

**THE PATTERN OF RISK OF SLEEP APNOEA AND ITS ASSOCIATED RISK FACTORS  
AMONG PEOPLE AGED MORE THAN 30 YEARS RESIDING IN A MUNICIPALITY OF  
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**ABSTRACT**

**Back ground** Obstructive sleep apnoea was prevalent in 9 to 25% of the general adult population and is also linked to cardiovascular, cerebrovascular and metabolic disorders. **Objective** 1. To find out prevalence of high risk of sleep apnoea among population aged more than 30 years residing in Annamalai nagar municipality. 2. To find out the association between selected socio demographic, behavioural risk factors and risk of OSA. **Methodology** The cross-sectional study was carried out in Annamalai nagar municipality located in Cuddalore district of Tamilnadu. The study population included all the persons residing in Annamalai nagar municipality aged more than 30 years. The study was conducted between 10<sup>th</sup> September 2019 to 20<sup>th</sup> September 2019. STOP BANG questionnaire was used to screen the persons for the risk of sleep apnoea. The sample size calculated was 186. SPSS version 23 was used for statistical analysis. **Results** Out of the population surveyed, 53.7% were less than 50 years of age. Females formed 69.4% of the study participants. In about 50.5% of the study participants, the per capita monthly income was found to be less than 5000 INR. Ten percent of the study participants were smokers and almost thirteen percentage were alcoholics. Thirty-seven study participants (20%) were found to be at high risk for sleep apnoea. At the end of cross tabulation, three variables namely age, income and being alcoholic were found to have significant association with high risk of sleep apnoea. **Conclusion** Two factors mainly alcoholism and lower income were associated with high risk of sleep apnoea. Interventions targeting alcoholism and general improvement of socio-economic status can aid in decreasing risk of sleep apnoea in the study population.

**KEYWORDS:** Screening, Obstructive sleep apnoea, alcohol, STOPBANG questionnaire, Prevalence, risk.**INTRODUCTION**

An absence of inspiratory air flow for at least 10 seconds is termed as "apnoea". Lesser decrease in airflow lasting for 10 seconds or longer along with drop in arterial oxyhaemoglobin saturation or an electroencephalographic arousal is termed as hypopnea. They can be further classified into obstructive and central.<sup>[1]</sup> Obstructive sleep apnoea was defined as 'repeated episodes of complete (apnoea) or partial (hypopnea) air flow cessation in the upper airways during sleep. OSA results into oxygen desaturation and brief awakenings from sleep (arousals).<sup>[2,3]</sup>

Obstructive sleep apnoea is prevalent in 9-25% of the general adult population.<sup>[4]</sup> The presence of OSA (AHI  $\geq$  5) has been reported to increase over time in various populations.<sup>[5]</sup> Its increasing frequency is parallel with increase in the frequency of established risk factors like age and obesity.<sup>[2]</sup> Obstructive Sleep Apnoea (OSA) is linked to cardiovascular, cerebrovascular disorders,

metabolic disorders and impaired neurocognitive function.<sup>[1,4]</sup> The pathogenesis behind these morbidities were explained by oxidative stress, upregulation of redox sensitive genes and inflammatory cascade.<sup>[6]</sup>

It was estimated that 80% of the individuals with moderate to severe OSA remain undiagnosed. Prompt diagnosis and treatment of these undiagnosed OSA is of prime importance due to various morbidities associated with it.<sup>[4]</sup> Treatment of OSA with Continuous Positive Airway Pressure (CPAP) were found to reduce the level of inflammatory mediators, improve insulin sensitivity and reduce the non-dipper or riser nocturnal BP along with other benefits.<sup>[1]</sup>

Though the gold standard tool for the diagnosis of OSA is an overnight polysomnogram (PSG), it is time consuming, labour intensive and costly. The above qualities along with the requirement of an expert in sleep medicine for its application makes it difficult for

utilizing it in a community setting. The ideal method will be to use a simple and reliable tool for screening those with high risk of sleep apnoea and then applying PSG in the high risk group for diagnosis.<sup>[4,7]</sup>

In order to identify the sub group with high risk for OSA, various scales like Berlin questionnaire, STOP questionnaire, STOP BANG Questionnaire, Epworth sleepiness scale were used.<sup>[3]</sup> Amra et al reported SQ and SBQ to be more reliable tools when compared to other scales for screening OSA among sleep clinic patients.<sup>[8]</sup> STOP BANG questionnaire consisted of 8 dichotomous items related to clinical features of sleep apnoea.<sup>[7]</sup> It is an easy, reliable and self-reportable screening tool. The first four were subjective items (STOP: Snoring, Tiredness, Observed apnoea and high blood Pressure) and second four demographic items (Bang: BMI, age, neck circumference, gender).<sup>[4]</sup> The present study was done with primary objective of finding out the prevalence of high risk of sleep apnoea among population aged more than 30 years residing in Annamalai nagar municipality. Followed by finding out the association between selected socio demographic, behavioural risk factors and risk of OSA.

