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# ASSESSING THYROID FUNCTION IN OBSTRUCTIVE SLEEP APNEA (OSA) PATIENTS: A CORRELATION WITH SLEEP SEVERITY PARAMETERS

*Original Research*

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## ABSTRACT

**Background:** Obstructive sleep apnea (OSA) is a common sleep-related breathing disorder caused by upper airway obstruction, leading to repeated episodes of apnea and hypopnea during sleep. It is frequently associated with cardiovascular, metabolic, and endocrine disturbances, including thyroid dysfunction. Hypothyroidism may contribute to the pathogenesis of OSA by altering upper airway muscle tone and respiratory drive. Early detection of thyroid abnormalities in OSA patients can aid in improving clinical outcomes and reducing symptom burden.

**Objective:** To determine the frequency of thyroid dysfunction in patients with obstructive sleep apnea and its association with the severity of OSA.

**Methods:** A descriptive cross-sectional study was conducted in the Chest Medicine Ward, Pulmonology Department, Jinnah Postgraduate Medical Centre, Karachi, from June to December 2024. Sixty-seven newly diagnosed OSA patients aged 18–60 years were recruited using non-probability consecutive sampling. Diagnoses were confirmed by overnight polysomnography, and thyroid function was evaluated using blood levels of TSH, FT3, and FT4. Demographic, anthropometric, and clinical data were recorded using a structured proforma. Statistical analysis was performed using SPSS version 25, with significance set at $p \leq 0.05$.

**Results:** The mean age of participants was 51.8 ± 6.4 years, with 74.6% being female. Mean BMI was 30.2 ± 4.9 kg/m². The mean apnea, hypopnea, and AHI were 29.3 ± 32.7, 30.8 ± 14.8, and 28.0 ± 11.1 episodes/hour, respectively. Severity of OSA was mild in 22.4%, moderate in 16.4%, and severe in 61.2% of cases. Thyroid function revealed euthyroid status in 89.6%, overt hypothyroidism in 7.5%, and subclinical hypothyroidism in 3.0%. No significant correlation was found between thyroid disease and OSA severity.

**Conclusion:** Thyroid dysfunction was infrequent among OSA patients, and no significant association was observed with disease severity. Screening for thyroid disorders may be more beneficial in high-risk or symptomatic individuals rather than routine testing in all OSA cases.

**Keywords:** Apnea-Hypopnea Index, Hypothyroidism, Obstructive Sleep Apnea, Polysomnography, Sleep Disorders, Thyroid Function Tests, TSH.

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## INTRODUCTION

Obstructive sleep apnea (OSA) is a complex sleep-related breathing disorder characterized by repeated episodes of partial or complete upper airway obstruction during sleep, leading to apneas, hypopneas, and intermittent hypoxemia (1,2). This chronic condition poses a substantial public health challenge due to its association with excessive daytime sleepiness, impaired cognitive performance, cardiovascular complications, and reduced overall quality of life (3,4). Globally, nearly one billion adults are affected by OSA, with the highest prevalence reported in China, followed by the United States and Brazil. Estimates of its prevalence in the middle-aged population range widely from 7.8% to 77.2%, reflecting differences in diagnostic approaches, population characteristics, and awareness levels (4–6). Within Asia, and particularly in resource-limited settings such as Pakistan, the burden of OSA is underreported, though one local study has suggested a prevalence rate of 12.75% (7). In addition to its well-established cardiovascular and neurocognitive consequences, OSA has increasingly been linked with metabolic and endocrine dysfunctions. One such area of interest is the interplay between OSA and thyroid function. Thyroid hormones play a crucial role in regulating basal metabolism, growth, and energy homeostasis (8). Disruptions in thyroid hormone production—particularly hypothyroidism—may influence respiratory drive, upper airway patency, and neuromuscular control, potentially exacerbating or even precipitating OSA (9,10). Conversely, OSA-induced intermittent hypoxia and sleep fragmentation can impair hypothalamic-pituitary-thyroid axis function, thereby influencing thyroid hormone secretion and activity. This bidirectional relationship has been noted in several studies, with hypothyroidism observed in 6.7% to 12% of patients with OSA (11,12). Moreover, hypothyroidism may remain subclinical or undiagnosed in OSA patients, further complicating management and worsening outcomes.

