ORIGINAL ARTICLE

Snoring and its Risk Factors in Obese Indian Population

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ABSTRACT

Objective: To investigate the prevalence of snoring and its risk factors in obese Indian Population.

Method: Cross – sectional study. 300 subjects, with BMI > 25 kg /m^2 were evaluated with a questionnaire for symptoms of sleep disorders, details of significant medical history, family history, anthropometric measurements, and Epworth Sleepiness Scale (ESS) were noted. A univariate and logistic regression analysis was done a ROC curve generated. The sensitivity, specificity was calculated and formula devised for calculating the snoring score.

Results: The mean age was 34.59 (sd 10.83), M: F = 1:1, 49 (16%) had history of habitual snoring. Univariate and multivariate logistic regression analysis revealed age, gender, nocturia, and presence of arthritis, family history of snoring, smoking and higher ESS score as significant risk factors of snoring.

Conclusion: Snoring is more common in males, the modifiable risk factor being smoking.

Keywords: Obesity, BMI, Snoring

Introduction

Obesity is defined as a condition characterized by excessive bodily fat.[1]

The clinical definition of obesity is usually expressed in terms of body mass index (BMI) derived by dividing wt $^{kg.}$/(ht. in m^2), overweight being BMI>25, and obesity as BMI>30[2]. The prevalence of obesity varies according to race, ethnicity, but has been reported in US as 20.9% [3]. Overweight and obesity have been associated with increased risk of a large number of disorders, dyslipidemias [4], type II diabetes mellitus [5], hypertension[6], coronary artery disease [7], osteoarthritis[8] , sleep apnea[9]. Snoring is a common condition, caused by movement of air across soft tissues of mouth and throat. The prevalence rates reported range from 40% in men and 20% in women with increasing prevalence with age.[10,11] It is considered as a risk factor for hypertension and ischaemic heart disease [12]

Snoring is one end of the spectrum of Sleep Disordered breathing with Obstructive Sleep apnoea (OSA) at the other end. Snoring can be considered as a predecessor of OSA and needs to be evaluated and managed at an early stage. There is a close relationship between obesity and snoring. Obesity induces multiple physiologic changes at the respiratory and circulatory system level. 24% of over weight men, 9% of women have Sleep Disordered Breathing compared with 1-4% of total population.[13,14,15]. There are various studies evaluating the presence of Obstructive Sleep Apnoea in obese patients[16] with OSA in 50% of obese patients with BMI>40. Neck circumference and BMI being strong predictions of Sleep Apnoea.[16]

The diagnosis of OSA requires an overnight PSG [17], which is an expensive test with limited availability. Thus various prediction formulas have been developed for

diagnosis of OSA. Neck circumference, waist/hip ratio, snoring with pauses and excessive daytime sleepiness are simple inexpensive tools used for this prediction.[18,19] The diagnosis of snoring is based on history available from bed-partner. However in case of subjects sleeping alone no such history may be available. It would be useful to have a prediction formula in order to label them as potential snorers. This would help to prioritize patients for further testing with a high priori probability of having a positive test.

There are no studies available on the prevalence of snoring in the Indian population. The aim of the present study was to evaluate the prevalence of snoring in adult obese Indian population and to estimate its gender specificity & risk factors.

Material & Method

Obese Subjects with BMI>25 kg/m^2 formed the study group. All were attending an obesity control program at a slimming center.(VLCC) Health Care Pvt Ltd., New Delhi.

A pre-designed questionnaire was administered to all, in a direct face to face interview, after obtaining informed consent. A detailed clinical history was taken in a predesigned proforma which included family history of snoring upto third degree, a sleep questionnaire for symptoms of OSA, modified from the Cleveland Veterans Affairs Hospital sleep questionnaire [20] and the Epworth sleepiness scale score [21] questionnaire. This was divided into 4 sections. Section 1 contained questions on demographic information, age, education, race, weight, height, neck circumference, waist and hip measurements. BMI was calculated as wt. in kg/ ht.^{2} in (m). Section 2 enquired about presence/absence of sleep disorder and further defined its nature. Section –3: included questions for associated medical illnesses, systemic hypertension, hypothyroidism, coronary artery disease, chronic obstructive airway disease. Section - 4: The Epworth Sleepiness scale. This is a simple tool to assess the general level of daytime sleepiness (average sleep propensity). ESS measures the probability of falling asleep in eight situations (score 0-3, total = 24).

