Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 08, 2024

Glycemic profile and lipid profile in COPD patients with and without Metabolic syndrome

Binod Mahatoi[1], Dr. Shreya Nigoskar[2], Lingidi Jhansi Lakshmi[3], Doddigarla Zephy[4*].

[1] Ph. D. Scholar, *Department of Biochemistry, Index Medical college & Research Centre, Malwanchal University, Indore.*

[2] *Professor & Head of the Department, Department of Biochemistry, Index Medical college & Research Centre, Malwanchal University, Indore.*

[3]*Associate Professor, Department of Biochemistry, Hi-Tech Medical College & hospital, Rourkela.*

[4*] *Corresponding author , Associate Professor, Department of Biochemistry, Hi-Tech Medical College & hospital, Rourkela.*

Corresponding author: Doddigarla Zephy

Abstract:

You must change your perspective in order to have a deeper comprehension of the connection between metabolic syndrome (MetS) and chronic obstructive pulmonary disease (COPD). This means using a patient management approach that is more system- and holistic-focused. This change recognizes the reality that the human body is a complex network of interrelated organs and systems and that illness in one area of the body may spread to seemingly unrelated areas of the body. **Aim:** The purpose of this study is to determine the lipid profile, mean blood glucose while fasting, impaired fasting glucose, and COPD patients with and without MetS. **Materials & methods:** After receiving permission from the Institutional Ethics Committee, the researchers started to work on their project. Patients diagnosed with MetS/COPD numbered a total of one hundred. We obtained information on the patient's whole medical history, including details about their occupation, income, smoking habits, diabetes, hypertension, and acute episodes. When determining body composition, height and mass were also taken into consideration. Every patient had a chest x-ray as well as an electrocardiogram. **Result:** The study indicated that fifty-five percent of patients had abdominal obesity, fifty-two percent had hypertension, fifty-two percent had impaired fasting glucose, forty-two percent had elevated triglycerides, and forty-eight percent had inadequate HDL cholesterol. We found hypertension, diabetes, and dyslipidemia to be the most frequent factors, contrary to global research that found abdominal obesity to be the most common. Our department must enhance non-communicable disease screening to detect COPD

patients with undiagnosed diabetes, dyslipidemia, or hypertension. **Conclusion:** Abdominal obesity, high blood pressure, high triglycerides, and low HDL cholesterol were more common in metabolic syndrome patients. Many differences existed between the groups. Patients with COPD who also have diabetes, impaired fasting glucose, dyslipidemia, or high blood pressure should begin adequate antihypertensive medicine, oral hypoglycemic drugs or insulin, and lipid-lowering therapy. Patients with COPD who only have one of these conditions should begin all four therapies. Patients diagnosed with MetS had significantly higher levels of body mass index (BMI), weight, waist-hip ratio, hip circumference, and VLDL cholesterol.

Keywords: Chronic Obstructive Pulmonary disease; Impaired Fasting Glucose; Mean Blood Glucose; Triglycerides; High Density Lipoproteins; Emphysema.

Introduction:

The characteristics of chronic obstructive pulmonary disease (COPD) include enhanced long-term inflammatory response in the lungs and airways to irritating particles or gases, as well as persistent airflow restriction and progression [1]. Sputum output, prolonged coughing, and dyspnea are common symptoms that become worse with time [2]. As the illness worsens, patients often have exacerbations, which may lead to hospitalization as well as increased costs associated with medical treatment [3]. Tobacco use, which is considered the primary risk factor for COPD, is responsible for around 90 percent of all instances of the condition. Other variables that contribute to the development of COPD include things like genetics, respiratory infections, and occupational exposure [4].

Emphysema and chronic bronchitis are the two most common forms of COPD's principal subtypes [5]. Chronic bronchitis may be identified by its telltale symptoms, which include inflammation and constriction of the bronchial tubes. These symptoms manifest themselves in the form of a persistent cough and increased mucus production [6]. Emphysema, on the other hand, is characterized by a breakdown of the alveolar walls, which results in a loss of lung flexibility and a decrease in the capacity for gas exchange [7]. Patients diagnosed with COPD often exhibit combinations of the two types, which may lead to complex clinical presentations. COPD is

routinely misdiagnosed and undertreated despite its severity and prevalence. Early identification and treatment reduce illness costs and improve patient outcomes [8]. Furthermore, it is now acknowledged that COPD is a systemic illness affecting several organ systems, including the metabolic system [9]. It is new that many extrapulmonary symptoms of chronic obstructive pulmonary disease (COPD) are caused by a systemic illness. In a similar vein, metabolic syndrome, sometimes known as MetS, refers to a collection of cardiovascular and metabolic risk factors, as opposed to just referring to metabolic abnormalities by itself. In order to appreciate how COPD and MetS interact with one another, a shift in the dominant paradigm toward a treatment strategy that is more all-encompassing and system-based for patients is required. This modification acknowledges that sickness in one part of the body may spread to other parts of the body that seem to be unconnected, as well as the fact that the human body is a complicated network of interconnected organs and systems. As a result, the purpose of this research is to compare COPD patients who have and do not have MetS in terms of their lipid profiles, mean blood glucose levels when fasting, and levels of impaired fasting glucose.