Despite growing international interest, data on the interrelationship between OSA and thyroid dysfunction remains sparse, especially in South Asian populations where OSA often goes undiagnosed and untreated. Given the overlapping symptoms and shared risk factors, such as obesity and metabolic dysregulation, a clearer understanding of this association is clinically pertinent. Identifying thyroid abnormalities in OSA patients could pave the way for earlier interventions, improved symptom control, and reduced morbidity. Therefore, this study seeks to evaluate thyroid function in individuals diagnosed with OSA and to explore the correlation between thyroid status and the severity of sleep-disordered breathing. The findings aim to support a more integrated approach to the diagnosis and management of OSA, particularly in settings with limited access to specialized care (13).

## METHODS

This descriptive study was carried out over a six-month period from June 15, 2024, to December 14, 2024, in Ward 12 of the Chest Medicine Unit, Department of Pulmonology, Jinnah Postgraduate Medical Centre (JPMC), Karachi. The study aimed to assess thyroid function in patients newly diagnosed with obstructive sleep apnea (OSA) and explore its association with sleep severity parameters. The sample size was calculated using OpenEpi software, based on a reported prevalence of hypothyroidism (6.72%) among individuals with OSA (14,15). With a 95% confidence interval and a 6% margin of error, the required sample size was estimated to be 67 participants. A non-probability consecutive sampling technique was employed to recruit eligible patients. Participants included male and female adults aged 18 to 60 years who were newly diagnosed with OSA and scheduled for thyroid function testing. Individuals with known thyroid disorders or those undergoing thyroid treatment, patients on medications that could affect thyroid function (including sedatives), cases of central sleep apnea, pregnant women, and those who declined to provide informed consent were excluded from the study. Ethical approval was obtained from the Institutional Review Board (IRB) of JPMC, and written informed consent was secured from all participants prior to enrollment (16). Comprehensive demographic and clinical data were collected using a structured proforma. Age, gender, height, and weight were recorded, and body mass index (BMI) was calculated using the standard formula (BMI = weight in kg/height in $m^2$). Oxygen saturation was measured via pulse oximetry. A detailed history was obtained, including comorbidities such as diabetes mellitus (DM), hypertension (HTN), coronary heart disease (CHD), family history of thyroid disorders, smoking habits, and alcohol use (17,18).

All patients underwent standard polysomnography (PSG), performed in a controlled sleep laboratory under the supervision of a trained technician. The diagnosis and classification of OSA severity were based on the apnea-hypopnea index (AHI), defined as the number of apnea and hypopnea events per hour of sleep. Blood samples were collected in the morning following PSG for thyroid function assessment, including serum levels of thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), and free thyroxine (FT4). All laboratory investigations were performed using standardized protocols (19,20). Statistical analysis was conducted using SPSS version 25. Quantitative variables, such as age, height, weight, BMI, apnea events, hypopnea events, oxygen saturation, AHI, and thyroid hormone levels (TSH, FT3, FT4), were summarized using means and standard deviations for normally distributed data. Normality was assessed using the Shapiro-Wilk test, with a p-value >0.05 indicating a normal distribution. For skewed variables, medians and interquartile ranges (IQRs) were reported. Categorical variables, including gender, BMI classification, age groups, comorbidities, OSA severity, and thyroid status, were presented as frequencies and percentages. Stratification was performed to examine effect modifiers

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such as gender, age, BMI, and medical history in relation to thyroid disease status. The chi-square test was applied to assess associations between categorical variables, and Fisher's exact test was used in cases where the expected cell frequency was less than five. A p-value of ≤0.05 was considered statistically significant (21-23).

