

Brief communication (Original)

Sleep-disordered breathing and risk factors in Thailand

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Background: Sleep-disordered breathing or obstructive sleep apnea (OSA) has an important effect on the quality of life. Very few data of OSA are available for Thai persons.

Objective: Investigate the prevalence of high risk to OSA and the relationship between OSA and risk factors in Thai medical students.

Materials and methods: Three hundred seven subjects were recruited from all of the medical students (fourth year to sixth year) the Faculty of Medicine, Srinakharinwirot University, Thailand for this cross-sectional study. Data was collected between June and September 2010. The Berlin questionnaire was used to determine risk for OSA. Logistic regression analysis was performed with p-value less than 0.05 for statistical significance.

Results: The prevalence of high risk to OSA was 6.8%. Total mean of sleep duration, bedtime, and wake-time was 6.59 hours. Bedtime of male students was significantly later than female students. The medical students with body mass index (BMI) >23 kilogram/meter² and with underlying diseases were at high-risk for OSA.

Conclusion: Prevalence of high-risk to OSA of Thai medical students was 6.8%. The medical students with BMI >23 kilogram/meter² and with underlying diseases were at high risk for OSA but gender, age, academic year, and academic achievement did not relate to OSA.

Keywords: Medical student, obstructive sleep apnea (OSA), sleep-disordered breathing

Sleep-disordered breathing or sleep apnea is a cessation of breathing during sleep lasting more than 10 seconds. An obstruction of upper airway during respiration is called obstructive sleep apnea (OSA) [1]. OSA is a condition characterized by excessive daytime sleepiness, loud snoring, and repetitive episode of upper airway collapse during sleep that causes sleep disruption and nocturnal hypoxia [2]. Pasha and Khan reported that the prevalence of OSA in men and women in Pakistani medical students were 6% and 5%, respectively [3]. According to Young et al. [4], OSA in men and women in US workers were 2% and 4%, respectively.

OSA frequently associates with obesity. Weight gain over time increases the development of OSA [2, 5]. Risk factors for OSA are medical disorders such as allergic rhinitis, hypothyroid, renal disorder, diabetes, and chronic cough including gastro-esophageal reflux

disease, upper airway cough syndrome, and cough variant asthma [7-9]. In addition, male gender and increasing age are risk factors for OSA [6]. For assessment of risk for OSA in general population, Berlin questionnaire is often used, including snoring behavior, wake-time sleepiness, and the presence of obesity or hypertension [10, 11].

Persons with OSA may increase risk of motor vehicle accidents, reduces the quality of life, and have a multiplicity of cardiovascular, psychiatric, cognitive dysfunction, and metabolic abnormalities [12-15]. To date, very few data of OSA are available for Thai persons [16]. In particular, no study has addressed the epidemiology of OSA in Thai medical students.

In this study, we investigated the prevalence of high risk to OSA, and determined the relationship between OSA and risk factors such as gender, age, academic year, body mass index (BMI), and underlying diseases in medical students at Srinakharinwirot University. In addition, we determined the association between OSA and academic achievement.

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Materials and methods

Three hundred seven subjects were recruited from the medical students (fourth year to sixth year) from the Faculty of Medicine, Srinakharinwirot University, Thailand for this cross-sectional study. The research proposal was approved by the Ethics Committee, Faculty of Medicine, Srinakharinwirot University. Data was collected between June and September 2010.

Anonymous questionnaires were used to collect data. The questionnaire composed of two parts. The first part surveyed general demographic data, including gender, age, academic year, weight, height, underlying disease, sleeping time, and awakening time. The second part was Berlin questionnaire that is a questionnaire asking about risk factors for OSA, including snoring behavior, wake-time sleepiness or fatigue, and the presence of obesity or hypertension [11]. The interpretation of high and low risk for OSA depended on responses in three categories as follows. In category 1, high risk was defined as persistent symptoms (three to four times per week) of snoring in two or more questions. In category 2, high risk was defined as persistent symptoms of wake-time sleepiness, drowsy driving, or both. In category 3, high risk was defined as a presentation of high blood pressure or BMI more than 30 kg/m². To be considered at high risk to OSA, a medical student had to be high risk for at least two symptom categories. Those who had no persistent symptoms or who had high risk for only one symptom category were considered at the

lower risk group [11]. According to Nikolaus et al. [15], Cronbach's α coefficient of this questionnaire is 0.86 to 0.92 with sensitivity of 0.86, specificity of 0.77, positive predictive value of 0.89, and likelihood ratio of 3.79 for respiratory disturbance index (RDI) greater than 5.

