

Prevalence of Obstructive Sleep Apnea Among Obese Individuals in Ahmedabad - An Observational Study

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ABSTRACT

Introduction: Obstructive sleep apnea (OSA) is a disorder characterized by partial or complete narrowing of the pharyngeal airway during sleep, resulting in repeated episodes of airflow cessation, oxygen desaturation, and sleep interruption. Obesity is the most powerful risk factor for OSA. Obesity structurally increases the collapsibility of the pharyngeal airway due to excessive fat deposition. Prevalence of obesity in India is 40.3%. STOP-BANG questionnaire (SBQ) is a concise, effective, and reliable OSA screening tool. The purpose of this study was to find the prevalence of OSA among obese individuals in Ahmedabad by using SBQ.

Method: Approval of the ethical committee was taken. Using Convenient sampling method Selection of 204 subjects according to the inclusion criteria and exclusion criteria has been done. After taken written informed consent from the subject Screening of all subject has been done. BMI More than 25kg/m², Age ≥18 years, both male and female and non-alcoholics were included. Not willing to participate and subjects unable to understand were excluded. Statistical analysis was done. Then prevalence has been ruled out.

Results: All data analysis was performed using SPSS 16. It was found that the prevalence of OSA was highest in Obese class-3 (84.61%), age group of 50–59 (85.29%) and male gender (71.42%). According to Chi –Square test, Association was found with male gender, age more than 50 years, and body mass index >30kg/m².

Conclusion: 204 subjects taken for study showed prevalence of OSA among obese in Ahmedabad is 69.11%. It was also found that prevalence rate was 5.12% higher in obese males than females.

Keywords: Prevalence, Obstructive sleep apnea, Obese, Ahmedabad.

INTRODUCTION

Obstructive sleep apnea (OSA) is a disorder characterized by partial or complete narrowing of the pharyngeal airway during sleep, resulting in repeated episodes of airflow cessation, oxygen desaturation, and sleep interruption.^[1]

Obstructive sleep apnea (OSA) is a chronic, sleep-related respiratory disorder that is becoming more prevalent.^[2] Most people with OSA are undiagnosed and untreated. The primary cause of OSA is a small or unstable Pharyngeal airway.^[3] Patients with OSA may complain of symptoms that occur at night, such as excessive snoring, gasping or choking sensations during sleep,

breathing pauses during sleep (witnessed apneas), nocturia, diaphoresis and poor-quality sleep. Poor quality sleep, night after night, results in a wide spectrum of daytime symptoms. These include excessive daytime sleepiness, fatigue, morning headaches, memory impairment, an increased tendency to be involved in motor vehicle accidents, personality changes and depression.^[4]

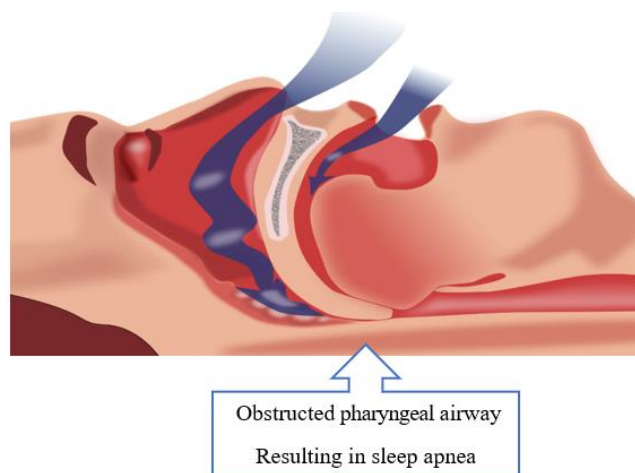
Obesity is the most powerful risk factor for obstructive sleep apnea OSA.^[5] Obesity occurs over time with the consumption of too many calories or too little expenditure of calories through activity or exercise or both overconsumption and underexpenditure.^[6]

Prevalence of obesity in India is 40.3%.^[7] More than two-thirds of obese people have OSA. Obesity narrows the upper airway, causes upper airway collapsibility, and disrupts the normal physiologic respiratory drive. Specifically, it has been shown that obesity is associated with the deposition of peri pharyngeal fat, which may increase pharyngeal collapsibility.^[6] Obstructive

sleep apnea occurs during sleep when the muscles of the upper airway relax, resulting in partial (hypopnea) or complete (apnea) obstruction to airflow. This loss of muscle tone leads to a collapse of the upper airway during sleep, especially if a predisposing factor such as obesity is present.^[4]

