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A study on dyslipidemia and its association with body mass index and smoking with or without chronic obstructive pulmonary disease among tribal population attending a teaching hospital in West Bengal state of India

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ABSTRACT

Background: A large number of tribal populations reside in different parts of India. The indigenous population experiences a greater burden of diseases. Effects of tobacco smoking and smoking related disease such as chronic obstructive pulmonary disease (COPD) may be different among tribal populations. **Aims and Objectives:** This study was carried out to find out pattern of dyslipidemia and its association with body mass index (BMI) and smoking with or without COPD in tribal population. **Materials and Methods:** This cross-sectional and observational study carried out in a teaching hospital over a period of 1 year. All willing patients of both genders above 12 years of age belonging to any tribal community attended to hospital were included in this study. Demographic and anthropometric data along with reports of biochemical and other relevant tests were collected. SPSS version 27 was used for statistical analysis. Descriptive statistics and Chi-square tests were used. $P \leq 0.05$ was considered significant. **Results:** Among 190 patients, mean age of the study population was 46.3053 ± 17.2563 (mean ± standard deviation) years with male: female ratio of 4.94:1. About 14.7% patients were underweight, 66.3% patients were normal weight, 15.3% patients were overweight, and 3.7% patients were obese. Low high-density lipoprotein cholesterol was most common (47%) form of dyslipidema. No significant association found between dyslipidemia and BMI. 35.3% of patients were smoker. Association of BMI versus history of smoking was not statistically significant. Among smokers 29.9% patients had COPD. Association between COPD and history of smoking was statistically significant. Statistically significant association also found between with all component of lipid profile with smoking and COPD. **Conclusion:** Dyslipidemia is an important risk factor in ethnic tribal population. Smoking of tobacco is common among them. Smoking has significant association with all components of lipid profile. COPD has high prevalence among smokers of tribal community. COPD has significant association with all components of lipid profile among them.

Key words: Tribal population; Body mass index; Dyslipidemia; Smoking; Chronic obstructive pulmonary disease

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INTRODUCTION

Dyslipidemia is an abnormal level of lipids in the blood. It is well-known fact that dyslipidemia is a major risk factor for ischemic heart disease (IHD) and stroke in both developed and developing world. Obesity and body mass index (BMI), especially excess weight around waist, are one of the major factors that can influence lipid profile of a person.

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Smoking is a practice in which a substance is burnt and the resultant smoke is breathed in primarily for recreational use. Most commonly used substance is the dried leaves of the tobacco plant containing nicotine. Smoking generally has negative impact on health. Tobacco use is a major risk factor for diseases of the respiratory (chronic obstructive pulmonary disease [COPD]), cardiovascular (IHD) systems, stroke (cerebrovascular accidents), and a large number of malignancies (primarily lung cancer). Smoking also has negative impacts on serum lipid profile by lowering the high-density lipoprotein (HDL) cholesterol and increasing the levels of total cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides, and very LDL (VLDL) cholesterol. COPD is a type of obstructive lung disease. Smoking of tobacco is the primary and most common cause of COPD apart from air pollution and genetic cause. COPD is now one of the top three causes of death worldwide and 90% of these deaths occur in low and middle income countries.[1] Globally, the COPD burden is projected to increase in coming decades because of continued exposure to COPD risk factors and aging of the population.[2] Indigenous Peoples in India comprise an estimated population of 8.6% of the national population.[3] A large number of different tribal populations are found in different parts of India and they are genetically distinct from other sections of population of the society.[4] Their social environment, jobs, life style, food habit, physical activity, stress, and challenges in life are quite different from other sections of the society. The indigenous population everywhere in the world experiences a greater burden of diseases.[5] Effects of tobacco smoking and smoking-related disease such as COPD may be different among tribal populations.

Aims and objectives

The objective of this study was to find out the pattern of dyslipidemia and its association with BMI and smoking with or without COPD in a hospital based sample of tribal population.

