

## Health Related Quality Of Life among Chronic Obstructive Pulmonary Disease Patients and Its Determinants in a Hospital Based Observational Study from South India

S.Elamparithi , K.Bharathi Babu

**Abstract: Background:** Burden of Chronic Obstructive Pulmonary Diseases (COPD) throughout the world is increasing and likely to increase in the future with increasing burden of air pollutants and ageing of the population. It is not only associated with death but also affects quality of life. This study aimed to find the quality of life of patients suffering from COPD and its demographic and clinical correlates.

**Methods:** Hospital based cross-sectional study conducted in two tertiary care centers. Basic demographic details were collected from the 250 participants. Each participant underwent anthropometry, skin fold thickness, six minutes walk test, spirometry followed by spirometry with bronchodilator. This was followed by filling of St. George Respiratory Questionnaire, Patient Health Questionnaire-9 (PHQ-9), Modified Medical Research Council (MMRC), COPD Assessment Test (CAT) questionnaires. BMI and BODE index was calculated.

**Results:** Around 76% participants were male and 78% had normal BMI. 80% participants were smokers. Around 35% of participants belonged to MMRC grade 2. Mean CAT score was 25.5 with SD of 6.1. 42% participants belong to GOLD stage 2. On multivariate analysis, BODE index and GOLD stage 4 only were significantly associated with SGRQ score and its components.

**Conclusion:** Health related quality of life (HRQL) as measured by SGRQ was found to be poor in COPD patients. BODE index was found to be a better predictor of HRQL in these patients.

**Keywords:** chronic obstructive pulmonary disease, quality of life, cross-sectional study, hospital based, BODE index

---

Date of Submission: 28-03-2018

Date of acceptance: 12-04-2018

---

### I. Introduction

Chronic Obstructive Pulmonary Diseases (COPD) is an umbrella term used for respiratory diseases leading to decreased airflow.<sup>(1)</sup> According to an estimate by the World Health Organization (WHO) 65 million people throughout the world are suffering from mild to moderate COPD.<sup>(2)</sup> COPD is responsible for 30 million of DALYs lost and about 5% of total deaths worldwide.<sup>(3)</sup> The main risk factors for COPD include exposure to air pollution (indoor and outdoor) and smoking.<sup>(4-6)</sup> Thus with increasing pollution and ageing of the population, the number of people with COPD is more likely to increase.<sup>(5)</sup> COPD not only leads to premature and increased mortality but also leads to disability and low quality of life. Health Related Quality of Life (HRQL) measures the quality of life that can be attributed to the health and disease of the Individual.<sup>(7)</sup> Many studies done outside India have shown that HRQL got severely affected even in stable COPD patients.<sup>(8-11)</sup> HRQL was also found to be related to severity of COPD.<sup>(10,12)</sup> HRQL may also be affected by coexisting factors like exercise capacity, depression, obesity in the patients of COPD.<sup>(13-15)</sup>

A few studies have been conducted in India to determine the quality of life among the COPD patients and its association with demographic and clinical parameters but results remained inconclusive. This study aimed to estimate the health related quality of life and severity of symptoms of patients suffering from Chronic Obstructive Pulmonary Disease (COPD) and to explore the factors associated with quality of life in these patients.

### II. Methods

This was a hospital based cross-sectional study conducted in two tertiary care centers namely Institute of Thoracic Medicine and Rajiv Gandhi Government General Hospital at Chennai. Sample size was calculated using STATA 12 software with power 85% and  $\alpha$  of 0.05, mean HRQL score was taken as 52.7 and minimum difference of 0.2.<sup>(16)</sup> Total sample size came out to be 250 taking in to account 10% refusal rate. Patients aged more than 40 years with dyspnea or chronic cough or chronic sputum production or with history of exposure to tobacco smoke, smoke from cooking fuel or occupational dust and chemicals were subjected to spirometry.<sup>(17)</sup> Before spirometry each participant was demonstrated the procedure of blowing air in to the

spirometer. Those with low Forced Expiratory Volume at 1 minute (FEV1) to Forced Vital Capacity(FVC) ratio less than 0.7 were included in the study.<sup>(17)</sup> Participants who were admitted with acute exacerbation in last one month, with comorbid condition, those with locomotor diseases and those with cognitive impairment were excluded from the study as these may affect additionally affect the Health Related Quality of Life.

