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EXPLORING THE LINK BETWEEN CHRONIC OBSTRUCTIVE PULMONARY DISEASE, BRONCHIAL ASTHMA, AND LIPID PROFILES: A CROSS-SECTIONAL STUDY.

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ABSTRACT.

Introduction:
This pilot cross-sectional study intended to explore the relationship between Chronic Obstructive Pulmonary Disease (COPD), Bronchial Asthma, and serum lipid levels (HDL, LDL, Total Cholesterol, Triglycerides) as well as serum urea and creatinine. Conducted at Patna Medical College and Hospital, Patna it involved 21 clinically diagnosed stable COPD and bronchial asthma patients. The study cohort was categorized into Mild, Moderate, and Severe COPD based on GOLD criteria.

Methods:
Data collection involved detailed medical histories and fasting blood specimens. Serum lipids were assessed via enzymatic colorimetric assays, and LDL, HDL, and total cholesterol levels were calculated. Fasting and postprandial blood sugar levels were measured.

Results:
The study revealed associations between COPD severity and lipid profiles. Notably, Total Cholesterol was 177.19 mg/dL, HDL was 41.87 mg/dL, LDL was 109.92 mg/dL, and Triglycerides were 115.58 mg/dL. An increase in airway resistance, detectable with an impulse oscillometer, was observed even with minor airway alterations. The study indicated significant correlations between serum triglycerides, LDL, LDL/HDL ratio, cholesterol/HDL ratio, and elevated airway resistance in individuals with bronchial asthma and COPD.

Conclusion:
This pilot study provides initial insights into the interplay between COPD, Bronchial Asthma, and lipid profiles. While lipid findings generally fell within the normal range, elevated LDL levels emphasize the need for monitoring and potential interventions to mitigate cardiovascular risk in COPD patients.

Recommendations:
Healthcare providers should regularly monitor serum lipid levels, urea, and creatinine in COPD and bronchial asthma patients, particularly those with severe COPD, to detect and manage abnormalities early, potentially enhancing patient outcomes. Further research with larger sample sizes is required to validate these findings and develop comprehensive guidelines for the care of COPD and bronchial asthma patients.

Keywords: Chronic Obstructive Pulmonary Disease, Lipid Profile, Bronchial Asthma, Serum Level
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INTRODUCTION.
Chronic obstructive pulmonary disease (COPD) is a prevalent etiology of significant mortality and morbidity on a global scale. The problem in question represents a significant concern in the realm of public health, necessitating comprehensive oversight and intervention beginning at the prime healthcare level [1]. COPD is categorized by an irreversible, progressive, and persistent limitation of airflow, which is accompanied by symptoms such as dyspnea, cough, and expectoration. These symptoms are primarily instigated by substantial contact with air impurities [2]. As per the report by the World Health

Organization, the worldwide occurrence of COPD is assessed to affect approximately 210 million individuals. COPD ranks fifth among the foremost causes of mortality globally, attributable to various health-related factors. COPD is anticipated to become the 3rd leading cause of death globally by 2030, as indicated by multiple sources [3,4].

According to the GOLD 2023 guidelines, COPD is a pulmonary ailment of a diverse nature, marked by persistent respiratory signs such as dyspnea, sputum production, and cough. These symptoms arise from the aberrations present in the airways, namely bronchitis and bronchiolitis, as well as in the alveoli, specifically emphysema. Consequently, this condition leads to an enduring and frequently worsening obstruction of airflow. According to GINA 2022 guidelines, Bronchial Asthma is a multifaceted pathological condition, distinguished by persistent inflammation of the airways. The condition under consideration is characterized by a documented medical record of respiratory symptoms, including wheezing, dyspnea, thoracic constriction, and cough, which exhibit fluctuations in both frequency and severity. Additionally, there is evidence of intermittent expiratory airflow restriction, which may progress to a state of sustained limitation.

