The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 6, 2025

LIPID PROFILE PATTERNS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND ITS CORRELATION WITH THE SEVERITY OF DISEASE

Sajjad Ali[*1], Nousheen Ahmed[2], Saifullah chachar[3], Naveen Balachand[4], Nisar Fatima[5], Zahoor jatoi[6], Sadam[7]

*[*1]Post graduate trainee Jinnah postgraduate medical center(JPMC) Karachi*
[2]Head of department of pulmonology JPMC Karachi
[3]Assistant professor Department of pulmonology JPMC Karachi
[4]Senior registrar Department of pulmonology JPMC Karachi
[5]Post graduate trainee JPMC Karachi department of pulmonology
[6]Register department of pulmonology JPMC Karachi
[7]Post graduate Department of gastroenterology LUMHS Jamshoro

[*1]Sajjadalee29@gmail.com

DOI: https://doi.org/10.5281/zenodo.16874882

Keywords
COPD, Lipid Profile, HDL, Severity

Article History
Received on 28 March 2025
Accepted on 23 June 2025
Published on 28 June 2025

Corresponding Author: *
Sajjad Ali

Abstract

Background: *Chronic Obstructive Pulmonary Disease (COPD) has become one of the most important morbidity and world mortality causes. It implies systemic manifestation, such as metabolic changes, as well as chronic inflammation of the airways. Dyslipidemia in the patient with COPD has been increasingly identified as a possible contributor to cardiovascular diseases that are found to coexist with COPD. The investigation of the alterations in the lipid profile can contribute to the insight into the evolution of the disease and other involved body systems.*

Objectives: *To determine the relationship between lipid profile abnormalities and the severity of COPD.*

Study design: *A Cross-sectional study.*

Place and duration of study: *Department of Pulmonology at Jinnah Postgraduate Medical Center from September 2024 to March 2025*

Methods: *out of 96 patients with COPD, identified with the help of spirometry, were considered as the study group of the cross-sectional observational study. The measurements were taken regarding lipid profiles such as total cholesterol, LDL, HDL, and triglycerides. These patients were staged on the basis of FEV1% predicted using the GOLD criteria. There was mean, standard deviation and correlation testing in statistical analysis. Significant were found to be P-values <0.05. ANOVA and Pearson correlation coefficient were used in the relationship between lipid parameters and the disease severity.*

Results: *96 participants who were 62.4 8.3 years in a mean age. The correlations between the HDL and the severity of COPD were statistically significant thus showing an inverse relationship (p = 0.002). There was significant difference in the LDL levels and Triglycerides between the GOLD stage III/IV and other stages (p = 0.01 and p = 0.03, respectively). There was no significant trend in the change of the total cholesterol levels at the stages (p = 0.09). The data indicates that, with the progressive deterioration of COPD symptoms, lipid abnormalities worsen, in*

particular, the increase of TG and the decrease of HDL concentration, denoting the large cardiovascular risk status.

Conclusion: *The study shows that there is an observable correlation between the abnormalities in lipids and progressing COPD severity. Abnormal levels of triglycerides and lower levels of HDL in more severe COPD cases draw attention to the presence of systemic inflammation and poor metabolism. Recommendations are to regularly screen COPD patients with lipid profile to define cardiovascular risk. The diagnosis and treatment of dyslipidemia should be managed early as it could enhance better prognosis and minimize comorbid complications in these patients.*