Written informed consent was obtained from participants. Height, weight and skin fold thickness was measured using standard methods.<sup>(18)</sup> Skin fold thickness was measured using adult skin calipers at four sites, front of the arm back of the arm, at the level of the scapula in the inter-scapular region and at hip. Each patient was assessed for health related quality of life, severity of symptoms, degree of airflow obstruction with and without salbutamol, exercise-capacity with six meter walk test, presence, severity of depression and severity of smoking by pack years.

Questionnaires were filled from the participant in a calm and quite environment away from the relatives to prevent any bias. Questions were explained to the participant in case of any doubts. Participants who were unable to fill the questionnaire or were illiterate, they were helped by the investigator.

Health related quality of life was assessed using Tamil version of St. George Respiratory Questionnaire (SGRQ), a tool specifically designed to assess health related quality of life in COPD and asthma.<sup>(19)</sup> This tool contains two parts. 1<sup>st</sup> part deals with patients' symptoms over one year while the second part contains questions related to patients' current functional status. Severity of symptoms was subjectively assessed using Modified Medical Research Council (MMRC) grades and COPD Assessment Test (CAT). MMRC questionnaire categorizes exercising capacity of person.<sup>(20)</sup> The MMRC grade varies from 0 to 4. A grade of zero indicates minimal impairment of exercising capacity while a grade of four indicates breathlessness during dressing or exercising. COPD Assessment Test is a subjective assessment test of severity of symptoms with eight questions.<sup>(21)</sup> The score in each question ranges from maximum score of five to a minimum score of zero. Higher score indicates higher impact on health of patient. The severity of symptom was measured objectively by exercise capacity using 6 minutes walk test. Participants were asked to wear comfortable footwear and to avoid heavy meals before the test. Patients were instructed to continue usual medications and to rest for 10 minutes before beginning the test. All participants were demonstrated the test before the actual test. The distance walked in six minutes were measured and expressed as proportion of expected physical activity for age, gender and weight calculated using the formula.

Depression was assessed using Patients Health Questionnaire-9 (PHQ-9). PHQ-9 has nine questions and score of each question ranges from zero to three- higher the score higher the severity of depression.<sup>(22)</sup>

Data entry was done using Microsoft excel 2013. Data analysis was done using STATA-12. Results were expressed as proportion and 95% CI. Scores were calculated and expressed as median and IQR. The SGRQ questionnaire was analyzed using excel based SGRQ calculator provided by university of London. The total score obtained by this calculator shows the impact of COPD on over all health of patient. Score was represented in a score of 0 to 100. Score of 100 indicates worst possible health where as zero indicates best possible health.

BMI was calculated from the height (in meters) and weight (in Kg.) by formula weight in K.G. divided by square of height in meter. Body density was calculated using skin fold thickness using Durnin and Womersley equation.<sup>(23)</sup> Body fat index was calculated using Siri Equation.<sup>(24)</sup>

BODE index was calculated using FEV1 after bronchodilator, 6 minutes walk test, MMRC dyspnea scale, BMI. Final score was calculated using scores as indicated in table-1.<sup>(25)</sup> BODE index is calculated by summing the score obtained in each heading. Score ranges from 0 to 10. Multivariate analysis was done and results were expressed as odds ratio with 95% CI.

The study was approved by the Institutional Review Board of the institutions where the research was carried out.