Metabolic syndrome is a frequently encountered extrapulmonary comorbidity observed in individuals diagnosed with COPD and bronchial asthma. The association between COPD and bronchial asthma with dyslipidemia, a significant element of metabolic syndrome, is unequivocal. Furthermore, it is important to note that both COPD and Bronchial Asthma are chronic inflammatory conditions that can also affect renal function and profile over an extended period.

While limited study has been conducted on the impression of dietary patterns on the respiratory health of individuals with COPD, there remains a lack of knowledge regarding the influence of circulating lipoproteins in the context of COPD. Nevertheless, it is plausible to believe that a rational perception of the association between elevated levels of free lipids in the bloodstream and COPD may arise from an underlying mechanism involving impaired fat oxidation, ultimately culminating in the expansion of metabolic syndrome. Two case-control studies have demonstrated elevated levels of circulating low-density lipoprotein in individuals diagnosed with bronchial asthma and COPD when compared to individuals without these respiratory conditions [5,6]. Nevertheless, the precise association between lipid profile and lung function in individuals with COPD remains indeterminate. The primary aim of this pilot cross-sectional study is to inspect the correlation between COPD and bronchial asthma, and the serum concentrations of HDL, LDL, total cholesterol (TC), triglyceride, as well as serum urea and serum creatinine.

MATERIAL AND METHODS.

Study Design.

This case-control investigation employed a cross-sectional study design.

Study Setting.

The study was conducted within the Department of Physiology in collaboration with the Department of Respiratory Medicine at Patna Medical College and Hospital, Patna.

Participants.

The study included a cohort of 21 patients who were clinically diagnosed with stable Chronic Obstructive Pulmonary Disease (COPD) and bronchial asthma. These patients were selected from the outpatient department of the Respiratory Department.

Categorization.

The study cohort was stratified into three distinct cohorts based on the GOLD guidelines, classified as Mild, Moderate, and Severe COPD.

Ethical Considerations.

Informed consent was obtained from each participant, ensuring their voluntary participation in the study and adherence to ethical principles.

Data Collection.

An inclusive evaluation of the patient's medical background was conducted, encompassing details of present and past ailments pertinent to the research protocol, familial medical history, addiction history, drug usage history, surgical history, and other relevant factors.

Blood Sample Collection.

Blood specimens were procured from the study subjects during the early hours of the day, ensuring a minimum fasting period of 12 hours since their most recent ingestion.

Serum Separation.

The serum was separated and subsequently stored at a temperature of -80°C for future utilization.

Laboratory Measurements.

- The levels of total cholesterol, triglyceride, and HDL were assessed utilizing available kits following enzymatic colorimetric tests.

- The levels of LDL and very low-density lipoprotein (VLDL) were determined utilizing the Friedewald equation.
- Fasting blood sugar levels were assessed using a commercially accessible kit, following the guidelines outlined in the instruction manual.
- A subsequent blood sample was obtained at the two-hour mark following the ingestion of a meal to assess the postprandial glycemic response.

Inclusion criteria.

Patients who had not experienced any exacerbations within the preceding two-month period and were clinically diagnosed with stable COPD were included. The present investigation incorporated the subsequent criteria for participant selection:

- Patients with COPD and bronchial asthma who have been diagnosed clinically and confirmed through spirometry, following the standardization guidelines set by ATS and ERS, and are currently in stable condition. These patients have been categorized based on GOLD guidelines.
- The subjects involved in this study were individuals who did not exhibit any documented cardiovascular, metabolic, neurological, musculoskeletal, endocrinal, or respiratory conditions, except COPD.

Exclusion criteria:

Patients with a history of recent exacerbations or other medical conditions that could confound the study results were excluded. The subsequent criteria were deemed ineligible for inclusion in the study:

- Individuals afflicted with a respiratory ailment, excluding chronic obstructive pulmonary disease (COPD), alongside any prevailing cardiovascular, neurological, endocrinal, and musculoskeletal pathologies that possess the potential to impede respiratory functionality, as duly verified by the attending medical practitioner.
- The patients exhibited a manifestation of significantly advanced COPD.
- Individuals receiving pharmacotherapy for the management of dyslipidemia.