STOP-BANG questionnaire is a concise, effective, and reliable OSA screening tool which has a sensitivity of 92.9% and 100%, for detecting moderate and severe OSA, respectively. The SBQ (Stop-Bang questionnaire) includes four subjective (STOP: Snoring, tiredness, observed apnea, and high blood pressure) and four objective items (BANG: BMI, Age, Neck circumference, Gender). For each question, answering “yes” scores 1, a “no” response scores 0, and the total score ranges from 0 to 8.^[8,9]

There are studies which have shown the prevalence of obstructive sleep apnea in obese individuals, but there is scarcity of such studies in India.



(Reference: - https://en.m.wikipedia.org/wiki/Obstructive_sleep_apnea)

AIM:

To find out prevalence of obstructive sleep apnea among obese individuals.

OBJECTIVE:

To find out prevalence of obstructive sleep apnea among obese individuals by using stop bang questionnaire.

LITERATURE REVIEW

- **Snigdha Pattanaik, Rajagopal R** (2018): The objective of this study was to assess prevalence of obstructive sleep apnea using STOPBANG questionnaire in which 1012 participants were included randomly from a health centre. The participants were asked to fill in the STOP-Bang questionnaire in face-to-

face interview. The prevalence of OSA was found to be 13.7% by using the Stop Bang questionnaire. It was found that the prevalence of OSA was highest in the age group of 50–59 (21.7%) and least in the age group of 18–29 (12.0%). Gender-wise distribution of OSA based on the scoring was seen to be more among males (14.8%) and in females it was (12.9%). Hence, they concluded, that the prevalence of OSA is considerably high with noticeable variation and increase in age and gender. [10]

MATERIALS & METHODS

- **Ethical approval:** Ethical approval was obtained from institutional ethical committee.
- **Study design:** Observational study.
- **Study setting:** Ahmedabad, Gujarat, India.
- **Sampling technique:** Convenient sampling method.
- **Study duration:** 6 months.
- **Sample size:** 204 [Justification: - assuming that 15% of the subjects in the population have the factor of interest (according to previous study), the study would require a sample size of: 204 for estimating the expected proportion with 5% absolute precision and 95% confidence].

- **Selection Criteria: -**
- ❖ **Inclusion criteria:**
 - ✓ BMI More than 25kg/m²
 - ✓ Age More than 18 years
 - ✓ Both male and female
 - ✓ Subjects not taking alcohol

- ❖ **Exclusion criteria:**
 - ✓ Not Willing to participate
 - ✓ Patient Unable to understand

- **Materials Required: -**
 1. Stop Bang Questionnaire
 2. Pencil, Pen, Paper, Rubber
 3. Consent Form and Assessment form
 4. Non-stretchable Measuring tape

5. Sphygmomanometer
6. Stethoscope
7. Weighing machine
8. Stadio-Meter

➤ **Data collection tool: -**

❖ **Stop Bang Questionnaire-**

Specificity: 74.7%, Sensitivity- 98% and Reliability- 0.7. [11,12]

It included subjective and objective assessment. In subjective section consisted of four questions, with dichotomous (yes/no) options related to the clinical features of sleep apnea (snoring, tiredness, observed apnea, high blood pressure) and objective section included (body mass index (BMI), age, neck circumference, and male gender). Response for each question answering “Yes” scored 1, and “No” scored 0, and the total score ranged from 0 to 8. Subjects completed STOP questionnaire while BANG questionnaire (BMI, age sex, neck circumference) was recorded.

Interpretation: -

- i. Low risk of OSA: 0-2
- ii. Moderate (intermediate) risk of OSA: 3-4
- iii. High risk of OSA: 5-8

Objective assessment [18]: -

- a) **Height (H):** We measured height without shoes. Make sure your head, shoulders, and buttocks are contacting the wall as you stand with your feet flat on the floor. Then a stadiometer was used to measure height.