MATERIALS AND METHODS

It was a hospital-based, cross-sectional, and observational study carried out in Indoor and outdoor department of general medicine, Midnapore Medical College and Hospital at Paschim Medinipur over a period of 1 year from July 2019 to June 2020 after obtaining permission from Project Officer cum District Welfare Officer, Backward Class Welfare, Paschim Medinipur, West Bengal (No: 2101/BCW/Mid(W), Dated 10/12/2018) and clearance from Institutional Ethics Committee (No: MMC/IEC-2019/193 Dated 20/01/2019). All willing patients of both genders above 12 years of age belonging to any tribal community attended or admitted to hospital for any health-related problems were included in this study. Tribal patients had primarily been identified by their surnames. Then, we had confirmed their tribal status by further enquiring them before their inclusion in the study. In no condition, their caste certificate was being checked. Informed consents were taken from the participants or their legal guardians in case of <18 years old participant. Patients who were taking statin group of drugs, having history of malabsorption, known patients of hepatic failure, immunocompromised patients on anti-retroviral therapy, pregnant patients, and unwilling patient were excluded from this study.

During sample size calculation, the blood cholesterol level was taken as the primary point of interest. In a recent study from Tamil Nadu, Nikkin and Stanly found the prevalence of hypercholesterolemia in a tribal population to be 6%.[6] Taking that study as a reference, for 95% confidence interval, the sample size for that prevalence study came as 87. Now, considering a 10% margin of error, the sample size became 95. We have doubled the sample size to 190 for better understanding of the study findings.

Parameters studied include baseline demographic and anthropometric characteristics including age, sex, detailed smoking history, measurement of body weight, height, calculation of BMI, study of the fasting lipid profile of the patients, chest radiography, electrocardiography, and spirometric evaluation of selected cases.

To diagnose dyslipidemia, fasting lipid profile (9–12 h fasting) is obtained and the results are analyzed and increased levels (dyslipidemia) of individual cholesterols are identified according to National Cholesterol Education Program (NCEP)-ATP III guidelines.[7]

Total cholesterol: <200 mg/dL – Desirable, 200–239 mg/dL – Borderline high, and >240 mg/dL – High LDL cholesterol: <100 mg/dL – Optimal, 100–129 mg/dL – Near optimal/above optimal, 130–159 mg/dL – Borderline high, 160–189 mg/dL – High, and >190 mg/dL – Very high

HDL cholesterol: <40 – Low and >60 High

Serum Triglycerides: <150 mg/dl – Normal, 150–199 mg/dl – Borderline high, 200 – 499 mg/dl – High, and 500 mg/dl – Very high

The data collection form was modeled on the standard WHO STEPS manual.

Statistical analysis

The data have been checked for normalcy before application of any test. Suitable descriptive analyses and

inferential statistics were employed. For statistical analysis, data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS version 27 software. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests were used for a difference in mean involved independent samples or unpaired samples. Unpaired proportions were compared by Chi-square test. P≤0.05 was considered for statistically significant.

RESULTS

In our study, the mean age of the population was 46.3053±17.2563 (mean±standard deviation [SD]) years. Among 190 tribal patients, 158 (83.2%) patients were male 32 (16.8%) were female. Male: female ratio was 4.94:1. Mean BMI of patients was 20.7 ± 2.4 (mean±SD).

Distribution of mean different components of lipids is shown in Table 1. In this study, 170 (89.5%) patients had normal total cholesterol level, 14 (7.4%) patients had borderline high and 6 (3.2%) patient had high level of total cholesterol. We found that 173 (91.1%) patients had normal, 14 (7.4%) patients had borderline high, 2 (1.1%) patients had high, and 1 (0.5%) patient had very high serum LDL cholesterol level. We also found that 90 (47.4%) patients had low, 89 (46.8%) patients had normal, and 11 (5.8%) patients had high HDL cholesterol. Our study showed, 133 (70.0%) patients had normal, 37 (19.5%) patients had borderline high, and 20 (10.5%) patients had high triglyceride level. In our study, 134 (70.5%) patients had normal and 56 (29.5%) patients had high VLDL cholesterol level.

Association of lipid profile with BMI

Among underweight, normal weight, overweight, and obese patients, mean total serum cholesterol levels were 151.5714±29.8247, 153.0159±46.6483, 150.2414±45.1186, and 188.4286±17.8872 (mean±SD) mg/dL, respectively (Figure 1).

Among underweight, normal weight, overweight, and obese patients, the mean serum LDL cholesterol levels were 93.2143±26.3627, 88.9127±28.0676, 85.6552±25.7408, and 83.1429±6.4402 (mean±SD) mg/dL respectively (Figure 2).

Among underweight, normal weight, overweight, and obese patients, mean serum HDL cholesterol levels were 42.3929±11.8801, 40.2302±10.3963, 45.9655±10.7188, and 41.7143±8.9762 (mean±SD) mg/dL, respectively (Figure 3).

