ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 17, Issue 7, 2024

Online - 2455-3891
Print - 0974-2441

Research Article

CLINICAL PROFILE, RISK FACTORS, AND PULMONARY FUNCTION TESTS IN PATIENTS OF OBSTRUCTIVE SLEEP APNEA

GUGULOTH MANOSRI SOWMYA, A MOUNIKA, B BHANU REKHA*

Department of Pulmonary Medicine, Dr. Pinnamaneni Siddartha Institute of Medical Sciences and Research Foundation, Vijayawada, Andhra Pradesh, India.
***Corresponding author: B Bhanu Rekha; E-mail: bhanurekha96@gmail.com**

Received: 08 April 2024, Revised and Accepted: 20 May 2024

ABSTRACT

Objectives: The aim of this study was to analyze clinical profile, risk factors, and pulmonary function test (PFT) in patients with obstructive sleep apnea (OSA).

Methods: This was a prospective study undertaken in the department of pulmonary medicine of a tertiary care medical institute in which adult patients OSA were included on the basis of a predefined inclusion and exclusion criteria. Demographic details of patients were noted. Gender distribution, age distribution, clinical profile, and risk factors were studied. Severity of OSA was assessed by apnea hypopnea index (AHI). PFTs were done in all the cases.

Results: Out of 60 studied cases, there were 39 (65.00%) males and 21 (35.00%) females with a M: F ratio of 1: 0.53. The mean age of the studied cases was 51.58±11.14 years. The most common risk factor present in studied cases was increased neck circumference. Severity of OSA, as determined by AHI, was found to be mild, moderate, and severe in 34 (56.67%), 20 (33.33%), and 6 (10.00%) patients, respectively. Snoring that was bothersome to others was the most common presenting complaints in studied cases and was found in 52 (86.67%) cases. PFT was normal in 23 (38.33%) patients whereas obstructive as well as restrictive features were seen in 16 (26.67%) and 14 (23.33%) patients, respectively.

Conclusion: PFTs should be included during workup of patients with OSA and obstructive lung disease may coexist and cause an increase in mortality.

Keywords: Obstructive sleep apnea, Risk factors, Snoring, Pulmonary function test.

 DOI: http://dx.doi.org/10.22159/ajpcr.2024v17i7.51818. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Obstructive sleep apnea (OSA) is a sleep disorder which is characterized by repeated episodes of cessation or significantly decreased airflow despite the presence of breathing efforts. These episodes characteristically ensue during sleep and lead to disrupted breathing patterns and intermittent hypoxia. The incidence of OSA is reported to be increasing steadily. Various studies have reported the prevalence of OSA up to 26% of adult's population worldwide. This sleep-related breathing disorder is reported to be associated with an adverse health outcome, including cardiovascular diseases, metabolic disorders as well as impaired cognitive function [1].

The pathophysiology of OSA is multifactorial and complex, involving anatomical, neuromuscular, and inflammatory factors. The major mechanism underlying OSA is the collapse of the upper airway that typically occurs at the pharyngeal level, during sleep. Factors contributing to this collapse include anatomic abnormalities. The predisposing factors for OSA include obesity, a retrognathic jaw, enlarged tonsils, and impaired neuromuscular control of the upper airway. In individuals prone to develop OSA, the tone of these muscles decreases significantly during sleep, and the airway tends to collapse more easily [2].

OSA usually presents with clinical features such as loud snoring which becomes bothersome for others, nocturia, restlessness during sleep, and gasping and choking sensation that causes arousal from sleep. These night-time symptoms subsequently cause daytime symptoms such as non-restorative sleep (waking up tired), morning headaches, daytime sleepiness, and daytime tiredness, and in severe cases, it may even cause cognitive deficits and intellectual impairments [3].

The risk factors for the development of OSA include advancing age, being overweight or obese (body mass index [BMI] ≥25 kg/m^2), craniofacial abnormalities, smoking, and chronic alcoholism. Comorbidities associated with OSA include hypertension, diabetes mellitus, ischemic heart disease, and even stroke [4].

