

Obstructive sleep apnea syndrome among a snoring community

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ABSTRACT

Objectives: To evaluate the relation between snoring and the presence of obstructive sleep apnea (OSA) in terms of relevant health parameters and questionnaire responses.

Methods: Selective random sampling within a household survey in the cities of Al-Khobar and Dammam, Kingdom of Saudi Arabia over a 3 month period during the year 2000, was carried out. One hundred and fifty-two persons, aged 17-62 years, with a positive history of snoring as determined by the spouse or other members of the family were selected.

Results: The presence of OSA was determined using the Epworth sleepiness scale (ESS). The predictors included age,

gender and body mass index. Snoring was found to be more associated with OSA as suggested by ESS in the study sample. The severity of snoring and its pattern are more associated with apneic patients.

Conclusion: Snoring is common and may be a serious medical problem. This study revealed that snoring is associated with symptoms suggesting OSA syndrome as detected by ESS. The family doctor and his team should be aware of the condition, using simple screening test such as ESS, improves the patient care, and finding of suspected cases.

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Snoring is a major source of irritation for the snorer and his/her sleeping partner. It has been reported that 60% of men and 40% of women over 60 years of age snore.^{1,2} Habitual snoring occurs in 44% of middle-aged men and 28% of middle aged women.³ In the first large-scale epidemiological study on snoring 24% of men and 14% of women in San Marino were reported to habitually snore.⁴ The age adjusted prevalence rate of regular loud snoring among 1222 Hispanic-American adults was 27.8% in men and 15.3% in women.⁵ The frequency of snoring increases with obesity.⁶ Other major independent risk factors for snoring are male gender, age between 40 and 60 years, and cigarette smoking. Snoring increases with age up to 60-65 years.⁷ The prevalence of snoring is slightly increased in

subjects who regularly use alcohol or hypnotics.⁸ Male predominance, observed in all epidemiological studies, remains unexplained. It may be due to differences in perception of snoring by men and women, or differences in airway collapsibility due to hormonal factors. The sound of snoring occurs when the soft palate and the tongue relax during sleep and vibrate the soft tissues at the back of the mouth. The tongue becomes retro-displaced falling posteriorly as a result of gravity and relaxation of the genioglossus (GG).⁹ Upper airway muscle activity during wakefulness is higher in patients with obstructive sleep apnea (OSA) than in non-snorers, suggesting that this activity may compensate for a smaller airway in such patients.¹⁰ This results in the condition known as sleep apnea hyponea syndrome

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(SAHS). Self-reported loud snoring and observed breathing pauses (high likelihood of OSA) were associated with increased frequency of World Health Organization Grade 4 dyspnea, admissions to hospital with chest pain, myocardial infarction, raised blood pressure, and high levels of fasting blood sugar, fasting triglyceride (women only), and uric acid (women only) after adjustment for body fat distribution and other potential confounders.¹¹ Multivariate analysis revealed that men who reported both snoring and EDS at baseline were at an increased risk of occupational accidents during the following 10 years.¹² From a population based study involving 2668 individual, it was concluded that, in males aged 30-69 years, habitual snoring is associated with an increased incidence of diabetes within 10 years.¹³ An evaluation showed that 48% of the patients were acute vascular disease, mainly stroke and myocardial infarction, compared to only 30% of the controls were habitual snorers.¹⁴ A logistic regression analysis showed that habitual snoring carries a significant risk factor for stroke and myocardial infarction, even after adjusting for other factors.