Among underweight, normal weight, overweight, and obese patients, mean serum triglyceride levels were 131.8214±34.7840, 137.3413±51.7607, 135.3793±41.2591, and 142.1429±34.9353 (mean±SD) mg/dL (Figure 4).

In our study, we did not found any significant association between each of the components of dyslipidemia with BMI in our study population of tribal community. P value of difference of mean total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride with four BMI groups was 0.2008, 0.6951, 0.0721, and 0.9351, respectively.

Association of smoking and BMI

In our study, 67(35.3%) of the total study population were smoker. Among patient with positive smoking history, 10 (14.9%) patients were underweight, 47 (70.1%) patients were normal weight, 8 (11.9%) patients were overweight, and 2 (3.0%) patients were obese. Association of BMI groups versus history of smoking was not statistically significant (P=0.7728). Difference of mean BMI with both (yes/no) history of smoking was not statistically significant (P=0.5575) (Table 2).

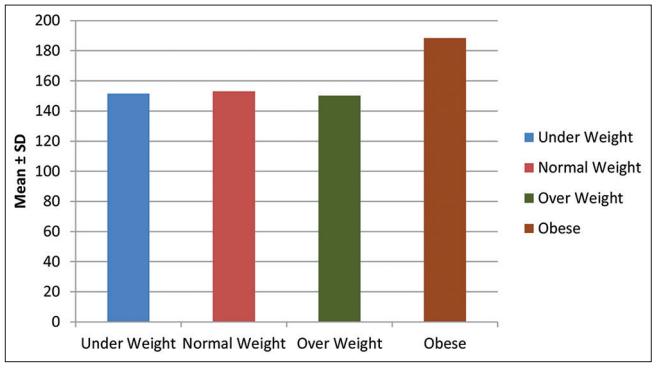

Figure 1: Difference of mean total cholesterol (mg/dL): Body mass index

Table 1: Distribution of mean different components of lipids (mg/dL)

Components of lipid	Number	Mean	SD	Minimum	Maximum	Median
Total cholesterol	190	153.6842	43.8805	98	460	148
LDL cholesterol	190	88.8368	26.933	56	287	82
HDL cholesterol	190	41.4789	10.7461	20	72	41
Triglyceride	190	136.4053	47.3371	81	400	123.5
VLDL cholesterol	190	27.2737	9.4572	16	80	24.5

Table 2: Mean BMI: History of smoking (yes/no)

Smoking	Number	Mean BMI	SD	Minimum	Maximum	Median	P-value
No	123	20.7746	2.3541	16.3847	25.6369	20.7756	0.5575
Yes	67	20.5621	2.4320	15.2416	27.5312	20.7612	

BMI: body mass index

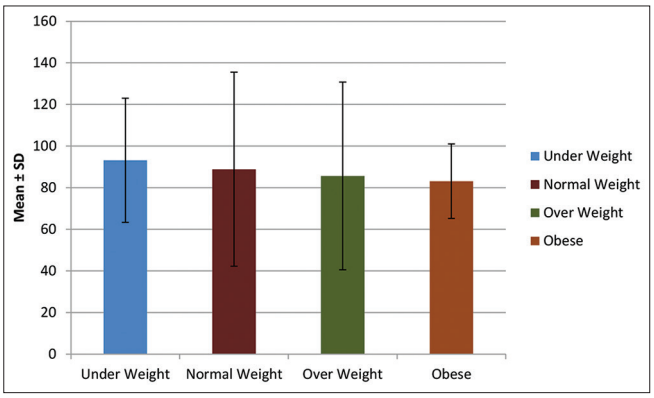

Figure 2: Difference of mean low-density lipoprotein cholesterol (mg/dl): Body mass index

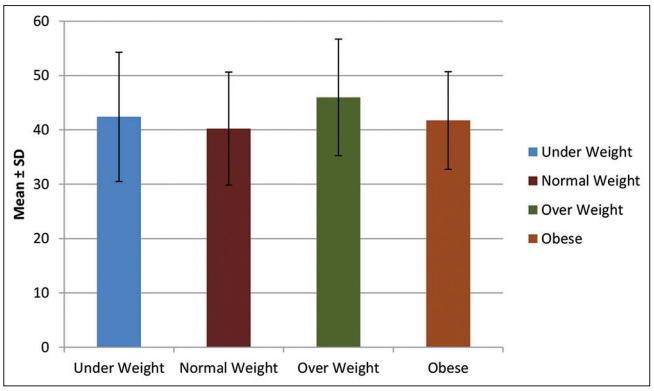

Figure 3: Difference of mean body mass index cholesterol (mg/dL): Body mass index