### **III. Results**

A total of 250 participants were included in the study. Majority of participants belongs to the age category of 45 to 50 years with mean age group of 52 years. Around 76% participants were male. Majority of participants belongs to normal BMI category with mean BMI of 20.2 and SD of 2.5. Four fifth of participants were smokers with mean smoke years of 36. When severity of symptoms was assessed subjectively with MMRC score, majority belonged to the 2<sup>nd</sup> category, followed by one fourth of the participants who belonged to category three and equal number of participants to category one and three. None of the participants belonged to category zero. Subjective assessment by CAT score showed majority (58%) of the participants belonged to high CAT score category followed by very high and medium category.

Median CAT score was found to be 25.5 with aSD of 6.1. Majority of the patients were in the category of GOLD stage-2 followed by stage-3 and 1. Very few participants belonged to GOLD stage-4. Depression was

assessed using PHQ-9. About half of the participants were not depressed with mean PHQ-9 score of 7.13 and a SD of 6.7. Six minute walk test with mean of 274.2 and aSD of 86.7.

Health related quality of life of the patients as measured by St. George Respiratory Questionnaire had a median score of 54.6 with inter-quartile range of 34.7 to 70.0. All participants had score above the level of 10 which is the upper limit of normal.

Total SGRQ score varied significantly with in the groups of age, BMI, MMRC grade, CAT score, GOLD stage, depression and six meter walk test. But no significant relation was found between gender and SGRQ score. Distribution of various SGRQ score and SGRQ components are represented in Fig-1.

Univariate analysis showed that age, BMI, FEV1/ FVC ratio, six meter walk test % were found to be negatively associated with total SGRQ, whereas MMRC score, BODE index, CAT score, GOLD stage, PHQ score were found to be positively associated with HRQL. In multivariate analysis, only BODE index and GOLD stage -4 were found to be associated with total SGRQ score. Similar results were obtained with SGRQ symptom score, Activity Score, and Impact score. No other factors were found to be related to SGRQ score.

#### IV. Discussion

Mean age of participants was 52.2 years, about three fourth of the participants were male. Median BMI of the participants was 19.7 kg/mt<sup>2</sup>. Around four fifth of the participants were smoker with mean smoking status of 36 pack years. Almost all participants were equally distributed in MMRC score categories. Majority of participants belong to high CAT score with median score of 25. Around 42% of the participants belonged to the GOLD stage-2. Around 54% of participants belonged to the category of no depression by PHQ-9 scale with median score of 4. Median SGRQ score was found to be 54.6 with a minimum score of 15.5. In multivariate analysis BODE index and GOLD stage -4 was found to be associated with HRQL.

Health related quality of Life: In this current study we found that the mean score of HRQL as measured by SGRQ was 53.4 with standard deviation of 20.5. This result was similar to that obtained by Negi et al., Sarkar et al., Matrega et al. and Shavro et al.<sup>(16,26-28)</sup> but higher than that obtained by Agrawal et al.<sup>(29)</sup>

Relation between HRQL and factors associated: In univariate analysis, we found age, BMI, MMRC score, FEV1/ FVC ratio, fat%, six meter walk test %, BODE index, CAT score, GOLD stage, and PHQ score was found to be related to the SGRQ score. But in multivariate regression we found only GOLD stage 4 and BODE index was found to be related with quality of life as measured by SGRQ scale.

Study by Negi et al. found health related quality of life was associated positively with MRC dyspnea scale, PHQ, GOLD stage and negatively associated with BMI, FEV1, FEV1/ FVC.<sup>(16)</sup> Another study by Agrawal et al. found no association between SGRQ and GOLD stage, but positive association between FEV1%, FEV1/ FVC ratio, 6MWT% and SGRQ.<sup>(29)</sup> Similarly, study by Sarkar et al. found that SGRQ score was positively associated with the, BODE index, BMI, MMRC dyspnea grade and negative association between 6-minute walk distance, FEV1 predicted.<sup>(26)</sup> Shavro et al. also found MRC grade was associated positively with SGRQ score.<sup>(27)</sup> These differences between the current study and other studies can be explained as majority of studies had not used multivariate analysis. As BODE index is a composite index of FEV1%, 6MWD, MMRC dyspnea grade and BMI the presence of BODE index in the multivariate analysis in our study nullified the effect of its components.