Diagnosis of OSA is usually made on the basis of a sleep study undertaken overnight or polysomnography. In polysomnography, sleep stages are recorded through an electroencephalogram, electro-oculogram, and electromyogram whereas heart rhythm is monitored with a single-lead electrocardiogram. Breathing is monitored using both a thermal sensor and a nasal pressure transducer; breathing efforts are monitored using inductance plethysmography. The breathing pattern is analyzed for the presence of apnea and hypopneas. Polysomnography results are categorized into mild (apnea hypopnea index [AHI] score of 5–15), moderate (AHI score of 16–30), and severe (AHI score of more than 30) [5]. Patients with OSA exhibit a range of structural and functional abnormalities in their upper airway during sleep, which can be reflected in their pulmonary function test (PFT) results. PFTs are useful to assess the type of pulmonary dysfunction [6] which is non-invasive, easy to operate, and reproducible.

Despite a well-known impact of OSA on health, there remains a critical gap in our understanding of the clinical profile and risk factors for the development of OSA. Existing literature has predominantly focused on specific subgroups or the studies have been conducted in selected populations thereby limiting the applicability of findings to the general population. In addition, variations in study methodologies and diagnostic criteria have led to discrepancies in the reported prevalence rates and risk factors. Furthermore, while OSA is known to have a significant impact on public health, there is a paucity of data regarding its

prevalence in specific demographic and clinical subgroups. This gap in knowledge is particularly evident in the context of diverse populations, where cultural, genetic, and environmental factors may influence the presentation and severity of OSA. Understanding the unique clinical profiles and risk factors in different populations is essential for tailoring effective preventive and therapeutic interventions [7].

This study aims to bridge the existing gap in knowledge by comprehensively investigating the clinical profile and risk factors for OSA in a diverse adult population.

Aims and objectives

The aim of the study was to analyze the clinical profile, risk factors, and PFTs in patients with OSA.

MATERIALS AND METHODS

This was a prospective study conducted in the department of pulmonary medicine of a tertiary care medical institute in which adult patients with OSA were included on the basis of a pre-defined inclusion and exclusion criteria. The duration of the study was 1 year extending. The sample size was calculated on the basis of a pilot study done on the subject of OSA by Shivalkar *et al*. [8]. Minimum sample size required was 54 patients. Based on the central limit theorem, the sample size was calculated to be sufficient if it was more than 54 and thus 60 patients were included in our study.

Demographic details of each patient such as age, gender, and BMI were noted. A thorough clinical history was taken with respect to the presence and severity of snoring, disturbed sleep, somnolence during the day, and the presence of irritability during daytime. History that will reveal the presence of risk factors such as advancing age, being overweight or obese (BMI ≥ 25 kg/m^2), craniofacial abnormalities, smoking, and chronic alcoholism was asked for and noted in each patient. The history of comorbid illnesses, including diabetes mellitus, hypertension, and bronchial asthma, was recorded. Polysomnography was done in all the cases and reports were analyzed for severity of sleep apnea. The patients were divided into three groups on the basis of the severity index of OSA as per apnea hypopnea index (AHI) – mild OSA (AHI 5–14), moderate OSA (14–28), and severe OSA (>28). The risk factors for OSA were analyzed in each patient. PFTs were done in all the cases. Spirometry findings were correlated with OSA severity.

Statistical analysis was done using the Statistical Package for the Social Sciences version 21.0 software. Quantitative data were presented as mean and standard deviation. Qualitative data were presented with incidence and percentage tables. For quantitative data, an unpaired t-test was applied and for qualitative data, a Chi-square test was used. $p<0.05$ was taken as statistically significant.

Inclusion criteria

1. Patients diagnosed with any degree of OSA on the basis of polysomnography
2. Age above 30 years
3. Patient ready to give informed and written consent to be part of the study.

Exclusion criteria

1. Age <30 years
2. Patients who refused consent to be part of the study
3. Patients with sleep disorders including night terror, parasomnias, narcolepsy, somnambulism, somniloquy, or restless leg syndrome
4. Patients with psychiatric illnesses such as mood disorders, bipolar disorder, and significant illness likely to affect the cognitive functions
5. Patients on antidepressants, antipsychotics, sedatives, or antiepileptic drugs
6. Patients with progressive neurological disorders such as multiple sclerosis, Alzheimer's disease, and Parkinson's disease.

RESULTS AND DISCUSSION

Out of 60 studied cases, there were 39 (65.00%) males and 21 (35.00%) females with a M: F ratio of 1: 0.53 (Fig. 1).

The analysis of the age distribution in studied cases showed that the most of the patients were between 51 and 60 years (31.67%) and 41–50 years (28.33%). Fourteen (23.33%) patients were below 50 years of age whereas only 3 (5.00%) patients were below 30 years. The mean age of the studied cases was 51.58±11.14 years (Table 1).

