JMSCR Vol||05||Issue||11||Page 29977-29982||November 2017

www.jmscr.igmpublication.org
Impact Factor 5.84
Index Copernicus Value: 71.58
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v5i11.28

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Body Composition in Patients with Chronic Obstructive Pulmonary Disease: A Case-Control Study

Authors
Dr Sreedevi. A[1], Dr Ramesan .K[2], Dr Jesinkumar.C.[3], Dr Vinayak Mohan[4], Dr Manoj.D.K[5], Dr Rajani.M[6]
[1]Senior Dietecian, Pariyaram Medical College
[2]Assistant Professor, Department of Medicine, Pariyaram Medical College
[3,4]Junior Resident, Department of Respiratory Medicine, Pariyaram Medical College
[5]Professor & HOD, Department of Respiratory Medicine, Pariyaram Medical College
[6]Professor, Department of Respiratory Medicine, Pariyaram Medical College
Corresponding Author
Dr Ramesan .K
Assistant Professor, Department of Medicine, Pariyaram Medical College
Email: *ramesankdr@gmail.com*

Abstract
Background: *Chronic obstructive pulmonary disease (COPD) is a disease with multiple systemic effects. Among them, weight loss and muscular wasting are responsible for low exercise capacity [(1).] Body composition is therefore important in the assessment of COPD patients, as well as exercise capacity and muscular strength.*
Methods: *The study was carried out at Pariyaram medical college hospital, Kannur, Kerala. 50 stable male COPD patients (cases), referred to Department of Pulmonary Medicine, outpatient clinic, for pulmonary rehabilitation, and 50 healthy male volunteers (controls), who were age matched, were studied.*
Results: *The mean weight, body mass index, mid upper arm circumference, calf circumference and hip circumference of the case group were found to be significantly lower than the control group. The waist circumference was also lower in the case group, whereas, the waist hip ratio was found to be higher than the control group.*
Conclusion: *Rehabilitation in COPD patients should be directed at maintaining a positive protein and energy balance by dietary counselling, supplementing essential amino acids, PUFAs, anabolic steroids along with exercise training.*
Keywords: *Body Composition, Copd, Fat Free Mass, Body Mass Index.*

Introduction

Chronic obstructive pulmonary disease (COPD) is a disease with multiple systemic effects. Among them, weight loss and muscular wasting are responsible for low exercise capacity [(1).] Body composition is therefore important in the assessment of COPD patients, as well as exercise capacity and muscular strength. Body mass index (BMI) is an independent prognostic factor in COPD [(2, 3)], but the negative effect of low body

weight on survival can be reversed by appropriate therapy in some COPD patients [2]. Body mass can be divided into two types: fat mass (FM) and fat free mass (FFM) which can be directly measured by bioelectrical impedance analysis (BIA). Fat free mass index (FFMI = FFM/height^2) is a strong predictor of peripheral skeletal muscle weakness [4], exercise capacity [5-7], reduced health status [8], and mortality [9].

Low BMI and involuntary weight loss are frequent in COPD patients, with a wide prevalence range depending on the selection criteria of patients, as well as on the severity of the disease.

Cachexia (low BMI and low FFMI) is found in 5-15% of patients with congestive heart failure and COPD [10]; due to COPD prevalence, COPD cachexia is the most frequent cachexia subtype, and mortality rates of these patients range from 10% to 15% per year [10]. Even though loss of FFM is more frequent in patients with severe COPD or with hypoxemia, data regarding the correlation of FFM with bronchial obstruction are controversial [11, 12]

FFMI of COPD patients correlate with their exercise capacity expressed as, six minutes walking distance (6MWD) [12, 9]. Body mass index (BMI) is a prognostic factor in COPD [13].

Low BMI cause harmful effects in COPD patients which are due to the effect of a low fat free mass index (FFMI). OBESITY PARADOX: - In advanced COPD, obesity is associated with a decreased mortality. Obesity reduces the resting hyperinflation. Studies have also shown that the peak oxygen uptake was higher in obese and overweight patients with COPD [14].