## MATERIAL AND METHODS

The cross-sectional study was carried out in Annamalai nagar municipality located in Cuddalore district of Tamilnadu. The study population included all the persons residing in Annamalai nagar municipality aged more than 30 years. The study was conducted between 10<sup>th</sup> September 2019 to 20<sup>th</sup> September 2019. STOP BANG questionnaire was used to screen the persons for the risk of sleep apnoea.

The sample size for the study was calculated using the formula,  $n = [z^2 * p(1-p)] / e^2$ . By substituting  $z$  as 1.96,  $p$  as 38.6% based on a study by Foroughi et al,<sup>[9]</sup> absolute precision as 7%. The sample size obtained was 186. The sampling technique adopted was convenient sampling where single ward was selected based on the convenience of access. A house to house survey was conducted in the ward selected. All the houses were covered till the sample size of 186 was obtained.

The data collection was done using a pre tested and semi structured questionnaire. The questionnaire consisted of three parts. Part I included sociodemographic characteristics of the study participant. Part II included all the eight questions from the STOPBANG questionnaire. STOPBANG questionnaire was used, since it was having higher predictive value than the rest.<sup>[10]</sup> Part III included the questions regarding selected behavioural risk factors like smoking, alcohol and co-morbid condition diabetes mellitus. All the questions under part II were dichotomous questions, which when answered "yes" were scored one else scored zero. If the study participant scored a 5 or more than 5 in the second part, he/she was considered to be high risk for sleep apnoea.

Height was measured using an inch tape. The participant was asked to remove his foot ware and to stand close to vertical wall. The Frankfurt plane was checked. A wooden scale was placed above the head parallel to the floor and perpendicular to the vertical wall and the height was marked, which was later measured using inch tape close to 0.1 cm. For measuring the weight, the participant was asked to remove the foot ware and to wear light cloths. He/she was then asked to stand on the bathroom weight scale with both the legs together. Weight was measured, after asking the participant to look straight. Weight was measured close to 0.1kg. Neck circumference was measured using the inch tape. Larynx was identified. And inch tape was placed directly on the skin and just below the larynx. The neck circumference was measured close to 0.1cm. Body mass Index (BMI) was calculated using the formula body weight in kilogram divided by height in meter square ( $\text{Kg/m}^2$ ).

The data collected were entered into Microsoft excel 2019 and imported into IBM SPSS version 23 for analysis. Descriptive statistics were applied to concisely express the data collected. Chi-square test was applied to find out the association between selected risk factors and risk of OSA.

## RESULTS

The total population surveyed was 186. Out of the population surveyed, 53.7% were less than 50 years of age. Females formed 69.4% of the study participants. A Majority (80%) were doing unskilled occupation. In about 50.5% of the study participants, the per capita monthly income was found to be less than 5000 INR. Ten percent of the study participants were smokers and almost thirteen percentage were alcoholics. Forty-eight (25.8%) reported suffering from diabetes mellitus (Table 1).

When asked whether they snore loudly while sleeping, 23 (12.4%) reported that they do so. Eighty-six (46.2%) reported that they felt tired, fatigued and sleepy during the day time. Three persons reported that someone has observed them either stop breathing or choking or gasping during sleep. Thirty-seven (19.9%) reported that they were having high blood pressure. In about 10 study participants (5.4%) the BMI was found to be more than  $35 \text{ Kg/m}^2$ . Seventy-seven study participants (41.4%) were aged more than 50 years. Nine study participants (4.8%) had a neck circumference of more than 40 CMS (Table 2). Thirty-seven study participants (20%) were found to be at high risk for sleep apnoea (fig 1).