The prevalence of clinically significant OSA in the general population is high. It is found in at least 2% of women and 4% of men, making it as prevalent as asthma or diabetes. Obstructive sleep apnea with daytime impairment, is estimated to occur in one of 20 adults, is usually unrecognized and undiagnosed, and results in behavioral and cardiovascular morbidity.¹⁵ On the basis of the average of prevalence estimates from population-based cohorts in Wisconsin, PA, United States of America,^{16,17} and Spain⁸ of predominantly white men and women with mean BMI of 25-28 it is estimated that roughly one out of every 5 adults has at least mild OSA and one out of every 15 has at least moderate OSA.¹⁹ Although OSA is fairly common, it often remains undiagnosed in primary care practice. The vast majority of patients with OSA snore. The important issue, however, is not how common snoring is in patients with sleep apnea, but the converse that is, how common sleep apnea is among snorers. Several screening tools are used to determine OSA in the community. Among those is the Epworth scale test (EST) for daytime sleepiness. The Epworth Sleepiness Scale (ESS) developed by researchers in Australia and first published in 1991 was designed to measure subjective sleep propensity as it occurs in ordinary life situations.²⁰ It is currently the most utilized subjective test of daytime sleepiness in clinical practice. The Epworth scale usually has strong correlation with the presence of OSA and with a degree of objective sleepiness. Johns²¹ conducted reliability and validation studies. The advantages of the ESS are that it is a validated, reliable tool for assessing subjective sleepiness and that it is able to distinguish normal patients from patients with sleep disorders.²² Epworth sleepiness scale scores to increase as a function of increasing severity of their sleep-disordered breathing.²³ The association of Apnea-hypopnea index (AHI) with

Table 1 - List of the 8 questions used for the Epworth test for daytime sleepiness.

Serial n	Situation	Chance of dosing (0-3)*
1	Sitting and reading	
2	Watching television	
3	Sitting inactive in a public place (movie theater or meeting)	
4	As a passenger in a car for an hour without a break	
5	Lying down to rest in the afternoon when circumstances	
6	Sitting and talking to someone	
7	Sitting quietly after a lunch	
8	In a car, while stopped for a few minutes in traffic	
Total		
*Key 0=Would never doze, 1=Slight chance of dozing, 2=Moderate chance of dozing, 3=High chance of dozing		

Table 2 - Demographic features of 152 subjects.

Sex	n (%)	Mean age (years) ± SD
Males	83 (54.6)	32.3 ± 4.3
Females	69 (43.3)	30.9 ± 3.4
Total	152 (100)	31.6 ± 13.3
		Mean ± SD
Body mass index (BMI) (Kg/m ²)		26.8 ± 6.3
Neck circumference (inch)		14.2 ± 2.8
Systolic blood pressure (BP) (mm Hg)		127.6 ± 10.5
Diastolic blood pressure (BP) (mm Hg)		86.5 ± 8.7

sleepiness was similar in subjects older and younger than age 65 years and was independent of sex, BMI, or evidence of insufficient sleep time.²⁴ The objective of this study was to explore the prevalence of OSA among snorers using ESS.

Methods. A community survey of households was conducted over a 3 month period during the year 2000 in

Al-Khobar and Dammam, Kingdom of Saudi Arabia (KSA), using a random sampling technique. The map of the area was studied, and we used a random table to select the household; the subjects were then interviewed in the randomly selected household. Subjects participating in the survey were approached using pre-tested and pre-coded questionnaires. Face-to-face interviews were also carried out by a team of 3 nurses after receiving training on the use of EST to measure day time sleepiness. Only persons who had a positive history of snoring, as judged by the subject's spouse or members of family took part in the study. To determine the presence/absence of OSA among the survey sample EST for daytime sleepiness was used. The response of each participant to the 8 questions shown in **Table 1** was scored on a scale of 0-3, and the total determined. A total score of 9 or more out of 24 suggest the presence of OSA.²⁰ The survey was carried out over a 3 months period. All investigation instruments were translated into Arabic and the translation was checked by being re-translated into English. All information was gathered through interviews under the supervision of the first author. During the study period, 10% subsample of the questionnaire were rechecked for reliability by means of the Kappa index resulting 85% agreement.

Results. Sample characteristics. One hundred and fifty-two subjects (69 females and 83 males) that satisfied the inclusion criteria (**Table 1**) showed the mean and standard deviation of demographic features of the sample. The overall mean age was 31.6 ± 13.3. years; males more than females. **Table 2**

Obstructive sleep apnea as diagnosed with Epworth scale. When OSA was assessed according to EST 46 (30.3%) patients were found to be at risk of OSA. Of the 83 males, 36 (43%) had a positive ES test, in contrast of the 69 females only 10 (14.5%) had a positive EST (**Table 3**). The difference was statistically significant (p<0.001) with regard to the relation between positive EST test and self-reporting snoring pattern, 32 (71%) of 46 patients who scored positive in the EST reported waking up suddenly and unable to breathe. In contrast, only 10 (10.2%) out of 108 patients who scored negative in the EST reported this phenomenon, the difference was statistically significant (p<0.0001). In that respect, 32 (71%) patients were found to snore more while lying on their back and had more signs of apnea than others (p<0.0001). Indicating that among subjects who had positive EST, snoring was found to increase while they slept on their back, than those who had a negative EST. According to Epworth criterion (**Table 1**), 46 subjects were positive which constitutes a prevalence rate of 30.3% of all the study subjects, with male predominance.