Patients were divided into being underweight (BMI<18.5), healthy weight (18.5–24.9), overweight (25–29.9), and obese (30 or above) on the basis of body mass index. The majority of the patients presenting with OSA were either obese (61.67%) or overweight (30.00%). OSA was less common in individuals having healthy BMI (6.67%) (Table 2).

All patients were analyzed for the presence of risk factors or comorbidities. The most common risk factor present in studied cases was increased neck circumference (more than 39 cm in men and more than 35 cm in women) which was seen in 45 (75.00%) patients. Systemic hypertension was present in 23 (38.33%) cases whereas diabetes mellitus and hypothyroidism were seen in 13 (21.67%) and 5 (8.33%) patients, respectively. History of smoking and alcohol consumption was present in 19 (31.67%) and 21 (35.00%) patients, respectively (Fig. 2).

The severity of OSA, as determined by AHI, was found to be mild (AHI 5–14), moderate (AHI=15–30), and severe (AHI>30) in 34 (56.67%), 20 (33.33%), and 6 (10.00%) patients, respectively (Table 3).

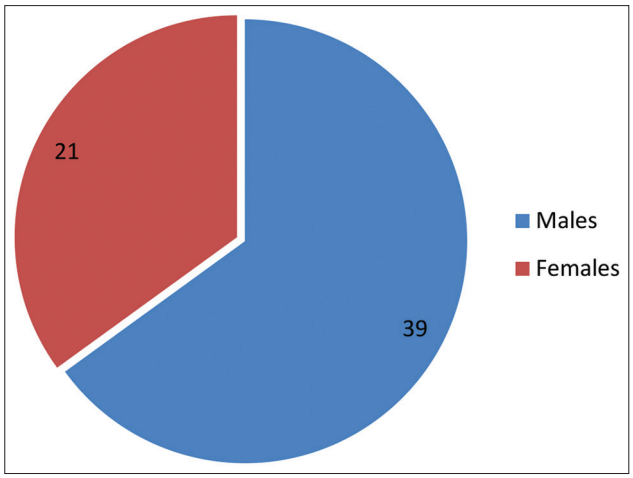

Fig. 1: Gender distribution in studied cases

Table 1: Distribution of age groups among studied cases

Age in years	Frequency	Percentage
<30	3	5.00
31–40	7	11.67
41–50	17	28.33
51–60	19	31.67
>60	14	23.33
Total	60	100.00

Mean age : 51.58±11.14 years

Table 2: Body mass index in studied cases

Body mass index	Frequency	Percentage
Underweight (<18.5)	1	1.67
Healthy weight (18.5–24.9)	4	6.67
Overweight (25–29.9)	18	30.00
Obese (30 or above)	37	61.67
Total	60	100.00

Bothersome snoring was one of the most common presenting complaints in studied cases and was found in 52 (86.67%) cases. The other common presenting complaints were daytime somnolence (41.67%), non-restorative sleep (40.00%), waking up midnight (31.67%), and nocturia (23.33%). Mood changes (5%) and palpitations (3.33%) were fewer common manifestations in studied cases (Table 4).

Spirometry was done in all studied cases to find the pattern of lung disease and the findings were correlated with various grades of AHI. Patients were divided to be having obstructive features (decreased forced expiratory volume in the first second [FEV1] along with decreased forced vital capacity [FVC]), restrictive features (normal or increased FEV1/FVC), and obstructive and restrictive features on the basis of FEV1 and FVC values. In patients with mild OSA (AHI 5–15), 7 (11.67%) and 5 (8.33%) patients were found to have an obstructive and restrictive pattern, respectively, whereas obstructive as well as restrictive pattern was seen in 3 (5%) patients. In cases with moderate OSA (AHI 15–30), restrictive and obstructive patterns were seen in 8 (13.33%) and 7 (11.67%) cases, respectively. In cases of severe OSA (AHI>30), obstructive features were seen in 2 (3.33%) patients (Table 5).