In Thailand, BMI is classified as follows [17]: <18.5=underweight, 18.5-22.9=normal, 23.0-24.9=risk of becoming overweight, 25.0-29.9=obesity type 1, >30=obesity type 2. This study defines the term "overweight" for the subject with BMI >23. This includes risk of becoming overweight, both obesity type 1 and obesity type 2.

Statistical analysis

For response variables, significant explanatory variables were first identified through bivariate analysis and through multivariate analysis by logistic regression, which explored variables by stepwise method. A two-tailed p-value of less than 0.05 was considered significant.

Results

The study sample comprised 307 medical students (85.8% response rate). The prevalence of high risk to OSA of Thai medical students was 6.8%. Information on sleep habits of medical students across gender is shown in **Table 1**. We note that total mean of sleep duration was 6.59 hours, and bedtime of male students was significantly later than female students.

Table 1. Sleep habits of 307 medical students across gender

| Sleep habit | Men Number (%) | Women Number (%) | P-value |
|----------------------------|-------------------|---------------------|---------|
| Mean Sleep duration | 6.46 hours | 6.65 hours | 0.207* |
| <7 hours | 66 (56.4%) | 85 (48.0%) | 0.171** |
| 7-8 hours | 47 (40.2%) | 78 (44.1%) | |
| >8 hours | 4 (3.4%) | 14 (7.9%) | |
| Total | 117 (100%) | 177 (100%) | |
| Mean Bedtime | 00:29 | 00:14 | 0.013* |
| <22:00 | 1 (0.9%) | 0 | 0.043** |
| 22:00-24:00 | 66 (55.9%) | 122 (68.9%) | |
| >24:00 | 51 (43.2%) | 55 (31.1%) | |
| Total | 118 (100%) | 177 (100%) | |
| Mean Wake time | 06:56 | 06:53 | 0.583* |
| <7:00 | 42 (35.9%) | 70 (39.6%) | 0.528** |
| >7:00 | 75 (64.1%) | 107 (60.4%) | |
| Total | 117 (100%) | 177 (100%) | |

*Independent t test, **Chi square test

Table 2 shows the result of the bivariate analysis. We note that high risk to OSA was associated with male gender, BMI >23 kilogram/meter², and the presence of underlying diseases.

The association between high risk to OSA and BMI >23 kilogram/(meter)² and the presence of underlying diseases remained significant after adjusting for gender, underlying diseases, and BMI (**Table 3**).

Table 2. Bivariate analysis between high risk to OSA and gender, BMI, year, underlying disease, age, and Grade Point Average (GPA)

| Factor | High risk to OSA | | p-value |
|--|------------------|------------------|---------|
| | Yes (n=21) | No (n=286) | |
| Gender (%) | | | |
| Male (n=116) | 13 (11.2) | 103 (88.8) | 0.020* |
| Female (n=188) | 8 (4.3) | 180 (95.7) | |
| BMI (%) | | | |
| <23 kilogram /meter ² (n=241) | 10 (4.1) | 231 (95.9) | <0.001* |
| >23 kilogram /meter ² (n=66) | 11 (16.7) | 55 (83.3) | |
| Academic year (%) | | | |
| Year 4 (n=100) | 7 (7) | 93 (93) | 0.397* |
| Year 5 (n=95) | 4 (4.2) | 91 (95.8) | |
| Year 6 (n=111) | 10 (9) | 101 (91) | |
| Underlying disease (%) | | | |
| No (n=207) | 10 (4.8) | 197 (95.2) | 0.037* |
| Yes (n=76) | 9 (11.8) | 67 (88.2) | |
| Age (mean + SD) | 22.09 years+1.41 | 21.91 years+1.02 | 0.567** |
| GPA (mean + SD) | 3.19+0.39 | 3.25+0.33 | 0.469** |

*Chi square test, ** Independent t test. Underlying disease composed of allergic disease (n=64), migraine headache (n=3), peptic ulcer (n=5), systemic lupus erythrematosus (n=1), glucose-6-phosphate dehydrogenase deficiency (n=1), Grave's disease (n=1), and gastro-esophageal reflux (n=1)