## RESULTS

The study included 67 participants diagnosed with obstructive sleep apnea (OSA), with a mean age of 51.8 years (SD = 6.4; range: 38–60 years). The majority were female (74.6%), and over half of the participants (58.2%) were aged above 50 years. The average body mass index (BMI) was 30.2 kg/m² (SD = 4.9), indicating that most participants were either overweight or obese; 49.3% were obese, and 35.8% were overweight. The mean oxygen saturation was 94.7% (SD = 2.6), with a statistically significant p-value <0.001. Apnea and hypopnea episodes per hour varied considerably, with mean values of 29.3 (SD = 32.7) and 30.8 (SD = 14.8), respectively, and a combined mean apnea-hypopnea index (AHI) of 28.0 (SD = 11.1), reflecting moderate to severe OSA severity. Severe OSA was present in 61.2% of the study population. Thyroid function tests revealed a median thyroid-stimulating hormone (TSH) level of 1.8 uIU/mL, with free triiodothyronine (FT3) and free thyroxine (FT4) having median values of 2.5 pmol/L and 1.5 pmol/L, respectively. The prevalence of thyroid disease in the study population was 10.4%, with 7.5% diagnosed with overt hypothyroidism and 3.0% with subclinical hypothyroidism. Most participants (89.6%) were euthyroid.

Chronic conditions were common, with 31.3% of participants having diabetes mellitus, 55.2% diagnosed with hypertension, and 17.9% with coronary heart disease. Family history of thyroid disease was reported in 4.5% of cases. Regarding lifestyle factors, 80.6% were non-smokers, 13.4% were current smokers, and only 1.5% reported alcohol consumption. Stratification of thyroid disease by demographic and clinical characteristics revealed several notable trends. Females exhibited a higher overall prevalence of thyroid dysfunction; 60% of overt hypothyroidism and 50% of subclinical hypothyroidism cases were reported among women. However, within the male subgroup, a relatively higher proportion of thyroid dysfunction was observed despite their smaller representation. All cases of both overt and subclinical hypothyroidism occurred in participants older than 50 years, indicating a strong age-related association (p = 0.052). Obesity was more frequently associated with thyroid dysfunction; 60% of overt hypothyroid patients and 50% of subclinical cases were obese, though this trend lacked statistical significance (p = 0.946).

Thyroid dysfunction appeared more prevalent among participants with diabetes mellitus; 40% of those with overt hypothyroidism and all individuals with subclinical hypothyroidism had diabetes (p = 0.088). Similarly, hypertension and coronary artery disease were more common in individuals with thyroid dysfunction, though not statistically significant (p = 0.266 and p = 0.066, respectively). Significant associations were found with family history of thyroid disease (p = 0.027) and smoking status (p = 0.008). Current smokers showed the highest prevalence of subclinical hypothyroidism (100%). No meaningful associations were observed between alcohol use and thyroid dysfunction (p = 0.104), nor between OSA severity and thyroid disease status (p = 0.574), although the majority of hypothyroid cases were seen in the severe OSA group.

Table: Descriptive statistics of continuous variables

| Variables | N | Min. | Max. | Mean | SD | P-Value | Median (IQR) |
|---|---|---|---|---|---|---|---|
| Age (Year) | 67 | 38.0 | 60.0 | 51.8 | 6.4 | 0.001 | 52 (10) |
| Height (m) | 67 | 1.5 | 1.7 | 1.6 | 0.1 | <0.001 | 1.5 (0.1) |
| Weight (Kg) | 67 | 49.0 | 85.0 | 74.2 | 9.4 | <0.001 | 80 (10) |
| BMI (Kg/m²) | 67 | 19.5 | 37.3 | 30.2 | 4.9 | <0.001 | 29.8 (8.5) |
| Apnea (episodes per hour) | 67 | 0.0 | 106.0 | 29.3 | 32.7 | <0.001 | 17 (41) |
| Hypopnea (episodes per hour) | 67 | 8.0 | 75.0 | 30.8 | 14.8 | 0.001 | 29 (17) |
| AHI (episodes per hour) | 67 | 5.0 | 40.0 | 28.0 | 11.1 | <0.001 | 35 (15) |
| Oxygen Saturation (%) | 67 | 83.0 | 98.0 | 94.7 | 2.6 | <0.001 | 95 (1.0) |
| TSH (uIU/mL) | 67 | 0.2 | 5.8 | 2.0 | 1.5 | <0.001 | 1.8 (1.7) |
| FT3 (pmol/L) | 67 | 0.3 | 3.7 | 2.3 | 1.0 | 0.002 | 2.5 (1.8) |
| FT4 (pmol/L) | 67 | 0.1 | 9.6 | 2.8 | 2.7 | <0.001 | 1.5 (3.6) |