A logistic regression model. A logistic regression model was applied to predict the snoring pattern according to those who showed positive EST at different age and sex groups. It was evident that the score of EST

Table 3 - Relation between Epworth Score and snoring pattern according to spouse report.

Variables	Epworth score		p value		
	+ve	-ve			
Wake up suddenly and unable to breath					
Little	1	2.2	70	71.4	<0.0001
Sometimes	12	26.7	18	18.4	
Much	32	71.1	10	10.2	
Snoring increases with difficulties in breathing while sleeping on the back					
Little	1	2.2	70	71.4	<0.0001
Sometimes	12	26.7	24	24.5	
Much	32	71.1	4	4.1	
Sex					
Male	36	43.3	47	56.7	<0.001
Female	10	14.5	59	85/5	

Table 4 - Logistic regression to predict snoring pattern according to Epworth sleep test from age.

Variable	β	SE	p-value	Odds ratio
Constant	-0.7212	0.7446	0.333	
Age	0.0708	0.0161	<0.0001	1.073
Sex	-1.8024	0.4767	0.0002	0.165
- beta, SE - standard error				

increased gradually with age; for example the higher the score the older the patient. (Odds ratio (OR)=1.07). Furthermore, males were at a greater risk of developing obstructive sleep apnoea according to EST than a female (OR=0.16).

Discussion. Obstructive sleep apnea with its associated snoring, creates an enormous burden on society and constitutes a serious health problem resulting in high morbidity and mortality²⁵ and its attendant high medical costs if undiagnosed.²⁶ The cardinal symptoms of OSA are snoring and excessive daytime sleepiness.²⁷ However, both symptoms may be denied or minimized by the patient. Most symptoms of OSA occur during sleep. The patient may not be aware of it unless informed by his or her spouse. Observation by a member of the family of loud snoring, apnea or nocturnal choking may be the only reported hints. Patients with OSA may be misdiagnosed as having gastroesophageal reflux, dry mouth, hypertension, sore throat or polyuria. Sleepiness develops slowly over years and patients may forget what normal alertness is

like. In our society, middle-aged women staying at home may not be aware of sleepiness unless it is very severe.

Although polysomnography (PSG) remains the gold standard diagnostic test for OSA,²⁸ to be able to perform this test, the patient needs to spend at least one night in a sleep disorder center (SDC), where different physiological parameters can be continuously monitored and recorded by a trained sleep technologist. Due to the paucity of proper SDCs and well trained polysomnographic technologists, physicians have to rely on other methods to be able to screen patients for OSA. Among these are some anthropometric measures, such as, BMI, neck circumference, hip-waist ratio and history of snoring. Several simple questions have been adopted to screen for sleep apnea. Epworth sleepiness scale is among those and is widely used to screen for OSA. This is a simple questionnaire measuring the general level of day time sleepiness; for example the probability of falling asleep in a variety of situations. The conceptual basis of ESS involves a 4-process model of sleep and wakefulness.²⁹ Epworth sleepiness scale is a simple and reliable method for measuring persistent daytime sleepiness in adults.³⁰ Due to the fact that the prevalence of OSA ranges between 2-8% in any given community while its prevalence increases to up to 30% among snorers, the idea of this study was developed. According to the best knowledge of the investigators, this is the first community based study conducted in the KSA. The study focused only on adults, although OSA is common also in children.³¹ Another survey will be needed to study this group. In accordance with reported literature,³² we have demonstrated a high prevalence of EDS among the snoring community (30.3%) which may suggest the diagnosis of obstructive sleep apnea. However, Tami et al³³ reported an incidence of OSA as high as 72% among patients with snoring referred for surgery. This is however; a highly selected population of patients; hence, the results may not be comparable to those of this study. It is not certain if, the snoring is a sequel or a contributing factor to the occurrence of OSA. Teculescu³² had suggested that the vibrations transmitted to pharyngeal structures by snoring span a large range of frequencies. A deleterious affect of these vibrations is mucosal injury and edema leading to airway obstruction and contributing to OSA.³⁴ The association between the pattern of snoring and the severity of symptoms is quite obvious in this study. Subjects found to have OSA by (ESS) (71%) reports history of frequent arousals wake up suddenly and unable to breath causing sleep fragmentation and excessive day time sleepiness. Regular continuous snoring usually does not have sleep disturbing effects. However, discontinuous snoring associated with increased upper airway resistance leads to recurrent arousals.³⁵ Males scored higher than females and they were older. This observation is similar to those of other studies.³⁶ Using a logistic regression analysis we found that increasing age and male gender are significant