The sleep questionnaire contained symptom specific questions for various sleep disorders including OSA. It contained thirty questions in total, six for the diagnosis of OSA. They were presence of snoring, long pauses in breathing during night, motor restlessness, excessive daytime sleepiness, feeling unrefreshed after the night sleep and presence of morning headache. The questions carried definite scores (0-4), score (1) rarely, score (2) 1-2/week, (3) 3-4/week and (4) always, based on the frequency of occurrence of symptoms and 0, if the patient is asymptomatic.

Data Analysis

All data recorded was managed on Excel spreadsheets. Quantitative variables were summarized by means and standard deviation and categorical by counts.

The quantitative variables were compared between snorers & nonsnorers, using students t-test with $p < 0.05$ considered as statistically significant.

A multivariate logistic regression analyses was conducted after categorization of age, neck circumference, BMI, waist-hip ratio, & presence/absence of arthritis, nocturia, hypertension to calculate odds ratio for all the variables. The ROC was generated and a formula was devised for prediction of snoring.

Results: There were 300 subjects in all, with mean age of 34.59 (10.83) M: F ratio 1:1, 227 (75.7%) were unmarried, 297 had education (99%) were IX and above. Table 1.

On the question " do you have any sleep disturbance?" 63(21%) answered 'yes'. The commonest abnormality was difficulty in falling asleep in 31(10%) frequent awakening in 9, and increased sleepiness in 11, 8 patients had >1 complaint. 65 (21 %) complained of snoring, but significant snoring was in 49(16.3%) 43 complained of waking up unrefreshed, 6 reported falling asleep while driving.

There was history of Hypertension in 37, ischaemic heart disease in 5,polyuria in 7, 5 complained of heartburn in sleep, 12 had breathing difficulty, 17 with arthritis, 9 had previous adenoid/tonsillectomy. Family history for snoring was positive in 82, with increased sleepiness in 11. Forty were regular smokers, and 58 gave history of regular intake of alcohol.

On univariate analysis, a significant association was observed between snoring and age, BMI, Neck circumference, ESS Total, details in Table 1.

For further analysis the variables were categorized as age >35& <35 years, BMI >30 and <30, Neck circumference in males >&<40, females >&<34. W/H ratio in males >0.95 & less, in females >&<0.83,

Table 1: Results of univariate analysis between snorers and non-snorers

P < 0.05= clinically significant

	Snoring number (%)	Non-Snoring Number (%)	P-Value
No.	49	251	-
Age yrs mean(SD)	40.6 ± 113	33.4 ± 10.33	0.000
BMI	32.5 ± 4.8	30 ± 4.1	0.000
Neck Cicurmference (cms)	40.5 ± 3.3	36.4 ± 4.1	0.000
ESS Total	4.4 ± 3.6	2.0 ± 3.1	0.000
M:F	8.8:1	-	0.000
Increased Daytime Sleepiness	3 (6.1)	8 (3.1)	0.31
Pauses at night	3 (6.1)	3 (1.2)	0.02
Motor movt. at pause End	2 (4.0)	0 (0.0)	0.001
Disturbed sleep	2 (4.0)	6 (2.3)	0.5
Talking in sleep	2 (4.0)	1 (0.4)	0.01
Diabetes	6 (12.2)	0 (0.0)	0.000
HT	16 (32.6)	22 (8.7)	0.000
Chest Pain	3 (6.1)	2 (0.8)	0.008
Polyuria	5 (10.2)	2 (0.8)	0.000
Heart burn	3 (6.1)	2 (0.8)	0.008
Arthralgia/Arthritis	8 (16.3)	9 (3.5)	0.000
F/History of snoring	26 (53.0)	56 (22.3)	0.000
Smoking	18 (36.7)	22 (8.7)	0.000
Alcohol	23 (46.9)	35 (13.9)	0.000
Dur. Smoking	3.0 ± 6.2	.46 ± 2.3	0.000
Dur. Alcohol	3 ± 6.0	.84 ± 3.3	0.000

ESS>&<2. These were then co-related with snoring and odds ratios calculated, details in Table 2.

A logistic regression analysis was done, sensitivity and specificity calculated and a ROC curve generated. Fig1. The sensitivity was 82.47%, specificity of 83.87 for the formula.

The formula devised for prediction of snoring is :

Snoring score = 99 + 1.2 (age cat) + 1.8 (sex) + 3.7 (polyuria) + 2.5 (arthritis) + 1.3 (f. history of snoring) + 1.9 (smoking) + 1 (ESS cat)

Discussion

The prevalence of habitual snoring in the present study in obese Indian population was 16%. This is the first study in our population. Age, gender, family history of snoring, smoking, presence of arthritis, nocturia and higher ESS score were significant risk factors. Snoring was more common in men than women. Snorers were found to have more illnesses especially hypertension and arthritis as has been reported earlier [22-25] Diabetes, hypertension, ischemic Heart Disease, joint pains were significantly higher in snorers. Snorers were more often smokers with history of regular intake of alcohol.