Measurement of height and weight in obese subject

- b) Weight (W): Measured by a weighing scale in kilograms without shoes, and with subjects wearing light weight clothes.
- c) BMI: Calculated using Quetelet formula calculated by dividing weight (kg) with the square of height (m). Body mass index (BMI) expresses the relationship between weight and height and is used to classify patients as underweight, healthy weight, overweight, obese, or morbidly obese. The formula for calculating BMI in kilograms and meters is:

$$\text{BMI} = \frac{\text{Actual body weight (kg)}}{\text{height}^2 (\text{m}^2)}$$

- d) Neck circumference: it was measured in the midway of the neck, between mid-cervical spine and mid anterior neck, using non-stretchable measuring tape with the subjects standing upright. In men, it was measured just below the laryngeal prominence (Adam's apple). While taking this reading, the subject was asked to look straight ahead, with shoulders relaxed. Care was taken not to involve the shoulder/neck muscles (trapezius) in the measurement.



Measurement of neck circumference in obese subject

➤ Procedure: -

Approval of the Ethical committee was obtained (GSIIESC/37/21). Selection of subjects was done based on the inclusion criteria and exclusion criteria. Screening of all subject was done After taking written informed consent from the subject. Statistics Analysis was done by used chi-square test. Then the prevalence has been ruled out.

Statistical Analysis

The present study done to know prevalence of OSA among obese individuals in ahmedabad by using STOPBANG questionnaire. Total 204 obese subjects enrolled in the study according to inclusion and exclusion criteria.

Statistical analysis was done using SPSS 16 and Microsoft Excel. For the demographic information, frequency distribution was reported for the Gender, Age, and BMI of the subjects. Non-Parametric test (chi-square test) was used to test for associations among categorical variables. P value calculated for statistical significance - P value <0.01.

RESULT

Statistical analysis was done using SPSS 16 and Microsoft Excel.

Table no.: 1 Gender distribution

Gender	Frequency	Percentage
Male	112	54.9%
Female	92	45.1%
Total	204	100%

Table no.: 2 Age Distribution

Age	Frequency	Percentage
18 - 29 years	42	20.60%
30 - 39 years	38	18.60%
40 - 49 years	31	15.10%
50 - 59 years	34	16.80%
60 - 69 years	29	14.20%
70 - 80 years	30	14.70%
Total	204	100%

Table no.: 3 BMI Categorization

BMI	Class	Frequency	Percentage
25 - 29.9	Overweight	78	38.23%
30 - 34.9	Obese -1	64	31.37%
35 - 39.9	Obese - 2	36	17.66%
≥40	Obese - 3	26	12.74%
Total	-	204	100%

Pie Chart no.: 1- OSA Distribution

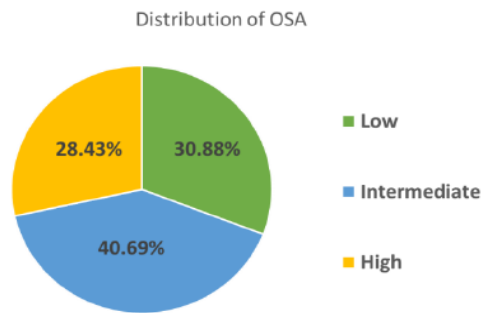


Table no.: 4- OSA Risk in BMI categories

BMI CATEGORY	Low	Intermediate	High	Total	Test statistics
Overweight	57	9	12	78	Chi-square Value (χ^2) = 177.42 Degrees of Freedom: 6 P value <0.01
Obese - 1	6	53	5	64	
Obese - 2	0	14	22	36	
Obese - 3	0	4	22	26	

