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Study Of Spectrum Of Chronic Obstructivepulmonary Disease(Copd) In Smokers And Non-Smokers At Tertiary Care Centre.

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Abstract
Background: *Even though COPD among non-smokers (NS-COPD) is common, very less is known about this phenotype. We compared NS-COPD subjects with smoking COPD (S-COPD) patients in a tertiary care centre using a variety of criterias like age,sex,residence, biomass exposure , spirometry and radiology.*
Material & Methods*: The present observational study was conducted at department of respiratory medicine of our tertiary care hospital. In our study, we enrolled 200 study participants presented in our OPD , who were presented with signs and symptoms of chronic obstructive pulmonary disease. Clearance from Institutional Ethics Committee was taken before start of study. Written informed consent was taken from each study participant.*
Results: *In smoker COPD, males were comparatively more while in non-smoker COPD group, females were comparatively more with statistically significant difference. Mean age in smokers and non-smokers COPD group was 64.54±6.83 and 60.13±7.02 years respectively. Though mean age was found to be more in smokers as compared to non-smokers COPD group, but insignificant difference was found. GOLD III and IV was revealed more in smoker COPD group while class I, II was reported more in non smoker COPD group with statistically significant difference. More than 60% of the subjects in smokers and non-smokers COPD group were from rural area. Mean BMI in smokers and non-smokers COPD group was 19.98±2.89 and 21.76±2.53 respectively. Though BMI was found to be less in smokers as compared to non-smokers COPD group, but insignificant difference was found.*
Conclusion*: Nonsmoker-COPD subjects were more in younger age group compared to smoker. Non smoker COPD patients had greater BMI and predominant sex was female compared to smoker COPD..Emphysema was more predominant phenotype in smokers compared to non smokers. Spirometric indices were found lower in Smoker compared to non smoker COPD subjects. Biomass fuel exposure was most common risk factor among the non smoker COPD. Other non smoker risk factor were environmental risk factor, occupational exposure and recurrent infections.*
Keywords*: Chronic obstructive pulmonary disease, biomass smoke, non-smoking COPD,biomass fuel exposure.*

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I. INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to abnormalities in airway and/or alveoli usually caused by significant exposure to noxious particles and gases[1] . Recently, this definition has been revised in 2023 as COPD is a heterogenous lung condition characterized by chronic respiratory symptoms[dyspnoea, cough, sputum production, exacerbation] due to abnormalities of the airways[bronchitis, bronchiolitis] and/or alveoli [emphysema] that cause persistent often progressive, airflow obstruction[2] . Severity of COPD has been classified into mild, moderate, severe and very severe on the basis of spirometry. In 2011 severity assessment was shifted from simple spirometric assessment to the combined assessment by incorporating level of symptoms based on CAT and Mmrc scoring system into A,B,C,D. Now this ABCD classification has been revised as ABE in GOLD guideline 2023 [2] It is the third leading cause of death worldwide, accounting for over 3 million deaths/year [2] . Over 90% of these deaths occur in low-income regions of the world, particularly in South Asia, South East Asia, Sub-Saharan Africa and South America [3] . .Simultaneously, COPD also has huge econonomic burden particularly in country like India. According to report by National Commission on macroeconomics and health burden of disease in India that 35000 crore rupee has been spent in managing COPD.It is expected to increase in coming years. [4] . Cost of managing

acute exacerbation of COPD is responsible for the substantial part(>70%) of total COPD economic burden[5] . Apart from leading cause of mortality and huge economic burden, COPD also significantly impact on DALY(disability adjusted life years).It is a very important contributor to the disability and mortality around the globe. Global burden of disease estimated in 2017 that daily rate 1068.02/lac population. COPD is second leading cause of reduced DALY trailing only to Ischaemic heart disease. [6] . .Global prevalence of COPD is 10.3%. According to the World Health Organization report, the prevalence of COPD is somewhere between 4% and 20% in the Indian adults. Recent systematic review, the prevalence of COPD seems to range between 6.5% and 7.7% in rural and up to 9.9% in urban India[7] These figures may be the tips of iceberg, since these studies are based on questionnaire-based prevalence estimates which tend to be lower than the true spirometry-based estimates of copd. [8] . Further, with increasing smoking habits, environmental pollution and ageing population prevalence of COPD is expected to be on rising trend in future. [9] Tobacco smoking has always been an established risk factor for COPD for more than five decades and virtually to all our knowledge about the clinical, physiological, pathological and radiological features of COPD, as well as variation in lung function and efficacy of various available treatments.[10,11] The non-smokers,copd is relatively under recognized entity for the clinicians in compare to smoking related COPD . In recent years, non-smoker COPD is being recongnized as studies from low middle income group countries are coming up. This may be partly attributed to an increased rampant use of biomass fuels for household need of their population and other non smoking risk factors . [12] The burden of nonsmoker COPD is much higher than thought previously. Literature from developed world showed smoking is main regarding etiogenic risk factor in 70% of COPD cases, while recent data from developing world state that smoking is responsible for only 40% of COPD population, while rest 60% of COPD population having non smoker risk factor of like wood, animal dung, stubble burning and coal . [13] Overall more than 50% burden of COPD patients is considered due to non smoking risk factor world wide. Almost 3 billion people globally use biomass fuel(BMFs) and coal for their need for cooking, heating and other domestic uses. So very large number of population specially in developing and low income countries is at risk to develop COPD due to use of biomass fuel. [14-16] Other non smoking risk factors like occupational exposures to dust and gases, ambient ozone exposure, poverty, repeated respiratory tract infections during childhood, poor lung development and malnourishment, uncontrolled asthma and previous tubercular lung disease are responsible for COPD .Scarcity of literature regarding comparative study of COPD in smoker vs non smoker in this part of the world prompted us to take this study.

