Snoring and its Risk Factors in Obese Indian Population

M. Bhatia, V. Aggarwal, R.M. Pandey

Introduction

Obesity is defined as a condition characterized by excessive bodily fat. The clinical definition of obesity is usually expressed in terms of body mass index (BMI) derived by dividing wt/ht. in m2), overweight being BMI>25, and obesity as BMI>30. The prevalence of obesity varies according to race, ethnicity, but has been reported in US as 20.9% . Overweight and obesity have been associated with increased risk of a large number of disorders, dyslipidemias, type II diabetes mellitus, hypertension, coronary artery disease, osteoarthritis, sleep apnea. 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. It is considered as a risk factor for hypertension and ischaemic heart disease.

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 predictor 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 overweight men, 9% of women have Sleep Disordered Breathing compared with 1-4% of total population. There are various studies evaluating the presence of Obstructive Sleep Apnoea in obese patients with OSA in 50% of obese patients with BMI>40. Neck circumference and BMI being strong predictors of Sleep Apnoea.

The diagnosis of OSA requires an overnight PSG, 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.\textsuperscript{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\textsuperscript{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\textsuperscript{20} and the Epworth sleepiness scale score\textsuperscript{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.\textsuperscript{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 & non-snorers, 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, ischemic 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

<table>
<thead>
<tr>
<th></th>
<th>Snoring number (%)</th>
<th>Non-Snorers number (%)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>49</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>Age yrs mean(SD)</td>
<td>40.6 ± 11.3</td>
<td>33.4 ± 10.33</td>
<td>0.000</td>
</tr>
<tr>
<td>BMI</td>
<td>32.5 ± 4.8</td>
<td>30.4 ± 4.1</td>
<td>0.000</td>
</tr>
<tr>
<td>Neck Circumference (cm)</td>
<td>40.5 ± 3.3</td>
<td>36.4 ± 4.1</td>
<td>0.000</td>
</tr>
<tr>
<td>ESS Total</td>
<td>4.4 ± 3.6</td>
<td>2.0 ± 3.1</td>
<td>0.000</td>
</tr>
<tr>
<td>N:F</td>
<td>8:8:1</td>
<td>0:0:0</td>
<td>0.000</td>
</tr>
<tr>
<td>Increased Daytime Sleepiness</td>
<td>3 (6.1)</td>
<td>8 (14.1)</td>
<td>0.31</td>
</tr>
<tr>
<td>Pauses at night</td>
<td>3 (6.1)</td>
<td>3 (1.2)</td>
<td>0.02</td>
</tr>
<tr>
<td>Motor activity at pause</td>
<td>2 (4.0)</td>
<td>0 (0.0)</td>
<td>0.001</td>
</tr>
<tr>
<td>Disturbed sleep</td>
<td>2 (4.0)</td>
<td>6 (2.3)</td>
<td>0.3</td>
</tr>
<tr>
<td>Talking in sleep</td>
<td>2 (4.0)</td>
<td>1 (0.4)</td>
<td>0.01</td>
</tr>
<tr>
<td>Diabetes</td>
<td>8 (14.2)</td>
<td>0 (0.0)</td>
<td>0.000</td>
</tr>
<tr>
<td>ESS&gt; &amp;&lt;2</td>
<td>3 (6.1)</td>
<td>2 (1.2)</td>
<td>0.000</td>
</tr>
</tbody>
</table>

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. 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. Snoring is a simple inexpensive tool and has been used in screening questionnaires for diagnosis of OSA. 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 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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References

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Snoring</th>
<th>p-value</th>
<th>Unadjusted OR (C.I.)</th>
<th>Adjusted OR (C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&lt; 35</td>
<td>17 (35)</td>
<td>0.000</td>
<td>3.2 (1.7-6.2)</td>
<td>5.0 (2.11-11.8)</td>
</tr>
<tr>
<td></td>
<td>&gt; 35</td>
<td>32 (65)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gender</td>
<td>M</td>
<td>44 (89.8)</td>
<td>0.000</td>
<td>12.03 (4.6-31.4)</td>
<td>15.1 (4.2-53.7)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>5 (10.2)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Neck circumference</td>
<td>Normal</td>
<td>23 (48)</td>
<td>0.000</td>
<td>3.4 (1.8-6.4)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
<td>25 (52)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waist/ Hip Ratio</td>
<td>Normal</td>
<td>14 (28.5%)</td>
<td>0.000</td>
<td>5.8 (2.9-11.3)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
<td>35 (71.4%)</td>
<td>75 (30.2%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>H/o Polyuria</td>
<td>7</td>
<td>5 (10.2)</td>
<td>0.000</td>
<td>14.14 (2.66-75.2)</td>
<td>8.1 (1.11-59.3)</td>
</tr>
<tr>
<td>H/o Arthritis</td>
<td>17</td>
<td>8 (16.3)</td>
<td>0.000</td>
<td>5.2 (1.9-14.4)</td>
<td>8.9 (1.98-40.6)</td>
</tr>
<tr>
<td>Smoking</td>
<td>40</td>
<td>18 (36.7)</td>
<td>0.000</td>
<td>6.0 (2.9-12.5)</td>
<td>2.8 (1.12-7.13)</td>
</tr>
<tr>
<td>Family H/o Snoring</td>
<td>82</td>
<td>26 (53)</td>
<td>0.000</td>
<td>3.9 (2.1-7.4)</td>
<td>3.5 (1.58-8.06)</td>
</tr>
<tr>
<td>ESS</td>
<td>&gt; 2</td>
<td>32 (65%)</td>
<td>0.000</td>
<td>3.5 (1.8-6.6)</td>
<td>2.8 (1.27-6.13)</td>
</tr>
</tbody>
</table>