Table: Distribution of demographic and clinical characteristics

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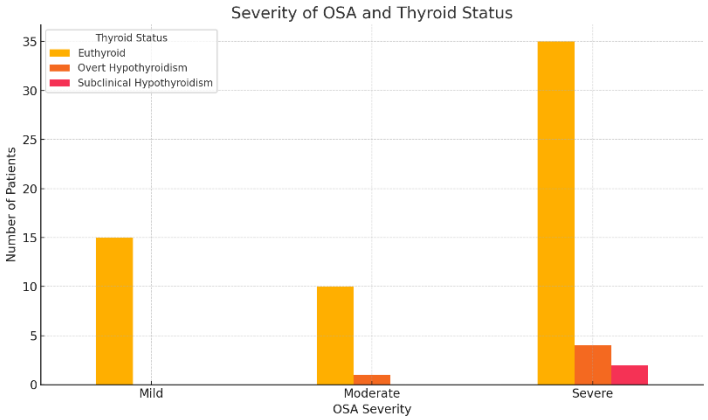
| Characteristic | Frequency | Percentage |
|---|---|---|
| Gender | | |
| Male | 17 | 25.4% |
| Female | 50 | 74.6% |
| Age Groups (Years) | | |
| ≤ 50 Years | 28 | 41.8% |
| > 50 Years | 39 | 58.2% |
| BMI Classification | | |
| Normal Weight | 10 | 14.9% |
| Overweight | 24 | 35.8% |
| Obese | 33 | 49.3% |
| Diabetes Mellitus | | |
| Yes | 21 | 31.3% |
| No | 46 | 68.7% |
| Hypertension | | |
| Yes | 37 | 55.2% |
| No | 30 | 44.8% |
| Coronary Heart Disease | | |
| Yes | 12 | 17.9% |
| No | 55 | 82.1% |
| Family History of Thyroid Disease | | |
| Yes | 3 | 4.5% |
| No | 64 | 95.5% |
| Smoking Status | | |
| Current Smoker | 9 | 13.4% |
| Ex Smoker | 4 | 6.0% |
| Non Smoker | 54 | 80.6% |
| Alcohol Drinking | | |
| Current Drinker | 1 | 1.5% |
| Non Drinker | 66 | 98.5% |
| Severity of OSA | | |
| Mild | 15 | 22.4% |
| Moderate | 11 | 16.4% |
| Severe | 41 | 61.2% |
| Thyroid Disease | | |
| Euthyroid | 60 | 89.6% |

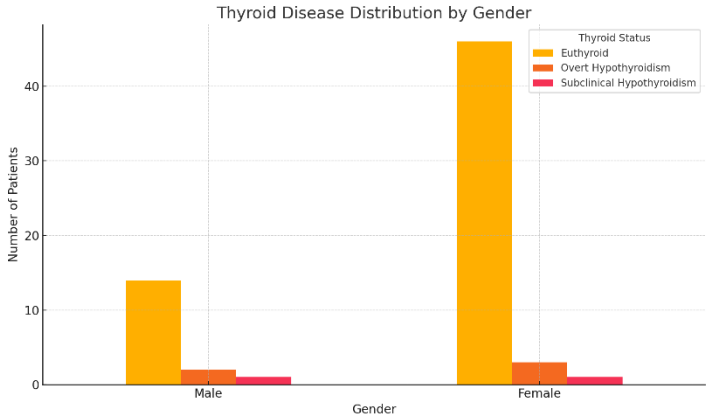
| | | |
|---|---|---|
| Overt Hypothyroidism | 5 | 7.5% |
| Subclinical Hypothyroidism | 2 | 3.0% |

