

## The Lipid Profile Parameter in Chronic Obstructive Pulmonary Disease Patients and Correlation with Severity of Disease

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### ABSTRACT

**Introduction:** More than 90% of the deaths caused by chronic obstructive pulmonary disease (COPD) occur in the low- and middle-income countries. The main aim of this study was to investigate the lipid profile levels in COPD patients and examine the correlation of total cholesterol, triglycerides, low-density lipoproteins, high density lipoproteins, and LDL/HDL risk ratio with COPD stages that are developed by the global initiative for chronic obstructive lung disease (GOLD)

**Materials & Methods:** A total of 100 COPD patients including 25 COPD non-smokers were enrolled in this study. The diagnosis of COPD was carried out by using the spirometry following the GOLD guidelines (post-bronchodilator forced expiratory volume (FEV<sub>1</sub>)/forced vital capacity (FVC) ratio < 70% predicted). Accordingly, the patients were divided into four groups based on the severity of their disease in accordance with the GOLD guidelines, including mild COPD (stage I, FEV<sub>1</sub> ≥ 80% predicted), moderate COPD (stage II, 50% ≤ FEV<sub>1</sub> < 80% predicted), severe COPD (stage III, 30% ≤ FEV<sub>1</sub> < 50% predicted), and very severe COPD (stage IV, FEV<sub>1</sub> < 30% predicted). The fasting blood samples of lipid profile were collected. The four COPD groups were compared using the ANOVA test.

**Results:** According to the results, the majority 53 patients (53%) were in age group 40 to 60 years with mean age of 60.46 +/-11.56. Most of the patients had moderate to severe airflow obstruction (GOLD stages II and III). The severity of COPD had no significant correlation with the triglycerides, LDL, HDL, and LDL/HDL risk ratio. The mean total cholesterol levels in the stages I and IV were 151.92±32.82 and 128.50 ±21.46 mg/dL, respectively, which was statistically significant (P=0.04).

**Conclusion:** The present study indicates that there was no significant correlation between various lipid profile parameters and severity of COPD.

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### Introduction

According to the statistics, chronic obstructive pulmonary disease (COPD) accounts for almost three million (5%) deaths worldwide in 2015. This disease is likely to increase in the coming years due to the growing prevalence of smoking and population aging in many countries (1). Metabolic syndrome which includes central

obesity, diabetes, hypertension, and hyperlipidaemia, is known entity in COPD patients (2). Metabolic syndrome was associated with markers of systemic inflammation like Interleukin-6, C reactive protein, and fibrinogen etc (3). There are limited number of studies investigating dyslipidemia in the COPD patients. These studies

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have generally relied on questionnaires or diagnostic codes to determine the frequency of dyslipidemia in the patients with COPD, and it is unknown if dyslipidemia is another independent factor that could explain the increased risk of cardiovascular morbidity and mortality in the COPD patients (4). The COPD patients are expected to have a deranged lipid profile for various reasons like smoking, aging, and using such drugs as steroids.

A recent Indian study observed significantly elevated Low density lipoproteins (LDL) in COPD patients when compared with controls but Very low density lipoprotein (VLDL), Triglycerides, High density Lipoprotein (HDL) and total cholesterol were normal and it may be due to increased number of smokers in this group (5). Don D. and S.F. Paul (6) study observed significantly decreased level of triglycerides level in severe COPD patients ( $p < 0.05$ ) but HDL, LDL and HDL/LDL risk ratio were normal.

The literature includes contradictory findings in this regard; nevertheless, no study has investigated the exact lipid profile in the COPD patients. With this background in mind, the present study was conducted to investigate the lipid profile levels in the COPD patients and examine the correlation of total cholesterol, triglycerides, LDL, HDL and LDL/HDL risk ratio with COPD stages that are developed by the global initiative for chronic obstructive lung disease (GOLD).