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a major cause of morbidity and mortality worldwide and is characterized by persistent airflow limitation and chronic inflammation of the airways [1]. It is commonly associated with environmental risk factors, including cigarette smoking, occupational dust exposure, and air pollution [2]. COPD is increasingly recognized as a systemic disease affecting multiple organ systems beyond the lungs, including the cardiovascular and metabolic systems [3]. One of the notable metabolic disturbances in COPD is dyslipidemia, which involves abnormal lipid metabolism and is strongly linked to systemic inflammation [4].Several studies have demonstrated that COPD patients often exhibit elevated levels of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein (LDL), alongside decreased levels of high-density lipoprotein (HDL) [5]. Smoking, a major risk factor for COPD, also contributes to lipid abnormalities by increasing oxidative stress and inflammation, leading to alterations in lipid metabolism [6]. Moreover, the chronic hypoxia associated with COPD can further exacerbate dyslipidemia by impairing lipid oxidation and promoting fat accumulation [7].The relationship between lipid profile alterations and COPD severity remains an area of ongoing research. Some studies suggest that lipid abnormalities worsen with increasing COPD severity, potentially due to escalating systemic inflammation and oxidative stress [8]. However, other studies report conflicting results, highlighting the need for further investigation [9]. The GOLD (Global Initiative for Chronic Obstructive Lung Disease) classification system categorizes COPD severity based on spirometric measures, particularly the forced expiratory volume in one second (FEV1). Understanding how lipid profiles correlate with GOLD-defined COPD stages could provide insights into the systemic effects of COPD and inform better management strategies [10].This study aims to analyze lipid profile patterns in COPD patients and their correlation with disease severity. By identifying specific lipid abnormalities associated with different COPD stages, this research may contribute to improved risk stratification and targeted therapeutic interventions for COPD patients [11].

Methods:

This cross sectional study conducted in Department of Pulmonology at Jinnah Postgraduate Medical Center from September 2024 to March 2025 in 6 months, in a tertiary care hospital. The overall number of 96 COPD patients with minimal diseases were included in the study and divided into the groups of mild, moderate, severe, and very severe disease based on the GOLD. Following the informed consent, the complex history, physical, and pulmonary functions were carried out. Blood collection was done in a fasting state and used to measure the lipid levels as Total Cholesterol (TC), Triglycerides (TG), LDL, and HDL. Known metabolic or any hepatic disorder excluded the patients. Biochemical assessments of all kinds were conducted in one and the same accredited laboratory with the use of standardized procedures. Data were registered and processed with the help of SPSS version 24.0.

- **INCLUSION CRITERIA:**

Following patients will be included:

- Adults aged ≥40 years.
- Stable COPD patients categorized into

severity stages using spirometer.
- Patients not on lipid-lowering medications.

- **EXCLUSION CRITERIA:**

Following patients will be excluded:
- Patients with known diabetes, liver disease, or renal disease.
- Patients with acute exacerbations of COPD within the last four weeks.
- Patients unable to undergo spirometry.

Ethical Approval Statement:

The ethical approval will be under the review board of the institution. All the respondents will give an informed consent. Patient data on security will be secured.**Ehical approval No.F.2-81/2024-GENL/289-A/JPMC**

Data Collection:

There were recorded evidence on patient demographics, clinical history, smoking index, body mass index (BMI), GOLD staging and spirometry data. Blood samples were drawn in fasting condition and taken to perform the profile of lipid. The severity of the disease was coded to GOLD. Conventional case report forms were used to collect data which were checked against the other by two independent study in ascertaining accuracy.

Statistical Analysis:

The analysis of the statistics was conducted in the software of SPSS version 24.0. Demographic variables were computed by using descriptive statistics. Lipid measures by ANOVA and independent t-tests with GOLD stages were compared. Associations were assessed using Pearson correlation. Stat circular bilateral probabilities significance was of $P < 0.05$.

Results:

96 COPD patients whose average age was 62.4 8.3 years. Of those, 66 (68.7%) were males as well as 30 (31.3%) were females. Distribution by GOLD staging was Stage I (12.5%), Stage II (34.4%), Stage III (30.2% and Stage IV (22.9). The average level of HDL was also much lower in patients with GOLD Stage III and IV than patients with Stage I and II ($p = 0.002$). The levels of triglyceride and LDL were found to rise with the severity of the disease and the values were statistically significant (TG: $p = 0.01$; LDL: $p = 0.03$). There was no consistent trend observed in the levels of total cholesterol though ($p = 0.09$). The level of TG was found to have a negative correlation with FEV1% and HDL had a positive correlation with parameters of lung function. Lipid abnormalities were also more common in patients with advanced GOLD stages with low HDL levels (<40 mg/dL) and high triglyceride levels (>150 mg/dL). It implies vigorous relation between airflow limitation dynamics deteriorating and dyslipidemia potentially caused by the overall inflammation and physical inactivity during severe illness.