Bar chart no.: 1- OSA Risk in BMI categories

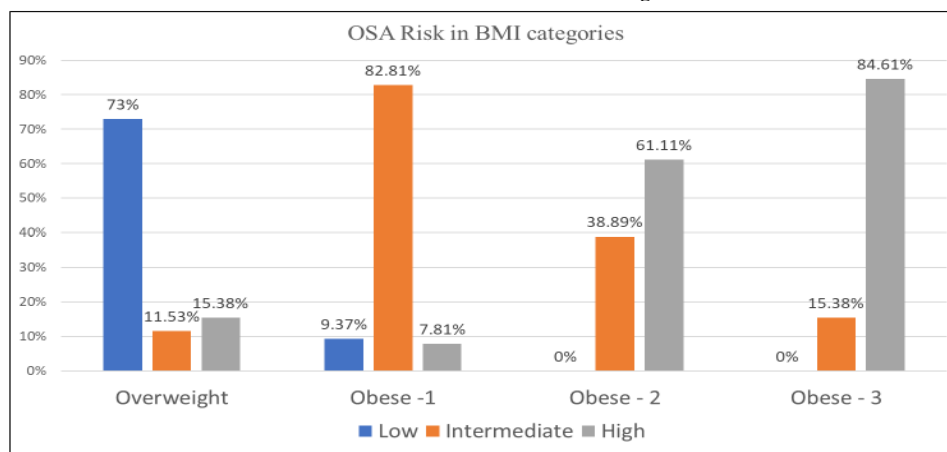


Table no.: 5- OSA Risk in Age Categories

Age category	Low	Intermediate	High	Total	Test statistics
18 - 29 years	26	14	2	42	Chi-square Value (χ^2) = 65.46 Degrees of Freedom: 10 P value <0.01
30 - 39 years	16	20	2	38	
40 - 49 years	10	14	7	31	
50 - 59 years	5	16	13	34	
60 - 69 years	5	9	15	29	
70 - 80 years	1	10	19	30	

Bar chart no.: 2- OSA Risk in Age Categories

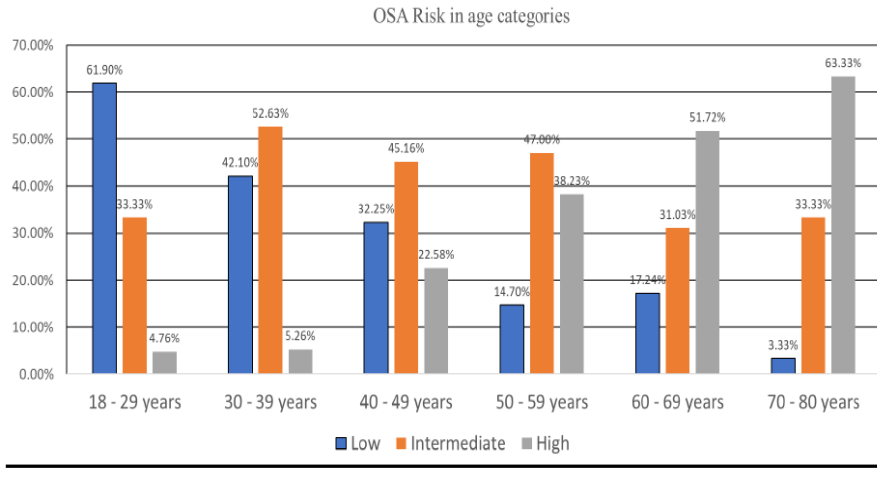


Table no.: 6- Prevalence of OSA in Male and Female

Gender	Low	Intermediate	High	Total	Test statistics
Male	32	31	49	112	Chi-square Value(χ^2) = 31.25 Degrees of Freedom: 2 P value <0.01
Female	31	52	9	92	

Bar chart no.: 3- Prevalence of OSA in Male and Female

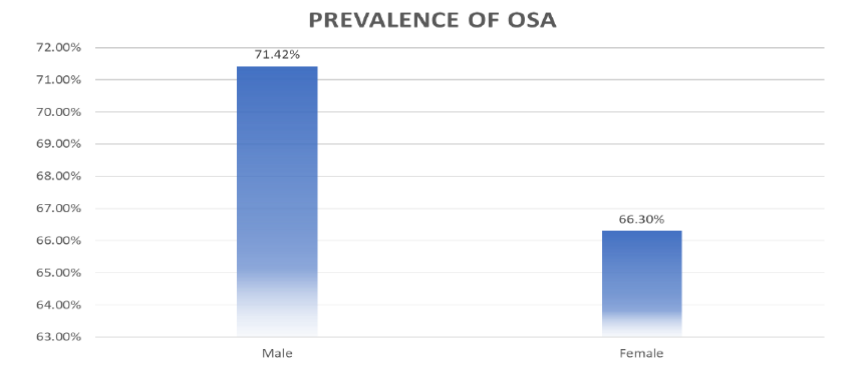
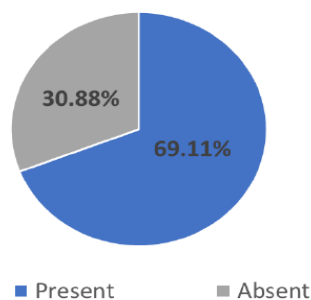