The prevalence of snoring in the present study was lower as compared to previous studies, firstly due to the inclusion of only those patients who had snoring or > 3 nights/week i.e. habitual snorers, and those with occasional snoring were excluded. Secondly, 75% of subjects were unmarried in the present study, and as there was no bed partner, so may not have been accurate in their response.

OSA, is a significant, risk factor for HT, IHD, stroke, and daytime sleepiness 26,27. Snoring is a simple inexpensive tool and has been used in screening questionnaires for diagnosis of OSA [18]. However, the history may not be available in single subjects with absence of a bed partner. Thus it would be useful to have a tool for predicting subjects with snoring. Thus the incorporation of the formula for prediction of snoring is a useful tool, which can help identify patients for evaluation with overnight PSG for diagnosis of OSA

The present study devised a formula, based on the multivariate analysis. The formula had a sensitivity of 82.4%, and specificity of 83.8% for diagnosis of snoring. The incorporation of this formula for prediction of OSA needs to be evaluated. This would enable patients to be prioritized for further studies, resulting in early diagnosis and intervention for preventing morbidity.

As even mild OSA & habitual snoring are associated with significant morbidity. strategies to decrease the high prevalence and associated morbidity are needed. Thus the role of potentially modifiable risk factors such as obesity, alcohol consumption, and smoking need to be stressed. The focus on weight control is especially important, with the current epidemic of overweight and obesity, weight reduction [28,29] would be a more cost-effective strategy, for snoring and OSA, as treatment of OSA & its complications are more expensive particularly for developing countries.

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Table 2: Results of bivariate and multivariate logistic regression analysis with snoring (yes/ no) as outcome

Variable	Category	Snoring		p=value	Unadjusted OR (C.I.)	Adjusted OR (C.I.)
		Yes	No			
Age	? 35	17 (35)	159 (64)	0.000	3.2 (1.7-6.2)	5.0 (2.11-11.8)
	> 35	32 (65)	92 (36)	-	-	-
Gender	M	44 (89.8)	106 (42)	0.000	12.03 (4.6-31.4)	15.1 (4.2-53.7)
	F	5 (10.2)	145 (57)	-	-	-
Neck circumference	Normal	23 (48)	180 (76)	0.000	3.4 (1.8-6.4)	-
	Abnormal	25 (52)	58 (24)	-	-	-
Waist/Hip Ratio	Normal	14 (28.5%)	173 (69.7%)	0.000	5.8 (2.9-11.3)	-
	Abnormal	35 (71.4%)	75 (30.2%)	-	-	-
H/o Polyuria	7	5 (10.2)	2 (0.8)	0.000	14.14 (2.66-75.2)	8.1 (1.11-59.3)
H/o Arthritis	17	8 (16.3)	9 (3.5)	0.000	5.2 (1.9-14.4)	8.9 (1.98-40.6)
Smoking	40	18 (36.7)	22 (8.7)	0.000	6.0 (2.9-12.5)	2.8 (1.12-7.13)
Family H/o Snoring	82	26 (53)	56 (22.3)	0.000	3.9 (2.1-7.4)	3.5 (1.58-8.06)
ESS	?2	17 (35%)	159 (64%)	0.000	3.5 (1.8-6.6)	2.8 (1.27-6.13)
	>2	32 (65%)	88 (35%)	-	-	-

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References

1. Merriam Webster New Collegiate Dictionary. Springfield, MA, *G & C Merriam Company*, *1999.*
2. **Pi-Sunyer XF (ed)**: Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults – the evidence report. *Obes Res 1998 6:51S,-210S.*
3. **Mokdad AH**, Ford ES, Bowman, DA, Dietz WH, et al. Prevalence of obesity, diabetes and obesity related health risk factors. *JAMA 2003 1: 289:76-9*
4. **Denke MA**, Sempos CT, Grundy SM. Excess body weight: An unrecognized contributor to high blood cholesterol levels in white American women. *Arch Intern Med 1994 154: 401-410.*
5. **Coiditz G**, Willett W, Rotnizky A, et al. Weight gain as a risk factor for clinical diabetes mellitus in women. *Ann Intern Med 1995; 122: 481-486.*
6. **Havlik R**, Hubert H, Fabsitz R, et al. Weight and hypertension. *Ann Intern Med 1983; 98: 855-859.*

7. **Hubert HB**, Feinleib M, McNamara PM, et al. Obesity as an independent risk factor for cardiovascular disease: A 26 year follow-up of participants in the Framingham Heart Study. *Circulation 1983; 67: 968-977.*

