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Research Article

Comparison of ccq, cat score & bode index in assessing severity and exacerbations of copd - a comprehensive study

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality worldwide. While spirometry remains the cornerstone for diagnosis, it does not adequately capture symptom burden or predict quality of life. Hence, tools like the Clinical COPD Questionnaire (CCQ), COPD Assessment Test (CAT), and BODE Index have been developed to offer a more comprehensive assessment of disease severity and progression. This study aimed to compare these tools in evaluating severity and exacerbations among COPD patients.

Methods: A cross-sectional study was conducted on 60 COPD patients attending PES Institute of Medical Sciences & Research, Kuppam. Participants were assessed using CAT, CCQ, and BODE Index. Spirometry was used to determine FEV_1 levels. Statistical analysis was done using SPSS software. Pearson correlation and Chi-square tests were applied to analyze associations between scoring tools and FEV_1 values.

Results: Most participants were male (75%) and aged above 60 years. Smoking (70%) and biomass fuel exposure (36.7%) were common risk factors. The most frequent FEV_1 category was mild obstruction (43.3%). Strong positive correlations were found between CCQ and CAT ($r = 0.788$), CCQ and BODE Index ($r = 0.759$), and CAT and BODE Index ($r = 0.766$), all statistically significant ($p < 0.01$). Significant associations were observed between all three scoring tools and spirometric severity.

Conclusion: CCQ, CAT, and BODE Index are strongly correlated and effective in assessing COPD severity. These tools offer practical alternatives to spirometry in evaluating symptom burden and predicting functional status. Their integration into clinical practice can enhance comprehensive management of COPD patients.

Keywords: COPD, BODE Index, CAT Score, CCQ Score, Spirometry, Disease Severity, Quality of Life, Exacerbation.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) continues to be a major cause of morbidity and mortality globally, with its burden expected to increase.[1] The Global Initiative for Chronic Obstructive Lung Disease (GOLD) suggests extensive evaluation beyond spirometry, since airflow limitation is not a consistent predictor of symptom intensity or health-related quality of life. Dyspnoea, chronic cough, sputum production, chest tightness, intolerance to exercise, and psychological distress are frequent symptoms that contribute to functional limitation and decreased quality of life.[1] Whereas thorough measures like the St. George's Respiratory Questionnaire (SGRQ)[2] and the Chronic Respiratory Questionnaire (CRQ)[3] provide rich evaluations, their sophistication is a barrier to their use in everyday clinical practice. In contrast, short, well-validated measures like the COPD Assessment Test (CAT)[4], the Clinical COPD Questionnaire (CCQ)[2], and the multidimensional BODE Index (which involves Body Mass Index, airflow Obstruction, Dyspnoea, and Exercise capacity) are useful and reliable instruments. They enable both monitoring of the disease and prediction.[4]

The present study aims to assess and compare the utility of CAT, CCQ, and the BODE Index in evaluating health status and disease severity in patients with stable COPD.

METHODOLOGY

A cross-sectional observational study was conducted over 18 months in the Department of General Medicine at a tertiary care centre in Andhra Pradesh. The study included 60 patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD), both from outpatient and inpatient settings.

Patients were recruited according to the diagnostic criteria in the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines, which include clinical history, physical examination, and spirometric verification (post-bronchodilator FEV_1/FVC ratio < 0.70). Inclusion criteria included adults aged ≥ 18 years with stable COPD. Patients were excluded if they presented with an acute exacerbation, major comorbid conditions (e.g., severe cardiac, renal, or liver disease), or other diagnoses including pneumonia, bronchiectasis, or interstitial lung disease.

A standardized pro forma was utilized to ascertain clinical and demographic information, such as age, sex, occupation, dust or fume exposure, smoking history (type, duration, and amount), and history of passive smoking. Clinical symptoms, such as cough, expectoration, dyspnoea, hemoptysis, weight loss, and alteration of appetite, were noted.

All the patients received a thorough physical examination and baseline tests, which included complete blood count, ESR, fasting blood sugar, renal function tests, liver function tests, urine test, and HIV status (ICTC). Chest X-rays were performed on all patients, and HRCT thorax was performed in a few selected cases. Spirometry was employed to determine airflow obstruction.

In the current study, the following instruments were employed for assessment:

- COPD Assessment Test (CAT): 8-item questionnaire assessing symptom severity.
- Clinical COPD Questionnaire (CCQ): 10-item scale addressing symptom, functional, and mental domains.
- BODE Index: Multidimensional score that includes Body Mass Index (BMI), post-bronchodilator FEV_1 (% predicted), dyspnoea (mMRC scale), and 6-minute walk distance (6MWD).