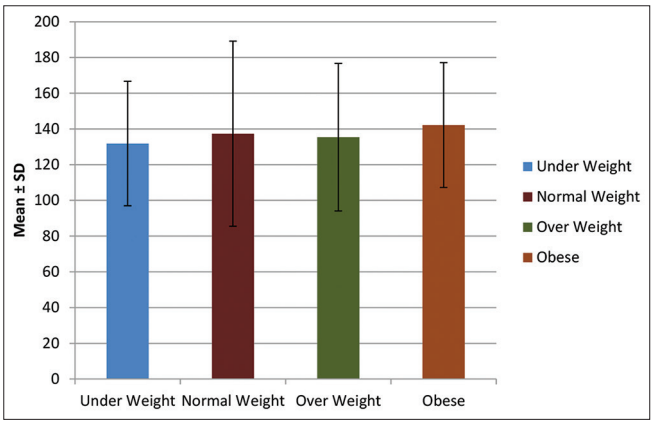

Figure 4: Difference of mean triglyceride (mg/dL): Body mass index

Association between smoking and lipid profile

Among patients with positive smoking history, 55 (82.1%) patients had normal, 11 (16.4%) patients had borderline high, and 1 (1.5%) patients had high total cholesterol level. Association of serum cholesterol versus history of smoking was statistically significant (P=0.0015). Difference of mean total cholesterol (mg/dL) with both (yes/no) history of smoking groups was statistically significant (P=0.0471) (Table 3). Among smokers, 54 (80.6%) patients had normal, 12 (17.9%) patients had borderline high, and 1 (1.5%) patients had high LDL cholesterol level. Association of serum LDL cholesterol versus history of smoking was statistically significant (P=0.0005). Difference of mean LDL cholesterol (mg/dL) with both (yes/no) history of smoking groups was statistically significant (P<0.0001) (Table 3).

Among patients with positive smoking history, 55 (82.1%) patients had low, 11 (16.4%) patients had normal, and 1 (1.5%) patients had high HDL cholesterol level. Association of serum HDL cholesterol versus history of smoking was statistically significant (p<0.0001). Difference of mean HDL cholesterol (in mg/dl) with both (yes/no) history of smoking groups was statistically significant (P<0.0001) (Table 3).

Among smokers, 21 (31.3%) patients had normal, 31 (46.3%) patients had borderline high, and 15 (22.4%) patients had high triglyceride level. Association of serum triglyceride versus history of smoking was statistically significant (P<0.0001). Difference of mean triglyceride (mg/dL) with both (yes/no) history of smoking groups was statistically significant (P<0.0001) (Table 3).

Association between COPD with smoking and BMI

Among patients with history of smoking, 20 (29.9%) patients had COPD. Association of COPD versus history of smoking was statistically significant (P<0.0001). Among COPD patients, 5 (25.0%) patients were under weight, 13 (65.0%) patients had normal weight, and 2 (10.0%) patients were overweight. Association of BMI versus COPD was not statistically significant (P=0.4181).

Association between COPD and lipid profile

Among COPD patients, 12 (60.0%) patients had normal, 7 (35.0%) patients had borderline high, and 5 (2.9%) patients had high total serum cholesterol level. Association of total cholesterol versus COPD was statistically significant (P<0.0001). Difference of mean

total cholesterol (mg/dL) with both COPD groups (yes/no) was statistically significant (P=0.0010) (Table 4).

Among COPD patients, 9 (45.0%) patients had normal, 10 (50.0%) patients had borderline high, and 1 (5.0%) patient had high serum LDL cholesterol level. Association of LDL cholesterol versus COPD was statistically significant (P<0.0001). Difference of mean LDL cholesterol (in mg/dL) with both COPD groups (yes/no) was statistically significant (P<0.0001) (Table 4).

Among COPD patients, 20 (100.0%) patients had low serum HDL cholesterol level. Association of HDL cholesterol versus COPD was statistically significant (P<0.0001). Difference of mean HDL cholesterol (in mg/dL) with both COPD groups (yes/no) was statistically significant (P<0.0001) (Table 4).