This study was limited by the fact that it was a hospital based cross-sectional study thus the patients coming to hospital may be more symptomatic and thus may have poor quality of life. The strengths of the study include objective and subjective assessment of severity of symptoms.

In conclusion, this study found that the quality of life was severely impaired in patients suffering from COPD. Although all the measures used for measuring the severity and GOLD staging found to be associated with quality of life we found that BODE index is an important predictor of quality of life of patient. BODE index can be used as a predictor of quality of life in COPD patients.

**Table-1:** Scoring system for calculation of BODE index

Character	Score
-----------	-------

FEV1% bronchodilator	after	> 65%	0
		50- 64%	1
		36- 49%	2
		<= 35%	3
Six minutes distance	walk	>= 350 meters	0
		250- 349 meters	1
		150- 249 meters	2
		<= 149 meters	3
MMRC dyspnea scale		MMRC 0	0
		MMRC 1	0
		MMRC 2	1
		MMRC 3	2
		MMRC 4	3
BMI		> 21	0
		<=21	1

Fig-1 Distribution of SGRQ scores

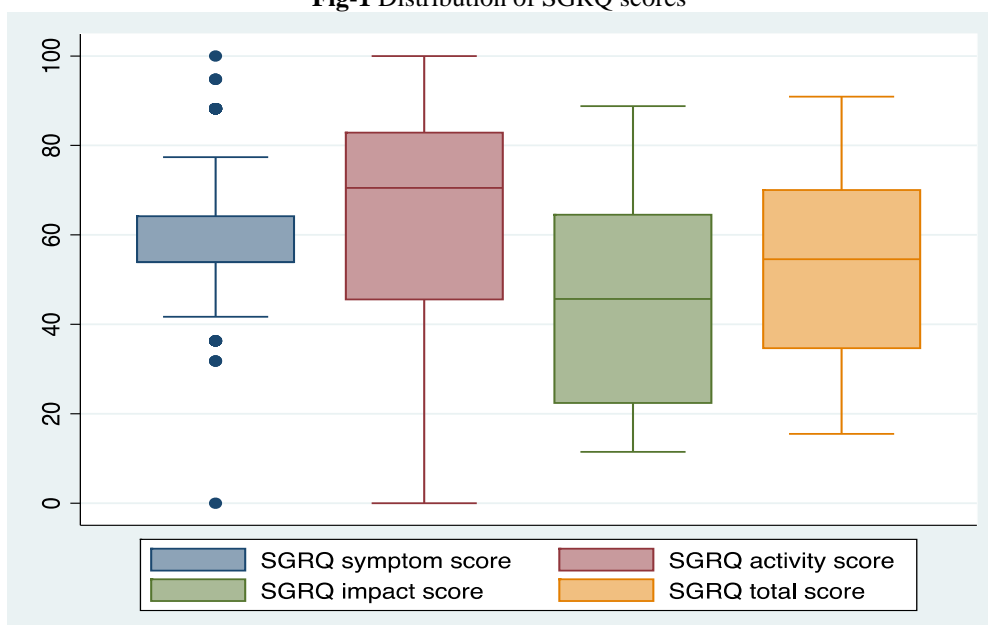


Table-2:SGRQ score Clinical and Demographic Characteristics of Participants

Character		N	Mean (SD)	Total SGRQ (SD)	P value
Age	45- 50 yrs.	104 (41.6)	52.2 (4.8)	61.0 (18.8)	0.000
	51- 55 yrs.	76 (30.4)		47.4 (20.4)	
	56- 60 yrs.	62 (24.8)		48.2 (19.6)	
	61- 65 yrs.	8 (3.2)		53.1 (22.5)	
Gender	Male	190 (76.0)	-----	52.1 (20.7)	0.612
	Female	60 (24.0)		57.8 (19.5)	
BMI category	Undernourished	46 (18.4)	20.2(2.5)	59.3 (20.1)	0.018
	Normal	196 (78.4)		52.8 (20.1)	
	Overweight	5 (2.0)		33.7 (19.7)	
	Obese	3 (1.2)		39.3 (30.4)	
Smoker		263 (79.2)	-----		
MMRC Grade	1	51 (20.4)	-----	33.2 (14.9)	0.000
	2	86 (34.4)		48.0 (15.8)	