Materials & methods:

Before the current study was begun, it was reviewed by the appropriate Institutional Ethics Committee, which provided its approval. A study project using a cross-sectional design was carried out, and it included one hundred people who had metabolic syndrome and COPD. The biochemistry department of Index Medical College and Hospital is qualified to participate in the research since it meets all of the requirements. Participants in the study need to be at least 40 years old, have a history, clinical examination, and lung function tests that indicate they have COPD, and they can't have had any exacerbations in the last year. Participants cannot participate if they have active pulmonary TB, malignancy, significant comorbidities that prevent the study from being completed, acute COPD exacerbations, have taken systemic steroids in the past three months, or have cardiovascular disorders.

After giving informed permission, patients were provided all the information they needed to make an informed choice about participating in the experiment. Patients were chosen for participation in the study based on their compliance with the inclusion and exclusion criteria, which were

determined after a thorough examination and history to assess patient eligibility for the research project. There were one hundred people who had COPD and MetS who participated in the trial. The patient was explicitly questioned about their employment, income, smoking habits, blood pressure, and blood sugar levels, as well as any recent changes that may have occurred in their health. The measurements of height and weight were used to derive anthropometric characteristics. Every patient was given both an electrocardiogram as well as a chest x-ray. Patients were regarded to be smokers if they had smoked more than 100 cigarettes throughout their lives. Spirometry will be performed both before and after bronchodilator treatment, and patients will be diagnosed in accordance with GOLD standards after a process that involves collecting a detailed medical history.

Measurements of the individuals' waist circumference, serum HDL, triglycerides, fasting blood glucose, systolic to diastolic blood pressure ratio, and LDL were made in order to identify metabolic syndrome. The participants' systolic and diastolic blood pressure were taken twice at intervals of three minutes after a fifteen-minute rest period. The means of these readings were computed for analysis. The individuals' fasting blood glucose and TAG levels were measured in the morning, after an 8–12 hour fast. The topmost lateral border of each participant's right ileum was measured to ascertain their waist circumference after they had finished a typical exhale. In doing so, the participant's ileum faced the appropriate direction.

The definition of MetS provided by the AHA/NHLBI in 2005 was based on the revised NCEP ATP III criteria, which included three or more of the following indicators to identify the occurrence of MetS. WBC: men ≥90 cm, women ≥80 cm; TAG levels ≥150 mg/dL or medication treatment for elevated TG levels; HDL levels <40 mg/dL in men and <50 mg/dL in women or medication treatment for decreased HDL levels; SBP ≥130 mm Hg or DBP ≥85 mm Hg or antihypertensive medication treatment with a history of hypertension; and FBS levels ≥100 mg/dL are indicative of abdominal obesity.

Statistical analysis:

SPSS 20 will be used in the process of carrying out the statistical analysis. Utilizing the unpaired t-test, compare the mean values of the groups' respective variables. When comparing the means of two or more different categories, we employ the one-way analysis of variance (ANOVA). Multiple regression analyses are used in order to compare the group means. The link between the two variables was investigated with the help of the Pearson correlation. The threshold for significant differences was set at less than 0.05.

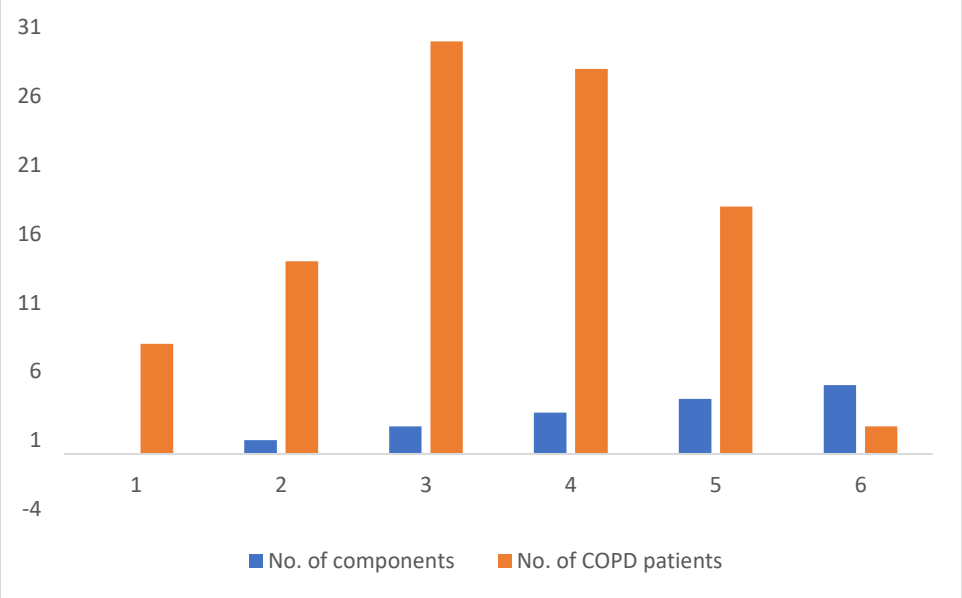
Results:

Table 1: Characteristics of the study population

Variable	Total	Mean	Standard Deviation
FBS (mg/dl)	100	102.4	16.3
Tc (mg/dl)	100	168.2	44.3
HDL (mg/dl)	100	43.1	6.5
LDL (mg/dl)	100	94.2	46.4
TAG (mg/dl)	100	164.2	43.2
VLDL (md/dl)	100	39.2	6.9

In our study, the average waist-hip ratio is 0.98 ± 0.02. Average systolic and diastolic blood pressure in our study (Table 1) was 138.4 ± 16.1 and 91 ± 10.2 mmHg, respectively. On average, FBS is 102.4 ± 16.3 mg/dl. The mean Tc and TAG values are 164.2 ± 43.2 and 168.2 ± 44.3 mg/dl, respectively. Our population has mean HDL, LDL, and VLDL cholesterol readings of 43.1, 94.2, and 39.2 mg/dl.

gure 1: Distribution of MetS Components In COPD Patients



Only two of the participants in our study (figure 2) were found to have all five of the MetS components, while the other seven individuals had none of them at all.Only fourteen patients had only one component of the MetS, whereas thirty people had two components of the MetS. The 46 people who had either one or both of the components of MetS had an increased risk of developing cardiovascular disease and are more likely to go on to develop MetS in the future. As a direct consequence of this, these people need MetS screening.

We discovered that 59% of patients with COPD and 52% of individuals with impaired fasting glucose had MetS (Figure 2). In comparison, 48% of individuals with normal fasting glucose do not experience this. The incidence of metabolic syndrome was higher in both groups—those with impaired fasting glucose and those without—but the difference was not statistically significant ($p > 0.05$).

Figure 3 shows patients with MetS and abdominal obesity from the study population. Fifty-five percent of the individuals in our research were obese in the abdomen. Thirteen patients, or thirty percent, did not have metabolic syndrome, but the remaining thirty-one patients, or seventy percent, had. Thirteen individuals with COPD or MetS did not exhibit any signs of abdominal

obesity. Patients with COPD who are abdominally obese have a significantly higher prevalence of MetS than those who are not (p value < 0.05). This difference exists between patients who are abdominally obese and those who are not.