II. MATERIALS AND METHODS

Study Design: Hospital based observational study.

Study location: Department of Respiratory Medicine Mahatma Gandhi Medical College & Hospital, Jaipur (Rajasthan).

Study Duration: March 2021-June 2022

Sample Size: 200 COPD patients were divided into two group (100 smoker/100 non-smoker) presented to OPD in the Department of Respiratory Medicine of MGMC during March2021-June 2022 year of study period were included in our study.

METHODOLOGY: Patients who visited Respiratory medicine OPD with detailed demographic data and their symptoms and exposure to the risk factors i.e smoking and environmental and occupational were taken. Detailed past history of any respiratory disease and systemic diseases was taken. Patients with all grades of COPD (smoker/nonsmokers) will be enrolled for the study.

Smoking Status

Current Smoker- atleast smoked 100 cigarettes in his life and still smoking.
No Smoker- never smoked or less than 100 cigarettes in his life.

Clinical Examination
1) Anthrometric Indices- height in centimeters, weight in kg with BMI calculated as BMI= Wt in kg/Ht in mt^2
2) Chest XRAY- was done to look for the radiological changes of COPD and exclude the other respiratory diseases.
3) Spirometry- was performed with computerized spirometer true flow NDD700-1- 01UPC.During the test patient was made to sit comfortably with loose clothes with nasal clip. Deep inspiration and cover the clip

around the mouth piece and blow out hard and fast as possible. Spirometry Criteria for the diagnosis of COPD taken as
FEV1> 80% -MILD
FEV1 50-80-MODERATE
FEV130-50% -SEVERE
FEV1 <30%- VERY SEVERE
Written informed consent was taken from all the patients.

4) Plan for Statistical analysis of the study: OUTCOME MEASURES : Data were recorded on a predesigned proforma managed in Microsoft Excel spreadsheet. Data collected was analyzed by frequency, percentage, mean, standard deviation (S.D).

III. RESULTS

In 100 Smoker COPD 40 patients belong to 51-60 year of age group followed by 28 patient in 61- 70 yr group.12 patient were in 41-50 and >70 year of age group each. Least patients were in <40 year age group. In 100 non smoker group most of the patient(33) were in 51-60 year age group followed by 32 in 61-70 year age group followed by 30 patients in 41- 50 year age group and least were in <40 year age. Mean age in smoker and non smoker was 64.54 and 60.13 respectively(**TABLE 1**).

Age Group (inyears)	**Smoker COPD**		**Non-smokers COPD**		**p value**
	N	**%**	**N**	**%**	
<40	8	8	5	5	<0.01*
41-50	12	12	30	30	
51-60	40	40	33	33	
61-70	28	28	32	32	
>70	12	12	0	0	
Total	100	100	100	100	
Mean, SD	64.54	6.83	60.13	7.02	0.18

Table 1: Age distribution in study groups

Out of 100 Smoker COPD patients majority (91%) were male while 9% were females. In Non smoker group most of patients were female(78%) while 22% were male. It was statistically significant having male and female predominance in smoker and non smoker respectively.65% smokers were from rural area and 35% were from urban area respectively.63% non smokers were from rural area and 37% from urban area respectively.

Mean BMI in smokers and non-smokers COPD group was 19.98±2.89 and 21.76±2.53 respectively. Though BMI was found to be less in smokers as compared to non-smokers COPD group, but insignificant difference was found (**TABLE 2**).

Group	**BMI kg/m^2**		**p value**
	Mean	**SD**	
Smoker COPD	19.98	2.89	0.07
Non-smokers COPD	21.76	2.53	

Table 2: Mean BMI kg/m^{2}among the study groups

32% patients belong GOLD class 4 followed by 26% in GOLD class2 and 23% belong to class 2 least 19% in GOLD class 1 in Smoker COPD group. In non-smoker group 41% patients belong to GOLD class2 while 24% in GOLD class 1 followed by 22% in GOLD class3 and 13% in class 4. Severity of COPD is statistically significant in smokers group.