	3	61 (24.4)		64.5 (18.3)	
	4	52 (20.8)		69.3 (12.9)	
CAT score	Low (0-10)	3 (1.2)	25.5 (6.1)	27.4 (18.5)	0.000
	Medium (11-20)	43 (17.2)		36.8 (17.1)	
	High (21-30)	145 (58.0)		53.1 (19.3)	
	Very High (31-40)	59 (23.6)		67.8 (14.6)	
GOLD stage	Stage-1	48 (19.2)	-----	37.5 (16.9)	0.000
	Stage-2	105 (42.0)		51.0 (20.4)	
	Stage-3	82 (32.8)		61.9 (16.3)	
	Stage-4	15 (6.0)		74.7 (9.8)	
Depression (By PHQ-9)	None	135 (54.0)	7.1 (6.7)	42.9 (18.5)	0.000
	Mild	38 (15.2)		61.8 (14.2)	
	Moderate	23 (9.2)		62.5 (17.7)	
	Moderately severe	46 (18.4)		69.2 (14.9)	
	Severe	8 (3.2)		75.1 (8.0)	
Six min walk distance	≥350 m	47 (18.8)	274.2 (86.7)	32.7 (14.8)	0.000
	250-349m	101 (40.4)		50.2 (17.9)	
	150-249m	53 (21.2)		62.6 (18.1)	
	≤149m	49 (19.6)		69.9 (12.1)	

Table-3:

Character	Univariate		Multivariate							
	Total Score		Total Score		Symptom score		Activity Score		Impact score	
	$\beta$ coefficient	P value	$\beta$ coefficient	P value	$\beta$ coefficient	P value	$\beta$ coefficient	P value	$\beta$ coefficient	P value
Age	<b>-1.09</b>	<b>0.000</b>	-0.06	0.802	0.03	0.900	-0.05	0.879	-0.17	0.529
BMI	<b>-2.63</b>	<b>0.000</b>	-0.154	0.757	-0.40	0.327	-0.31	0.615	0.17	0.889
Smoke year	-0.10	0.128	-0.05	0.483	0.00	0.916	-0.07	0.415	-0.05	0.504
MMRC score										
1	1									
2	<b>14.76</b>	<b>0.000</b>	-1.42	0.717	-3.02	0.347	3.29	0.502	-4.80	0.257
3	<b>31.34</b>	<b>0.000</b>	3.31	0.578	1.14	0.814	7.96	0.284	-0.00	1.000
4	<b>36.08</b>	<b>0.000</b>	-1.61	0.836	-1.88	0.768	4.26	0.661	-5.96	0.476
FEV1%	<b>-0.44</b>	<b>0.000</b>	0.16	0.672	0.32	0.295	0.29	0.533	0.27	0.508
FEV1/FVC ratio	<b>-0.93</b>	<b>0.000</b>	0.23	0.713	-0.16	0.757	0.02	0.976	0.21	0.754
Fat %	0.27	0.135	-0.15	0.757	-0.13	0.467	-0.15	0.565	-0.22	0.325
6 meter walk test %	<b>-0.83</b>	<b>0.000</b>	0.16	0.273	0.09	0.417	0.06	0.734	0.22	0.162
BODE index	<b>6.19</b>	<b>0.000</b>	<b>7.21</b>	<b>0.000</b>	<b>3.67</b>	<b>0.020</b>	<b>7.19</b>	<b>0.003</b>	<b>8.48</b>	<b>0.000</b>
CAT score	<b>1.69</b>	<b>0.000</b>	-0.01	0.954	0.12	0.520	-0.04	0.894	-0.35	0.889
GOLD stage										
1	1									
2	<b>13.52</b>	<b>0.000</b>	6.12	0.136	4.59	0.171	7.83	0.126	6.52	0.140
3	<b>24.39</b>	<b>0.000</b>	12.54	0.146	10.96	0.120	20.27	0.60	13.3	0.151
4	<b>37.17</b>	<b>0.000</b>	<b>22.58</b>	<b>0.042</b>	<b>20.02</b>	<b>0.028</b>	<b>29.48</b>	<b>0.034</b>	<b>26.24</b>	<b>0.028</b>
PHQ score	<b>1.68</b>	<b>0.000</b>	-0.34	0.158	-0.13	0.508	-0.53	0.079	-0.23	0.572

