Research Article

Behaviour of quality of life in COPD patients as assessed by BODE score and its comparison with SGRQ score and NHP scale

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Abstract

Context:

COPD is an important cause that leads to higher mortality in India and worldwide, along with airflow limitation, patients with COPD also have systemic manifestations. Due to persistent symptoms, these patients have a poor health-related quality of life (HRQOL). Many subjective and objective scales are designed but they are either complex for use or nonspecific. Hence a simple tool like the BODE index is suggested to measure HRQOL in COPD patients.

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Aims:

1) To measure health-related quality of life in stable COPD patients by BODE index

2) To evaluate the validity of the BODE index as Health-related quality of life index (HRQLI) with SGRQ and NHP scales.

Methods and Material:

The present study was a cross-sectional study in the general population. Stable COPD patients who were diagnosed by spirometry based on GOLD guidelines, after considering inclusion and exclusion criteria were enrolled in the study. Demographic details, MMRC dyspnea grading, clinical examination, lung function tests, and oral questionnaires i.e. SGRQ and NHP were taken and a 6-minute walk test was conducted on the same day in the same order. Finally, the BODE index was calculated using BMI, FEV1, MMRC scale and 6MWD of the patient.

Statistical Analysis:

Pearson correlation coefficient was used to know the association between the BODE index, SGRQ and NHP scales. Univariate and multivariate analysis was done to predict the validity of the BODE index.

Results:

155 stable COPD patients were initially included in the study. After considering the selection criteria, 124 patients were considered for the study. The mean age of the study population was 67.37+ 7.93 years and 64.5% of them were men. Pearson correlation coefficient analysis shows a positive correlation between BODE index, SGRQ (p-value = 0.001) and NHP scores (p-value = 0.001). Regression analysis shows that BODE index had 54.2% (r^2 = 0.542) validity as compared to SGRQ scale and 61.1% (r^2= 0.611) validity as compared to NHP scale to measure HRQOL.

Conclusion:

BODE index is a simple and robust tool to measure health-related quality of life in stable COPD patients.

Keywords:

COPD, BODE index, Health-related quality of life, SGRQ, NHP.

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Introduction

COPD is one of the leading causes of death. Because of irreversible airflow limitation, patients have persistent symptoms that cause the poor health-related quality of life (HRQOL). The severity of symptoms differs from person to person since it is a heterogenous systemic disorder (2). Though the quality of one's life is affected, the progress of this disease is still measured with spirometry values which is an objective test and subjective evaluation is still not a part of the treatment line. Hence patient-centered outcome measures have to be acknowledged and effective target diagnosis and treatment plans should be varied with each patient. Recent GOLD guidelines (3) emphasized the same and focussed on the primary aim of treatment is to lessen symptom rate, future exacerbations risk while improving health-related quality of life.

There are various subjective scales to measure HRQOL like SGRQ, Sickness impact profile, NHP, etc. Among these scales, St George Respiratory Questionnaire (SGRQ) is COPD specific (4). The only limitation is these scales are long, not validated in local languages and difficult to implement in patients who visit OPD. BODE index is a multidimensional scale to measure health-related quality of life in COPD patients. It has four components i.e. measure of BMI, level of airflow obstruction by FEV1, dyspnea by MMRC grading and exercise capacity by 6 Minute Walk Test (6MWT) (5). BODE index utility was reported in various studies to predict hospitalizations (6), mortality (7) and effectiveness of pulmonary rehabilitation programmes (8).

The primary objective of the present study is to measure HRQOL in stable COPD patients by BODE index and evaluate the predictive validity of the BODE index by comparing it with a general scale-like Nottingham Health Profile (NHP) and a COPD specific scale-like SGRQ.

Materials and Methods

This study was a cross-sectional study conducted in a tertiary care hospital. It is done in stable COPD patients from January 2018 to December 2018 in Belgaum, Karnataka.

Methods of Data collection

Data was collected from diagnosed COPD cases as per GOLD guidelines attending Respiratory Medicine OPD in a tertiary care hospital in Belgaum, Karnataka.

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Inclusion Criteria

All stable COPD patients (without exacerbations for at least 8 weeks before the study) whose age was >40 years diagnosed by spirometry with post-bronchodilator FEV1 / FVC ratio < 0.70 attendings outpatient department of Respiratory Medicine were included in the study.