Patients with COPD have been reported to have a raised BMR, partly because of an increase in the energy cost of breathing. However, there is no universal agreement on this issue. Traditionally, it has been explained on the basis of an increased oxygen consumption of the respiratory muscles due to the increased work of breathing that characterizes the disease.

However, it has been recently shown that skeletal non-respiratory muscle oxygen consumption is higher at any given load in patients with COPD than in age-matched healthy controls, which indicates that, bioenergetics abnormalities are also present in non-respiratory muscles, and that these abnormalities probably contribute to the increased metabolic rate in patients with COPD[15]. Low body weights have been shown to be associated with increased mortality with reduced survival. Almost 50% of all COPD patients become underweight, and several studies have shown that a low body mass index (BMI) or body composition with low fat-free mass index (FFMI) is a major mortality risk factor [16]. When weight loss does occur, it is associated with a decrease in respiratory muscle strength and endurance, decreased diaphragmatic size, as well as increased incidence of cor pulmonale [17].

Materials and Methods

The study was carried out at Pariyaram medical college hospital, Kannur, Kerala. 50 stable male COPD patients (cases), referred to Department of Pulmonary Medicine, outpatient clinic, for pulmonary rehabilitation, and 50 healthy male volunteers (controls), who were age matched, were studied. Pulmonary function tests were performed for all. The mean height, weight, mid upper arm circumference (MUAC), waist circumference (WC), hip circumference (HC) and calf circumference (CC), were measured for both groups using standard procedures. Body fat percentage was measured using the method of bio electric impedance with a TANITA TBF-531 body fat monitor.BMR was also calculated using ICMR (Indian Council for Medical Research) prediction equation. Combinations or simple ratios of these measurements such as Body mass index (BMI), waist hip ratio (WHR), fat mass index (FMI) and fat free mass index (FFMI) were also calculated.

The data were statistically analysed using SPSS version 16.

Ethical clearance – The study was approved by institutional ethical committee.

Figure 1: Tanita TBF-531 Body Fat Monitor

Results

Chronic obstructive pulmonary disease (COPD) is related to a low body mass index (BMI), reduced functional capacity and reduced bone density, thus justifying the importance of evaluating all these parameters in the patients with the disease. Results of the present study are presented as mean (±SD) for all variables that were normally distributed. The mean age of the study group was 61.17 with standard deviation of 9.394.Minimum age was 45 and maximum age was 81.

The mean weight, body mass index, mid upper arm circumference, calf circumference and hip circumference of the case group were found to be significantly lower than the control group. The waist circumference was also lower in the case group, whereas, the waist hip ratio was found to be higher than the control group.

The mean values for body composition profiles such as fat percent, fat kg, fat free mass kg, fat mass index and fat free mass index of the case group were found to be lower than the control group which was statistically significant (p value<0.001). The basal metabolic rates as predicted by the ICMR prediction equation were also significantly lower in COPD patients

Table 1: Comparison of Anthropometric Profiles

VARIABLE	CASE (Mean ± S.D.)	CONTROL (Mean ± S.D.)	p value
WEIGHT	54.64 ± 10.36	68.58 ±10.98	<0.001
BMI	20.31 ± 3.46	24.42 ± 3.27	<0.001
MUAC	25.26± 2.79	29.48± 2.65	<0.001
CC	29.75± 3.17	33.91± 2.53	<0.001
WAIST	85.55± 10.90	91.52± 8.14	0.003
HIP	84.01± 6.52	93.57± 5.96	<0.001
WHR	1.02± 0.09	0.98± 0.05	0.015

Table 2: Comparison of Body Composition Profile and BMR

VARIABLE	CASE (Mean ± S.D.)	CONTROL (Mean ± S.D.)	p value
FAT%	13.48 ± 7.78	19.62 ± 5.98	<0.001
FAT KG	7.93 ± 5.78	13.95 ± 6.22	<0.001
FFM KG	46.71 ± 6.22	54.43 ± 6.13	<0.001
FMI	2.96 ± 2.07	4.97 ± 2.16	<0.001
FFMI	17.45 ± 1.87	19.39 ± 1.46	<0.001
BMR (Kcal/day)	1162.42±132.58	1340.77± 140.58	<0.001