Among COPD patients, 3 (15.0%) patients had normal, 8 (40.0%) patients had borderline high, and 9 (45.0%) patients had high serum triglyceride level. Association of triglyceride versus COPD was statistically significant (P<0.0001). Difference of mean triglyceride (mg/dL) with both COPD groups (yes/no) was statistically significant (P<0.0001) (Table 4).

DISCUSSION

In our study, 190 tribal patients were included in the study. It was a male predominant study sample with male: female ratio of 4.94:1. Mean age of the study population was 46.3053±17.2563 (mean±SD) years. Our study finding is similar to study done by Som et al., which found 144 male and 67 female among 211 subjects with average age of patient being 47.6±9.1 years.[8] Kandpal et al., found mean age of their subject of 41.3±11.04 years but unlike us they found female predominant sample with 184 female and 104 male among 288 study participants.[9]

Dyslipidemia in respect to total cholesterol was found among 10.52% patients. Similar finding regarding prevalence of high total cholesterol was reported in study by Ismail et al.,[10] (8.3%) by Nikkin et al.,[6] (6%) and by Joshi et al.,[11] (13.9%) in The ICMR-INDIAB study. But our finding is contradictory to finding by Deo et al.[12] (0.6%). Dyslipidemia in respect to LDL cholesterol was found among 8.9% of patients. Our finding is close to finding of study by Ismail et al.,[10] (5%) and by Joshi et al.,[11] (11.8%) but less than finding by Ramalingam et al.[13] (42.2%). We found 47.4% of patient of having low HDL cholesterol (<40 mg/dL). Our finding is close to the finding of study by Hathur et al.,[14] (57.2%) but less than finding in study by Ramalingam et al.[13] (87.9%). Dyslipidemia in respect to triglyceride level was found among 30% of patients. Our finding is close to the finding of the study done by Hathur et al.,[14] (32.9%) and to the study by Sen et al.,[15] (29.21%) but less than the study finding by Ismail et al.[10] (39.2%). We found 29.5% of the total study population of having high VLDL cholesterol level. This finding is near to the study finding by Ismail et al.[10] (38%).

Out of total 190 patients, 28 patients (14.8%) were underweight, 126 patients (66.3%) were having normal

Table 3: Association of different mean lipid components with smoking history (yes/no)

Components of lipid	Smoking	Number	Mean	SD	Minimum	Maximum	Median	P value
Total cholesterol (in mg/dL)	No	123	149.0244	46.4357	98.0000	460.0000	138.0000	0.0471
	Yes	67	162.2388	37.5944	101.0000	260.0000	156.0000	
LDL cholesterol (in mg/dL)	No	123	81.1382	25.0515	56.0000	287.0000	78.0000	<0.0001
	Yes	67	102.9701	24.5752	60.0000	170.0000	96.0000	
HDL cholesterol (in mg/dL)	No	123	44.4065	10.8150	20.0000	72.0000	44.0000	<0.0001
	Yes	67	36.1045	8.3178	22.0000	62.0000	35.0000	
Triglyceride (in mg/dL)	No	123	118.7886	39.7418	81.0000	400.0000	109.0000	<0.0001
	Yes	67	168.7463	43.0948	90.0000	292.0000	162.0000	

LDL: Low-density lipoprotein, HDL: High-density lipoprotein

Table 4: Association between different mean lipid component and COPD (yes/no)

Components of lipid	COPD	Number	Mean	SD	Minimum	Maximum	Median	P-value
Total cholesterol (in mg/dl)	No	170	150.1235	42.8922	98.0000	460.0000	145.0000	0.0010
	Yes	20	183.9500	41.3757	113.0000	260.0000	183.0000	
LDL cholesterol (in mg/dl)	No	170	84.1176	23.8640	56.0000	287.0000	80.0000	<0.0001
	Yes	20	128.9500	16.0377	101.0000	170.0000	130.0000	
HDL cholesterol (in mg/dl)	No	170	42.6000	10.6900	20.0000	72.0000	42.0000	<0.0001
	Yes	20	31.9500	5.0417	23.0000	39.0000	33.5000	
Triglyceride (in mg/dl)	No	170	130.2118	44.2223	81.0000	400.0000	120.0000	<0.0001
	Yes	20	189.0500	40.4338	92.0000	261.0000	194.5000	