FEV1% pre and post bronchodilator was 46.8±13.2, 59.15±9.84 and 42.41±9.57, 62.38±6.71 in smoker and non smoker COPD group respectively.This was statistically significant in smoker COPD(P< 0.05)(TABLE 3).

FEV1%	**Smoker COPD**		**Non-smokers COPD**		**p value**
	Mean	**SD**	**Mean**	**SD**	
Pre Bronchodilator	46.8	13.2	42.41	9.57	0.13
Post Bronchodilator	59.15	9.84	62.38	6.71	0.042*

Table 3: FEV1% among the study groups

FVC% pre and post bronchodilator was 78.12±8.79, 87.09±9.27 and 68.60±10.01, 62.38±6.71 in smoker and non smoker COPD group respectively. This was statistically significant (P<0.05)(**TABLE 4**).

FVC%	**Smoker COPD**		**Non-smokers COPD**		**p value**
	Mean	**SD**	**Mean**	**SD**	
Pre Bronchodilator	78.12	8.79	68.60	10.1	0.036*
Post Bronchodilator	87.09	9.27	79.05	9.68	0.041*

Table 4: FVC% among the study groups

FEV1%/FVC% ratio in smokers is 51.27 in pre bronchodilation and 52.83 in post bronchodilation, In non smokers 53.50 in pre-bronchodilation and 55.11 post brocho dilation.

37% of smokers have mMRC grade 3 dyspnea followed by 33% grade2 and 29% grade 1.In non smokers 49% were of grade 1 32% in grade 2 followed by 11% in grade3 and 8% in grade 0. This is statistically significant (P<0.05)(**TABLE 5**).

mMRC	**Smoker COPD**		**Non-smokers COPD**		**p value**
	N	**%**	**N**	**%**	
0	1	1	8	8	<0.01*
1	29	29	49	49	
2	33	33	32	32	
3	37	37	11	11	
4	0	0	0	0	

Table 5 mMRC grade of dyspnea among the study groups

All the patients having BMFs exposure in non smoker COPD. Out of 37 patients who has only BMFs as risk factor 35 have mild category whereas 2 have moderate to severe COPD. While BMFs associated with other risk factor environmental, occupational, recurrent infections have 14,13,6 patients in moderate to severe category respectively while 13,6,11 in mild category(P<0.05)(**TABLE 6**).

RISK FACTORS	MILD COPD AMONG NON SMOKERS(N=65)	MODERATE TO SEVERE COPD AMONG NON SMOKERS(N=35)
BMFs	35	2
BMFs+ENVIRONMENTAL EXPOSURE	13	14
BMFs+OCCUPATIONAL EXPOSURE	6	13
BMFs+RECURRENT INFECTIONS	11	6

Table 6. Exposure to various risk factors and severity of COPD in non smoker

IV. DISCUSSION

Chronic obstructive pulmonary disease (COPD) is one among the most common causes of morbidity and mortality in the world and in Indian subcontinent. Tobacco smoking is the major risk factor causing COPD. In recent years non smoker COPD is increasing in prevalence. The aim of this study was to evaluate the spectrum of chronic obstructive pulmonary disease (COPD) in smokers and non-smokers at tertiary care centre.In our study, most of the patients 40 belong to 51-60 year of age group while 28 patient in 61-70 yr group.12 patient were in 41-50 and >70 year of age group each. Least patients were in <40 year age group. In

non smoker group most of the patient(33) were in 51-60 year age group followed by 32 in 61-70 year age group followed by 30 patients in 41-50 year age group and least were in <40 year age. Mean age in smoker and non smoker was 64.54 and 60.13 respectively however it was not statistically significant.In Sundeep S Salvi et al {19} stated that mean age of smoker COPD is 67.2±7.4 and biomass COPD is 62±7.3 while occupational COPD 66.7±8.1,these observations are similar to our study.In another study by Jing Zhang et al[20] showed mean age of 65.1±9.2 and 64.7±8.1 years in nonsmoker and smoker respectively which is also equivalent to our study.In this study among the smoker group, males were predominating which are 91% and females were 9% .In non smoker 78% were females and 22% were malesAccording to Sundeep S. Salvi et al[19], strong sex differences were observed between S- COPD and NS-COPD subjects (100% and 53% males respectively),Mean BMI in smokers and non-smokers COPD group was 19.98±2.89 and 21.76±2.53 respectively. Though BMI was found to be low in smokers as compared to non-smokers COPD group, but this statistically non significant. Tobacco is supposed to be reducing the weight by increasing calorie consumption and reducing appetite. Temporal relationship of nicotine and other toxins of tobacco smoke is supported by the fact that quitting smoking helped in weight gain.Sundeep S. Salvi et al(19) study had similar observation to our study that BMI 19.3±3.4 in smoker and 21.3± 4.4 in non smokers.In our study had maximum patients(71%) belong to moderate to severe/ very severe category of spirometric grading as per GOLD guideline in smoker group., whereas non smoker group majority patient(65%) belong to mild to moderate category. Severe/very severe category had only 35% of the patients in non smoker COPD. Severity of COPD is statistically significant in smokers group.Salvi et al{19} compared lung function in smoker and non smoker COPD with healthy persons, they found that lung function was lower in both smoker and non smoker COPD than healthy persons. They said FVC value was lower (statistically significant but clinically very small) in smoker than non smoker, however they didn't find any difference in other parameters.