Discussion

Almost 50% of all COPD patients become underweight, and several studies have shown that a low body mass index (BMI) or body composition with low fat-free mass index (FFMI) is a major mortality risk factor [18]. Chen et al. (2007) reported that WC is negatively associated with the pulmonary function especially FVC and FEV1 [19]. So, if the subjects have greater waist circumferences, their lung function will be

worsen. Thus, reduction of pulmonary functions in the elderly subjects may clinically associate with increased mortality rates. Waist circumference is related to lung impairment because the pressure in the abdomen pushes on the diaphragm. Therefore, losing a few centimeters from the waist may result in better lung function. The main cause of weight loss in COPD is the loss of skeletal muscle mass as indicated by the depletion of FFM. Also loss of fat mass contributes to the weight loss in a small amount. The body composition changes in patient with COPD can occur without clinically significant weightloss[20,21,). Furthermore, reduction of fat stores and wasting of muscle mass were observed in tuberculosis patients[22]. Moreover, FFM progressively decreases in elderly, particularly in men, like that of COPD patients[23). Therefore, measuring of FFM becomes important in not only COPD but also in other restrictive pulmonary disorders patients. Nordenson et al. [24] stated that COPD patients who are underweight or are losing weight involuntarily have a higher mortality rate than other patients with COPD.

Even though the waist circumference and hip circumference were lower in COPD patients in the present study, the WHR was increased. This may be due to the excessive gluteal muscle wasting in COPD patients.The reduction in the mid upper arm circumference and calf circumference further indicate the muscle wasting in these groups of muscles[25].

The present study showed a negative correlation of the fat free mass and calf circumference with the 6MWD of COPD patients, which was in concurrence with previous studies[26].

The fat free mass account for over one half of the inter individual variation in BMR, The fat free mass as well as BMR of COPD group of the present study was found to be significantly lower than the healthy controls, which may be a reflection of the total weight loss and under nutrition along with the decreased physical activity. Thus the fat free mass is an important determinant of the quality of life in COPD patients.

Conclusion

Anthropometric measurements are an easy and cost-effective method for evaluating, prognosticating COPD patients and guiding rehabilitation strategies in COPD patients. The muscle mass decline in underweight and fat mass increase in overweight/obese patients is associated with worsening health status. The current study indicates that therapeutic strategies should depend not on BMI but on body composition. Since BMR is the major component of energy expenditure, enrgy requirements are based on BMR. But in the case of severely wasted COPD patients as seen in the present study, the lowered BMR cannot be taken into consideration for energy requirements, but the physical activity level and actual BMR should also be assessed. Rehabilitation in COPD patients should be directed at maintaining a positive protein and energy balance by dietary counselling, supplementing essential amino acids, PUFAs, anabolic steroids along with exercise training.

References

1. Global strategy for the diagnosis, management and prevention of chronicobstructive pulmonary disease. GlobalInitiative for Chronic Obstructive Lung Disease. Available from http://www. goldcopd.org. Updated: 2017.
2. Schols AMWJ, Slangen J, Volovics L,et al. Weight loss is a reversible factor in the prognosis of chronic obstructive pulmonary disease. *Am J Respir CritCare Med* 1998; 157:1791-7
3. Celli BR, Cote CG, Marin JM, et al.– The body-mass index, airflowobstruction, dyspnea, and exercisecapacity index in chronic obstructivepulmonary disease. *N Engl J Med* 2004; 350:1005-12
4. Engelen MP, Schols AM, Does JD, etal. – Skeletal muscle weakness is associated

with wasting of extremityfat-free mass but not with airflow obstruction in patients with chronic obstructive pulmonary disease. *Am J Clin Nutr* 2000; 71:733-8