Data were analyzed by SPSS software. Correlation between assessment instruments and spirometric values was established by Pearson's or Spearman's correlation coefficient. The value of $p < 0.05$ was regarded as statistically significant.

RESULTS

In the present study, the majority of participants (50%) were in the 61–70 years age group, indicating a higher prevalence of COPD among older adults. Only 15% were below 50 years. Smoking (70.0%) and a known case of COPD (90.0%) were the most common risk factors, followed by biomass fuel exposure (36.7%).

Table 1: Age & Gender Distribution of Study Participants

		Frequency	Percent
Age	<50 years	9	15.0%
	51-60 years	10	16.7%
	61-70 years	30	50.0%
	>71 years	11	18.3%
Gender	Male	45	75.0%
	Female	15	25.0%

Table 2: Distribution of Risk Factors among Study Participants

		Gender		Total	P value
		Male	Female		
Smoking	n	42	0	42	0.001
	%	93.3%	0.0%	70.0%	
Biomass fuel exposure	n	7	15	22	0.001
	%	15.6%	100.0%	36.7%	

K/C/O COPD	n	42	12	54	0.15
	%	93.3%	80.0%	90.0%	

Smoking (70.0%) and a known case of COPD (90.0%) were the most common risk factors, followed by biomass fuel exposure (36.7%).

Table 3: Chest X-Ray Findings among Study Participants

		Frequency	Percent
CHEST X RAY	Emphysematous changes	1	1.7%
	Hyperinflated lung fields	22	36.7%
	Prominent Bronchovascular markings	1	1.7%
	Prominent Bronchovascular markings, Reticulonodular opacities in lower and upper zones	1	1.7%
	Reticulonodular opacities in lower and upper zones	3	5.0%
	Reticulonodular opacities in lower zones	4	6.7%
	Normal	28	46.7%
	Total	60	100.0%

The most common finding was a normal chest X-ray (46.7%), followed by hyperinflated lung fields (36.7%). Reticulonodular opacities and emphysematous changes were observed less frequently.

Table 4: Distribution Of Clinical COPD Questionnaire (CCQ) Scores Among Study Participants

Scores		Frequency	Percent
CCQ score	0-1.0	8	13.3%
	1.1-2.0	32	53.3%
	2.1-3.0	6	10.0%
	3.1-4.0	8	13.3%
	4.1-5.0	6	10.0%
COPD Assessment test score (CAT SCORE)	0-10	9	15.0%
	11-20	28	46.7%
	21-30	20	33.3%
	31-40	3	5.0%
BODE Index	0 to 2	9	15.0%
	3 to 4	27	45.0%
	5 to 6	16	26.7%
	7 to 10	8	13.3%

Table 5: Distribution of FEV1 (Forced Expiratory Volume) Among Study Participants

		Frequency	Percent
FEV1	Normal	14	23.3%
	Mild Obstruction	26	43.3%
	Moderate Obstruction	14	23.3%
	Severe Obstruction	6	10.0%
	Total	60	100.0%

The majority of participants (43.3%) had mild obstruction, followed by 23.3% with moderate obstruction and another 23.3% with normal FEV1 values.

Table 6: Distribution of MMRC (Modified Medical Research Council) Dyspnea Grades among Study Participants

		Frequency	Percent
MMRC GRADE	0 (I only get breathless with strenuous exercise)	0	0.0%
	1 (I get short of breath when hurrying on level ground or walking up a slight hill)	18	30.0%
	2 (On level ground, I walk slower than people of my age because of breathlessness, or I have to stop for breath when walking at my own pace on the level)	25	41.7%
	3 (I stop for breath after walking about 100 yards or after a few minutes on level ground)	15	25.0%
	4 (I am too breathless to leave the house or I am breathless when dressing/undressing)	2	3.3%
	Total	60	100.0%

The majority of participants (41.7%) had a Grade 2 score, 30.0% of participants had a Grade 1 score, 25.0% had a Grade 3 score, Only 3.3% of participants had a Grade 4 score.