In our study, significant male preponderance in cases with OSA was found. Various factors have been reported to increase propensity of men for developing OSA generally tend to have a higher ratio of visceral fat to subcutaneous fat than women, thereby increasing the likelihood of airway obstruction due to the deposition of fat around the neck. Studies have reported that postmenopausal women have an increased incidence of OSA as comparable to premenopausal women and men. The influence of estrogen is thought to have a protective effect in premenopausal women, maintaining upper airway muscle tone and reducing the incidence of airway collapse during sleep [9]. Kapse *et al*. conducted a comparative study to analyze gender differences in clinical profile and risk factors for OSA [10]. In this study, 94 patients with sleep-disordered breathing and age more than 13 years were included in the study. The authors found that risk factor of OSA had gender differences in their distribution. Female patients with OSA were older on average than male patients, with a significantly higher mean age (52.9 vs. 44.7 years). In addition, females had a significantly higher BMI compared to males (38.2 vs. 31.5), although males had a greater neck circumference (44.7 vs. 38.1 cm). Smoking and alcoholism were more prevalent risk factors among males, whereas endocrine disorders were more common in females. The study included 58 males and 36 females, resulting in a male-to-female ratio of 1:0.62. The male preponderance reported in this study was similar to our study. Similar male preponderance was reported by authors such as Lin *et al*. [11] and Shepertycky *et al*. [12]

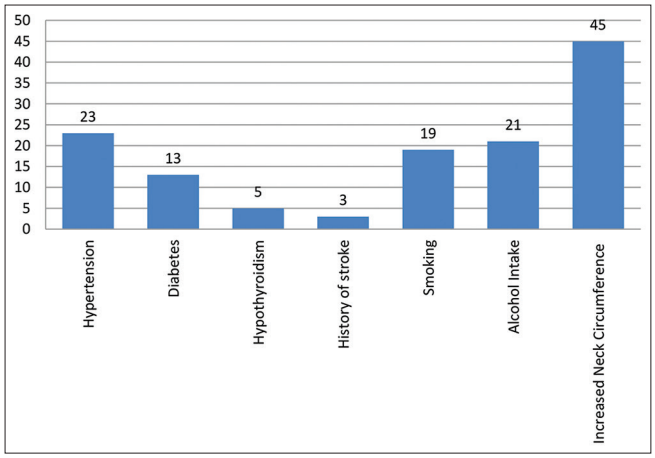

Fig. 2: Risk factors or comorbidities in studied cases

Table 3: Severity of OSA in studied cases

Sleep apnea severity	No. of patients	Percentage
Mild (AHI 5–14)	34	56.67
Moderate (AHI=15–30)	20	33.33
Severe (AHI>30)	6	10.00
Total	60	100.00

OSA: Obstructive sleep apnea, AHI: Apnea hypopnea index

Table 4: Clinical features in studied cases

Clinical features	No. of cases	Percentage
Significant snoring	56	93.33
Disturbed sleep	34	56.67
Daytime somnolence	25	41.67
Non-restorative sleep	24	40.00
Waking up midnight	19	31.67
Nocturia	14	23.33
Mood changes	3	5.00
Palpitations	2	3.33
Total	60	100.00

In our study, most of the patients were between 51 and 60 years (31.67%), and the mean age of the studied cases was found to be 51.58±11.14 years. Kareem *et al*. conducted a study of patients of OSA to analyze the risk factors for OSA [13]. The study included 504 patients with OSA. The authors reported that the prevalence of sleepiness was found to be 32.5% (95% confidence interval [CI], p<0.001) in these patients. The high-risk OSA group had mean measurements of 37.41±3.396 cm for neck circumference, 105.90±11.28 cm for waist circumference, and a waist-to-hip ratio of 1.01±0.065. In contrast for the low-risk group, these parameters were 35.45±2.652 cm, 98.75±10.87 cm, and 0.99±0.080, respectively (95% CI, p<0.001). The mean blood pressure ≥133.52/84.37 mmHg was recorded in patients with a high risk of OSA (95% CI, p<0.05), and resistant hypertension (3.3%) was significantly associated with the risk of OSA. The mean age of the studied cases was found to be 56±11 years which was similar to the mean age of cases in our study. Similar mean age was also reported by authors such as Nair *et al*. [14] and Bouloukaki *et al*. [15].

In our study, majority of the patients presenting with obstructive sleep apnea were either obese (61.67%) or overweight (30.00%). OSA was less common in individuals having healthy BMI (6.67%). History of smoking and alcohol consumption was present in 19 (31.67%) and 21 (35.00%) patients, respectively. Obesity is uniformly reported to be one of the significant risk factors for the development of OSA in various studies. Mitra *et al*. conducted a study to analyze risk factors for the development of OSA [16]. The authors reported important risk factors contributing to OSA to be age >35 years; BMI ≥ 25 kg/m^2, alcoholism, and higher Epworth sleepiness scale. Severe OSA (AHI≥30) was significantly linked to excessive daytime sleepiness and a higher oxygen desaturation index. The study concluded that the risk of OSA and its associated morbidities can be reduced by managing overweight/obesity, alcoholism, smoking, hypertension, diabetes mellitus, and hyperlipidemia. Similar risk factors for OSA were also reported by authors such as Thompson *et al*. [17] and Qian *et al*. [18].