Figure 2: Impaired fasting glucose and MetS in the study population

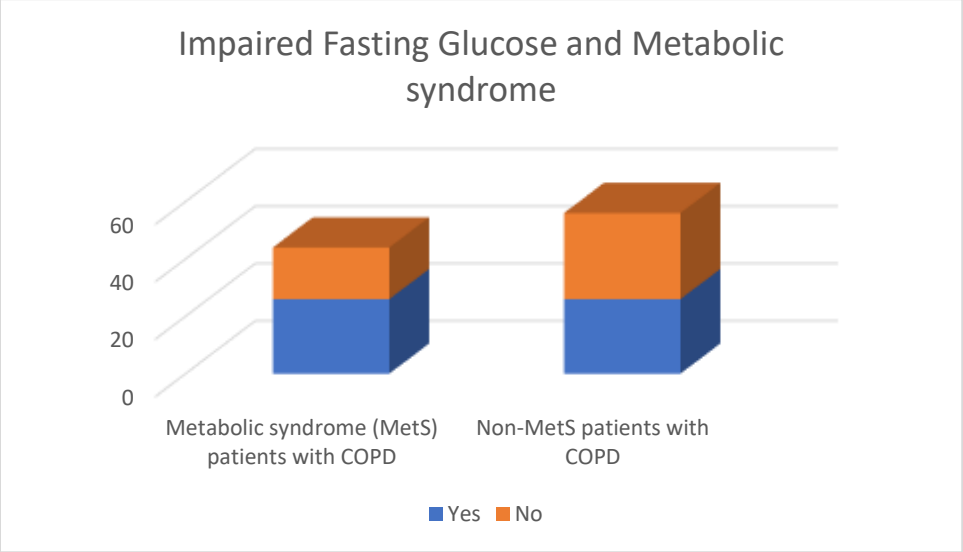


Figure 3: Abdominal obesity and MetS patients in study population

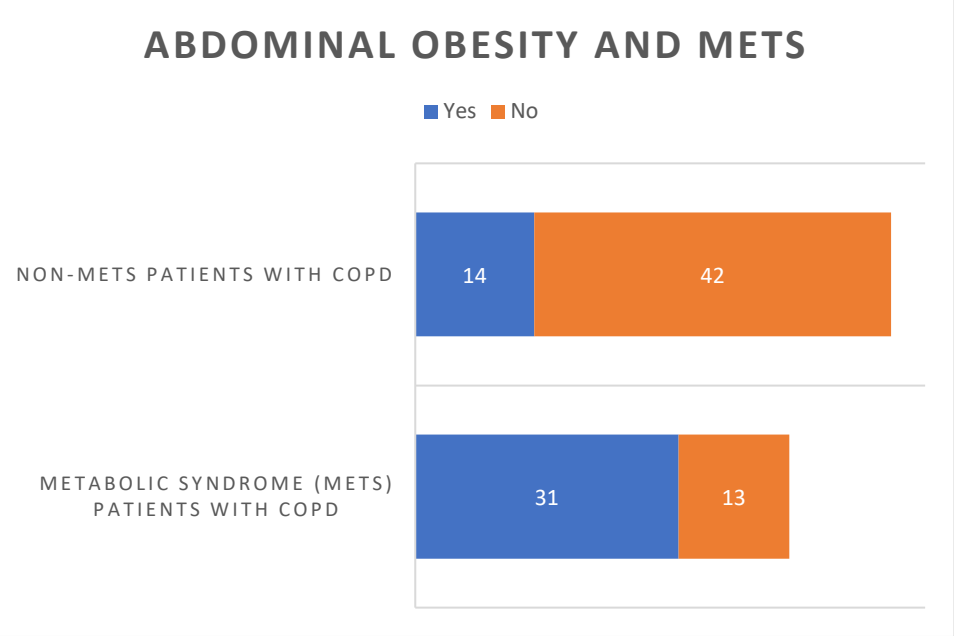
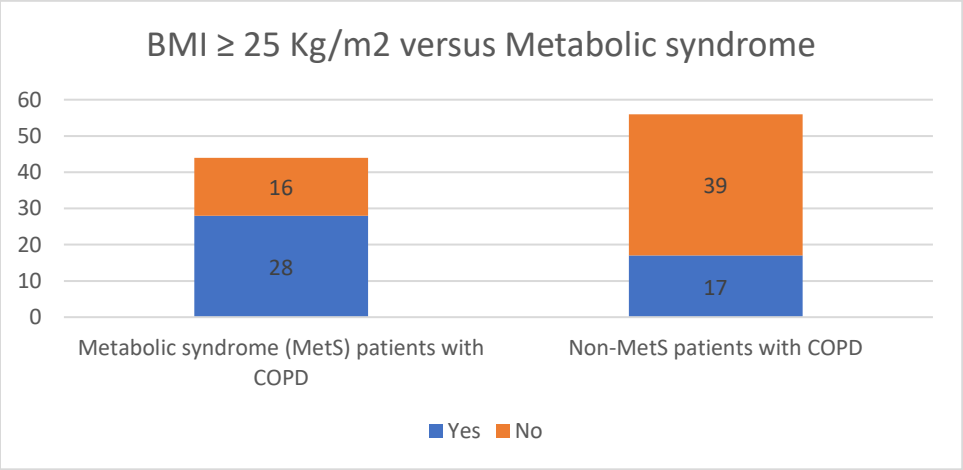
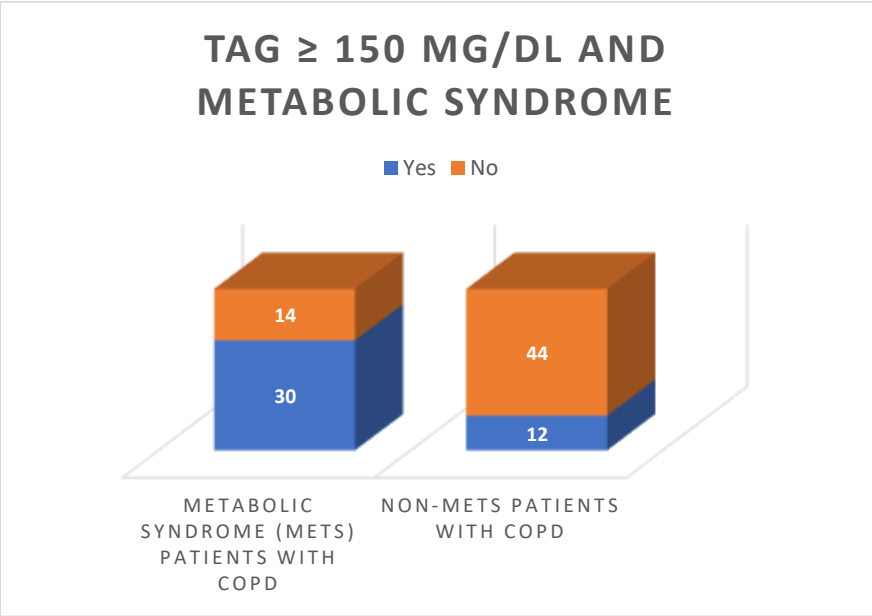