5. Schols AM, Mostert R, Soeters PB, etal. – Body composition and exercise performance in patients with chronic obstructive pulmonary disease. *Thorax* 1991; 46:695-9
6. Baarends EM, Schols AM, Mostert R,et al. – Peak exercise response inrelation to tissue depletion in patientswith chronic obstructive pulmonarydisease. *Eur Respir J* 1997; 10:2807-13
7. Sabino PG, Silva BM, Brunetto AF– Nutritional status is related to fat-freemass, exercise capacity and inspiratorystrength in severe chronic obstructivepulmonary disease patients. *Clinics (SaoPaulo)* 2010; 65:599-605
8. Mostert R, Goris A, Weling-ScheepersC, et al. – Tissue depletion and health related quality of life in patients with chronic obstructive pulmonary disease.*Respir Med* 2000; 94:859-867
9. Budweiser S, Meyer K, Jörres RA, etal. – Nutritional depletion and itsrelationship to respiratory impairment in patients with chronic respiratoryfailure due to COPD or restrictive thoracic diseases. *Eur J Clin Nutr* 2008;62:436-43
10. von Haehling S, Anker SD – Cachexia as a major underestimated and unmetmedical need: facts and numbers. *JCachexia Sarcopenia Muscle.* 2010; 1:1-5
11. Vermeeren MAP, Creutzberg EC,Schols AMWJ, et al. – Prevalence of nutritional depletion in a large out-patient population of patients withCOPD. *Respir Med* 2006; 100:1349-55
12. Ischaki E, Papatheodorou G, Gaki E, etal. – Bodymass and fat-free mass indices in COPD: relation with variables expressing disease severity.*Chest* 2007; 132:164-9
13. Vestbo J, Prescott E, Almdal T, Dahl M, Nordestgaard BG, Andersen T, Sørensen TI, Lange P, Am J Respir Crit Care Med, 173 (2006) 79 J. Respir. Crit. Care Med. 153 (1996) 961–966.
14. Roxana G Galesanu,Sarah Bernard, Francois Maltais , obesity and chronic obstructive pulmonary disease: Is fatter really better? Can Respir J. sept-oct; 21(5):297-301 (2014)
15. E.C. Creutzberg, A.M. Schols, F.C. Bothmer-Quaedvlieg, E.F.Wouters, Prevalence of an elevated resting energy expenditure inpatients with chronic obstructive pulmonary disease in relationto body composition and lung function, Eur. J. Clin. Nutr. 52(199
16. K. Gray-Donald, L. Gibbons, S.H. Shapiro, et al, Nutritional status and mortality in chronic obstructive pulmonary disease,Am. J. Respir. Crit. Care Med. 153 (1996) 961–966.
17. A.G. Agustı´, J. Sauleda, C. Miralles, et al, Skeletal muscleapoptosis and weight loss in chronic obstructive pulmonary disease, Am. J. Respir. Crit. Care Med. 166 (2002) 485–489 8) 396–401
18. Schols AMWJ, Slangen J, Volovics L,et al. Weight loss is a reversible factorin the prognosis of chronic obstructivepulmonary disease. *Am J Respir CritCare Med* 1998; 157:1791-7
19. Chen Y, Rennie D, Cormier Yf,Dosman J, Am J Clin Nutr, 85 (2007) 35
20. Hopkinson Ns, Tennant Rc, Dayer Mj, Swallow Eb, HanselTT, Moxham J, Polkey MI, Respir Res, 8 (2007) 25.
21. Sabino Pg, Silva Bm, Brunetto Af, Clinics (Sao Paulo), 65 (2010)599.
22. Tungdim Mg, Kapoor S, Coll Antropol, 33 (2009) 1033.
23. Buffar, Floris Gu, Putzu Pf, Marini E, Coll Antropol, 35 (2011)259.62:436-43
24. A. Nordenson, A.M. Gro¨ nberg, L. Hulthe´n, et al, A validateddisease specific

prediction equation for resting metabolic rate in underweight patients with COPD, Int. J. Chronic Obstructive Pulm. Dis. 5 (2010) 271–276

25. Barreiro E, Gea J. Respiratory and limb muscle dysfunction in COPD. COPD 2015; 12:413-426
26. Shu- Chuan Ho, Min- Fang Hsu, Han- Pin Kuo, Jiun- Yi Wang ,Li- Fei Chen, Kang-Yun Lee and Hsiao - Chi Chuang. The relationship between anthropometric indicators and walking distance in patients with COPD Int J Chron Obstruct Pulmon Dis. 2015; 1857-1862.