Table no.: 7- Prevalence of OSA among Obese individuals

STOP-BANG Score	OSA	%
	Present	141 (69.11%)
Absent	63 (30.88%)	
Total	204 (100%)	

Pie Chart no.: 2- Prevalence of OSA among Obese individuals

% of prevalence of OSA among OBESE



Above result **shows prevalence of OSA was found to be 69.11% by using the Stop - Bang questionnaire.** It was found that the prevalence of OSA was highest in the age group of 50–59 (85.29%) and least in the

age group of 18–29 (38.00%). Gender-wise distribution of OSA based on the scoring was seen to be more, among males (71.42%) than females (66.30%).

APPENDIX 1: STOP-BANG SLEEP APNEA QUESTIONNAIRE

STOP		
Do you SNORE loudly (louder than talking or loud enough to be heard through closed doors)?	Yes	No
Do you often feel TIRED , fatigued, or sleepy during daytime?	Yes	No
Has anyone OBSERVED you stop breathing during your sleep?	Yes	No
Do you have or are you being treated for high blood PRESSURE ?	Yes	No

BANG		
BMI more than 35kg/m ² ?	Yes	No
AGE over 50 years old?	Yes	No
NECK circumference > 16 inches (40cm)?	Yes	No
GENDER : Male?	Yes	No

TOTAL SCORE		

High risk of OSA: Yes 5 - 8

Intermediate risk of OSA: Yes 3 – 4

Low risk of OSA: Yes 0 - 2

DISCUSSION

Obstructive sleep apnea (OSA) is a chronic, sleep-related respiratory disorder that is becoming more prevalent. Most people with OSA are undiagnosed and untreated. OSA, when left untreated, may lead to life-threatening consequences. The primary cause of OSA is a small or unstable pharyngeal airway. The major risk factors for OSA are obesity and male sex. India is undergoing a rapid epidemiological

transition, from underweight to overweight/obese population.

Recent study (2021) done by Murali Venkatrao, Raghuram Nagarathna et al shows prevalence of obesity in India is 40.3%. Study shows Obesity levels in India are very high, across all zones in India. obesity increases with age, and is higher among women and among urban dwellers. Obesity is the highest among aging urban men and women who are college educated

and are sedentary. Physical activity and aging are the strongest determinants of obesity. Neeta J. Vyas, Mona I. Chaudhary, Megha S. Sheth conducted a study (2014) and found that prevalence of obesity was 15% in middle aged population of Ahmedabad. [7,13]

There are studies which have shown the prevalence obstructive sleep apnea in obese individuals, but there is scarcity of such studies in India. So, purpose of this study was to find out prevalence of obstructive sleep apnea among obese individuals by using stop bang questionnaire.

Overnight polysomnography remains “gold standard” for OSA diagnosis; however, unfortunately, it is expensive, time consuming, labour-intensive, costly has less accessibility. [8]

Some easy-to-use questionnaires have been developed as low-cost alternatives to PSG for detecting OSA.

There are many screenings questionnaire for sleep apnea including Epworth sleepiness scales (ESS), Berlin questionnaire (BQ), STOP questionnaire (SQ), STOP-BANG questionnaire (SBQ), American Society for Anaesthesiology (ASA) screening questionnaire, and the Sleep Apnea Clinical Score (SACS) all have been validated for use as screening for OSA. But STOP-Bang questionnaire is a concise, effective, and reliable OSA screening tool. [8,6,12,14]

Frances Chung, MBBS; Hairil R. Abdullah, MBBS; and Pu Liao, MD [8] conducted a study on “STOP-BANG Questionnaire a Practical Approach to Screen for Obstructive Sleep Apnea”. They found that STOP-BANG questionnaire is a concise, effective, and reliable OSA screening tool. As the STOP-BANG score increases, the probability of severe OSA rises. Using the STOP-BANG questionnaire, sleep clinicians can quickly and reliably identify those at risk of severe OSA and prioritize patients for polysomnography.