## Materials and Methods

This cross-sectional study was conducted on the inpatients and outpatients attending the Department of Respiratory Medicine of Sri Aurobindo Medical College and PG institute, Indore, India during June 2013-May 2015. The diagnosis of COPD was carried out by using spirometry following the GOLD guidelines (post-bronchodilator forced expiratory volume ( $FEV_1$ )/forced vital capacity (FVC) ratio  $< 70\%$  predicted). The patients were divided into four groups based on the severity of their disease in accordance with the GOLD guidelines, including mild COPD (stage I,  $FEV_1 \geq 80\%$  predicted), moderate COPD (stage II,  $50\% \leq FEV_1 < 80\%$  predicted), severe COPD (stage III,  $30\% \leq FEV_1 < 50\%$  predicted), and very severe COPD (stage IV,  $FEV_1 < 30\%$  predicted). Therefore, a total of 100 COPD patients including 25 COPD non-smokers were enrolled in the study.

The exclusion criteria included 1) uncooperativeness and unwillingness to participate in the study, 2) being seriously ill, 3) known case of carcinoma, bronchial asthma, active tuberculosis, diabetes, hypertension, collagen vascular disease, 4) inability to properly perform spirometry, and 5)

the presence of congenital or valvular cardiomyopathy or other familial hyperlipidemias. After obtaining the permission of the ethics committee, the informed consent was obtained from all the participants. Subsequently, the COPD patients were segregated and diagnosed based on the GOLD guidelines with such risk factors as dyspnea, chronic cough, chronic sputum production, history of exposure to the respective risk factors, and age of  $> 40$  years.

In addition to the spirometry, a detailed history was obtained from all the patients; furthermore, clinical examination and radiological tests were performed to confirm the presence of COPD and the associated cardiovascular complications. All cases were subjected for complete blood count test, erythrocyte sedimentation rate test, routine/microscopic urinalysis, lipid profile, electrocardiography, spirometry, and chest radiography. After a 12-hour overnight fast, 5 ml fasting blood samples were collected from all the participants in the morning. The total cholesterol, HDL, and triglycerides were directly analyzed using the standard enzymatic techniques. Friedewalds equation (7) was used to calculate the LDL cholesterol. The complete data was submitted to Microsoft Excel sheet and analysed with means  $\pm$  standard deviations for the linear variables whereas proportions was calculated for the categorical variables. The proportions were compared using the Chi-square or Fisher's exact tests (for low expected cell counts). In addition, the four COPD groups were compared using the ANOVA test. The Pearson's correlation coefficient was also employed to examine the relationship among the variables.

## Results

According to the results, 53% and 44% of the patients were within the age groups of 40-60 and 61-80 years, respectively, and the majority of the participants (75%) were male. In addition, 34%, 32%, 22%, and 12% of the patients were in stages III, II, IV, and I COPD, respectively (Table 1).

As illustrated in Table 2, the borderline high cholesterol was observed in the patients with stages II and III COPD. The mean difference across the four groups of COPD patients was statistically significant ( $P = 0.004$ ). The total cholesterol level found to be lower in stage IV COPD patients.

According to Table 3, 54% of the patients had undesirable low HDL cholesterol level. There was no statistically significant difference between the four groups in terms of the HDL cholesterol level ( $P = 0.92$ ). Therefore, HDL and COPD stages were not significantly correlated with one another.

As displayed in Table 4, 9% of the patients

**Table 1.** Distribution of patients in terms of age, gender, and chronic obstructive pulmonary disease stages

Age	40-60 years	53	53.00%
	61-80 years	44	44.00%
	More than 80 years	3	3.00%
Gender N=100	Male	75	75%
	Female	25	25%
Stages of COPD N=100	Stage I	12	12%
	Stage II	32	32%
	Stage III	34	34%
	Stage IV	22	22%

