard deviation; binary logistic regression test; OSA: Obstructive sleep apnea

Table 4. Association between tonsil size, history of hypertension and history of snoring in family with OSA

Variables	OSA		non-OSA		OR (95% CI)	p
	n	%	n	%		
Tonsil size					0.89 (0.31-2.6)	1.000
Increase	8	50.0	8	50.0		
Normal	46	52.9	41	47.1		
Hypertension					0.89 (0.32-2.46)	1.000
Yes	9	50.0	9	50.0		
No	40	47.5	45	52.5		
History of snoring in family					3.46 (1.51-7.94)	0.005
Yes	30	69.8	13	30.2		
No	24	40.0	46	60.0		

*Chi-square test; OSA=Obstructive sleep apnea

circumference, variable interplay each other, these when put them into statistical test, will simultaneously cause the effect in the multivariate analysis (co-linearity effect). Finally the multivariate analysis was performed only on four variables: BMI, neck circumference, family history of snoring, and the sleep duration less than seven hours in 24 hours (Table 6). Multivariate analysis showed that BMI, family history of snoring and the number of sleep hour in 24 hours was significantly associated with OSA, while the neck circumference had no relationship with OSA.

DISCUSSION

Polysomnography result

The results of PSG become an objective tool of OSA diagnosis. Parameters on PSG examination, which are: apnea, obstructive apnea, hypopnea, AHI, snoring, oxygen saturation and desaturation, were significantly different between OSA and non-OSA subjects. This was expected since the presence of obstruction during sleep in OSA subjects, either totally or partially, is recorded by PSG examination and became the gold standard for diagnosis of OSA.⁴ Other studies show the PSG results of OSA subjects showed significant differences in the value of AHI, apneas, obstructive apnea, hypopnea, snoring and oxygen desaturation.²¹

Table 5. Association between age, life habits and work with OSA

Variables	OSA		non-OSA		OR (95% CI)	p
	n	%	n	%		
Age (years old)					8.57 (0.84–87.83)	0.070
20–30	1	14.3	6	85.7		
31–40	20	55.6	16	44.4		
41–50	23	53.5	20	46.5		
51–60	10	58.8	7	41.2		
Sleep duration in 24 hours					3.20 (1.12–9.15)	0.047
<7 hours	48	57.8	35	42.2		
≥7 hours	6	30.0	14	70.0		
Smoking history					-	0.890
Ex-smoker	13	50.0	13	50.0		
Current smoker	30	48.4	32	51.6		
Non-smoker	11	73.3	4	26.7		
Drink Coffee					0.80 (0.36–1.75)	0.718
Yes	29	50.0	29	50.0		
No	25	55.6	20	44.4		
Exercise					1.51 (0.69–3.30)	0.405
No	21	46.7	24	53.3		
Yes	33	56.9	25	43.1		
Water drink					0.89 (0.24–3.31)	1.000
<2000 cc/24 hr	5	50.0	5	50		
≥2000 cc/24 hr	49	53.6	44	47.3		
Years of work					-	0.943
≤5 years	32	48.5	34	51.5		
>5–10 years	19	61.3	12	38.7		
>10 years	3	50.0	3	50.0		
Work schedule					1.14 (0.43–3.03)	0.994
Low	43	51.8	40	48.2		
High	11	55.0	9	45.0		
Duration of day work						
≥12 hours	0	0	2	100		
<12 hours	54	53.5	47	46.5		
Average kilometers travelled in one day					2.25 (0.65–7.84)	0.317*
≥300 km/day	9	69.2	4	30.8		
<300 km/day	45	50.0	45	50.0		
Shift					0.76 (0.25–2.29)	0.839
Day	47	53.4	41	46.6		
Night	7	46.7	8	53.3		

Chi-square test ; *Fisher test; OSA=Obstructive sleep apnea

Clinical symptoms of OSA

Snoring in subjects with OSA is significantly different than non-OSA subjects. This is consistent with the published literature which stated that

snoring is a major clinical symptom of OSA and reflects the typical basic pathophysiology of the disease.^{3,22} Approximately 95% of subjects with OSA have snoring as their symptom.²² Other symptoms

Table 6. Multivariate analysis of BMI, neck circumference, family history of snoring, and sleep duration less than seven hours in 24 hours with OSA

Variables	Adjusted OR	95% CI		p
		Lower	Upper	
BMI	0.60	0.45	0.79	0.001
Neck circumference	0.50	0.80	1.35	0.815
Family history of snoring	4.92	1.82	13.31	0.002
Sleep duration less than 7 hours in 24 hours	5.14	1.37	19.23	0.015

Binary logistic regression test

that were significantly associated in this study were headache or nausea when waking up. McNicholas²² reported that other symptoms that can occur in OSA patients include fatigue, morning sickness and headaches. Subjects with OSA did not feel refresh when waking up and fall asleep easily while driving. These complaints are suitable with one of the clinical symptoms in the criteria of the AASM 2005, which are unintentional sleep episodes during alertness and not refreshed after sleep.²⁰

Sleep apnea is one of the symptoms commonly reported from patient partner.²² In this study, sleep apnea is not a significant symptom, probably because the interview in this study was conducted directly to the subjects who do not know whether this condition is happening to them or not. In addition, most of the subjects lived in a rented house or in the company's inn alone, so that no one recognized whether apnea events occurred or not.

Drowsiness during the day (daytime sleepiness) is also a major symptom of OSA.³ In this study, daytime sleepiness which was assessed by ESS was not significantly different between OSA subjects (five people) and non-OSA (three people). Only 8.1% of subjects who have that complaint. The difference may be caused by possibility that subject is not entirely familiar with the questions from ESS. In addition, drowsiness may be obscured by the fatigue felt by the subject since his profession is taxi driving. McNicholas²² stated that drowsiness should be distinguished from other symptoms, such as feeling tired which is often underestimated by patients.