At the end of cross tabulation, three variables namely age, income and being alcoholic were found to have significant association with high risk of sleep apnoea. As the age increased the risk of sleep apnoea also increased. As the income increased the risk of sleep apnoea also increased. Alcoholics had a five times increased risk of getting sleep apnoea than the non-alcoholic counterparts.

**Table 1: Socio-demographic characteristics, selected risk factors and co-morbid conditions among study participants.**

Variables		Frequency (n)	Percentage (%)
Age (in years)	30-40	49	26.3
	40-50	51	27.4
	50-60	41	22.0
	60-70	30	16.1
	70-80	15	8.1
Sex	Male	57	30.6
	Female	129	69.4
Occupation	Skilled	8	4.3
	Semiskilled	12	6.5
	Unskilled	149	80.1
	Dependent	17	9.1
Income (per capita monthly income in INR)	≤ 5000	94	50.5
	5001-15000	61	32.8
	15001-25000	20	10.8
	>25000	11	5.9
Smoking	Yes	19	10.2
	No	167	89.8
Alcoholic	Yes	24	12.9
	No	162	87.1
Diabetic	Yes	48	25.8
	No	138	74.2
Total		186	100

**Table 2: Distribution of the study participants according to the variables listed in the STOPBANG questionnaire.**

Question	Answer	Frequency (n)	Percentage (%)
Do you snore loudly?	Yes	23	12.4
	No	163	87.6
Do you often feel tired, fatigued, sleepy during day time?	Yes	86	46.2
	No	100	53.8
Have anyone observed you stop breathing or choking or gasping during sleep?	Yes	3	1.6
	No	183	98.4
Do you have or being treated for high blood pressure?	Yes	37	19.9
	No	149	80.1
BMI more than 35 Kg/M <sup>2</sup> .	Yes	10	5.4
	No	176	94.6
Aged more than 50 years?	Yes	77	41.4
	No	109	58.6
Neck circumference more than 40 CMS.	Yes	9	4.8
	No	177	95.2
Male gender	Yes	57	30.6
	No	129	69.4

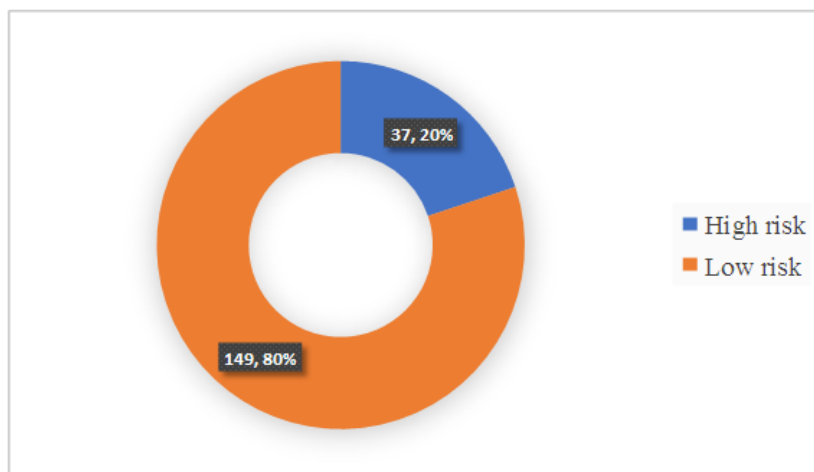


Fig. 1: Distribution of study participants according to risk of sleep apnoea.

Table 3: Association between selected sociodemographic characters, risk factors, comorbid conditions and the risk of sleep apnoea.

Variables		High risk		Low risk		P value
		n	%	n	%	
Age (in years)	30-40	5	13.5	44	29.5	<0.05* <sup>a</sup>
	40-50	5	13.5	46	30.9	
	50-60	12	32.4	29	19.5	
	60-70	9	24.3	21	14.1	
	70-80	6	16.2	9	6.0	
Occupation	Skilled	2	5.4	6	4.0	>0.05
	Semiskilled	3	8.1	9	6.0	
	Unskilled	30	81.1	119	79.9	
	Dependent	2	5.4	15	10.1	
Income (per capita monthly income in INR)	≤ 5000	10	27.0	84	56.4	<0.05* <sup>a</sup>
	5001-15000	19	51.4	42	28.2	
	15001-25000	6	16.2	14	9.4	
	>25000	2	5.4	9	6.0	
Smoking	Yes	7	18.9	12	8.1	>0.05
	No	30	81.1	137	91.9	
Alcoholic	Yes	12	32.4	12	8.1	<0.05* <sup>b</sup>
	No	25	67.6	137	91.9	
		<b>OR – 5.48 (2.21-13.56)</b>				
Diabetic	Yes	23	62.2	115	77.2	>0.05
	No	14	37.8	34	22.8	

\*Statistically significant association.