Jyoti Bajpaiet al[22] in their study said that majority (56.94%) of nonsmoker COPD patients had moderate disease (**GOLD grade II)** , while among smokers majority (43.5%) were in severe disease (**GOLD Grade III)**. These observations were almost comparable to our study.FEV1% pre and post bronchodilator was 46.8±13.2, 59.15±9.84 and 42.41±9.57, 62.38±6.71 in smoker and non smoker COPD group respectively. FVC% pre and post bronchodilator was 78.12±8.79, 87.09±9.27 and 68.60±10.01, 62.38±6.71 in smoker and non smoker COPD group respectively. Hence there was significant improvement in FEV I1% and FVC% post bronchodilator among both the groups, however increase was reported more in non-smoker COPD group. FEV1% / FVC% ratio was found to be comparable in smoker and non smoker COPD group post bronchodilator as $p>0.05$ in this study. Chronic inflammatory induced changes in the airways due to smoking in smokers COPD , maybe responsible for the poor post bronchodilator changes in lung function. Jyoti Bajpai et al {22} also reported similar observation to our study that change in FEV1 and FVC was better in non smokers than smokers.Jing Zhang et al[20] in their study didn't found differences in FEV1 and FVC between the two groups.Sundeep S. Salvi et al [19], the only spirometric difference between S-COPD and NS- COPD subjects was a lower FVC among NS COPD subjects.In our study 70%% of smokers had dysnea of grade mMRC grade II or beyond it while non smokers group, half of the patient had grade 1 dyspnea. Smoker have more severe grade dyspnea than of non smoker maybe due to late reporting to the heath provider or this maybe due to the inflammatory changes associated tobacco inhalation.All the patients having BMFs exposure in non smoker COPD .Out of 37 patients who has only BMFs as risk factor 35 have mild category whereas 2 have moderate to severe COPD. While BMFs associated with other risk factor environmental, occupational, recurrent infections have 14,13and 6 patients in moderate to severe category respectively while 13,6,11 in mild category ($P<0.05$)Panjwani et al (21) observed that non smoker COPD risk factor were Biomass fuel, mosquito coil with/without biomass fuel, kerosene oil with/without biomass fuel . While in our study we don't have mosquito coil and kerosene oil, probably non use of kerosene oil and mosquito coil maybe the reason behind it.In our study biomass fuel exposure associated with other non smoking risk factor had more severe COPD as compared to biomass fuel exposure alone. But we were not able to quantify the environmental and occupational exposure. Further study needed to look for the interaction of biomass fuel with other non smoking risk factors.In our study we found that those who had environmental pollution in addition to biomass fuels had more severe COPD.Traffic related pollution has been inversely related to the lung function, higher traffic density and living proximity to these areas ·In biomass fuel combined with occupational exposure (dust and fumes) is associated with greater deterioration of lung function. Mining of coal, gold, work related to construction, silica exposure, cotton exposure, welders ,metallic dust exposure are associated with deterioration of lung functions. however the combined effect of biomass fuel exposure with o ccupational exposure need to be studied more. In our study we had biomass smoke exposure superimposed respiratory tract infections that causing more detrimental effect on lung function. Bacterial infections as risk factors of acute exacerbation of COPD is well established. Increased bacterial load in airways is associated with decline in lung function. Colonization of infective microorganism in tracheobronchial tree could have act as a impetus for inflammation which is responsible for decline in lung function. Moreover, chronic infection in addition to direct inflammation may

cause synergize response with inflammatory reaction to biomass fuel or tobacco smoke may adversely affect the lung function. This may be the reason behind the greater severity of COPD in our study patient having biomass exposure with respiratory infections.

V. CONCLUSION

Nonsmoker-COPD subjects are more in younger age group compared to smoker. Non smoker COPD patients have greater BMI and predominant sex was female compared to smoker COPD..Emphysema is more predominant phenotype in smokers compared to non smokers. Spirometric indices were found lower in Smoker compared to non smoker COPD subjects. Biomass fuel exposure was most common risk factor among the non smoker COPD. Other non smoker risk factor were environmental risk factor, occupational exposure and recurrent infections.

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