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ORIGINAL ARTICLE

Dietary and Lifestyle Patterns Associated with Risk of Obstructive Sleep Apnea in Urban Area of Puducherry: A Case Control Study

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Abstract

Background: Obstructive Sleep Apnea (OSA) is a common and underdiagnosed condition that poses significant cardiovascular and metabolic risks. While obesity is a well-established risk factor, the role of dietary and lifestyle patterns remains less explored in the Indian context, particularly in Puducherry. **Objective:** To assess the association between dietary and lifestyle patterns with the risk of OSA among adults in an urban field practice area of Puducherry. **Methods:** A community-based case-control study was conducted from August to October 2023 at Manaveli, Ariyankuppam, Puducherry. 100 cases (high risk for OSA) and 100 controls (low risk) were identified using the STOP-BANG questionnaire. Participants' sociodemographic, anthropometric, lifestyle, and dietary data were collected using Epicollect5. Statistical analysis included Chi-square tests, Pearson correlation, and multiple logistic regression using SPSS v29. **Results:** Physical inactivity, obesity, male gender, and low fruit intake were significantly associated with high OSA risk. Obesity was present in 76% of cases compared to 19% of controls ($p < 0.01$). Lack of physical activity (52% vs. 35%), low fruit consumption, and male gender (62% vs. 32%) were also significantly higher among cases. **Conclusion:** This study highlights key modifiable lifestyle factors—such as obesity, physical inactivity, and poor dietary habits—associated with increased risk of OSA. Community-based awareness, screening, and lifestyle interventions should be prioritized as cost-effective approaches to mitigate OSA risk in resource-constrained settings.

Keywords: Obstructive Sleep Apnea, Lifestyle, Diet, Obesity, STOP-BANG, Puducherry

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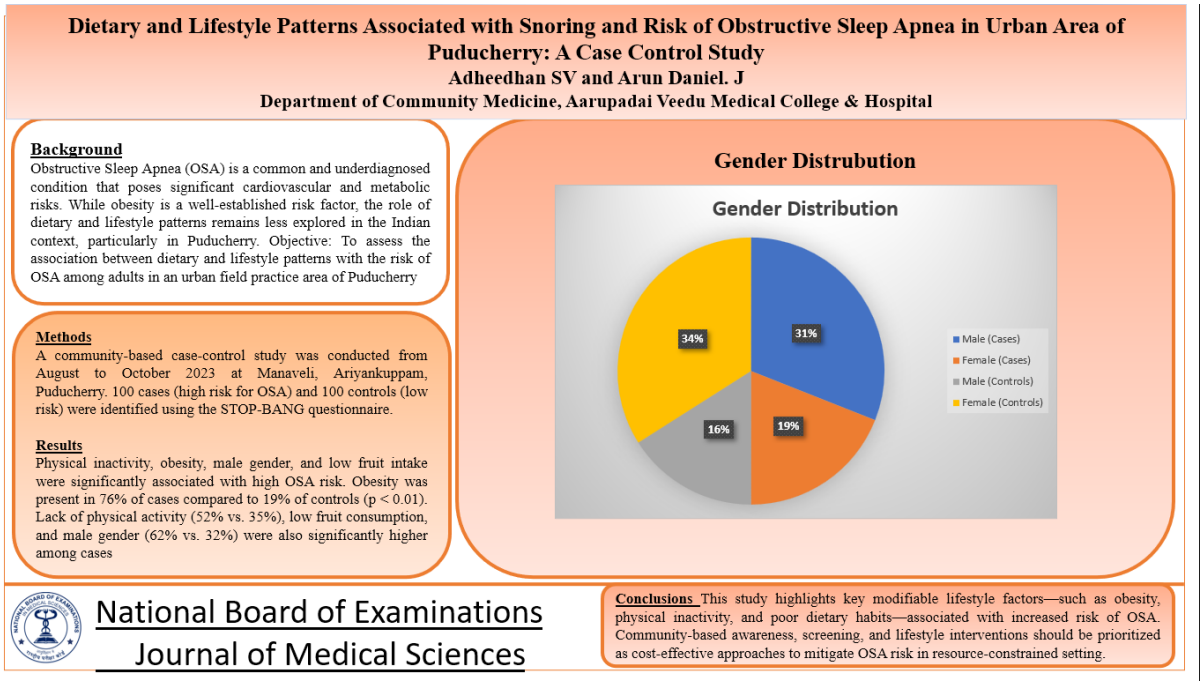
Graphical Abstract