Statistical analysis.

The numbers are presented in either the form of mean values accompanied by their respective standard deviations or as numerical counts accompanied by their corresponding percentages. The present study employed multiple linear regression models to investigate the relationship between HDL, total cholesterol level, and pulmonary function. The statistical studies were conducted utilizing SAS version 13.0. Statistical relevance was operationally defined as a two-tailed p-value below the threshold of 0.05.

RESULT.

The study involved 21 participants, with a fairly balanced distribution of gender (11 males and 10 females) and the researchers investigated various parameters related to COPD and lipid profiles among individuals. They categorized the severity of COPD into three groups i.e., Mild COPD (0.14 ± 0.03), Moderate COPD (0.33 ± 0.05), and Severe COPD (0.33 ± 0.01) as mentioned in Table 2.
Regarding lipid profiles (Table 1), the study provided valuable insights into cardiovascular health where the total cholesterol was 177.19 mg/dL, indicating an overall moderate cholesterol level. The HDL level was measured at 41.87 mg/dL, which fell within the normal range. Also, the mean LDL level was 109.92 mg/dL, suggesting a moderate LDL level. Additionally, the participants had an average triglyceride level of 115.58 mg/dL, indicating moderate triglyceride levels. Also, the urea (46.04 ±7.2) and creatinine (0.83 ± 0.15) levels were determined along with lipid profiling of the study group.

Table 1: Basic parameters of the study population

Characteristics	(Mean ± S.D.)
Participants	21
Sex (M: F)	11:10
Age	54.57 ± 6.9
Urea	46.04 ±7.2
Creatinine	0.83 ± 0.15
Cholesterol	177.19 ± 26.4
High Density Lipoprotein (HDL)	41.87 ± 8.4
Low Density Lipoprotein (LDL)	109.92 ± 22.1
Triglycerides	115.58 ± 30.2

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Table 2: COPD index in the study population

Study groups	COPD index (Mean ± S.D.)
Mild COPD	0.14 ±0.03
Moderate COPD	0.33 ± 0.05
Severe COPD	0.33 ± 0.01

DISCUSSION.

In this study involving 21 participants (11 males and 10 females), researchers investigated parameters related to COPD and lipid profiles. COPD severity was categorized into Mild (0.14 ± 0.03), Moderate (0.33 ± 0.05), and Severe (0.33 ± 0.01). Lipid profiles revealed insights into cardiovascular health (Total cholesterol: 177.19 mg/dL, HDL: 41.87 mg/dL, LDL: 109.92 mg/dL, and Triglycerides: 115.58 mg/dL). Also, the urea and creatinine levels were determined along with lipid profiling of the study group.

COPD commonly presents with either emphysematous or bronchitic patterns, which are predominantly linked to adipose tissue composition. The bronchitic pattern of COPD is distinguished by the occurrence of adipose tissue accumulation, whereas emphysema is related to a decrease in adipose tissue distribution. Within the confines of this particular investigation, the current study observations have revealed a notable prevalence of patients exhibiting a relatively diminished BMI, which serves as a pointer of an emphysematous pattern. Nevertheless, given the socioeconomic status of the study participants, it is plausible to consider that a diminished BMI may also be related to suboptimal nutritional intake. The impact of nutritional status on COPD has been extensively studied, and it has been observed that a decrease in BMI is related to higher rates of mortality from all causes specifically from COPD-related causes. However, it has not been demonstrated that a reduced BMI affects the severity of the disease [10]. In the context of GOLD Stage 1–2 COPD patients, it has been observed that an increased BMI is related to a greater risk of mortality. However, it is noteworthy that overweight and obese individuals with COPD in GOLD Stages 3 and 4 exhibit a comparatively lower relative mortality risk [10].