Table: Stratification of thyroid disease with respect to demographic and clinical factors

| Factor | Euthyroid | Overt Hypothyroidism | Subclinical Hypothyroidism | P-Value |
|---|---|---|---|---|
| Gender | | | | 0.463 |
| Male | 14 (23.3%) | 2 (40.0%) | 1 (50.0%) | |
| Female | 46 (76.7%) | 3 (60.0%) | 1 (50.0%) | |
| Age Groups (Years) | | | | 0.052 |
| ≤ 50 | 28 (46.7%) | 0 (0.0%) | 0 (0.0%) | |
| > 50 | 32 (53.3%) | 5 (100.0%) | 2 (100.0%) | |
| BMI Classification | | | | 0.946 |
| Normal Weight | 9 (15.0%) | 1 (20.0%) | 0 (0.0%) | |
| Overweight | 22 (36.7%) | 1 (20.0%) | 1 (50.0%) | |
| Obese | 29 (48.3%) | 3 (60.0%) | 1 (50.0%) | |
| Diabetes Mellitus | | | | 0.088 |
| Yes | 17 (28.3%) | 2 (40.0%) | 2 (100.0%) | |
| No | 43 (71.7%) | 3 (60.0%) | 0 (0.0%) | |
| Hypertension | | | | 0.266 |
| Yes | 31 (51.7%) | 4 (80.0%) | 2 (100.0%) | |
| No | 29 (48.3%) | 1 (20.0%) | 0 (0.0%) | |
| Coronary Heart Disease | | | | 0.066 |
| Yes | 9 (15.0%) | 3 (60.0%) | 0 (0.0%) | |
| No | 51 (85.0%) | 2 (40.0%) | 2 (100.0%) | |
| Family History of Thyroid Disease | | | | 0.027 |
| Yes | 1 (1.7%) | 1 (20.0%) | 1 (50.0%) | |
| No | 59 (98.3%) | 4 (80.0%) | 1 (50.0%) | |
| Smoking Status | | | | 0.008 |
| Current Smoker | 5 (8.3%) | 2 (40.0%) | 2 (100.0%) | |
| Ex Smoker | 4 (6.7%) | 0 (0.0%) | 0 (0.0%) | |
| Non Smoker | 51 (85.0%) | 3 (60.0%) | 0 (0.0%) | |
| Alcohol Drinking | | | | 0.104 |
| Current Drinker | 0 (0.0%) | 1 (20.0%) | 0 (0.0%) | |
| Non Drinker | 60 (100.0%) | 4 (80.0%) | 2 (100.0%) | |
| Severity of OSA | | | | 0.574 |
| Mild | 15 (25.0%) | 0 (0.0%) | 0 (0.0%) | |
| Moderate | 10 (16.7%) | 1 (20.0%) | 0 (0.0%) | |

| | | | | |
|---|---|---|---|---|
| Severe | 35 (58.3%) | 4 (80.0%) | 2 (100.0%) | |




## DISCUSSION

Obstructive sleep apnea (OSA) is a chronic sleep-related breathing disorder characterized by recurrent episodes of partial or complete upper airway obstruction during sleep, leading to fragmented sleep, intermittent hypoxemia, and substantial cardiovascular and metabolic strain. Its association with hypothyroidism has been widely acknowledged in literature, primarily through shared pathophysiological pathways such as upper airway myopathy, mucopolysaccharide deposition, and a heightened predisposition to obesity (16–18). The present study evaluated this relationship in a cohort of 67 newly diagnosed OSA patients, examining both the prevalence of thyroid dysfunction and its correlation with sleep severity parameters. The findings revealed that 10.4% of the study population had thyroid dysfunction, with 7.5% presenting overt hypothyroidism and 3.0% showing subclinical hypothyroidism. This prevalence aligns with prior international data reporting a variable hypothyroidism prevalence in OSA patients, ranging from 0.4% to 12% (14,15,21,22). While these figures confirm the coexistence of thyroid abnormalities in a subset of OSA patients, they do not indicate a high enough prevalence to warrant universal screening. Most patients were euthyroid, which corroborates previous literature suggesting that hypothyroidism is present in only a minority of OSA cases. However, the findings underscore the importance of symptom-guided screening, particularly in individuals with clinical features suggestive of thyroid dysfunction.