Introduction

Obstructive sleep apnea (OSA) is resulting due to increased collapsibility of the upper airway during sleep causing reduced or cessation of airflow. Compare to women men are more prone to obstructive sleep apnea [1]. The pathogenesis of OSA is multifactorial. Factors contributing OSA is by anatomical cause or non-anatomical cause. Obesity is independent factors contributing OSA. Other than obesity other factors contributing to OSA such as BMI (body mass index), neck circumference, waist circumference and waist hip ratio [1-3]. OSA is associated with high risk of cardio vascular disease. It is estimated around one billion people have OSA globally [4]. The overall prevalence of OSA in India is 11% in that 5% female and 13% male respectively. Even though the awareness about OSA in India is low [5]. The prevalence of OSA is ranging from 4% to 14% and its increasing with age and its commonly observed between the age group of 40 to 65 years.

People with OSA has higher risk of cardiac complications like coronary heart disease, congestive heart failure, myocardial infarction, cardiac arrhythmia [6]. In the age group of > 60 years the prevalence of OSA ranges from 27 to 80%. Severe OSA is an independent risk for cardio vascular mortalities. Mediterranean diet have antioxidant and anti-inflammatory properties that can reduce the mortality rate of major cardio vascular events [7].

The risk factor for OSA are male gender, age above 60 years, Obesity, smoking and family history. The first line treatment of OSA is Continuous positive airway pressure (CPAP), but recent report showed that 50% of patient refuse to continue CPAP treatment in the first year. Since obesity, dietary and lifestyle pattern is a risk factor for OSA. Other measures like dietary management, lifestyle modification and reducing the weight will improve OSA symptoms [8]. A 10% weight

loss reduces apnea-hypopnea index by 26% and improves OSA [9].

The association of dietary and lifestyle patterns with risk of obstructive apnea is not been done in Puducherry recently. In the current study we aim to study the association of dietary and lifestyle patterns with risk of obstructive sleep apnea.

Materials and Methods

It is a case control study which conducted in our field practice area Manaveli, Ariyankuppam, Puducherry. The study was conducted between the period of August 2023 to October 2023.

Inclusion criteria for cases

Age group >18 years of both genders residing at Manaveli with high risk of OSA.

Inclusion criteria for controls

Age group >18 years of both genders residing at Manaveli with low risk of OSA. We have used a STOP BANG questioner for risk assessment for OSA.

Exclusion criteria

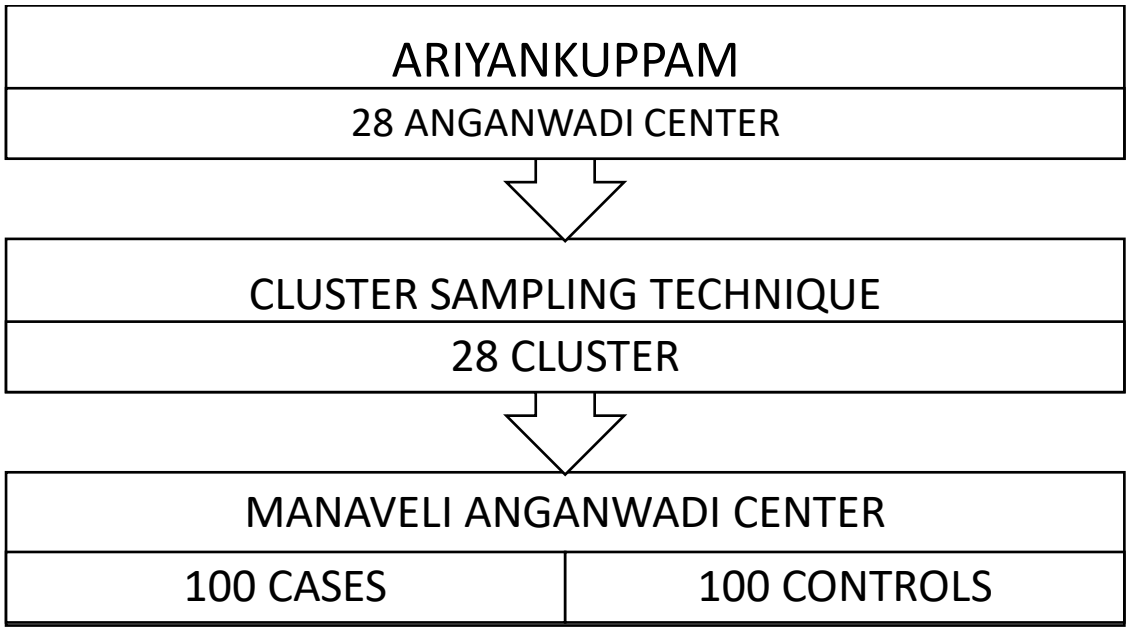
Age more than 60 years of age, people who went recent upper airway surgery and orthognathic surgery/ orthodontic treatment, people who are suffering from hypothyroidism, respiratory malignancy, congestive heart failure, pregnancy, people who are having craniofacial syndrome.