Table 1: Demographic and Clinical Characteristics of the Study Population (N = 96)

Parameter	Value
Mean Age (years)	62.4 ± 8.3
Gender (Male/Female)	66 (68.7%) / 30 (31.3%)
BMI (kg/m²)	23.8 ± 3.1
Smoking History (Pack-years)	38.6 ± 11.4
Duration of COPD (years)	6.2 ± 3.7

Table 2: Distribution of Patients According to GOLD Staging

GOLD Stage	Number of Patients (n)	Percentage (%)
Stage I (Mild)	12	12.5%
Stage II (Moderate)	33	34.4%
Stage III (Severe)	29	30.2%
Stage IV (Very Severe)	22	22.9%
Total	96	100%

Table 3: Lipid Profile in COPD Patients by GOLD Stage (Mean ± SD)

Lipid Parameter	Stage I	Stage II	Stage III	Stage IV	p-value
Total Cholesterol (mg/dL)	180.3 ± 25.7	185.6 ± 28.3	189.2 ± 30.1	191.4 ± 29.6	0.09
Triglycerides (mg/dL)	142.6 ± 31.4	157.9 ± 35.1	172.3 ± 37.5	181.7 ± 38.6	**0.01**
LDL (mg/dL)	108.5 ± 18.2	113.3 ± 21.7	121.4 ± 24.3	125.7 ± 27.6	**0.03**
HDL (mg/dL)	45.7 ± 6.3	42.1 ± 5.7	38.9 ± 5.1	35.3 ± 4.6	**0.002**

Table 4: Correlation Between Lipid Parameters and FEV1 (%)

Lipid Parameter	Correlation Coefficient (r)	p-value
Total Cholesterol	-0.152	0.14
Triglycerides	**-0.328**	**0.01**
LDL	-0.266	0.03
HDL	**+0.412**	**0.002**

Table 5: Prevalence of Dyslipidemia in COPD Patients by GOLD Stage

Dyslipidemia Type	Stage I	Stage II	Stage III	Stage IV	Total (n = 96)
Low HDL (<40 mg/dL)	2 (16.7%)	11 (33.3%)	19 (65.5%)	21 (95.4%)	53 (55.2%)
High TG (>150 mg/dL)	3 (25.0%)	14 (42.4%)	18 (62.1%)	20 (90.9%)	55 (57.3%)
High LDL (>130 mg/dL)	1 (8.3%)	6 (18.2%)	12 (41.4%)	15 (68.1%)	34 (35.4%)

Discussion:

The pattern of lipid profile of COPD patients and its association with the disease severity. The results indicated that there was inversely proportional correlation between HDL concentration and COPD severity whereas there was a positive relationship between increasing levels of triglycerides and LDL levels with progressively higher GOLD phases [12]. Such findings imply that systemic inflammation and metabolic disfunction become more relevant as COPD advances. Our results are consistent with several past study studies which underline the ubiquitous incidence of dyslipidemia amidst individuals with COPD. Celli et al. highlighted that systemic inflammation tends to crop up in COPD patients and result in metabolic syndrome with dyslipidemia being an essential component [13]. It is also possible that the chronic inflammatory condition could adversely influence the process of lipoprotein metabolism that modifies the activity of enzymes of lipoprotein lipase, hepatic lipase that produces changes in HDL and triglyceride levels. Sharma et al. showed similar tendencies, where HDL was drastically reduced in the severe and very severe patients with COPD and triglycerides and LDL went up proportionately [14]. They suggested that these