Exclusion Criteria

1)Other chronic respiratory diseases like Bronchial Asthma, Tuberculosis, Allergic Rhinitis, Bronchiectasis.

2)Cardiac patients suffering from congestive cardiac failure, unstable angina or recent MI

3)Any major life-threatening illness

4)Patients who were unable to perform PFT or 6-minute walk test.

5)Bronchogenic carcinoma

6)Neurological disorders

Procedure

The study was approved by the Institutional Ethical and Research committee.

Stable COPD cases, diagnosed by spirometry based upon GOLD guidelines **(3)** were included in the study. A questionnaire with demographic details like age, gender, height, weight, BMI, presenting complaints, history, habits (smoking, alcohol consumption, tobacco chewing), MMRC dyspnea grading along with the duration of COPD was filled up for each patient.

All patients were subjected to clinical examination, PFT and oral questionnaires on the same day. Within that session, clinical, social and demographic data were collected, PFT and 6minute walk tests were conducted for each patient.

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All questionnaires were completed in the same order: first St.George Respiratory Questionnaire (4) (SGRQ) which contains 3 components (Symptom score, activity score and impact score) in 2 parts will be completed first then Nottingham Health Profile (NHP) questionnaire10 which has 2 parts with 45 questions was completed. The second part is not necessary to be filled for this study and first part has various questions that can assess Energy level, Pain, Physical ability, Social isolation, Sleep and Emotional reaction. Each question had a specific score. Later dyspnea scale (MMRC), BMI and finally BODE index was calculated. SGRQ data was entered in an SGRQ excel sheet and each component score along with the total score was calculated. NHP component score and the total score was calculated by the simple addition of respective individual scores. With the help of BMI, FEV1, MMRC dyspnea grading and 6minute walk test, BODE scores were calculated.

Table 1: Baseline characteristics of patients

Variable	Mean	SD
Age (years)	67.37	7.93
COPD duration (years)	5.12	3.42
No: of hospitalisations	1.52	1.37
FEV_1	1.24	0.76
FEV_1 %	52.04	15.57
FVC	53.82	24.10
FVC %	61.66	15.73
FEV_1/FVC	0.66	0.38
SpO_2 (%)	95.23	2.64
6 MWD (METERS)	282.97	94.28
BMI (KG/M^2)	23.81	5.77
MMRC	1.84	1.22
SGRQ (Percentile)		
Symptom score	46.07	21.38
Activity score	37.91	20.91
Impact score	18.74	15.71
Total score	29.67	16.79
NHP		
Energy (EL)	10.99	16.48
Pain (P)	8.98	8.67
Physical activity (PA)	10.54	11.09
Sleep (S)	13.12	10.27
Social isolation (SI)	6.61	9.50
Emotional reaction (ER)	7.62	7.05
Total score	57.86	2.06

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Table 2: Correlation between BODE index and demographic details

		Age	COPD Duration	No: of Hospitalisations	BMI	MMRC	FEV$_1$
BODE	Pearson Correlation (r^2)	-.009	.119	.386	-.403	.866	-.476
	P value	.923	.186	.001	.001	.001	.001

*P Value < 0.05 is significant

Statistical Analysis

Obtained data were entered into Microsoft Excel spreadsheets and categorical data was expressed as rates, ratios and percentages. Continuous data were expressed as mean +/- standard deviation. Pearson correlations adjusting gender and age were used to know the association between the BODE Index and SGRQ, also with NHP. Univariate and multivariate analysis was done and r2 was calculated to check the validity of the BODE Index as a tool to determine HRQOL. SPSS version 12 software was used. The p-value of <0.05 (two-tailed) was considered statistically significant.

Results

Out of 155 patients, after selection criteria, 124 patients were analysed in detail for the study. Among them 80 were men and 44 were women. The mean age was 67.37 ± 7.93 years. Baseline characteristics are given in **Table 1**. A total of 63% of the study patients were smokers and 37% were non-smokers. The BODE index was calculated based on the empirical model described by Celli et al **(9)**.

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About 97.5% of the patients had breathlessness and 83% had a cough. About 58.8% of the patients had hypertension and 34.6% were diabetic. The maximum number of people was in the BMI range of 18.5-24.9 which was normal.