Table 7: Association between CCQ Score and FEV1 Among Study Participants

			FEV1				Total
			Normal	Mild Obstruction	Moderate Obstruction	Severe Obstruction	
CCQ score	0- 1.0	n	0	7	1	0	8
		%	0.0%	26.9%	7.1%	0.0%	13.3%
	1.1- 2.0	n	8	15	7	2	32
		%	57.1%	57.7%	50.0%	33.3%	53.3%
	2.1-3.0	n	3	2	1	0	6
		%	21.4%	7.7%	7.1%	0.0%	10.0%
	3.1-4.0	n	3	2	3	0	8
		%	21.4%	7.7%	21.4%	0.0%	13.3%
	4.1-5.0	n	0	0	2	4	6
		%	0.0%	0.0%	14.3%	66.7%	10.0%
CAT Score	0-10	n	2	7	0	0	9
		%	14.3%	26.9%	0.0%	0.0%	15.0%
	11-20	n	5	14	7	2	28
		%	35.7%	53.8%	50.0%	33.3%	46.7%
	21-30	n	7	5	6	2	20
		%	50.0%	19.2%	42.9%	33.3%	33.3%
	31-40	n	0	0	1	2	3
		%	0.0%	0.0%	7.1%	33.3%	5.0%
Bode Index	0 to 2	n	3	6	0	0	9
		%	21.4%	23.1%	0.0%	0.0%	15.0%
	3 to 4	n	9	16	2	0	27
		%	64.3%	61.5%	14.3%	0.0%	45.0%
	5 to 6	n	2	2	12	0	16
		%	14.3%	7.7%	85.7%	0.0%	26.7%
	7 to 10	n	0	2	0	6	8
		%	0.0%	7.7%	0.0%	100.0%	13.3%

The association was found to be statistically significant between CCQ score, CAT Score, BODE index and

FEV1 categories.

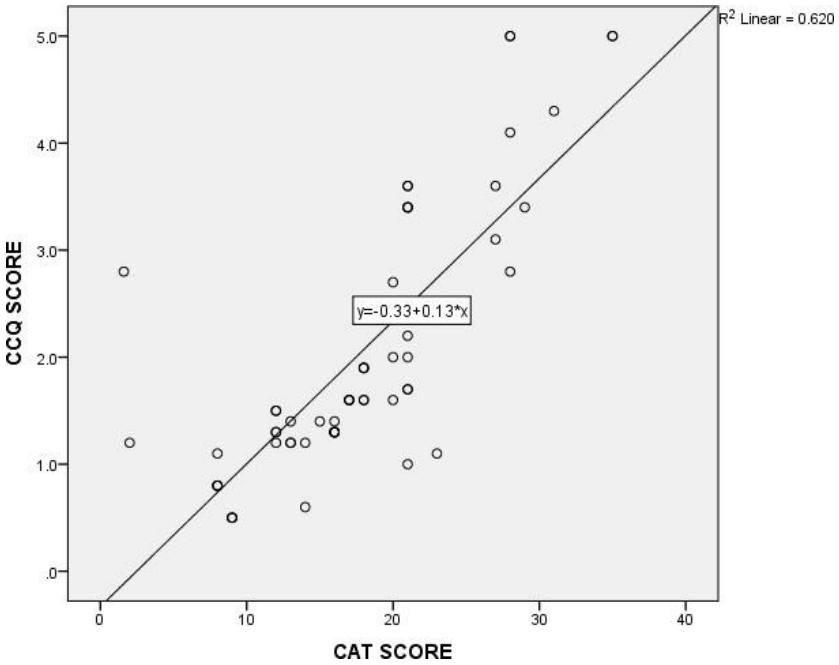

Figure 1: Correlation Between Clinical COPD Questionnaire (CCQ) And COPD Assessment Test (CAT) Scores

The Pearson correlation coefficient (r = 0.788) indicates a strong positive correlation between CCQ and CAT scores. The correlation is statistically significant at the 0.01 level (p = 0.0001).