alterations may be explained with protracted oxidative stress, inactive lifestyle, and raised the level of pro-inflammatory cytokines: IL-6 and TNF-alpha. Such inflammatory mediators suppress the production of HDL and stimulate hepatic synthesis of triglycerides, which changes the lipid profile Additional evidence is provided by studies of Gan et al., who performed meta-analysis that demonstrated that the level of circulating inflammatory markers is elevated in patients with COPD and is independently related to the development of cardiovascular diseases, insulin resistance, and dyslipidemia [15]. Therefore, lipid disorders in COPD can be the factor and the result of systemic complications. Moreover, the negative correlation between declining FEV1 and a deteriorating lipid profile was confirmed by the study conducted by Lam et al., who showed that it is lung deterioration that correlates with elevated triglycerides and LDL and decreased HD (in spite of the fact that age, smoking, and BMI are also considered the major confounding variables) This further supports the idea that in the case of COPD patients, lung dysfunction and abnormalities in metabolism proceed together. Interestingly, in our study the level of total cholesterol was not consistent throughout the GOLD stages. Such an observation is indicated in a report by Watz et al., who indicated that there is no significant change in the total cholesterol as the COPD worsens [16]. This could be described by the effect of the LDL and HDL fluctuation tending to equalize each other by resulting in the net effect of zero on the total cholesterol. Also, there could be some other implications of the connection between HDL levels and the severity of COPD. HDL does not merely protect cholesterol transport against reverse cholesterol transport but also contains antioxidant, anti-inflammatory, endothelial-stabilizing properties [17]. Lower levels of HDL might thus enhance vascular lesion and cause more cardiovascular accidents in the patients with COPD. Study conducted by Iwamoto et al. also showed that reduced HDL corresponded to increased carotid intima-media thickness in a test using COPD patients, which showed accelerated atherosclerosis in the population [18]. Such results reveal the necessity of cardiovascular risk evaluation and early treatment in the management of COPD. In their other related study, Çoban et al. compared the lipid levels of stable and exacerbating COPD patients and showed that there was more increased dyslipidemia associated with acute exacerbations and that therefore lipid metabolism could be dynamic and affected by the disease activity [18]. This is because we have only selected the stable COPD patients hence it gives a baseline depiction on the aberration of lipids [19,20].

Conclusion:

The study shows a significant relationship between COPD severity and abnormalities in lipids. In advanced stages, there were lower levels of HDL and elevated levels of triglycerides, which means the higher cardiovascular risk. The regular follow-up of lipid measurement among COPD patients may help early identify the problem and preventive measures, which may have long-term positive impacts on overall management of the disease.

Limitations:

The cross-sectional nature and single-center location of this study were its limitations, and they can limit the application of results. The factors of lifestyle, dietary habits, as well as inflammatory components were not considered, which may impact on the levels of lipids. The sample size should be larger with more diversity giving more statistical power and generalization.

Future Findings:

Longitudinal studies to demonstrate causal connection between dyslipidemia and COPD progression are to be introduced in the future studies. The investigation of the effects of lipid-lowering treatment on lung status and cardiovascular events can present the possible methods of combined treatment. Additional inflammatory and oxidative stress markers would also help explain the underlying pathophysiological processes.

Abbreviations:

1. COPD	Chronic Obstructive Pulmonary Disease
2. HDL	High-Density Lipoprotein
3. LDL	Low-Density Lipoprotein
4. TG	Triglycerides
5. TC	Total Cholesterol
6. VLDL	Very Low-Density Lipoprotein
7. FEV1	Forced Expiratory Volume in 1 Second
8. FVC	Forced Vital Capacity
9. GOLD	Global Initiative for Chronic Obstructive Lung Disease
10. BMI	Body Mass Index

Disclaimer: Nil
Conflict of Interest: Nil
Funding Disclosure: Nil

Authors Contribution

Concept & Design of Study: **SajjadAli[1],Nousheen Ahmed[2]**
Drafting:**Saifullah chachar[3]**
Data Analysis:**Naveen Balachand[4],Nisar Fatima[5]**
Critical Review:**Zahoor jatoi[6],Sadam[7]**
Final Approval of version: All Mentioned Authors Approved The Final Version.
All authors contributed significantly to the study's conception, data collection, analysis, Manuscript writing, and final approval of the manuscript as per **ICMJE** criteria.