Figure 4: Body Mass index (BMI) ≥ 25 Kg/m^2 and MetS patients in study population



The number of research group members with BMIs more than 25 kg/m2 who suffer from metabolic syndrome is shown in Figure 4. According to this results, 28% of COPD patients had metabolic syndrome and 45% of patients were overweight. Only sixteen people with BMIs under 25 were identified as having metabolic syndrome, nevertheless. Among COPD patients who were overweight, the prevalence of MetS was substantially different ($p < 0.05$) from that of those who were not overweight.

Figure 5: Triglycerides and MetS patients in study population



Only 14 of the people who did not have higher TAG levels were diagnosed with MetS, while 42% of the study group had high TAG levels, and 30 of those patients were diagnosed with MetS (Figure 5). There is a statistically significant difference in the prevalence of MetS between COPD patients who have increased TAG and those who do not have increased TAG, as shown by a p value that is less than 0.05.

Figure 6: Low HDL and MetS patients in study population

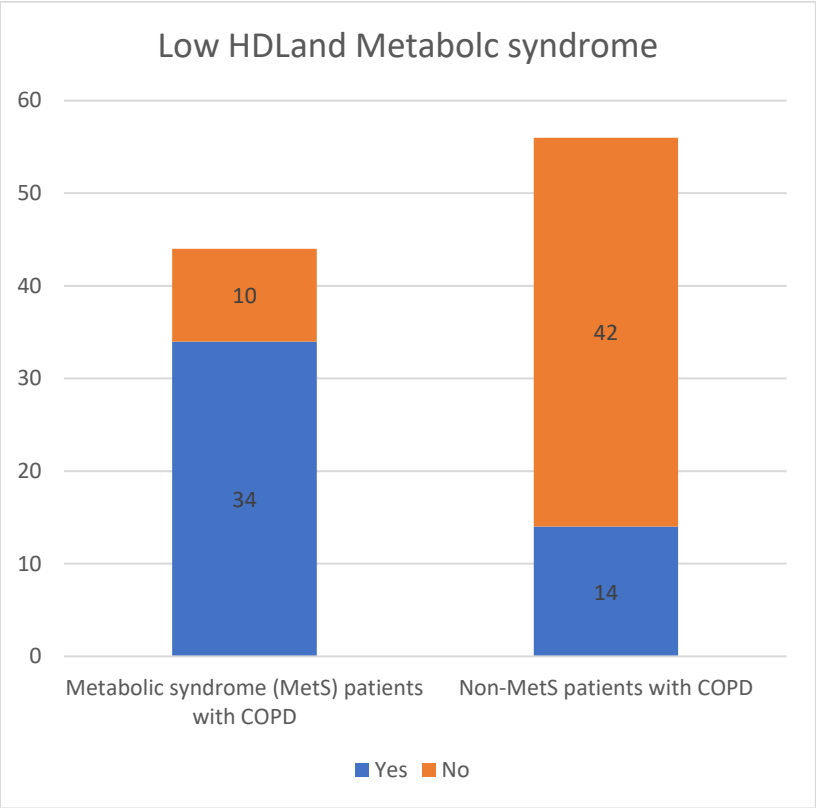
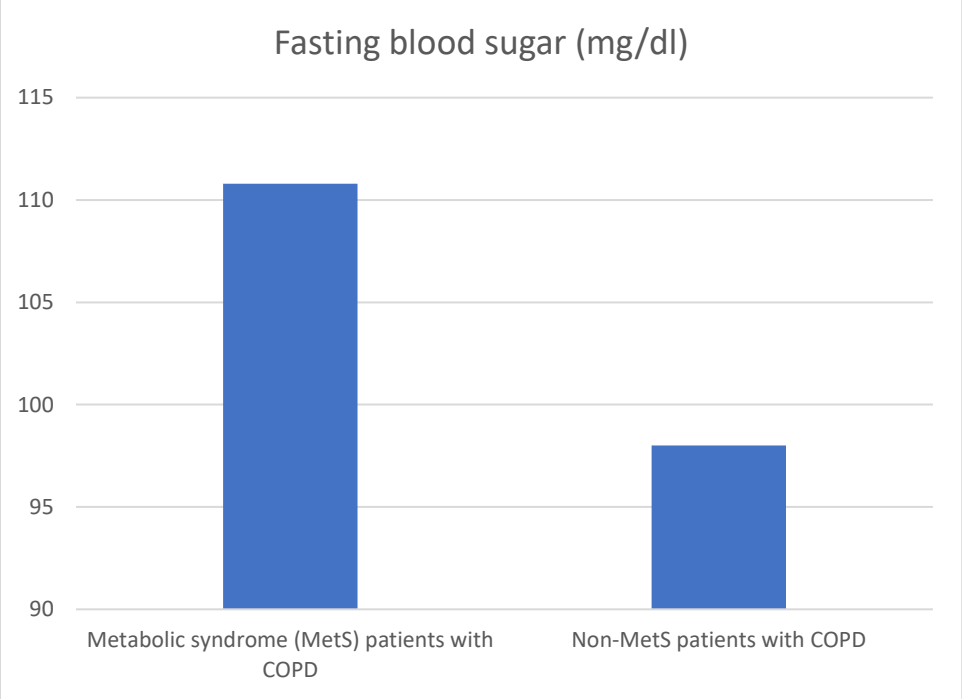