Demographic details like many hospitalizations, BMI, MMRC grading and FEV1 were significantly associated with the BODE index (**Table 2**) Positive correlation was observed between the BODE index and number of hospitalizations. BMI reduces with an increase in the severity of disease and FEV1 also reduces with increased severity of the disease. A strong positive correlation was observed between MMRC grading and the BODE index.

Fig.1 BODE Quartiles
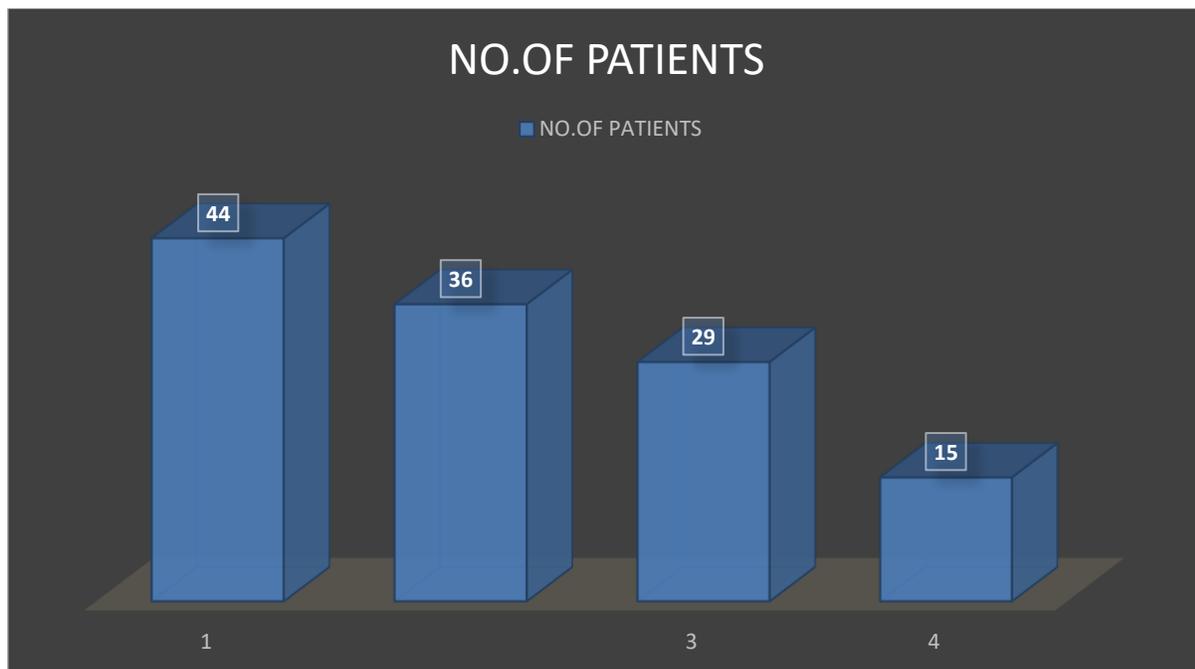
Patients were divided into BODE quartiles depending on their BODE scores. The first quartile had scores ranging from 0 to 2, second had a range of 3-5, third had a range of 6-8 and fourth had a range of 9 and 10. Though there were a good number of patients in the third and fourth quartiles, the maximum of them was in the first and second quartiles. These BODE quartiles were correlated with GOLD severity stages. (**Fig. 1**)

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Table 3: GOLD severity staging

FEV1 (%)	No: of patients
>80	4
51-80	57
30-50	58
<30	5

Many of the patients in all quartiles belonged to moderate and severe COPD groups as per GOLD staging which accounts for 47.6% and 46% respectively. 6.7% of the fourth BODE quartile patients were in the very severe COPD group which was high in comparison to other quartiles, 93.3% of the fourth quartile and 75.9% of the third quartile patients were in the severe COPD group. 86.4% of first quartile patients were in the moderate COPD group whereas 9.1% of patients of quartile 1 were in the mild COPD group (p-value = 0.001). It concludes GOLD severity staging was correlated with BODE quartiles. (**Table 3**)

Table 4: Correlation between BODE index and SGRQ score

		Symptom score	Activity score	Impact score	Total score
BODE	Pearson correlation coefficient (r^2)	.682	.643	.612	.698
	p value	.001	.001	.001	.001

p value < 0.05 is significant

The three components of the SGRQ scale along with the total score were significantly associated with the BODE index. There was a strong positive correlation between total score and BODE index and a moderate correlation is seen between symptom score, activity score, impact score and BODE index. (**Table 4**)