Sample Size Calculation

The sample size 85 cases & controls (170) rounded to 100 cases and 100 controls was calculated based on a similar study by Melaku Y A et al. The expected proportion of high risk of sleep apnea and low risk as 0.25 and 0.50. The level of significance and power were taken as 5% and 90%.

Study procedure

This study will be conducted in Ariyankuppam, our UHTC field practice area, there are around 28 Anganwadi centre in Ariyankuppam, each Angawadi is considered as each cluster, one cluster is randomly selected. Samples will be selected based on our inclusion & exclusion criteria from that cluster.



Data collection methods

After clearly explained about the nature of study in the language known by the people, informed & written consent will be taken from who all are willing to participate in the study. By using Epicollect5 application we have collected the data and extracted in the data in excel sheet. We have collected the sociodemographic profile, height, weight, BMI, dietary and lifestyle pattern, comorbidities, sleep pattern and we have used the STOP BANG questioner for assessing the risk of the OSA. The people with the score of more than 5 are high risk group and people with score of less than 5 will come under moderate and low risk group.

List variable wise statistical tests to be used for data analysis

Data entry will be done in Microsoft excel 2019 and analysed using SPSS software version 29. Descriptive data will be represented as percentages & frequencies in tables and graphs. The categorical variables will be differentiated using chi-square test. For all statistical tests, alpha error of 5% is available and p value of <0.05 will be considered significant (Table 1).

Results

Table 1. Frequency Table: Case vs Control by Variable

Variable	Cases	Controls	Total
Physical activity (1–2 h)	44	54	98
Physical activity (3–5 h)	4	11	15
Physical activity (none)	52	35	87
Fruit consumption (Daily)	25	34	59
Fruit consumption (Never)	2	0	2
Fruit consumption (Occasionally)	24	23	47
Fruit consumption (Rarely)	6	4	10
Fruit consumption (Several times/week)	43	39	82
Obesity (No)	24	81	105
Obesity (Yes)	76	19	95
Gender (Female)	38	68	106
Gender (Male)	62	32	94

The frequency distribution reveals important patterns related to risk factors for obstructive sleep apnea (OSA). Among the participants, 52 cases reported no physical activity compared to 35 controls, while moderate to higher levels of physical activity (1–2 hours and 3–5 hours per week) were more common among controls, suggesting that inactivity is more prevalent among those at high risk for OSA. In terms of fruit consumption, daily intake was higher among controls (34) than cases (25), and only cases reported never consuming fruits. Several-times-a-week consumption was similar between groups, while occasional and rare intake was slightly more common in cases. Obesity showed a marked difference, with 76 obese individuals among cases versus only 19 in controls, emphasizing obesity as a strong risk factor. Lastly, gender distribution showed that 62 males were in the case group compared to 32 in the control group, indicating a higher proportion of males among those at risk, while females were more common among controls (68 vs. 38). These frequency patterns suggest that lower physical activity, poor fruit intake, obesity, and male gender are more frequently observed among individuals at high risk for OSA (Figure 1).