Figure 6 presents the HDL as well as the MetS values for the population under study. Only ten people without low HDL levels had metabolic syndrome, whereas 48 percent of the research group had low HDL levels, and 34 of those patients had metabolic syndrome. There was a statistically significant difference in the prevalence of MetS between patients with COPD who had raised HDL and those who did not have elevated HDL ($p< 0.05$).

Figure 7: Comparison between COPD patients with MetS and non-MetS according to fasting blood sugar



According to our findings, individuals who have metabolic syndrome have mean blood glucose levels during fasting that are 110.8 mg/dl, whereas patients who do not have metabolic syndrome have mean blood glucose levels that are 98.2 mg/dl. A p value that is < 0.05 indicates that there is a statistically significant difference between the two groups.

Discussion:

The mean fasting blood glucose in a research by [10] was higher than the fasting blood glucose in our study (102.4 ± 16.3 mg/dl). While mean triglyceride and HDL cholesterol levels in our sample were 164.2 ± 43.2 mg/dl and 43.1 ± 6.5 mg/dl, respectively, in a research by [11] on MetS in COPD patients, the corresponding values were 136.04 mg/dl and 37. In comparison to the study population of [11], our study population had greater levels of HDL and triglycerides.

The mean Tc in our sample was 168.2 ± 44.3 mg/dl, while the mean LDL was 94.2 ± 46.4 mg/dl. The mean LDL and Tc of earlier studies [9] were found to be lower than the results of our investigation.

In our sample cohort of COPD patients, 44% of them exhibited three or more components of MetS, which indicates that MetS was prevalent in these individuals. The prevalence was found to be 57% in research that was done by [10], which was a higher number than the prevalence that we found in our study. However, the findings of a pooled review of the literature from PUBMED and EMBASE, which included the original research, indicated that the prevalence was 34%, which was lower than the prevalence that we found in our analysis.

Only two of the seven people who participated in our study were devoid of any MetS components, while the other seven individuals contained all five.Only fourteen patients had only one component of the MetS, whereas thirty people had two components of the MetS. The 46 patients with one or both MetS components had a higher risk of cardiovascular disease and MetS in the future. Because of this, they require MetS screening. MetS incidence varied significantly among COPD stages ($p < 0.05$). Many global investigations have confirmed the aforementioned conclusions.

64% of the people who took part in our study were classified as belonging to the upper lower socioeconomic class as well as the lower socioeconomic class (IV and V). In addition, 36% of the participants were from the lower middle class. One of the most significant risk factors for COPD is a low socioeconomic level, and the community that is the focus of this inquiry is a group that is a good match for this risk factor because of the prevalence of overcrowding and repeated infections of the respiratory tract. The prevalence of MetS was found to be 32%, 54%, and 14%, respectively, in classes III, IV, and V, however none of these classes had a significant p value greater than 0.05.

The study's conclusions showed that whereas 59% of individuals with normal fasting glucose levels had metabolic syndrome, 52% of COPD patients had abnormal fasting glucose levels. “When a p-value is greater than 0.05, it means that the difference in the prevalence of MetS between COPD patients with impaired fasting glucose and those without it is not statistically significant. Conversely, there was no difference in the prevalence of MetS between COPD patients without impaired fasting glucose.” In research by [12], the prevalence of high fasting blood glucose was found to be 66%; however, in our evaluation, the prevalence was only 50%, which was less than what was discovered in the previous study. In contrast, it was determined to be almost identical to our own in an experiment by [13] at 42.60 percent. In a different investigation, [14]

discovered that it was 57.1%. As to the results of a research conducted by [11], the most common metabolic syndrome component amongst COPD patients is hyperglycemia.