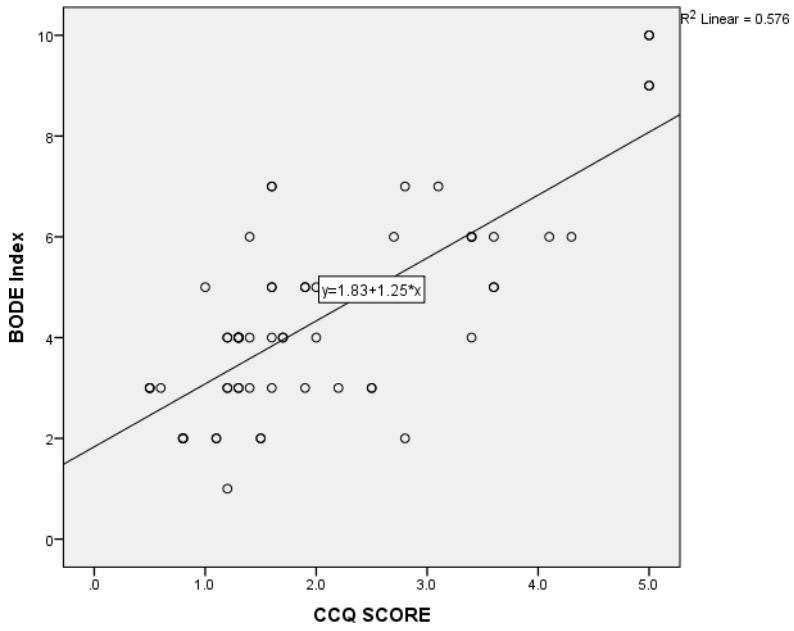

Figure 2: Correlation Between Clinical COPD Questionnaire (CCQ) And BODE Index

The Pearson correlation coefficient (r = 0.759) indicates a strong positive correlation between CCQ and BODE Index scores. The correlation is statistically significant at the 0.01 level (p = 0.0001). Graph 3: Correlation Between COPD Assessment Test (CAT) and BODE Index Scores

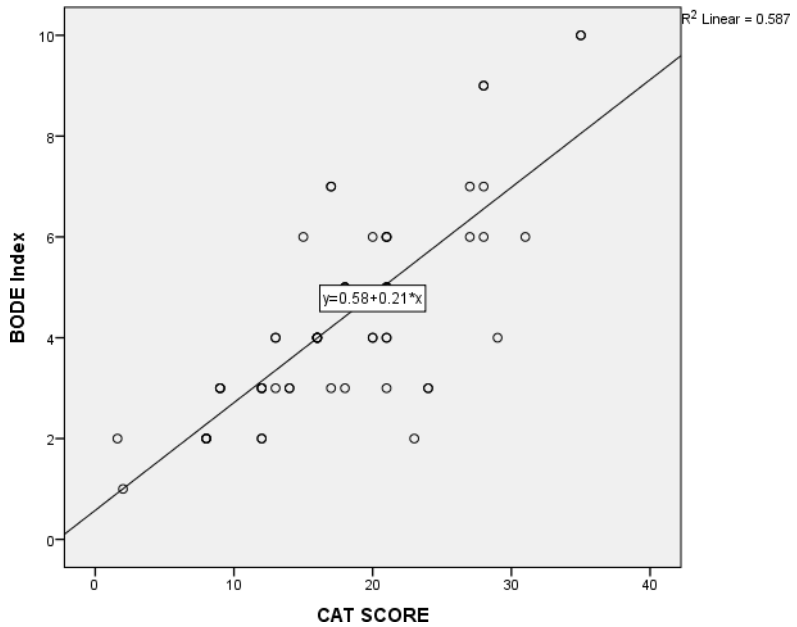

Figure 3: Correlation between Clinical CAT Score and BODE Index Scores

The Pearson correlation coefficient (r = 0.766) indicates a strong positive correlation between CAT and BODE Index scores. The correlation is statistically significant at the 0.01 level (p = 0.0001).

DISCUSSION

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory disease with airflow limitation that is not completely reversible. The assessment of the severity of disease is very important for creating individualized treatment plans and the prognosis of clinical outcomes. This trial assessed the Clinical COPD Questionnaire (CCQ), the COPD Assessment Test (CAT), and the BODE Index (Body Mass Index, Obstruction, Dyspnea, and Exercise Capacity) in patients with COPD. It sought to compare these measures with spirometric assessments and examine their inter-relationships in an attempt to determine their utility for prediction.

Demographic Characteristics

Most of the patients in the present study were in the 61-70 years age group (50%), giving it the age-related profile. Only 15% of participants were under the age of 50, while a small fraction exceeded 70 years. This distribution is consistent with epidemiological evidence showing increased COPD prevalence with advancing age. Studies by Kumar et al[5]. and Kaur et al.[6] also observed that older age groups had a higher proportion of severe COPD cases. Tsiligianni et al.[7] and Miravitlles et al.[8] had equivalent results, with mean patient ages between 67 to 71 years in strata of disease severity, again supporting the progressive course of the disease with age.