In our study, mild, moderate, and severe OSA were seen in 34 (56.67%), 20 (33.33%), and 6 (10.00%) patients, respectively. The most common clinical presentation was bothersome snoring which was seen in 52 (86.67%) cases. The other common presenting complaints were daytime somnolence (41.67%), non-restorative sleep (40.00%), waking up midnight (31.67%), and nocturia (23.33%). The analysis of PFTs of the studied cases showed that PFT was normal in 23 (38.33%) patients whereas obstructive and restrictive features were seen in 16 (26.67%) and 14 (23.33%) patients, respectively. Mixed obstructive as well as restrictive pattern on spirometry was seen in 7 (11.67%) patients. Mehfooz *et al*. conducted a study to investigate the correlation between

Table 5: PFT and its correlation with severity of OSA

Spirometry findings	Mild (AHI 5–14)		Moderate (AHI=15–30)		Severe (AHI>30)	
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
Normal	19	31.67	3	5.00	1	1.67
Obstructive features	7	11.67	7	11.67	2	3.33
Restrictive features	5	8.33	8	13.33	1	1.67
Obstructive+Restrictive	3	5.00	2	3.33	2	3.33
Total	34	56.67	20	33.33	6	10.00

PFT: Pulmonary function test, OSA: Obstructive sleep apnea, AHI: Apnea hypopnea index

spirometric indices and snoring, grades of the apnea-hypopnea index (AHI), and the STOP-BANG screening questionnaire for OSA [19]. There was a scarcity of literature showing correlation of STOPBANG with spirometric variables. The study found that the majority of patients had normal spirometric parameters (35; 50%), followed by obstructive pattern (28; 40%) and restrictive pattern (7; 10%). Obstructive pattern is more common that restrictive pattern was also the finding of our study. Similar spirometry findings in patients with OSA were also reported by authors such as Haponik *et al.* [20] and Abdeyrim *et al.* [21].

CONCLUSION

OSA may present with subtle clinical features. A high index of suspicion and early screening is necessary in patients with risk factors such as obesity and increased neck circumference. PFTs should be included during workup as OSA and obstructive lung disease may coexist and cause an increase in mortality.

CONFLICTS OF INTEREST

None.