Our results showed that in thirty-one patients (or seventy percent) with metabolic syndrome and in fourteen patients (or thirty percent) without metabolic syndrome, there was a link between abdominal obesity and the existence of metabolic syndrome. In addition, 13 people with MetS and COPD diagnoses did not have abdominal obesity. Patients with COPD who are abdominally obese have a significantly higher prevalence of MetS than those who are not (p value 0.05). Patients who are abdominally obese and those who are not vary in this regard. While the frequency was 51.10% in research [13], it was only 49% in study [10]. Abdominal obesity is the most frequent component of MetS, which is rather common in COPD patients, according to research by [11]. This is because individuals with COPD often have a very high frequency of illness.

Our results showed that 28 of the 45 percent of COPD patients had MetS and that their body mass index was over the recommended threshold. Merely 16 individuals with BMIs more than 25 were identified as having metabolic syndrome. “There was a statistically significant difference (p 0.05) in the prevalence of MetS between overweight COPD patients and those who were not. In research by [13], it was shown that the prevalence of metabolic syndrome in COPD patients with a BMI of less than 25 kg/m2 was 29%. In contrast, our study indicated that the prevalence was 61.7%, which is almost identical to the previously reported data with a substantial difference between the two groups.”

Ten individuals did not have metabolic syndrome; in contrast, forty-eight percent of the study group had low HDL levels, and 34 of those individuals had metabolic syndrome. Patients with COPD who had higher HDL compared to those who did not showed a statistically significant difference in the prevalence of MetS (p 0.05). The prevalence of low HDL was discovered to be 70% in a research by lo, which was found to be bigger than our study group, despite the fact that it was found to be 35.7% in another research by [11], which was considerably lower than our study population.

Compared to 30 patients who had increased TAG levels and made up 42% of our research group,

only 14 study participants who did not have elevated TAG levels had MetS. Patients with COPD who have increased TAG compared to those who do not have MetS is statistically significant ($p < 0.05$). While [10] reported 46%, our study sample exhibited a 54% prevalence of elevated triglycerides. 51.4% was discovered by [15], which was comparable to our findings.

TAG levels in COPD patients with MetS were 226.7 mg/dl, whereas those without MetS had 158 mg/dl, according to [11]. There was a significant difference between the two groups. The 178.2 and 152.9 mg/dl results between the two groups showed a statistically significant difference, according to our analysis. Our analysis, which was quite comparable to the previously described research, revealed that the group of people with MetS had somewhat higher triglyceride levels.

The results of research by [16] show that the BMIs of COPD patients with MetS and those without it differ statistically significantly. BMIs for people with MetS were 29.2 kg/m2, whereas BMIs for those without it were 22.5 kg/m2. The results of our study showed a substantial difference between the two groups, with 27.4 and 24.2 kg/m2 respectively. Compared to the individuals in the previously referenced research, the group of MetS patients in our study had a lower BMI. In another study, [17] discovered that it was 30.0 and 24.88 kg/m2, respectively. This was more than the population we utilized in our analysis and comparable to the research that [11] carried out.

The results of research [17] showed that the waist circumferences of COPD patients with MetS and those without the condition differed significantly, with the former group measuring 106.78 cm and the latter measuring 93.90 cm. The individuals' waist circumferences in our sample varied from 96.2 cm to 88.2 cm, with a significant difference between the two groups, which is in contradiction to the results of that research. The lower socioeconomic class, which has a larger percentage of undernourished people, might be one reason for this. A significant difference was seen in the mean FBS of COPD patients with MetS compared to those without the condition in research conducted by [17]. The mean results for the two groups were 94.59 mg/dl and 116.75 mg/dl, respectively. There was a significant difference between the two groups, as shown by the research by [11], which indicated that the FBS of COPD patients with MetS was 115.3 mg/dl and the FBS of COPD patients without MetS was 92.9 mg/dl. When compared to the previously described studies, we found that the FBS levels in our study population with MetS and non-MetS

were considerably different, with a significant difference in FBS levels being 110.8 mg/dl and 98.2 mg/dl, respectively, between the two groups.

Conclusion:

Individuals with metabolic syndrome were more likely to have high blood pressure, raised triglycerides, low HDL cholesterol, abdominal obesity, and other risk factors. A great deal of differences existed between the two groups. It is thus recommended that patients with COPD who also have diabetes, high blood pressure, dyslipidemia, or reduced fasting glucose levels start using insulin, lipid-lowering medications, and oral hypoglycemic medications. It has been shown that patients with metabolic syndrome had increased levels of VLDL, waist-to-hip ratio, total cholesterol, and waist circumference.

Conflict of interest:

There is no conflict of interest among the present study authors.