There was also a definite male preponderance, with 75% of the participants being male. This is in keeping with the conventional gender differences in risk factor exposure like smoking and industrial pollutants. Similar results were presented by Singh et al.[9], Kaur et al.[6], and Akor et al.[10], who both established smoking and workplace exposures as key factors in increased COPD prevalence in men. Kumar et al.[5] had only male participants to reduce variability in BMI and lung function with respect to sex, further affirming gender's role in COPD research.

Risk Factors and Clinical Profile

In our study, 70% of participants had a history of smoking, establishing tobacco exposure as a leading etiological factor. Furthermore, 36.7% had a history of exposure to biomass fuel, primarily from indoor cooking sources. These results are in accordance with Singh et al.[9], who noted a smoking history in 86% of patients, with a mean exposure duration of 14 years. Kaur et al.[6] also documented significant contributions of biomass fuel exposure (32%) and remote tuberculosis (22%) to COPD pathogenesis. Akor et al.[10] showed direct correlation between pack-years of smoking and rising disease severity (p = 0.001), highlighting the additive effect of risk exposures.

Correlation of Assessment Tools with FEV_1:
FEV_1 is one of the important spirometric parameters used in COPD diagnosis and staging. In the present research, a significant negative correlation was noted between FEV_1 values and CCQ scores (Chi-square = 36.28, p = 0.001). Greater CCQ scores reflected more severe airflow obstruction, validating CCQ's utility in measuring clinical severity. The same trends were noted by Liu et al. ($p < 0.001$), Tsiligianni et al.[7] (rho = −0.41, $p < 0.01$), and Miravitlles et al.[8] ($r = -0.41$, $p < 0.01$). Jo et al.[11] and Singh et al.[9] also showed negative correlations ($r = -0.39$ and -0.6155, respectively), validating the fact that CCQ scores are robust indicators of compromised lung function.

CAT scores also showed a significant negative correlation with FEV_1 values (Chi-square = 21.23, p = 0.01), emphasizing its use in determining the severity of COPD. This finding corresponds with those of Tsiligianni et al.[7] ($\rho = -0.35$), Miravitlles et al.[8] ($r = -0.35$), and Jo et al.[11] ($r = -0.28$) for weak-to-moderate inverse correlation. More robust correlations were observed by Singh[9] ($r = -0.6761$), Kaur[6] ($r = -0.2476$), and Akor[10]($r = -0.545$) in favor of the CAT score's sensitivity in reflecting symptom burden from declining lung function.

BODE Index had the highest negative correlation with FEV_1 ($X^2 = 75.26$, p = 0.01), and all patients with severe obstruction ($FEV_1 < 30\%$) had BODE scores ranging from 7–10. This result agrees with that of Liu et al. ($p < 0.001$), Tsiligianni et al.[7] (rho = −0.71), Singh et al. [9]($r = -0.8297$), and Akor et al.[10] ($r = -0.937$), who all proved that the BODE Index was a good indicator of the overall disease severity, with mixed functional, nutritional, and spirometric information.

Inter-correlation between CAT, CCQ, and BODE Index:

There was a high positive correlation between CCQ and CAT scores ($r = 0.788$, p = 0.0001), which implies that both questionnaires reflect similar facets of the severity of symptoms and the health state. This is consistent with previous research conducted by Tsiligianni[7] (rho = 0.64), Miravitlles[8](r = 0.748–0.780), Jo[11] (r = 0.70), and Singh[9] (r = 0.8479), which shows high agreement between these instruments in everyday clinical practice.

CCQ scores were also found to have a high positive correlation with the BODE Index ($r = 0.759$, $p < 0.0001$), indicating that CCQ, though easier to use, captures more global concepts of the disease such as function limitation and systemic burden. Liu et al.[12] had a similar observation ($r = 0.610$), and the strongest correlation was observed with the functional domain. Singh et al.[9] and Kaur et al.[6] also indicated correlations of $r = 0.6565$ and $r = 0.6841$, respectively, endorsing the applicability of CCQ in multidimensional testing.

Similarly, CAT scores were significantly associated with the BODE Index ($r = 0.766$, p = 0.0001). This infers that CAT not only measures symptoms but also measures functional impairment and disease burden. Similar correlations were documented by Tsiligianni[7] (rho = 0.48), Singh[9] ($r = 0.8038$), Kaur[6] ($r = 0.6847$), and Akor[10] ($r = 0.937$), all of which verify that CAT is a convenient proxy for holistic COPD assessment.