REFERENCES

1. Barletta P, Abreu AR, Ramos AR, Dib SI, Torre C, Chediak AD. Role of obstructive sleep apnea in cognitive impairment. Int J Head Neck Surg. 2019 Jul-Sep;10(3):57-61. doi: 10.5005/jp-journals-10001-1373, PMID: 34305353, PMCID: PMC8302067
2. Eckert DJ, Malhotra A. Pathophysiology of adult obstructive sleep apnea. Proc Am Thorac Soc. 2008 Feb 15;5(2):144-53. doi: 10.1513/pats.200707-114MG, PMID: 18250206, PMCID: PMC2628457
3. Trosman I, Trosman SJ. Cognitive and behavioral consequences of sleep disordered breathing in children. Med Sci (Basel). 2017 Dec 1;5(4):30. doi: 10.3390/medsci5040030, PMID: 29194375, PMCID: PMC5753659
4. Paschou SA, Bletsa E, Saltiki K, Kazakou P, Kantreva K, Katsaounou P, *et al*. Sleep apnea and cardiovascular risk in patients with prediabetes and type 2 diabetes. Nutrients. 2022 Nov 24;14(23):4989. doi: 10.3390/nu14234989, PMID: 36501019, PMCID: PMC9741445
5. Bloch KE. Polysomnography: A systematic review. Technol Health Care. 1997 Oct;5(4):285-305. doi: 10.3233/THC-1997-5403, PMID: 9429270
6. Liang BM, Lam DC, Feng YL. Clinical applications of lung function tests: A revisit. Respirology. 2012;17(4):611-9. doi: 10.1111/j.1440-1843.2012.02149.x, PMID: 22329710
7. Waters T. Alternative interventions for obstructive sleep apnea. Cleve Clin J Med. 2019 Sep;86(9);Suppl 1:34-41. doi: 10.3949/ccjm.86.s1.06, PMID: 31509502
8. Shivalkar B, Van de Heyning C, Kerremans M, Rinkevich D, Verbraecken J, De Backer W, *et al*. Obstructive sleep apnea syndrome: More insights on structural and functional cardiac alterations, and the effects of treatment with continuous positive airway pressure. J Am Coll Cardiol. 2006;47(7):1433-9. doi: 10.1016/j.jacc.2005.11.054, PMID: 16580533
9. Galvan T, Camuso J, Sullivan K, Kim S, White D, Redline S, *et al*. Association of estradiol with sleep apnea in depressed perimenopausal and postmenopausal women: A preliminary study. Menopause. 2017 Jan;24(1):112-7. doi: 10.1097/GME.0000000000000737, PMID: 27648659, PMCID: PMC5177515
10. Kapse V, Patel V, Mhaisekar D, Kulkarni M. Gender differences in clinical profile and risk factors for obstructive sleep apnea in a public health care setting. Int J Res Med Sci. 2019;7(7):2808-12. doi: 10.18203/2320-6012.ijrms20192924
11. Lin CM, Davidson TM, Ancoli-Israel S. Gender differences in obstructive sleep apnea and treatment implications. Sleep Med Rev. 2008;12(6):481-96. doi: 10.1016/j.smrv.2007.11.003, PMID: 18951050
12. Shepertycky MR, Banno K, Kryger MH. Differences between men and women in the clinical presentation of patients diagnosed with obstructive sleep apnea syndrome. Sleep. 2005;28(3):309-14. PMID: 16173651
13. Kareem O, Tanvir M, Bader GN. Prevalence of high risk obstructive sleep apnoea by Berlin questionnaire in patients with hypertension: Study from a tertiary care hospital. Sleep Sci Pract. 2020;4(1):15. doi: 10.1186/s41606-020-00052-0
14. Nair S, Paul T, Mehta AA, Haridas N, Kunoor A, Sudhakar N. Prevalence of overlap syndrome in patients with obstructive sleep apnea in a quaternary care center of Kerala. Indian J Public Health. 2022;66:S12-6. doi: 10.4103/ijph.ijph_1085_22, PMID: 36412466
15. Bouloukaki I, Fanaridis M, Stathakis G, Ermidou C, Kallergis E, Moniaki V, *et al*. Characteristics of patients with obstructive sleep apnea at high risk for cardiovascular disease. Medicina (Kaunas). 2021;57(11):1265. doi: 10.3390/medicina57111265, PMID: 34833483
16. Mitra AK, Bhuiyan AR, Jones EA. Association and risk factors for obstructive sleep apnea and cardiovascular diseases: A systematic review. Diseases. 2021;9(4):88. doi: 10.3390/diseases9040088, PMID: 34940026
17. Thompson C, Legault J, Moullec G, Baltzan M, Cross N, Dang-Vu TT, *et al*. A portrait of obstructive sleep apnea risk factors in 27,210 middle-aged and older adults in the Canadian longitudinal study on aging. Sci Rep. 2022;12(1):5127. doi: 10.1038/s41598-022-08164-6, PMID: 35332170
18. Qian Y, Dharmage SC, Hamilton GS, Lodge CJ, Lowe AJ, Zhang J, *et al.* Longitudinal risk factors for obstructive sleep apnea: A systematic review. Sleep Med Rev. 2023;71:101838. doi: 10.1016/j.smrv.2023.101838, PMID: 37639973
19. Mehfooz N, Siraj F, Shabir A, Mantoo S, Shah TH, Hafiz U, *et al*. Spirometric abnormalities in patients with sleep-related breathing disorders. J Fam Med Prim Care. 2021 Feb;10(2):1009-14. doi: 10.4103/jfmpc.jfmpc_1018_20, PMID: 34041113, PMCID: PMC8138423
20. Haponik EF, Bleecker ER, Allen RP, Smith PL, Kaplan J. Abnormal inspiratory flow-volume curves in patients with sleep-disordered breathing. Am Rev Respir Dis. 1981;124(5):571-4. doi: 10.1164/arrd.1981.124.5.571, PMID: 7305112
21. Abdeyrim A, Zhang Y, Li N, Zhao M, Wang Y, Yao X, *et al*. Impact of obstructive sleep apnea on lung volumes and mechanical properties of the respiratory system in overweight and obese individuals. BMC Pulm Med. 2015;15:76. doi: 10.1186/s12890-015-0063-6, PMID: 26209328