References:

1. Fekete M, Szollosi G, Tarantini S, Lehoczki A, Nemeth AN, Bodola C, Varga L, Varga JT. Metabolic syndrome in patients with COPD: Causes and pathophysiological consequences. Physiology International. 2022 Mar 10;109(1):90-105.
2. Keeratichananont W, Kaenmuang P, Geater SL, Manoret P, Thanapattaraborisuth B. Prevalence, associated factors, and clinical consequences of metabolic syndrome in chronic obstructive pulmonary disease patients: a 5-year prospective observational study. Therapeutic Advances in Respiratory Disease. 2023 Apr;17:17534666231167342.
3. Baniya S, Shrestha TM, Pant P, Aacharya RP. Metabolic Syndrome among Stable Chronic Obstructive Pulmonary Disease Patients Visiting Outpatient Department of a Tertiary care centre: A Descriptive Cross-sectional Study. JNMA: Journal of the Nepal Medical Association. 2023 Apr;61(260):355.
4. Bahrami M, Forouharnejad K, Mirgaloyebayat H, Darestani NG, Ghadimi M, Masaeli D, Fazeli P, Mohammadi H, Shabani M, Ardestani ME. Correlations and diagnostic tools for metabolic syndrome (MetS) and chronic obstructive pulmonary disease (COPD). International Journal of Physiology, Pathophysiology and Pharmacology. 2022;14(6):311.
5. Cruthirds CL, Deutz NE, Mizubuti YG, Harrykissoon RI, Zachria AJ, Engelen MP. Abdominal obesity in COPD is associated with specific metabolic and functional phenotypes. Nutrition & Metabolism. 2022 Dec;19(1):1-2.
6. Kumar DS, Samuel R, DSouza VS, Bangera MK. Prevalence of Metabolic Syndrome in Chronic Obstructive Pulmonary Disease and its Correlation with Body Mass Index, Airflow Obstruction, Dyspnea, and Exercise Index and C-Reactive Protein. Indian Journal of Respiratory Care¦ Volume. 2022 Oct;11(4):315.
7. Molina-Luque R, Molina-Recio G, de-Pedro–Jiménez D, Álvarez Fernández C, García–Rodríguez M, Romero-Saldaña M. The Impact of Metabolic Syndrome Risk Factors on Lung Function Impairment: Cross-Sectional Study. JMIR Public Health and Surveillance. 2023 Sep 5;9:e43737.

8. Liu S, Fu Y, Ziebolz D, Li S, Schmalz G, Li F. Transcriptomic analysis reveals pathophysiological relationship between chronic obstructive pulmonary disease (COPD) and periodontitis. BMC Medical Genomics. 2022 Dec;15(1):1-6.
9. Sikter A. Chronic psychic stress can cause metabolic syndrome through mild hypercapnia. Neuropsychopharmacol Hung. 2022 Sep 1;24(3):126-33.
10. Mekov E, Slavova Y, Tsakova A, Genova M, Kostadinov D, Minchev D, Marinova D. Metabolic syndrome in hospitalized patients with chronic obstructive pulmonary disease. PeerJ. 2015 Jul 2;3:e1068.
11. Breyer MK, Spruit MA, Hanson CK, Franssen FM, Vanfleteren LE, Groenen MT, Bruijnzeel PL, Wouters EF, Rutten EP. Prevalence of metabolic syndrome in COPD patients and its consequences. PloS one. 2014 Jun 20;9(6):e98013.
12. Cebron Lipovec N, Beijers RJ, van den Borst B, Doehner W, Lainscak M, Schols AM. The prevalence of metabolic syndrome in chronic obstructive pulmonary disease: a systematic review. COPD: Journal of Chronic Obstructive Pulmonary Disease. 2016 May 3;13(3):399-406.
13. Ghatas T. The relationship between metabolic syndrome and chronic obstructive pulmonary disease. Egyptian Journal of Bronchology. 2017 Mar;11:11-5.
14. Ali S, Wagh P, Aurangabadkar G, Jadhav U, Adwani S, Kadukar J. An observational study of metabolic syndrome in patients with chronic obstructive pulmonary disease. Journal of Datta Meghe Institute of Medical Sciences University. 2022 Apr 1;17(2):303-5.
15. Shah S. Frequency of metabolic syndrome and its relationship with systemic inflammation in patients of chronic obstructive pulmonary disease (COPD) in ethnic Kashmiri population of India. Chest. 2014 Mar 1;145(3):400A.
16. Patel B, Kadam M, Patel D, Jain U, Goyal S. Obesity and Copd Severity: An Observational Cross-Sectional Study. Journal of Coastal Life Medicine. 2023 Jan 11;11:2596-601.
17. Vujic T, Nagorni O, Maric G, Popovic L, Jankovic J. Metabolic syndrome in patients with chronic obstructive pulmonary disease: frequency and relationship with systemic inflammation. Hippokratia. 2016 Apr;20(2):110.