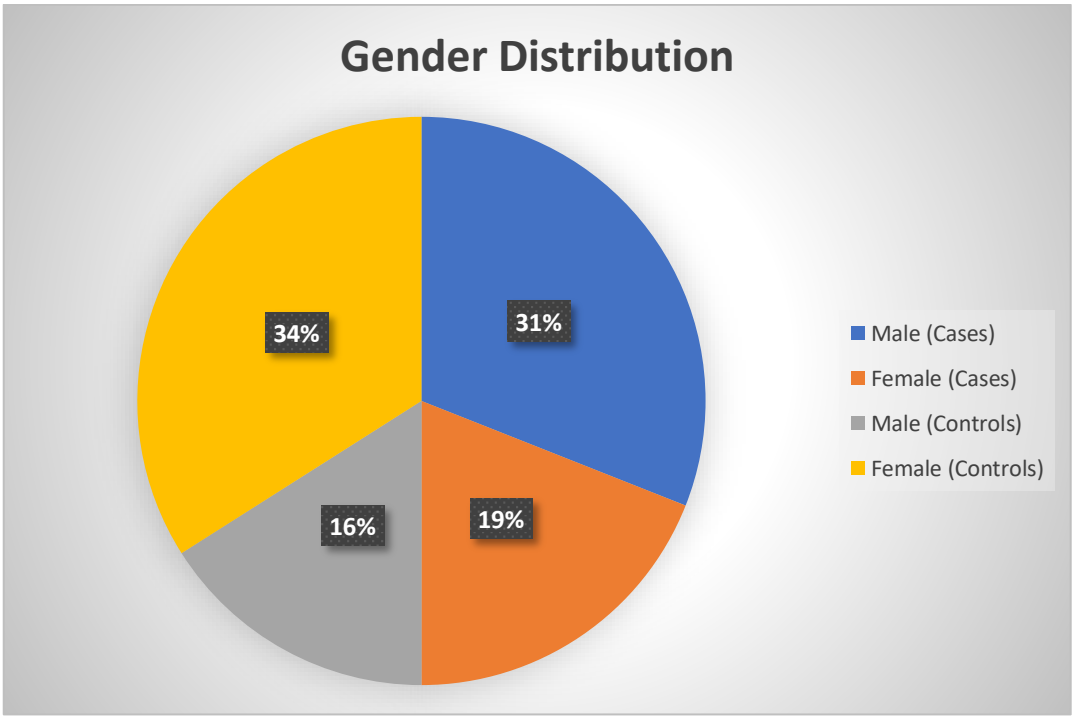


Figure 1. Gender distribution

The pie chart illustrates the gender distribution among cases and controls in the study. It shows that males constitute 31% of the cases and only 16% of the controls, indicating that a higher proportion of males are at high risk for obstructive sleep apnea (OSA). In contrast, females make up 34% of the controls and 19% of the cases, suggesting that females are less likely to be at high risk for OSA in this population. This

distribution highlights a significant association between gender and OSA status, with male gender emerging as a potential risk factor. These findings align with existing literature, which suggests that anatomical and hormonal differences contribute to the higher prevalence of OSA in males.

Table 2. Association Between Lifestyle and Demographic Factors with Risk of Obstructive Sleep Apnea (OSA) Among Study Participants (N = 200)

		Case/Control		Total	Chi-Square	p value
		case	control		4.602	0.021*
Physical activity in a week	1-2 h	44	54	98		
	3 - 5	4	11	15		
	none	52	35	87		
Total		100	100	200		
Consumption fruits in a week	Daily	25	34	59	3.989	0.032*
	Never	2	0	2		
	Occasionally	24	23	47		
	Rarely	6	4	10		
	Several times a week	43	39	82		
Total		100	100	200		
Obesity	No	24	81	105	65.143.	0.003**
	Yes	76	19	95		
Total		100	100	200		
Male	No	38	68	106	18.065	0.003**
	Yes	62	32	94		
Total		100	100	200		

There is a statistically significant association between physical activity. A higher percentage of cases (52%) reported doing no physical activity compared to controls (35%). Conversely, a higher percentage of controls reported engaging in some physical activity. This suggests that lack of physical activity may be associated with being a case. There is a significant association between fruit consumption. Daily and frequent fruit consumption was more common among controls. On the other hand, infrequent or no fruit consumption was slightly more common

among cases. This suggests that lower fruit intake may be associated with being a case.