Clinical Implications:

This research proves that CCQ and CAT scores, although patient-reported and more convenient to use, are statistically significantly correlated with objective spirometric findings and the BODE Index. Although the BODE Index remains the strongest multidimensional instrument—particularly for mortality and hospitalisation prediction—the CCQ and CAT offer equally useful information regarding symptom burden and health-related quality of life. Since they are easy to use, such tools can be easily utilized in primary care and outpatient settings, especially where spirometry or 6-minute walk distance (6MWD) testing is not easily accessible.

In addition, the very strong correlation between CCQ and CAT implies that either can be used consistently, depending on clinical situation and resource constraints. Their close association with the BODE Index only serves to emphasize their applicability to comprehensive COPD management.

CONCLUSION

The results of this study affirm that CCQ, CAT, and BODE Index are valid and intercorrelated instruments for measuring the severity of COPD. All three measures were strongly negatively correlated with FEV_1, most strongly with the BODE Index. CCQ and CAT scores were highly significantly and positively correlated with each other and with the BODE Index, highlighting their value in routine clinical assessment of symptom burden and functional impairment. In combination, the measures provide a multidimensional assessment approach for COPD and can be used synergistically to optimize patient outcomes through individualized care planning.

REFERENCES

1. Cheng SL, Lin CH, Wang CC, Chan MC, Hsu JY, Hang LW et al. Comparison between COPD Assessment Test (CAT) and modified Medical Research Council (mMRC) dyspnea scores for evaluation of clinical symptoms, comorbidities and medical resources utilization in COPD patients. Journal of the Formosan Medical Association. 2019 Jan 1;118(1):429-35.
2. World Health Organization. The World Health Report 2000: Health Systems: Improving Performance. Geneva: World Health Organization; 2000. Available from https://www.who.int/publications/i/item/924156198X. Last accessed on 12.07.2025.
3. Sundh J, Ställberg B, Lisspers K, Kämpe M, Janson C, Montgomery S. Comparison of the COPD Assessment Test (CAT) and the Clinical COPD Questionnaire (CCQ) in a clinical population. COPD: Journal of Chronic Obstructive Pulmonary Disease. 2016 Jan 2;13(1):57-65.
4. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS. Med 2006;3:e442.
5. Kumar P, Rai S. Assessment of severity and systemic involvement in chronic obstructive pulmonary disease by BODE index: a cross-sectional study. Int J Contemp Med Res. 2018;5(6):F8- F13.
6. Kaur A, Goyal A, Pandhi N. To study the correlation of chronic obstructive pulmonary disease (COPD) assessment test, clinical COPD questionnaire, and BODE index in patients of stable COPD. Assam J Intern Med. 2022;12:18-23.
7. Tsiligianni IG, van der Molen T, Moraitaki D, Lopez I, Kocks JW, Karagiannis K et al. Assessing health status in COPD. A head-to-head comparison between the COPD assessment test (CAT) and the clinical COPD questionnaire (CCQ). BMC pulmonary medicine. 2012 Dec;12(1):1-9.
8. Miravitlles M, García-Sidro P, Fernández-Nistal A, Buendía MJ, Espinosa de los Monteros MJ, Molina J. Course of COPD assessment test (CAT) and clinical COPD questionnaire (CCQ) scores during recovery from exacerbations of chronic obstructive pulmonary disease. Health Qual Life Outcomes. 2013;11:147.
9. Singh S, Daga MK, Hira HS, Kumar L, Mawari G. Correlation of chronic obstructive pulmonary disease assessment test and clinical chronic obstructive pulmonary disease questionnaire score with BODE index in patients of stable chronic obstructive pulmonary disease. Lung India. 2018;35(6):494-498.
10. Akor AA, Erhabor GE. The relation of COPD assessment test (CAT) and BODE index in assessing patients with COPD: is CAT alone simple and good enough? Ann Int Med Den Res. 2019;5(2):ME40-ME44.
11. Jo YS, Yoon HI, Kim DK, Yoo CG, Lee CH. Comparison of COPD Assessment Test and Clinical COPD Questionnaire to predict the risk of exacerbation. Int J Chron Obstruct Pulmon Dis. 2018;13:101–107.
12. Liu SF, Tseng CW, Tu ML, Wang CC, Tseng CC, Chin CH, Lin MC, Liu JW. The Clinical COPD Questionnaire correlated with BODE Index—A cross-sectional study. Scientific World Journal. 2012;2012:361535.