The outcomes of the present study reveal raised levels of serum triglyceride in healthy individuals when related to patients diagnosed with COPD, which aligns with a previously documented study [11]. Despite the absence of a definitive explanation in the preceding study, the results may be elucidated from a nutritional perspective. Within the scope of the investigation, it was observed that the individuals afflicted with COPD, predominantly of the female gender, exhibited a comparatively diminished consumption of animal-derived fats as part of their dietary intake. This observation potentially correlates with a decreased generation of non-oxidized lipid by products. Nevertheless, the investigation discovery of an elevated median circulatory LDL level in patients with COPD, despite the lack of statistical significance, aligns with previous investigations [12]. This observation may potentially be attributed to an expedited generation of oxidized lipids as a consequence of tobacco or biomass smoke exposure [13].

The study revealed a significant association between serum triglyceride, LDL, HDL, triglycerides, and cholesterol with elevated airway resistance in individuals diagnosed with bronchial asthma and COPD. There is a notable escalation in airway resistance, even in the presence of a slight alteration in the diameter of the airway. This increase can be attributed to airway remodeling or the presence of an obstructive characteristic. Notably, this change can be readily identified using an impulse oscillometer, whereas conventional lung function testing may fail to detect it. The aforementioned observation suggests the potential existence of intercommunication between lipid metabolites present in the bloodstream and the structural constituents of the pulmonary system. This is due to the heightened stiffness observed in the airway parenchyma, which can be attributed to the accumulation of esterified or oxidized lipid molecules within the intracellular milieu.

The outcomes of the current study reveal an inverse correlation between triglyceride levels and BMI, as well as FRC. These findings suggest that lipid metabolites may have a detrimental impact on the bio-physical characteristics of the pulmonary system by diminishing the expiratory reserve volume. It is noteworthy that the residual volume (RV) remains relatively stable in individuals with obesity. [15]. Nevertheless, the precise intricacies of this mechanism remain incompletely elucidated. According to the literature, individuals diagnosed with COPD are at an increased susceptibility to the development of metabolic syndrome. This can be attributed to the elevated release of non-esterified fatty acids into the bloodstream. Notably, the skeletal muscles have a propensity for triglycerides (TGRs) and free fatty acids, thus rendering individuals with dyslipidemia or unregulated lipid levels in circulation potentially vulnerable to this risk [14]. In a study conducted by Cirillo *et al*. [16], involving a total of 18162 individuals

from the third National Health and Nutritional Examination Survey, it was determined that there was no statistically noteworthy impact of total cholesterol and LDL on the decline of FEV1. This observation aligns with the findings of our study. It is imperative to bear in mind that the assessment of airway dysfunction in individuals with obesity or related conditions should not solely rely on the measurement of forced expiratory volume in one second (FEV1). This is because the structural modifications associated with these conditions primarily affect the peripheral or small airways, which are not adequately captured by FEV1. Consequently, the sensitivity of FEV1 in accurately evaluating the intricate and diverse alterations in these airways is limited [17]. Henceforth, the assessment of airway resistance may serve as a more pertinent indicator for monitoring minuscule alterations.

CONCLUSION.

In conclusion, this pilot study provides preliminary insights into the association between COPD, Bronchial Asthma, and lipid profiles. While the lipid profile findings are generally within the normal range, the elevated LDL levels suggest the need for monitoring and potential interventions to reduce cardiovascular risk, especially in individuals with COPD. Additional research with a greater sample size is warranted to confirm these results and establish stronger associations. Additionally, it's important to consider other factors that may contribute to COPD severity and lipid profile alterations.

LIMITATIONS.

The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

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LIST OF ABBREVIATIONS

COPD: Chronic Obstructive Pulmonary Disease

HDL: High Cholesterol Level

LDL: Low Cholesterol Level

TC: Total Cholesterol

VLDL: Very Low-Density Lipoprotein

BMI: Body Mass Index

RV: Residual Volume

TGRs: Triglycerides

FEV1: Forced Expiratory Volume in One Second

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The study was not funded.

CONFLICT OF INTEREST.

The authors report no conflicts of interest in this work.

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