COPD: chronic obstructive pulmonary disease

**Table 2.** Total cholesterol in relation to chronic obstructive pulmonary disease stages

Stages of COPD	Total cholesterol grading			Mean	SD	P-value
	<200 (Desirable) (N=91)	200-239 (Borderline high) (N=8)	>=240 (High risk) (N=1)			
Stage I	12(13.1%)	0(0.0%)	0(0.0%)	151.92	32.82	0.004
Stage II	28(30.7%)	4(50.0%)	0(0.0%)	149.53	34.26	
Stage III	29(31.8%)	4(50.0%)	1(100%)	153.38	37.20	
Stage IV	22(24.18%)	0(0.0%)	0(0.0%)	128.50	21.46	
Total	91	8	1			

COPD: chronic obstructive pulmonary disease

**Table 3.** High-density lipoproteins cholesterol in relation to chronic obstructive pulmonary disease stages

Stages of COPD	HDL cholesterol grading			Mean	SD	P-value
	Undesirable <40 (N=54)	Normal 40-60 (N=44)	Desirable >60 (N=2)			
Stage I	6(11.11%)	5(11.36%)	1(50.0%)	41.00	9.84	0.92
Stage II	20(37.04%)	12(27.27%)	0(0.0%)	40.06	10.39	
Stage III	19(35.19%)	14(31.82%)	1(50.0%)	39.76	9.40	
Stage IV	9(16.67%)	13(29.55%)	0(0.0%)	38.41	14.38	
Total	54	44	2			

COPD: chronic obstructive pulmonary disease, HDL: high-density lipoproteins

had borderline high LDL cholesterol, especially in stages II and III of COPD. Furthermore, there were no statistically significant differences between the four groups in terms of the LDL cholesterol (P=0.11).

Based on Table 5, only 6% of the patients had high triglyceride levels, especially in stages II and III COPD. The four groups of COPD patients showed no statistically significant difference regarding triglyceride levels (P=0.33). Therefore,

COPD stages and triglyceride level were not significantly correlated.

Table 6 shows that 8% of the patients had moderate risk LDL/HDL ratio, especially in stages II and III of COPD. There was no statistically significant difference between the four COPD groups in terms of the LDL/HDL ratio (P=0.21). As a result, there was no significant correlation between the LDL/HDL risk ratio and COPD stages.

**Table 4.** Low-density lipoproteins cholesterol in relation to chronic obstructive pulmonary disease stages

Stages of COPD	LDL cholesterol grading				Mean	SD	P-value
	<100 (Optimal) (N=71)	100-129 (Near optimal) (N=19)	130-159 (Borderline high) (N=9)	160-189 (High) (N=1)			
Stage I	9(12.6%)	2(10.5%)	1(11.1%)	0(0.0%)	84.25	27.64	0.11
Stage II	22(30.9%)	6(31.5%)	4(44.4%)	0(0.0%)	88.26	29.49	
Stage III	22(30.9%)	7(36.8%)	4(44.4%)	1(100.0%)	93.24	30.10	
Stage IV	18(25.3%)	4(21.0%)	0(0.0%)	0(0.0%)	74.59	20.61	
Total	71	19	9	1			

COPD: chronic obstructive pulmonary disease, LDL: low-density lipoproteins

**Table 5.** Triglycerides in relation to chronic obstructive pulmonary disease stages

Stages of COPD	Triglycerides grading			Mean	SD	P-value
	<150 (Normal) (N=86)	150-199 (Borderline high) (N=8)	200-499 (High) (N=6)			
Stage I	10(11.6%)	1(12.5%)	1(16.6%)	111	42.66	0.33
Stage II	26(30.2%)	4(50.0%)	2(33.3%)	113.44	52.60	
Stage III	30(34.8%)	2(25.0%)	2(33.3%)	110.94	43.35	
Stage IV	20(23.2%)	1(12.5%)	1(16.6%)	91.86	36.42	
Total	86	8	6			

COPD: chronic obstructive pulmonary disease

**Table 6.** Low-density lipoproteins/high-density lipoproteins ratio with chronic obstructive pulmonary disease stages

Stages of COPD	LDL/HDL ratio grading			Mean	SD	P-value
	<1.5 (Very low risk) (N=2)	1.6-3.2 (Average risk) (N=90)	3.3-5.0 (Moderate risk) (N=8)			
Stage I	0 (0.0%)	12(13.33%)	0(0.0%)	2.16	0.69	
Stage II	2(100.0%)	26(28.88%)	4(50.0%)	2.44	0.92	
Stage III	0(0.0%)	31(34.44%)	3(37.5%)	2.36	0.78	0.21
Stage IV	0(0.0%)	21(23.33%)	1(12.5%)	2.00	0.71	
Total	2	90	8			