References:

- [1] WHO. Chronic obstructive pulmonary disease (COPD) [Internet]. WHO. [cited 2017 Jun 26]. Available from: <http://www.who.int/respiratory/copd/en/>
- [2] WHO. Burden of COPD [Internet]. WHO. [cited 2017 Jun 26]. Available from: <http://www.who.int/respiratory/copd/burden/en/>
- [3] The Global Burden of Disease Report 2004 update [Internet]. World Health Organization; 2008. Available from: [http://www.who.int/healthinfo/global\\_burden\\_disease/GBD\\_report\\_2004update\\_full.pdf](http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf)
- [4] R P, F B, S S. Risk factors of chronic obstructive pulmonary disease]. *Ann Ist Super Sanita*. 2003;39(4):485–93.
- [5] Mannino DM, Buist AS. Global burden of COPD: risk factors, prevalence, and future trends. *The Lancet*. 2007 Sep 1;370(9589):765–73.
- [6] de Marco R, Accordini S, Marcon A, Cerveri I, Antó JM, Gislason T, et al. Risk Factors for Chronic Obstructive Pulmonary Disease in a European Cohort of Young Adults. *Am J Respir Crit Care Med*. 2011 Apr 1;183(7):891–7.
- [7] Allen PF. Assessment of oral health related quality of life. *Health Qual Life Outcomes*. 2003;1:40.
- [8] Jones PW, Brusselle G, Dal Negro RW, Ferrer M, Kardos P, Levy ML, et al. Health-related quality of life in patients by COPD severity within primary care in Europe. *Respir Med*. 2011 Jan 1;105(1):57–66.
- [9] Kaplan RM, Ries AL, Reilly J, Mohsenifar Z. MEasurement of health-related quality of life in the national emphysema treatment trial\*. *Chest*. 2004 Sep 1;126(3):781–9.
- [10] Ståhl E, Lindberg A, Jansson S-A, Rönmark E, Svensson K, Andersson F, et al. Health-related quality of life is related to COPD disease severity. *Health Qual Life Outcomes*. 2005;3:56.
- [11] Garrido PC, Díez J de M, Gutiérrez JR, Centeno AM, Vázquez EG, de Miguel ÁG, et al. Negative impact of chronic obstructive pulmonary disease on the health-related quality of life of patients. Results of the EPIDEPOC study. *Health Qual Life Outcomes*. 2006;4:31.
- [12] Antonelli-Incalzi R, Imperiale C, Bellia V, Catalano F, Scichilone N, Pistelli R, et al. Do GOLD stages of COPD severity really correspond to differences in health status? *Eur Respir J*. 2003 Sep 1;22(3):444–9.
- [13] Shoup R, Dalsky G, Warner S, Davies M, Connors M, Khan M, et al. Body composition and health-related quality of life in patients with obstructive airways disease. *Eur Respir J*. 1997 Jul 1;10(7):1576–80.
- [14] Cleland JA, Lee AJ, Hall S. Associations of depression and anxiety with gender, age, health-related quality of life and symptoms in primary care COPD patients. *Fam Pract*. 2007 Jun 1;24(3):217–23.
- [15] Wijkstra PJ, TenVergert EM, van der Mark TW, Postma DS, Altena RV, Kraan J, et al. Relation of lung function, maximal inspiratory pressure, dyspnoea, and quality of life with exercise capacity in patients with chronic obstructive pulmonary disease. *Thorax*. 1994 May 1;49(5):468–72.
- [16] Global Initiative for Chronic Obstructive Lung Disease (GOLD) [Internet]. Global Initiative for Chronic Obstructive Lung Disease (GOLD). [cited 2017 Jun 26]. Available from: The Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2013. Available from: <http://www.goldcopd.org/>
- [17] de Onis M, Garza C, Victora CG, Onyango AW, Frongillo EA, Martines J. The WHO Multicentre Growth Reference Study: Planning, Study Design, and Methodology. *Food Nutr Bull*. 2004 Mar 1;25(1\_suppl1):S15–26.
- [18] Jones PW, Quirk FH, Baveystock CM. The St George's Respiratory Questionnaire. *Respir Med*. 1991 Sep 1;85:25–31.
- [19] Launois C, Barbe C, Bertin E, Nardi J, Perotin J-M, Dury S, et al. The modified Medical Research Council scale for the assessment of dyspnea in daily living in obesity: a pilot study. *BMC Pulm Med*. 2012;12:61.
- [20] Jones PW, Harding G, Berry P, Wiklund I, Chen W-H, Leidy NK. Development and first validation of the COPD Assessment Test. *Eur Respir J*. 2009 Sep 1;34(3):648–54.
- [21] Spitzer RL, Williams JBW, Kroenke K, Hornyak R, McMurray J. Validity and utility of the PRIME-MD Patient Health Questionnaire in assessment of 3000 obstetric-gynecologic patients: The PRIME-MD Patient Health Questionnaire Obstetrics-Gynecology Study. *Am J Obstet Gynecol*. 2000 Sep 1;183(3):759–69.
- [22] DAVIDSON LE, WANG J, THORNTON JC, KALEEM Z, SILVA-PALACIOS F, PIERSON RN, et al. Predicting Fat Percent by Skinfolts in Racial Groups: Durnin and Womersley Revisited. *Med Sci Sports Exerc*. 2011 Mar;43(3):542–9.
- [23] Siri WE. Body composition from fluid spaces and density: analysis of methods. 1961. *Nutr Burbank Los Angel Cty Calif*. 1993 Oct;9(5):480–91; discussion 480, 492.
- [24] Powrie DJ. The BODE index: a new grading system in COPD. *Thorax*. 2004 May 1;59(5):427–427.
- [25] Negi H, Sarkar M, Raval AD, Pandey K, Das P. Health-related quality of life in patients with chronic obstructive pulmonary disease in North India. *J Postgrad Med*. 2014 Jan 1;60(1):7.