The study also noted that thyroid dysfunction was more prevalent among older adults, individuals with obesity, and those with comorbid conditions such as diabetes, hypertension, and coronary heart disease. In particular, all cases of hypothyroidism were observed in participants aged over 50 years, highlighting the potential influence of age-related endocrine changes. Furthermore, although statistical significance was not achieved, obesity showed a noticeable pattern of co-occurrence with thyroid dysfunction. These observations suggest that thyroid screening may be more appropriately targeted at older OSA patients and those with metabolic comorbidities, rather than being applied as a blanket strategy. Interestingly, the severity of OSA, as indicated by the apnea-hypopnea index (AHI), did not show a statistically significant association with thyroid status. Although six out of seven hypothyroid individuals were categorized as having severe OSA, the absence of a clear correlation in the broader sample resonates with findings from earlier studies, which have consistently failed to demonstrate a strong link between OSA severity and thyroid hormone levels (14,15). This reinforces the notion that while hypothyroidism may coexist with OSA, it may not significantly modulate the severity of apneic episodes once the disorder is established.

The current investigation possessed several strengths, including the use of laboratory-confirmed thyroid profiles and polysomnography for OSA diagnosis, ensuring diagnostic precision. It also comprehensively considered multiple demographic, clinical, and lifestyle-related variables, which enabled stratified analysis and yielded contextually rich findings. However, certain limitations must be acknowledged. The cross-sectional design inherently limits the ability to infer causal relationships. Additionally, the sample size was relatively small, reducing the statistical power to detect more subtle associations. The study also lacked assessment of dietary patterns, thyroid ultrasound findings, and autoimmune markers, all of which could provide deeper insights into thyroid pathology in this population. The gender distribution observed in this study, which showed a predominance of female participants, deviated from prior epidemiological trends where OSA is typically more common in males. This discrepancy may be attributed to selection bias or regional sociocultural factors influencing healthcare-seeking behavior. Despite this deviation, the observed gender-based differences in thyroid dysfunction—where females had a higher absolute prevalence but males showed proportionally greater dysfunction—warrant further exploration in larger, gender-balanced cohorts.

In conclusion, the study emphasizes that while thyroid dysfunction does occur in patients with OSA, the overall incidence remains modest. Routine screening for thyroid dysfunction in all OSA patients may not be justified. Instead, a more rational approach would involve selective screening in high-risk individuals, such as those over 50 years of age, those with obesity or diabetes, and those

presenting with clinical signs of hypothyroidism. Future longitudinal studies with larger samples and broader diagnostic workups are recommended to better delineate the complex interplay between thyroid status and sleep-disordered breathing.

## CONCLUSION

This study concluded that while thyroid dysfunction was present in a subset of individuals with obstructive sleep apnea, its overall frequency remained low, and no meaningful association was observed between thyroid disease and the severity of sleep-disordered breathing. These findings suggest that routine screening for thyroid dysfunction in all OSA patients may not be necessary; instead, a more focused approach targeting individuals with suggestive clinical features or high-risk profiles may be more effective. By identifying the limited overlap between these two conditions, the study offers valuable insight for refining clinical decision-making and supports a more tailored, symptom-guided strategy for managing thyroid assessment in the context of OSA.

## AUTHOR CONTRIBUTIONS

| Author | Contribution |
|---|---|
| Riya Kumari | Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision |
| Nausheen Saifullah | Methodology, Investigation, Data Curation, Writing - Review & Editing |
| Saifullah | Investigation, Data Curation, Formal Analysis, Software |
| Bilawal Ghulam Murtaza | Software, Validation, Writing - Original Draft |
| Karshma Bai | Formal Analysis, Writing - Review & Editing |
| Muhammad Yousuf | Writing - Review & Editing, Assistance with Data Curation |

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