COPD: chronic obstructive pulmonary disease, LDL: low-density lipoproteins, HDL: high-density lipoproteins ratio

## Discussion

The COPD is a disease which generally affects the elderly population more than 40 year of Age group. With the advancement of age the lung function gradually declines further and various other risk factors may increases the disease progression. In the present study, the majority i.e. 53% of the patients were within the age group of 40-60 years with the mean age of 60.46±11.56 years. The mean ages of the males and females were 60.47±11.87 and 60.44±10.84 years, respectively. The COPD is a male dominant disease, the high prevalence of this disease in males may be due to the higher prevalence of smoking among this gender. In our study, the prevalence rates of COPD in males and females were 75% and 25%, respectively, rendering a male-female ratio of 3:1. In India, cooking is predominantly performed by using wood and cow dung in a poorly ventilated kitchen, especially in rural areas. This can be a possible factor for the development of COPD among the females.

In another study conducted in India, the mean ages of the male and female participants were 63.32±10.73 and 63±10.18 years, respectively (6). The majority of the patients (88%) in the mentioned study were male. Furthermore, the mentioned study employed a control group consisting of 32 males and 8 females with the mean ages of 57.87±10.20 and 57.50±8.20 years, respectively.

Smoking leads to the elevation of LDL cholesterol, triglycerides, and VLDL. Furthermore, this habit results in the reduction of HDL. However, the lipid profile have not been well characterized in the COPD patients yet. It is unknown if dyslipidemia is another independent factor that could explain the increased risk of cardiovascular morbidity and mortality in the COPD patients (7,8). In a study conducted by Lucas et al., the prevalence rates of dyslipidemia were 48.3% and 31.7% in the COPD patients and control group, respectively (P=0.001) (9). In a recent study very severe COPD group have significantly higher average values of cholesterol (p = 0.039) while the values of LDL and HDL were insignificant different in the group with severe and very severe COPD (p = 0.66 and p = 0.11 respectively) (10).

In the present study, the lipid profile was performed on all 100 patients, and the variables were correlated with COPD severity. According to the results, the mean total cholesterol levels were 151.92±32.82 and 128.50±21.46 mg/dL in stages I and IV, respectively, which was indicative of a significant difference between these groups in this regard (P=0.04). Consequently, the level of cholesterol was lower in the stage IV COPD patients, which may due to their life style modifications, such as restricted diet, exercise, and ex-smoker status. Regarding this, life style modifications should be advised from the initial stages of COPD.

A recent study revealed that current smoking, depression, and dyslipidemia were more prevalent among the patients with mild to moderate COPD (P=0.008) than among those with severe to very severe COPD (P<0.02) (11). In our study, high triglycerides, low HDL cholesterol, and high LDL/HDL risk ratio, borderline high LDL cholesterol, and borderline high total cholesterol were observed, especially in stages II and III COPD patients; however, this values were not statistically significant among COPD groups and lipid profile variables. (P>0.05). Several studies have raised serious doubts about whether dyslipidemic state is a characteristic of COPD, and whether it can explain the increased risk of ischemic heart disease in these patients.

In a study conducted in a tertiary care hospital in South India, the mean LDL levels were 114.89±19.61 and 96.22 ± 19.96 mg/dL in the COPD patients and control group, respectively, which was statistically significant (P<0.05) (12). Furthermore, in a study carried out in Bangladesh, the mean total count levels were 181.83±20.11 and 176.28±15.35 mg/dL in the COPD patients and healthy control group, respectively (P<0.001) (13). The mentioned study also reported significantly higher values of triglycerides and LDL as well as decreased HDL level in the COPD patients as compared to the controls.