predictors of OSA by ESS (**Table 4**). This has also been noted and confirmed by others.³⁷ Epworth sleepiness scale is a simple screening tool for the sleep apnea syndrome. Primary health care doctors and other ambulatory health care team can be trained to detect OSA. This needs to be supported by formal sleep studies.

Approximately 60% of normal adults snore occasionally, and 40% are habitual snorers. The problem of snoring is more frequent in males and overweight persons, and it usually increases with age. When snoring is severe, it can cause serious, long-term health problems, including OSA. In this study using ESS, snoring was found to be associated with symptoms suggesting OSA syndrome. There is a great need for family doctors and the rest of primary care health providers to be aware of how to detect OSA among apparently normal individuals.

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References

1. Fairbanks D. Snoring: An overview with historical perspectives. Snoring and Sleep apnea. 2nd ed. London (UK): Raven Press; 1994. p. 1-16.
2. Soto F. Cardiovascular manifestations of obstructive sleep apnea. *Rev Med Chil* 1998; 126: 1112-1116.
3. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of Sleep-disordered breathing among middle-aged adults. *N Engl J Med* 1993; 328: 1230-1235.
4. Lugaresi E, Cirignotta F, Coggagna G. Some epidemiological data on snoring and cardiocirculatory disturbances. *Sleep* 1980; 3: 221-224.
5. Schmidt-Nowara WW, Coultas DB, Wiggins C, Skipper BE, Samet JM. Snoring in a Hispanic-American population: risk factors and association with hypertension and other morbidity. *Arch Intern Med* 1990; 150: 597-601.
6. Katz I, Stradling J, Slutsky AS, Zamei N, Hoffstein V. Do patients with obstructive sleep apnoea have thick necks? *Am Rev Respir Dis* 1990; 141: 1228-1232.
7. Kauffmann F, Annesi I, Neukirch F, Oryszczyn MP, Alperovitch A. The relation between snoring and smoking, body mass index, age, alcohol consumption and respiratory symptoms. *Eur Respir J* 1989; 2: 599-603.
8. Bloom J, Kaltenborn W, Quan S. Risk factors in a general population for snoring. Importance of cigarette smoking and obesity. *Chest* 1988; 93: 678-683.
9. Hoffstein V. Snoring. *Chest* 1996; 109: 201-222.
10. Mezzanotte WS, Tangel DJ, White DP. Waking genioglossal electromyogram in sleep apnea patients versus normal controls (a neuromuscular compensatory mechanism). *J Clin Invest* 1992; 89: 1571-1576.
11. Grunstein RR, Stenlof K, Hedner J. Impact of obstructive sleep apnea and sleepiness on metabolic and cardiovascular risk factors in the Swedish Obese Subjects (SOS) Study. *Int J Obesity* 1995; 19: 410-418.
12. Lindberg E, Carter N, Gislason T, Janson C. Role of snoring and daytime sleepiness in occupational accidents. *Am J Respir Crit Care Med* 2001; 164: 2031-2035.