<sup>a</sup> linear by linear association.

<sup>b</sup> Pearson chi-square test.

## DISCUSSION

The present study was a cross sectional study carried out in a municipality in Tamilnadu to find out the pattern of risk of sleep apnoea and associated risk factors. A house to house survey was conducted for collecting the data.

### Pattern of risk of sleep apnoea

According to the present study 20% of the study participants were found to have high risk of sleep apnoea. A systematic review reported that prevalence of OSA in general population was between 9% to 38%.<sup>[11]</sup> Foroughi M et al in his study among the general population in Tehran, Iran reported the prevalence of

high risk to be 38.4%.<sup>[9]</sup> Silva KVD in his study reported the proportion of high risk to be 42.4%.<sup>[11]</sup> Though many other studies also reported risk of sleep apnoea. The scope of comparability between them was limited as the scales used to find the risk was different and most of the studies were performed in a sub group of the population rather than general population. Senaratne CV in his review recommended to 'generate consensus on methodology and diagnostic threshold to define OSA so that the prevalence of OSA can be validly compared across regions and countries, and within age-/sex-specific subgroups'.<sup>[11]</sup>

### Age and risk of OSA

In the present study age was found to have linear relationship with high risk of sleep apnoea. Similar results were obtained by Ernst G et al where he compared three age groups 18 – 45 years, 46 – 65 years and more than 65 years respectively and reported that those with age more than 45 years were twice at risk of sleep apnoea than those less than 45 years of age.<sup>[12]</sup> Senaratne CV in his systematic review reported that the prevalence of OSA rose to 49% in advanced ages.<sup>[11]</sup> Foroughi M et al also reported a similar relationship between age and risk of OSA,<sup>[9,11]</sup> The risk of sleep apnoea increases with increase in age.

### Income and risk of OSA

The present study showed a linear relationship between risk of sleep apnoea and income. When per capita monthly income decreased the risk of sleep apnoea was found to be on the rise. Woods CE et al reported that indigenous population was having higher risk of obstructive sleep apnoea rather than others. They concluded that the above disparity was more due to lower socio-economic status rather than indigeneity. Lower socio economic status was associated with obesity, alcohol, tobacco use and comorbid medical conditions.<sup>[13]</sup>

### Alcohol and risk of OSA

Alcoholics had 5 times increased risk of getting OSA than the non-alcoholics. Simou E et al reported that alcohol consumption increased the risk of sleep apnoea by 25%.<sup>[14]</sup> Sarfo FS et al reported that usage of excess alcohol was related to sleep apnoea among stroke survivors.<sup>[15]</sup> Alcoholics were found to have an increased risk of sleep apnoea than the non-alcoholic counter parts. Issa FG and Sullivan CE in their research linked increased tendency of obstructive sleep apnoea after alcoholism to alcohol induced oropharyngeal muscle hypotonia and the increased duration of obstructive sleep apnoea to alcohol induced depression of arousal mechanisms.<sup>[16]</sup>

### Strengths and limitations

This is a community based descriptive study carried out to find out the risk of sleep apnoea. Since community based the study could address exactly the pattern of risk in community. Though sample size calculation and reaching appropriate sample size could be viewed as strength of the study, on the other hand convenient sampling was employed that could have introduced bias into the study design. The usage of STOP BANG questionnaire with high sensitivity and specificity could also be viewed as a strength as many studies have utilised other questionnaires which were found to have lesser validity.

Social desirability bias could also be present with respect to smoking, alcohol and certain other variables. In order to overcome the social desirability bias, participants were told that their identities would never be revealed at any

time during and at the end of the study. The scope of generalisability of the study results were also limited for the study.

### CONCLUSION

Two modifiable risk factors namely, being alcoholic and lower income were the risk factors determining high risk of sleep apnoea among the study population. A prospective study could be done among the alcoholics to accurately determine the risk sleep apnoea and sleep apnoea linked comorbidities among them. Interventions targeting alcoholism and general improvement of socio-economic status can aid in decreasing risk of sleep apnoea in the study population.

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