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Table 5: Correlation between BODE index and NHP score

		NHP	EL	P	ER	S	SI	PA
BODE	Pearson Correlation coefficient(r2)	.677	.488	.577	.422	.420	.444	.353
	p value	.001	.001	.001	.001	.001	.001	.001

*p value <0.05 is significant

Nottingham Health Profile (NHP) has 6 components that are energy level (EL), pain (P), emotional reaction (ER), sleep (S), social isolation (SI), physical ability (PA). The physical ability has a mild correlation with the BODE index and other components along with total score have a moderate correlation with the BODE index. BODE index has a 67.7% correlation with the NHP scale. (**Table 5**)

The univariate and multivariate analysis explains the amount of correlation between the two variables and the validity of the test scale. In this study, the test scale was the BODE index. Univariate analysis was done between the symptom score of the SGRQ scale and the BODE index. It showed that the BODE index was 46.5% valid as compared with the SGRQ symptom score. The BODE index was moderately correlated with activity score. It was 41.3% valid as compared with the activity score of the SGRQ scale. It was 37.4% valid in comparison with the impact score. Multivariate analysis was done between SGRQ scores and the BODE index to know the validity of the BODE index with fewer errors. R2 value in this multivariate analysis was 0.542 which showed the BODE index was 54.2% valid in comparison to SGRQ.

Nottingham Health Profile (NHP) has five components. Correlation between the BODE index and each component of NHP along with the validity of the BODE index in comparison to the NHP scale has been measured. The energy level component of NHP is moderately correlated with the BODE index. The BODE index was 23.8% valid in comparison to the energy level component of the NHP scale. The BODE index was moderately correlated with the pain component of the NHP scale. It was 33.3% valid in comparison to the pain component of the NHP scale. It was moderately correlated with the emotional reaction component of the NHP scale. It has 17.8% validity in comparison to the emotional reaction component of the NHP scale. It was significantly

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associated with the sleep component of the BODE index. Pearson correlation coefficient was 0.42, hence there was a moderate correlation between the two. BODE index and NHP scale were significantly associated and moderately correlated. The R2 value was 0.616 which explains that the BODE index was 61.6% valid in comparison with the NHP scale.

Fig.2: Correlation between SGRQ total score and BODE index

$y = 0.1216x + 0.6904$
$R^2 = 0.4865$
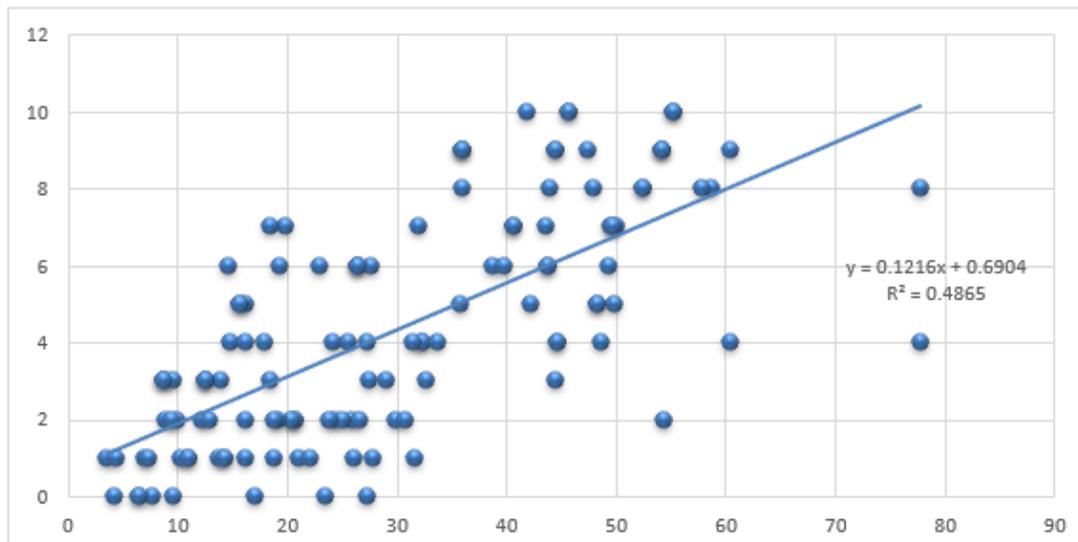
Discussion