As Shown in present study high prevalence of OSA significantly greater in higher BMI category found in this study. same findings found by Maxwell O. Akanbi, Patricia A.

Agaba, Obianuju B. Ozoh, et al. [15] They conducted an analytic cross-sectional study “Obesity and obstructive sleep apnea risk among Nigerians” on 694 subjects.

As shown in bar chart no.: 1, the association between obesity and OSA is compelling. Approximately 70% of individuals with OSA are obese. One possible explanation for the relationship between obesity and OSA is that the upper airway is narrowed in obese patients as a result of increased fat deposition in the pharyngeal walls. Another possible explanation for the relationship between obesity and OSA is the fact that obese subjects often have smaller lung volumes, particularly functional residual capacity (FRC), than nonobese subjects, which in turn can indirectly influence upper airway size and contribute to upper airway narrowing [5,17]

There is a consistent relationship between obesity and OSA, with a body mass index (BMI) ≥ 30 kg/m² having been reported in 60-90% of OSA patients. As the prevalence of obesity increases, there is likely to be a parallel increase in the prevalence of OSA. [4]

As present study shows that OSA is more common in men (71.42%) than women (66.30%) because of differences in upper airway anatomy, neurochemical mechanisms, the response to arousal, fat distribution and sex hormones all contribute to pathogenesis of the disease. Similar findings found by Snigdha Pattanaik, Rajagopal R, Neeta Mohanty, Swati Pattanaik. They conducted a study on 1012 subjects “prevalence of obstructive sleep apnea in an Indian population: using stop-bang questionnaire” [10]. They found that males had a higher prevalence of OSA compared to females. Imaging studies have revealed that men have increased fat deposition around the pharyngeal airway as compared with women and an increased length of the pharyngeal airway as compared with women. Modeling studies have revealed an important role for pharyngeal length in contributing to airway collapsibility. [16]

Therefore, present study could contribute to increase the identification of OSA among subjects with obesity. Since OSA is associated with obesity and obesity is associated with hypertension, stroke, coronary heart disease, and type 2 diabetes, hypercoagulable states, lower back pain, osteoarthritis. so, we believe that early prevention and treatment of OSA may be achieved by screening for OSA.

CONCLUSION

204 subjects taken for study showed prevalence of OSA among obese in Ahmedabad is 69.11%. It was also found that prevalence rate was 5.12% higher in obese males than females.

Clinical Implication:

Based on the current literature data and the values found in our work, these findings suggest high proportion of OSA was seen in obese subjects thus, it contributes to increase the identification of OSA among subjects with obesity as it is associated with hypertension, stroke, coronary heart disease, and type 2 diabetes, hypercoagulable states, lower back pain, osteoarthritis.

As OSA is strongly associated with higher values of BMI and since it is a modifiable factor, its early detection and management may facilitate prevention of OSA in obese subjects.

This study will provide a new perspective to physiotherapist as well as to other health care professionals regarding screening of obstructive sleep apnea in obese individuals. Obesity is modifiable risk factor for OSA. There is many treatment option available for reducing obesity like aerobic exercises, resistance exercises and flexibility exercise. Neck, fascial and oropharyngeal exercise for sleep apnea. Tai chi is combines gentle physical exercise and stretching with mindfulness and it can significantly improve the Quality of sleep in patients with OSA. Yoga, breathing exercises can help improving symptoms of OSA. Because of OSA sometimes patients get depressed and

irritated, in this conditions yoga and meditation is help a lot.

Limitations:

The study design was observational and hence did not include a follow-up assessment. Factors that have been suggested to contribute for risk of OSA like controlled hypertension, resistant hypertension, Menopause, smoking and depression were not included in the study.

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Ethical Approval: Approved

Abbreviations:

OSA- Obstructive sleep apnea

SBQ- STOP-BANG Questionnaire

SPSS- Statistical Package for Social Sciences

BMI- Body Mass Index

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