There is a highly significant association between obesity and being a case. A large majority of the cases (76%) were obese compared to only 19% of controls. In contrast, 81% of controls were not obese. This indicates a strong association between obesity and case status. There is a significant association between gender and case status. A higher proportion of cases were male (62%) compared to controls (32%). Conversely, females were more represented among controls (68%). This suggests that being male may be associated with higher odds of being a case.

Discussion

The present study explores the association between lifestyle and dietary patterns with the risk of obstructive sleep apnea (OSA) in a semi-urban population in Puducherry. It found that physical inactivity, obesity, lower fruit intake, and male gender were significantly associated with higher risk of OSA.

Consistent with previous literature, obesity emerged as a strong risk factor in this study. Among cases, 76% were obese compared to only 19% of controls. This finding supports the existing body of evidence that obesity is one of the most significant modifiable risk factors for OSA [3]. Increased fat deposition, particularly in the neck and upper airway region, contributes to upper airway narrowing and collapsibility, worsening sleep-disordered breathing [7].

The gender difference noted—where 62% of cases were male—also aligns with global and Indian prevalence patterns, where men are consistently more affected than women [2,5]. Hormonal differences, fat distribution, and airway anatomy are possible explanations for this discrepancy [9].

Importantly, physical inactivity was significantly associated with increased OSA risk. More than half of the cases reported no physical activity, compared to only 35% among controls. Similar associations have been reported in longitudinal studies where low physical activity contributed to both increased BMI and direct worsening of OSA severity [4]. Exercise, independent of weight loss, has been shown to improve sleep architecture and reduce apnea-hypopnea index.

Another noteworthy finding is the association between low fruit intake and OSA. Controls had higher daily or frequent fruit consumption, while cases reported rarer intake. This is supported by findings from [6], who noted that anti-inflammatory dietary patterns, including fruit and vegetable consumption, were associated with reduced OSA severity. Fruits are rich in antioxidants and flavonoids that may counteract systemic inflammation and oxidative stress, both of which are central to OSA pathophysiology.

The STOP-BANG questionnaire used in this study has been validated as a simple yet effective screening tool in primary care and field settings for identifying individuals at risk of OSA [1]. Given the low awareness of OSA in the general Indian population, community-level screening tools remain crucial [5].

This study highlights the need for non-CPAP interventions, particularly in low-resource settings. While CPAP remains the gold standard treatment, nearly half of the patients discontinue it due to discomfort or cost [8]. In such contexts, lifestyle interventions, especially those targeting diet, physical activity, and weight loss, offer practical and sustainable options.

However, some limitations must be noted. The case-control design cannot establish temporality. Dietary data was self-reported, potentially introducing recall bias. Additionally, objective diagnostic tools like polysomnography were not used, which could have added clinical precision to case classification.

Conclusion

This case-control study from Puducherry reveals that male gender, obesity, low physical activity, and poor dietary habits particularly low fruit intake are significantly associated with increased risk of obstructive sleep apnea. These findings underscore the importance of community-level screening and the potential for lifestyle-based interventions in reducing OSA burden. Public health strategies focusing on dietary improvements and physical activity promotion could serve as cost-effective measures in addressing OSA, especially in resource-limited settings.

Strengths

- ✓ The study was conducted in a real-world, community setting (Manaveli, Ariyankuppam, Puducherry), increasing the external validity and generalizability of findings to similar populations.
- ✓ A validated and widely used screening tool for OSA risk, ensuring consistency and ease of use in field settings.
- ✓ Investigated lifestyle and dietary factors that can be changed through public health interventions—making the findings actionable.
- ✓ With 100 cases and 100 controls, the study had sufficient power to detect statistically significant associations.
- ✓ Use of Digital Data Collection Tool (Epicollect5) Minimizes manual errors in data entry and allows for efficient and organized data collection.

Limitations

- ✓ Dietary habits, physical activity, and comorbidities were self-reported, introducing recall bias and social desirability bias.
- ✓ Individuals above 60 years were excluded, yet they are often at highest risk for OSA. This limits generalizability to older populations.
- ✓ Sampling from only one anganwadi cluster limits the geographical and demographic diversity of the sample.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

Funding

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