REFERENCE

1. Bilia AR, Bergonzi MC. The G115 standardized ginseng extract: an example for safety, efficacy, and quality of an herbal medicine. Journal of ginseng research. 2020;44(2):179-93.
2. Calvier L, Herz J, Hansmann G. Interplay of Low-Density Lipoprotein Receptors, LRPs, and Lipoproteins in Pulmonary Hypertension. JACC Basic to translational science. 2022;7(2):164-80.
3. Chanachon PN, Jotikasthira W, Kiewngam P, Sawatchai A, Kanchongkittiphon W, Manuyakorn W. TG/HDL-C Ratio Independent of Obesity Associates with Airflow Obstruction in Children with Asthma. Indian journal of pediatrics. 2022;89(1):92.
4. Clarenbach CF, Sievi NA, Kohler M. Annual progression of endothelial dysfunction in patients with COPD. Respiratory medicine. 2017;132:15-20.
5. Gunay S, Sariaydin M, Acay A. New Predictor of Atherosclerosis in Subjects With COPD: Atherogenic Indices. Respiratory care. 2016;61(11):1481-7.
6. Kotlyarov S. High-Density Lipoproteins: A Role in Inflammation in COPD. International journal of molecular sciences. 2022;23(15).
7. Lenártová P, Gažarová M, Mrázová J, Kopčeková J, Habánová M, Chlebo P, et al. Obesity, smoking status and their relationships in selected population groups. Roczniki Panstwowego Zakladu Higieny. 2021;72(3):291-9.
8. Li C, Yan L, Song J. [Plasma level of chemerin in COPD patients and the relationship between chemerin and lipid metabolism]. Zhong nan da xue xue bao Yi xue ban = Journal of Central South University Medical sciences. 2016;41(7):676-83.

9. Li C, Yan L, Xu J. [Correlations between lipid ratio/oxidative stress status in COPD patients and pulmonary hypertension as well as prognosis]. Zhong nan da xue xue bao Yi xue ban = Journal of Central South University Medical sciences. 2016;41(11):1168-74.
10. Li H, Liu Y, Wang L, Shen T, Du W, Liu Z, et al. High apolipoprotein M serum levels correlate with chronic obstructive pulmonary disease. Lipids in health and disease. 2016;15:59.
11. Markelić I, Hlapčić I, Rogić D, Rako I, Samaržija M, Popović-Grle S, et al. Lipid profile and atherogenic indices in patients with stable chronic obstructive pulmonary disease. Nutrition, metabolism, and cardiovascular diseases : NMCD. 2021;31(1):153-61.
12. Rafie S, Moitra S, Brashier BB. Association between the Serum Metabolic Profile and Lung Function in Chronic Obstructive Pulmonary Disease. Turkish thoracic journal. 2018;19(1):13-8.
13. Shirahata T, Sato H, Yogi S, Inoue K, Niitsu M, Miyazawa H, et al. Possible association of high-density lipoprotein cholesterol levels with trunk muscle deficits and decrease in energy expenditure in patients with or at risk for COPD: A pilot study. Respiratory investigation. 2022;60(5):720-4.
14. Tanaka S, Tymowski C, Tran-Dinh A, Meilhac O, Lortat-Jacob B, Zappella N, et al. Low HDL-Cholesterol Concentrations in Lung Transplant Candidates are Strongly Associated With One-Year Mortality After Lung Transplantation. Transplant international : official journal of the European Society for Organ Transplantation. 2023;36:10841.
15. Vicol C, Buculei I, Melinte OE, Dobrin ME, Stavarache EI, Gavrilescu CM, et al. The Lipid Profile and Biochemical Parameters of COPD Patients in Relation to Smoking Status. Biomedicines. 2022;10(11).
16. Xuan L, Han F, Gong L, Lv Y, Wan Z, Liu H, et al. Association between chronic obstructive pulmonary disease and serum lipid levels: a meta-analysis. Lipids in health and disease. 2018;17(1):263.
17. Xue X, Cai H, Chai Z, Shang F, Guan W, Zhang L, et al. Efficacy of statin therapy in chronic obstructive pulmonary disease: a systematic review and meta-analysis from 2008-2019. Panminerva medica. 2023;65(3):376-84.
18. Yakar HI, Kanbay A. Could monocyte level/HDL cholesterol ratio predict cardiovascular diseases in patients with COPD? Nigerian journal of clinical practice. 2020;23(4):450-5.
19. Ye Y, Xu H, Quan L, Zhu L, Zeng J, Zhou T, et al. The Lipid-lowering Effects of R-bambuterol in Healthy Chinese Volunteers: A Randomized Phase I Clinical Study. EBioMedicine. 2015;2(4):356-64.
20. Zhao T, Wang C, Duan B, Yang P, Wu J, Zhang Q. Altered Lipid Profile in COVID-19 Patients and Metabolic Reprogramming. Frontiers in microbiology. 2022;13:863802.