LDL: Low-density lipoprotein, HDL: High-density lipoprotein, COPD: Chronic obstructive pulmonary disease

weight, 29 patients (15.3%) were overweight, and 7 patients (3.7%) were obese according to BMI cutoff value for Asian Indian.[16] Our finding of occurrence of underweight (14.8%) is close to the result of the study done by Sajeev et al.,[17] (16.8%) and almost similar to finding by Mungreiphy et al.,[18] (14.4%) but less than the finding by Amoghashree et al.,[19] (33.3%). Our finding of occurrence of overweight (15.3%) is close to the findings in studies by Mungreiphy et al.,[18] (17.6%), by Gupta et al.,[20] (14.2%) and by Amoghashree et al.[19] (13.3%). 3.7% of our study population were obese. Our finding is close to the finding in study by Ramalingam et al.,[13] (5.5%) but more than the study by Sajeev et al.,[17] (0.7%) and less than the study by Amoghashree et al.[19] (19.2%).

Out of total 190 study population, 67 patients (35.3%) were tobacco smokers. Our finding is similar to the finding of study by Sajeev et al.,[17] (37.9%) and by Amoghashree et al.,[19](36.7%) but less than the finding of study done by Paul et al.[21] (46.6%). We found no significant association between BMI and smoking habit but we found significant association between dyslipidemia and tobacco smoking. "P" values were significant for total cholesterol (0.0015), LDL cholesterol (0.0005), HDL cholesterol (<0.0001), triglyceride (<0.0001), and VLDL cholesterol (<0.0001) with positive smoking history. Mean value for total cholesterol (162.2388 mg/dL), LDL cholesterol (102.9701 mg/dL), triglyceride (168.7463 mg/dL), and VLDL cholesterol (33.7612 mg/dL) in smokers were higher than the non-smokers of the study population (149.0244 mg/dL, 81.1382 mg/dL, 118.7886 mg/dL, and 23.7398 mg/dL, respectively). Mean HDL cholesterol (36.1045 mg/dL) value was lower in smoker than non-smokers (44.4065 mg/dL).

In our study, out of total 67 tobacco smokers, 20 patients (29.85%) had COPD. All 20 COPD patients in our study were tobacco smokers. Strong association found between development of COPD with positive history of tobacco smoking (P<0.0001). Kumar et al.,[22] in their study among Gond tribes in Madhya Pradesh during 2007–2009 found distribution of COPD cases significantly more among male smoker and above 45 years of age. In that study, the prevalence of COPD was 9.4% among smokers.[22] Our study found significant association between COPD and age (P<0.0001). No significant association found between BMI and COPD in our study but significant association found between COPD and total cholesterol (P<0.0001), LDL cholesterol (P<0.0001), HDL cholesterol (P<0.0001), triglyceride (P<0.0001), and VLDL cholesterol (P<0.0001) in our study. Mean value for total cholesterol (183.9500 mg/dL), LDL cholesterol (128.9500 mg/dL), triglyceride (189.0500 mg/dL), and VLDL cholesterol (37.8000 mg/dL) in COPD patients were higher than the patients without COPD of the study population (150.1235 mg/dL, 84.1176 mg/dL, 130.2118 mg/dL, and 26.0353 mg/dL, respectively). Mean HDL cholesterol (31.9500 mg/dL) value was lower in COPD patients than patients without COPD (42.6000 mg/dL).

Limitations of the study

Notable shortcomings of our study were like small sample size. The study has been conducted in a single center. Hospital bias cannot be ruled out as study was carried out in a tertiary care teaching institution. There was also lack of long-term follow-up data. Large study from multiple centers across different Indian states could produce generalizable result.

CONCLUSION

Dyslipidemia is an important risk factor in ethnic tribal population. Most common form of dyslipidema found in our study is low serum HDL cholesterol level and it has been found among 47% of the study population. No significant association found between dyslipidemia and BMI. Smoking of tobacco is very much common among tribal population. About 35.26% of them were smoker. Smoking has significant association with all components of lipid profile. COPD has high prevalence among smokers of tribal community. In our study, 29.85% of the smokers had COPD. COPD has significant association with all components of lipid profile.

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SS- Concept, literature search, Investigation, data collection, analysis, interpretation, and preparation of result in detail. **BKG**- Guidance, Investigation, data analysis and interpretation, validation, and reviewing manuscript. **UB**- Data analysis and interpretation, writing, and reviewing manuscript. **AD**- Literature search, Data analysis and interpretation, writing, reviewing, and editing manuscript. **BCS**- Guidance, Supervision, investigation, validation, and reviewing manuscript. **TDB**- Literature search, data analysis, reviewing, and editing manuscript..

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