Factors associated with OSA

The age range among OSA and non-OSA was not significantly different. OSA subjects were increased in the age range of 31–40 years and

41–50 years. This is consistent with the study from Wiadnyana, et al¹⁷ which concluded that patients who were >36 years old had two-fold risk of OSA compared to patients who were <36 years of age. OSA incidence increased progressively by increase of age.²³ Young et al²⁴ mentioned that the incidence of OSA increased especially in middle age. The mechanisms proposed for the age-related OSA are an increase deposition of fat in the parapharyngeal area, lengthening of the soft palate and changes in body structures surrounding the pharynx.²³

Physical examination showed that body weight, BMI, neck circumference, and abdominal circumference were significantly different between subjects with OSA and non-OSA. Study from Wiadnyana et al¹⁷ concluded that BMI >25 and neck circumference >40 cm had a significant relationship with suspected of OSA. The same results were reported by the sleep heart health study which stated that OSA was significantly associated with BMI, neck circumference and abdominal circumference.²³ Weight gain by 10% was known to be associated with a six-fold increased risk of OSA.⁶ Weight gain can affect airway during sleep through some mechanisms. The mechanisms are: 1) an increase in fat deposition on peripharynx cause upper airway constriction, 2) affects the neural compensatory mechanisms for maintaining the patency of airway, 3) instability of respiratory control system, and 4) reduction in the functional residual capacity due to the resultant decrease in the stability of the upper airway caudal traction.²³

Tonsil size was not significantly different between OSA and non-OSA subjects. Enlargement of tonsils as a risk factor for OSA in adults is debatable. As per one of the research, tonsil enlargement is one of risk factors of OSA.⁷ Lee et al²⁵ in reported that enlargement of tonsils stage III or IV is an

independent factor of the OSA. There are few studies that assess enlargement of tonsils as a risk factor for OSA in adults.²⁴ Some studies stated that tonsil and adenoid hypertrophy are major risk factors for OSA in children.^{5,26}

Hypertension status in subjects with OSA and non-OSA had no significant difference. This result was consistent with the study of Wiadnyana et al¹⁷ that concluded the absence of correlation between hypertension and suspected OSA. But, this result was in contrast with some of the previous studies which stated that hypertension was associated with OSA. There is a consistent association between OSA and hypertension in various studies.^{22,27,28} Incidence of hypertension increases in subjects suspected with OSA.²² Several studies reported that OSA was a cause of hypertension or uncontrolled hypertension.^{27,28} But only few studies have reported that hypertension is a risk factor of OSA.

Our study indicate that snoring history in family has a significant relationship with OSA. These results are consistent with existing research data. Previous data suggest that research inquiries about family history can certainly aid in identifying those that have OSA. Familial susceptibility to OSA directly increases with the number of affected relatives.²³ Young et al²⁹ reported that snoring history or OSA in family increases the risk of OSA. Wiadnyana et al¹⁷ reported that snoring history in family was significantly associated with suspected OSA.

Smoking is estimated as one of the risk factors associated with OSA. Epidemiological studies have shown that smoking is associated with an increased prevalence of snoring and OSA. Airway inflammation and damage due to cigarette smoke can affect the mechanical support function and neural upper airway, also increase possibility of airway collapse during sleep.²³ Even so, Young et al²⁴ said that only a few studies have reported association between smoking and OSA. Although there is a biological plausibility for a causal role of smoking, it is not yet firmly established as a risk factor. Results of this study showed no association between smoking and OSA. Smoking habits were not significantly different between OSA and non-OSA subjects. The same result was reported by Wiadnyana et al¹⁷ that showed no difference in smoking habits of taxi driver between those with and without suspected OSA. Differences in study

results are likely because taxi drivers usually smoke. Chuang et al³⁰ reported that 57.9% taxi drivers in Taiwan had smoking habits. Smoking habits are also common in Jakarta, Indonesia. It was estimated that approximately one-third of Jakarta population are smokers.³¹

Habits for drinking coffee, water in 24 hours and exercise habits did not differ between OSA and non-OSA subjects. Similar results were reported by Wiadnyana et al¹⁷ which stated that daily habits of taxi drivers are not associated with likelihood of OSA. Other habit that has a significant association with OSA is sleep duration less than seven hours in 24 hours. These results are in accordance with some recent studies regarding the association between sleep duration, obesity and OSA. Chin et al³² in his study at Japan said that number of sleep hours should be considered as an important factor in investigating the prevalence of severe OSA and metabolic syndrome.³² Risso et al³³ reported that sleep duration may be associated to the low mean oxygen saturation in OSA Patients. Kim et al³⁴ even proved that there is a significant relationship between sleep duration, OSA and visceral obesity in adult patients.

Job characteristics such as work period, work schedules, duration of day work, shift work and the average distance travelled in one day were not significantly different between subjects with OSA and non-OSA. Similar results were reported by Wiadnyana et al¹⁷ who reported that a taxi driver's job characteristics were not related to the suspected OSA. He reported that only work schedules variable is associated with suspected OSA.

In conclusion, significant symptoms of taxi drivers with mild and moderate OSA are snoring, unrefreshing sleep, headache or nausea while waking up in the morning and occasional sleep while a driving. Factors associated with OSA in taxi drivers with overweight and obesity are the increase of BMI, snoring history in family and sleep duration less than seven hours in 24 hours. Limitation of this study were small sample size, further studies are needed with larger sample size to validate these results.

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Conflict of interest:

The authors confirm there is no conflict of interest in this study.

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