## Conclusion

The COPD is considered as a systemic disease with multiple comorbidities, which may significantly affect the patient outcomes. In our study, high triglycerides, low HDL cholesterol,

and high LDL/HDL risk ratio were observed, especially in the moderate to severe COPD patients. This could be due to having more patients with current smoking status in the moderate and severe COPD groups. Dyslipidemia was more prevalent in the moderate to severe COPD patients; however, deranged lipid profile was not significantly correlated with severity of COPD. Further studies are needed to confirm the role of smoking and abnormal lipid profile status in the COPD patients.

### Limitations of the study

The lipid profile abnormality could not be compared between the genders since most of the male patients are smoker, while female patients are non-smoker. In addition, the small size of our samples might impose some limitations on the interpretation of our data.

### Conflict of Interest

The authors declare no conflict of interest.

### References

1. Senior RM, Anthonisen NR. Chronic obstructive pulmonary disease (COPD). *Am J Respir Crit Care Med.* 1998; 157:S139-47.
2. Barnes PJ. Chronic obstructive pulmonary disease: effects beyond the lungs. *PLoS Med.* 2010; 7:1-4.
3. Watz H, Waschki B, Kirsten A, Muller KC, Kretschmar G, Meyer T, et al. The metabolic syndrome in patients with chronic bronchitis and COPD: frequency and associated consequences for systemic inflammation and physical inactivity. *Chest.* 2009; 136:1039-46.
4. Chatila WM, Thomashow BM, Minai OA, Criner GJ, Make BJ. Comorbidities in chronic obstructive pulmonary disease. *Proc Am Thorac Soc.* 2008; 4:549-55.
5. Rao MV, Raghu SR, Kiran SP, Rao CH. A study of lipid profile in chronic obstructive pulmonary disease. *J Evolut Med Dental Sci.* 2015; 4:7287-96.
6. Sin DD, Man SF. Why are patients with chronic obstructive pulmonary disease at increased risk of cardiovascular diseases? The potential role of systemic inflammation in chronic obstructive pulmonary disease. *Circulation.* 2003; 107:1514-9.
7. Martin SS, Blaha MJ, Elshazly MB, Toth PP, Kwiterovich PO, Blumenthal RS, et al. Comparison of a novel method vs the Friedewald equation for estimating low-density lipoprotein cholesterol levels from the standard lipid profile. *JAMA.* 2013; 19:2061-8.
8. Pauwels RA, Buist AS, Calverley PM, Jenkins CR, Hurd SS. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. *Am J Respir Crit Care Med.* 2012; 176:532-5.
9. de Lucas-Ramos P, Izquierdo-Alonso JL, Rodriguez-Gonzalez Moro JM, Frances JF, Lozano PV, Bellón-Cano JM, et al. Chronic obstructive pulmonary disease as a cardiovascular risk factor. Results of a case-control study (CONSISTE study). *Int J Chron Obstruct Pulmon Dis.* 2012; 7:679-86.
10. Zafirova-Ivanovska B, Stojkovicj J, Dokikj D, Anastasova S, Debresliovska A, Zejnel S, et al. The level of cholesterol in COPD patients with severe and very severe stage of the disease. *Open Access Maced J Med Sci.* 2016; 2:277-82.
11. Caram LM, Ferrari R, Naves CR, Coelho LS, Vale SA, Tanni SE, et al. Risk factors for cardiovascular disease in patients with COPD: mild-to-moderate COPD versus severe-to-very severe COPD. *J Bras Pneumol.* 2016; 3:179-84.
12. Niranjana MR, Dadapeer K, Rashmi K. Lipoprotein profile in patients with chronic obstructive pulmonary disease in a tertiary care hospital in South India. *J Clin Diagn Res.* 2011; 5:990-3.
13. Begum K, Begum MK, Sarke ZH, Dewan MR, Siddique MJ. Lipid profile status of chronic obstructive pulmonary disease in hospitalized patients. *Bangladesh J Med Biochem.* 2010; 2:42-5.