The primary objective of this study was to measure the BODE index in stable COPD patients. BODE index constitutes four components: BMI which has a score of 0-1, Obstruction of airways which is measured by FEV1 (spirometric value) which has a score of 0-3, level of Dyspnea (MMRC grading) with a score of 0-3 and Exercise capacity (6MWT) with a score of 0-3. A combined score of all four components accounts for 0-10. Most of the patients in this study are in a score range of 1-6. To compare with GOLD severity staging, BODE quartiles were made and scores 0-2 were categorized as BODE quartile 1 which had 44 patients. This is the major group in this study. 2nd BODE quartile had 36 patients and score ranges from 3-5, 3rd quartile ranges from 6-8 with 29 patients and the 4th quartile had 15 patients with scores of 9 and 10.

It was correlated with mild, moderate, severe and very severe COPD as per GOLD 2019 guidelines3. Most of the study population belonged to moderate and severe COPD groups as per

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the GOLD classification. It belonged to mild, moderate and severe COPD patients as per BODE quartiles.

Fig.3: Correlation between NHP total score and BODE index
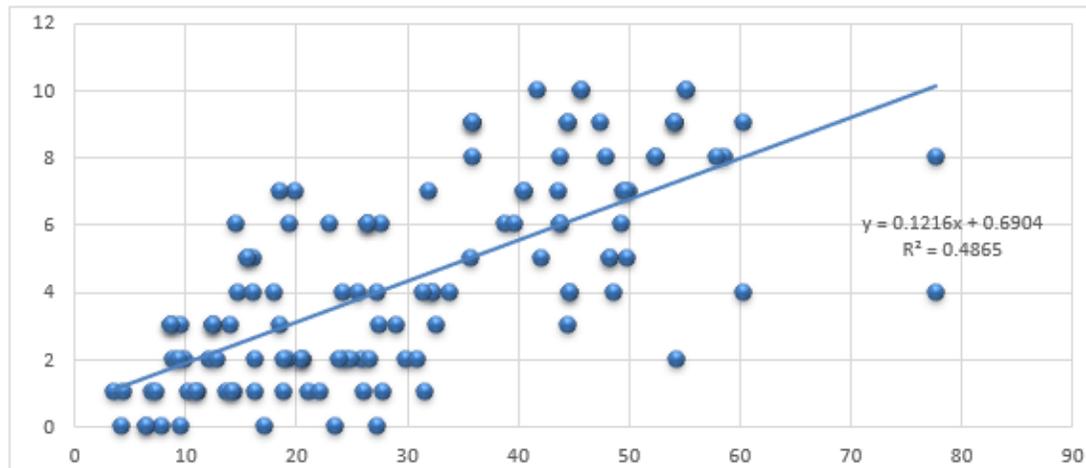
The secondary objective of the present study was to find out the predictive validity of the BODE index as a measure of HRQOL. St. George Respiratory Questionnaire (SGRQ) and Nottingham Health Profile (NHP) were used as tools to validate the BODE index. Pearson correlation coefficient analysis was done to know the association between the BODE index and HRQOL. Symptom score, activity score and impact score of SGRQ were observed to be moderately and positively correlated with BODE index. The total SGRQ score was strongly and positively correlated with the BODE index. A study done by Amoros et al **(11)**, in 67 COPD patients in Spain found a moderate positive correlation between individual SGRQ component scores and total score which is in co-ordinance with this study.

A study was done in 97 COPD patients by Shrikar Tripathi et al **(12)** in UP, India also found to have a moderate positive correlation between all SGRQ scores and BODE index. Secondary analysis i.e. Univariate analysis was done in between individual and total score of SGRQ and BODE index. The symptom score had a 46.5% correlation, activity score had 41.3% correlation, impact score had 37.4% correlation with the BODE index. The psychological and social impact of the disease appears to be least predicted by the BODE index. The total SGRQ score in univariate regression analysis showed 48.7% predictive validity of the BODE index which is in co-ordinance with the results of a Spanish study done by Amoros et al **(11)**, which had a correlation of 46.1% among BODE index and SGRQ. Unlike our study, their study had a very