8. **Cicuttini FM**, Baker JR, Spector TD. The association of obesity and osteoarthritis of the hand and knee in women: a twin study. *J Rheumatol 1996; 23: 1221-1226.*

9. **Shepard J**. Hypertension, cardiac arrhythmias, myocardial infarction and stroke in relation to obstructive sleep apnoea. *Clin Chest med 1992; 13: 437-458.*

10. **Lugaresi E**, Cocagna G, Cirignotta F. Snoring and its clinical implications. In: Guillemault C, Dement WC, eds. Sleep apnea syndromes. New York: *A R Liss*, *1978; 13-21.*

11. **Lugaresi E**, Cirignotta F, Coccagna G, Piana C. Some epidemiological data in snoring and cardiocirculatory disturbances. *Sleep 1980; 3:221-4.*

12. **Koskenvuo M**, Partinen M, Kaprio J, et al. Snoring and cardiovascular risk factors. *Ann Med 1994; 26:371-6.*

13. **Sergi M**, Rizzi M, Comi AL, Resta O, Palma P, De Stefano A, Comi D. Sleep Apnea in Moderate-Severe Obese Patients. *Sleep Breath 1999; 3(2):47-52.*

14. **Richman RM**, Elliott LM, Burns CM, Bearpark HM, Steinbeck KS, Caterson ID. The prevalence of obstructive sleep apnoea in an obese female population. *Int J Obes Relat Metab Disord 1994; 18(3): 173-7.*

15. **Young T**, Palta M, Dempsey J, et al . The occurrence of sleep disordered breathing among middle aged adults. *N Eng J Med 1993; 328: 1230*

16. **Resta O**, Foschino-Barbaro MP, Legari G, Talamo S, Bonfitto P, Palumbo A, Minenna A, Giorgino R, De Pergola G. Sleep related breathing disorders, loud snoring and excessive daytime sleepiness in obese subjects. *Int. J Obes Relat Metab Disord 2001; 25(5): 669-75.*

17. Standards of practise committee of the American Sleep Disorder Association. Practise parameters for the use of portable recording in the assessment of obstructive sleep apnoea. *Sleep 1994; 17: 372*

18. **Harding SM**. Prediction formulae for sleep-disordered breathing. *Curr Opin Pulm Med 2001; 7(6): 381-5.*

19. **Schafer H**, Ewig S, Hasper E, Ludertz B. Predictive diagnostic value of clinical assessment and nonlaboratory monitoring system recordings in patients with symptoms suggestive of obstructive sleep apnea syndrome. *Respiration 1997; 64 (3): 194-9.*

20. **Kenneth K**, Christopher W, Peter V, Tishler IB, Veronica F, Kingman P, Susan R. Assessment of the validity and utility of the sleep-symptom questionnaire. *American Journal of Resp and Critical Care Medicine 1994; 150: 735-41*

21. **Johns MW**. A new method of measuring daytime sleepiness: The Epworth sleepiness scale. *Sleep 1991; 14: 540-545*

22. **Ketterer MW**, Brymer J, Rhoads K, et al. Snoring and the severity of coronary artery disease in men. *Psychosom Med 1994; 56:232-6.*

23. **Hu FB**, Willett WC, Manson JE, et al. Snoring and risk of cardiovascular disease in women. *J Am Coll Cardiol 2000; 35:308-13.*

24. **Lindberg E**, Taube A, Janson C, et al. A 10-year follow-up of snoring in men. *Chest 1998; 114:1048-55.*

25. **Jennum P. Hein HO**, Suadicani P, Gyntelberg F. Headache and cognitive dysfunctions in snorers. A cross-sectional study of 3323 men aged 54 to 74 years: the Copenhagen Male Study. *Arch Neurol 1994; 51:937-42.*

26. **Bixler EO**, Vgontzas AN, Lin HM, et al. Association of hypertension and sleep-disordered breathing. *Arch Intern Med 2000; 160:2289-95.*

27. **Schulz R**, Olschewski Hh, Gimminger F, Seeger W. Prevalence of stroke and transitory ischemic attacks in obstructive sleep apnea: a retrospective analysis of 187 consecutive patients. *Pneumologie*. *2000 Dec;54(12):575-9.*

28. **Collard P**, Rodenstein DO. Management of simple snoring in adults. *Monaldi Arch Chest Dis 1993; 48:623-6 (review).*

29. **Braver HM**, Block AJ, Perri MG. Treatment for snoring. Combined weight loss, sleeping on side, and nasal spray. *Chest 1995; 107:1283-8.*