Table 3. Odds ratio of high risk to OSA after adjusting for gender, BMI, and underlying disease with logistic regression

| Factor | OR (crude) | 95%CI | OR (adjusted) | 95%CI | P-value |
|----------------------------------|------------|------------|---------------|-----------|---------|
| Gender | | | | | |
| Male | 1 | - | 1 | - | - |
| Female | 0.35 | 0.12-0.96 | 0.41 | 0.15-1.13 | 0.084 |
| Underlying disease | | | | | |
| No | 1 | - | 1 | - | - |
| Yes | 2.65 | 0.91-7.57 | 2.78 | 1.05-7.38 | 0.039 |
| Body mass index (BMI) | | | | | |
| <23 kilogram /meter ² | 1 | - | 1 | - | - |
| >23 kilogram /meter ² | 4.62 | 1.68-12.73 | 3.08 | 1.13-8.36 | 0.028 |

OR= odds ratio, CI=confidence interval

Discussion

Sleep duration of Thai medical students was nearly the same as other Thai university students from a study by Steptoe et al. [18]. In their survey, mean sleep durations of men and women were 6.95 and 7.08 hours, respectively, suggesting that university students had more short sleep (less than seven hours) than long sleep (more than eight hours) and short sleep can be associated with poor health outcome.

Sleep and wake habits of Thai medical students may be different from those in other countries. In fact, Nojomi et al. [19] reported that Iranian medical students usually go to bed at 22:00-24:00 (71%) and usually get up in the morning before 7:00 (93.3%). In our study, Thai medical students go to bed and get up in the morning later than Iranian medical students, as shown in **Table 1**. The delay bedtime may be caused by room-sharing of medical students. Because of that, they may have interpersonal communication late at night. Those could lead to poor sleep quality [20, 21]. According to Crowley et al. [22], delay in a circadian rhythm sleep may cause a sleep-onset insomnia and a difficulty in waking at the desired time in the morning. Hazama et al. [23] studied Japanese high school to university students, and suggested that promoting a regular sleep habit may prevent this problem. In our study, male students went to sleep later than female students, so that good sleep habit should be promoted among male students first.

The present study showed that more male students had high risk of OSA than female students (**Table 2**). This result was comparable to the report by Neruntarat and Chantapant [24] where in Thai office-based workers, the prevalence of OSA was 11.4%. According to Wolkove et al. [25], older people increase occurrence of obesity predisposing to upper-airway narrowing, decline in muscle tone enhancing upper-airway collapsibility, and impair pharyngeal sensory discrimination to make a persistence of upper-airway collapse during sleep. Fuentes-Pradera et al. [26] explained that sex hormone might influence neuromuscular control of upper airway and central pattern of body fat distribution, which related to OSA. However, in our study, the differences disappeared after adjusting for BMI. This indicates that body fat distribution, assessed by BMI, may have an effect on that result (**Table 3**).

BMI is high risk to OSA both unadjusted and adjusted with gender and underlying diseases. In a review of obesity-related OSA by Leinum et al. [27],

obesity increase deposit of fat surrounding the upper airway. This may lead to upper airway obstruction during sleep and deposit of fat over chest wall and abdominal wall. Therefore, it reduces chest wall compliance, which decreases the end-expiratory lung volume, and reduces the tug on the trachea during inspiration producing lateral pharyngeal wall thickening and upper airway narrowing. This obesity-related OSA may result in faster depletion of lung oxygen stores during apnea. However, the relationship between obesity and OSA may be bidirectional, i.e., patients with OSA may increase weight gain by increasing plasma leptin level, reducing physical activity from fatigue or daytime sleepiness [28].

According to Mullol et al. [29], patients with allergic rhinitis have high prevalence of OSA. Canova et al. [30] reported that patients with OSA are frequently sensitized to perennial allergens such as house dust mite, and concluded that perennial allergies is a risk factor for OSA. In our study, the prevalence of allergic disease is about 84% of total underlying diseases as shown in **Table 2**. According to Chung et al. [31], gastro-esophageal reflux may be a symptom of OSA. Thus, our medical students with underlying diseases might have higher risk of OSA than medical students without underlying diseases. Adequate treatment of underlying diseases may reduce the severity and prevention of OSA.

In conclusion, the prevalence of high risk to OSA of Thai medical students was 6.8%. The medical students with BMI >23 kilogram/meter² and with underlying diseases were at higher risk of OSA, but gender, age, academic year, and academic achievement did not relate to OSA.

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