13. Elmasry A, Janson C, Lindberg E, Gislason T, Tageldin MA, Boman G. The role of habitual snoring and obesity in the development of diabetes: a 10-year follow-up study in a male population. *J Intern Med* 2000; 248: 13-20.
14. Smirne S, Palazzi S, Zucconi M, Chierchia S, Ferini-Strambi L. Habitual snoring as a risk factor for acute vascular disease. *Eur Respir J* 1993; 6: 1357-1361.
15. Kushida CA, Nichols DA, Simon RD, Young T. Symptom-Based prevalence of sleep disorders in an adult primary care population. *Sleep Breath* 2000; 4: 9-14.
16. Bixler E, Vgontzas A, Ten Have T, Tyson K, Kales A. Effects of age on sleep apnea in men. *Am J Respir Crit Care Med* 1998; 57: 144-148.
17. Bixler E, Vgontzas A, Lin H, Ten Have T, Rein J, Vela-Bueno A, Kales A. Prevalence of sleep disordered breathing in women. *Am J Respir Crit Care Med* 2001; 163: 608-613.
18. Duran J, Esnaola S, Rubio R, Iztueta A. Obstructive sleep apnea-hyponea and related clinical features in a population-based sample of subjects aged 30 to 70 years. *Am J Respir Crit Care Med* 2001; 163: 685-689.
19. Young T, Peppard PE, Gottlieb DJ. Epidemiology of Obstructive Sleep Apnea. A Population Health Perspective. *American Am J Respir Crit Care Med* 2002; 165: 1217-1239.
20. Mitler MM, Miller JC. Methods of testing for sleepiness. *Behav Med* 1996; 21: 171-177.
21. Johns MW. Reliability and factor analysis of the Epworth Sleepiness Scale. *Sleep* 1992; 15: 376-381.
22. Hirshkowitz M, Gokecebay N, Iqbal S. Epworth Sleepiness Scale and Sleep-disordered breathing: replication and extension. *Sleep Res* 1995; 24: 249-256.
23. Gottlieb DJ, Whitney CW, Bonekat WH, Iber C, James GD, Lebowitz M, Nieto FJ, Rosenberg CE. Relation of sleepiness to respiratory disturbance index: the Sleep Heart Health Study. *Am J Respir Crit Care Med* 1999; 159: 502-507.
24. He J, Kryger MH, Zorick FJ, Conway W, Roth T. Mortality and apnea index in obstructive sleep apnea. Experience in 385 male patients. *Chest* 1988; 94: 9-14.
25. Kapur V, Blough DK, Sandblom RE, Hert R, de Maine JB, Sullivan SD, Psaty BM. The medical cost of undiagnosed sleep apnea. *Sleep* 1999; 22: 749-755.
26. Bahammam A, Kryger M. Decision making in obstructive sleep disordered breathing. Putting it all together. *Otolaryngol Clin North Am* 1999; 32: 333-348.
27. Chesson AL Jr. Practice parameters for the indications for polysomnography and related procedures. Polysomnography Task Force, American Sleep Disorders Association Standards of Practice Committee. *Sleep* 1997; 20: 406-422.
28. Brouillette RT, Fernback SK, Hunt CE. Obstructive sleep apnea in infants and children. *J Pediatr* 1982; 100: 31-40.
29. Johns MW. Daytime sleepiness, snoring and obstructive sleep apnoea. The Epworth sleepiness scale. *Chest* 1993; 1003: 30-36.
30. Johns MW. Reliability and factor analysis of the Epworth sleepiness scale. *Sleep* 1992; 15: 376-381.
31. Bearpark H, Elliott L, Grunstein R, Cullen S. Snoring and sleep apnoea. A population study in Australian men. *Am J Respir Crit Care Med* 1995; 151: 1459-1465.
32. Teculescu D. Can snoring induce or worsen obstructive sleep apnoea. *Med Hypotheses* 1998; 50: 125-129.
33. Tami TA, Duncan HJ, Pflieger M. Identification of obstructive sleep apnoea in patients who snore. *Laryngoscope* 1998; 108: 508-513.
34. Bloch KE. Sleep apnoea syndrome and morbid snoring. *Schweiz Rundsch Med Prax* 1995; 13: 736-741.
35. Lindberg E, Taube A, Janson C. A 10-year follow-up of snoring in men. *Chest* 1998; 114: 1048-1055.
36. Hoffstein V, Szalai JP. Predictive value of clinical features in diagnosing obstructive sleep apnoea. *Sleep* 1993; 16: 118-122.
37. Deegan PC, MC Nicholas WT. Predictive value of clinical features for obstructive sleep apnoea syndrome. *Eur Respir J* 1996; 1: 117-124.