- [26] Sarkar SK, Basuthakur S, Das SK, Das A, Das S, Choudhury S, et al. Evaluation of correlation of BODE index with health-related quality of life among patients with stable COPD attending a tertiary care hospital. *Lung India Off Organ Indian Chest Soc.* 2015;32(1):24–8.
- [27] Shavro SA, Ezhilarasu P, Augustine J, Bechtel JJ, Christopher DJ. Correlation of health-related quality of life with other disease severity indices in Indian chronic obstructive pulmonary disease patients. *Int J Chron Obstruct Pulmon Dis.* 2012;7:291–6.
- [28] Kumar S, Matreja PS, Gupta AK, Am, Singh E, Garg P. To Assess the Quality of Life (QOL) of Caregivers and Patients Suffering from Chronic Obstructive Pulmonary Disease (COPD). *J Allergy Ther.* 2012 May 26;1–4.
- [29] Agrawal SR, Joshi R, Jain A. Correlation of severity of chronic obstructive pulmonary disease with health-related quality of life and six-minute walk test in a rural hospital of central India. *Lung India Off Organ Indian Chest Soc.* 2015;32(3):233–40.

Bharathi Babu “Health Related Quality Of Life among Chronic Obstructive Pulmonary Disease Patients and Its Determinants in a Hospital Based Observational Study from South India “IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 4, 2018, pp 10-16.