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low correlation between symptom score and activity score with BODE index 19.5% and 30.7% respectively. On a whole, the BODE index can predict HRQOL by 54.2% in comparison to SGRQ which was predicted by multivariate regression analysis (minimal errors in comparison to univariate analysis)

Table 6: Pearson correlation coefficient between BODE index and HRQOL

Variable	Pearson coefficient (r)	P value
SGRQ total score	0.698	0.0001
SGRQ symptom score	0.682	0.0001
SGRQ activity score	0.643	0.0001
SGRQ impact score	0.612	0.0001
NHP total score	0.785	0.0001
NHP energy component	0.488	0.0001
NHP pain component	0.577	0.0001
NHP emotional reaction component	0.422	0.0001
NHP physical ability component	0.353	0.0001
NHP sleep component	0.420	0.0001
NHP social isolation component	0.444	0.0001

Pearson correlation coefficient analysis was done in between the BODE index and each component of NHP (**Table 6**). A moderate positive correlation was found in between components like energy level, pain, emotional reaction, sleep, social isolation and BODE index. Univariate analysis was done to know the level of correlation. BODE index can predict energy levels up to 23.8% in comparison to NHP. It can predict pain up to 33.3%, emotional reaction up to 17.8%, sleep up to 17.7%, social isolation up to 19.7% and physical ability up to 12.4% which is very low. But in multivariate analysis, the BODE index had a predictive validity of 61.1% in comparison to NHP.

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Table 7: Linear analysis of BODE index on HRQOL score (SGRQ and NHP)

Variable	ß	t	R^2	P value
SGRQ total score	0.698	1.792	0.487	0.0001
SGRQ symptom score	0.048	0.815	0.465	0.0001
SGRQ activity score	0.02	0.815	0.413	0.0001
SGRQ impact score	0.023	0.537	0.374	0.0001
NHP total score	.489	1.323	.616	0.0001
NHP energy component	.087	6.173	0.238	0.0001
NHP pain component	.195	7.800	.333	0.0001
NHP emotional reaction component	.175	5.149	.178	0.0001
NHP physical ability component	.353	4.163	.124	0.0001
NHP sleep component	.420	5.119	.177	0.0001
NHP social isolation component	.444	5.476	.197	0.0001

Hence it shows overall HRQOL is well predicted with the BODE index although individual components had no much validity (Table-7). In the present study done by Amoros et al (11), the correlation was found between NHP total score, physical ability and energy level. Other components (pain, sleep, social isolation, emotional reaction) did not correlate with the BODE index, unlike our study. In their study, the BODE index had only 14.8% validity, unlike our study which had 61.1% validity in comparison to NHP. Although, the low validity of individual components shows similarity with their study.

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Strengths of the Study

This study was a cross-sectional study and included all stable COPD patients who visited OPD of a tertiary care center in one year. The study used a structured analytical tool for measuring health-related life in COPD patients. Limited data was available about the predictive validity of the BODE index and this is one among the few studies done to predict health-related quality of life using the BODE index. This is the first of its kind to compare the BODE index with the general quality of life questionnaire that is Nottingham Health Profile.

Limitations of the Study

The samples were selected from a single center. The sample size is small which is not adequate to highlight the importance of the BODE index as a measure of HRQOL. Since SGRQ was a long, self-administered questionnaire, it was difficult to be administered in OPD, and most of the time, it was taken on an interview basis. Most of the questions in the SGRQ scale were not suitable in the Indian scenario, especially in our setup, like playing golf, swimming on regular basis, etc which might have created biased results and this requires to be customized for Indian patients. Since missing data doesn't give results in the SGRQ excel sheet, such questions had to be replaced by questions apt for the Indian scenario which is not validated by any study. This might have created a bias in the results.

Conclusion

BODE index is a simple yet powerful predictor of HRQOL in stable COPD patients. An increased score will result in poor HRQOL in stable COPD patients. It is simple to apply unlike SGRQ and other lengthy scales. It gives both subjective and objective evaluation of the disease. It helps the clinicians to predict HRQOL in patients to modify treatment and counsel them accordingly. Quality of life as a measurement of disease increases and compliments the clinical staging of disease, adding data to the psychological and social well-being of these patients at different stages.

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Acknowledgment

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