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RESEARCH ARTICLE
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A CROSS-SECTIONAL STUDY ON COPD IN NON-SMOKERS AT KING GEORGE HOSPITAL IN VISAKHAPATNAM, INDIA

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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a prevalent and significant respiratory condition characterized by persistent respiratory symptoms and airflow limitation, often attributed to airway or alveolar abnormalities resulting from exposure to noxious particles or gases [1] . Despite the strong association between COPD and smoking, an estimated 25-45% of individuals diagnosed with COPD have never smoked[2]. This indicates that the prevalence of non-smoking-related COPD is higher than previously believed, highlighting the importance of understanding this subset of the disease. However, there is a scarcity of studies focusing on COPD in non-smokers, which underscores the need for further research in this area. COPD is not only a leading cause of mortality but is also a growing contributor to chronic disability globally. Predictions suggest that by 2020, COPD will become the fifth most common cause of chronic disability worldwide. Recent projections by the World Health Organization indicate that COPD is expected to climb in the ranks of leading causes of death becoming the fourth most common cause by 2030[3]. The global burden of COPD is substantial, with an estimated 251 million people affected in 2016, and approximately 3.17 million deaths attributed to the disease in 2015, representing 5% of all global deaths that year[4]. Notably, the majority of COPD-related deaths occur in developing countries, highlighting the global impact of the disease. Chronic obstructive pulmonary disease (COPD) is caused by long term exposure to cigarette smoking and affects up to 25% of smokers. But emerging evidence suggests that other risk factors are important, especially in developing countries like environmental tobacco smoke, exposure to biomass fuel, genetic factors, outdoor air pollution, pulmonary tuberculosis, poorly treated asthma, poor nourishment and repeated lower respiratory tract infections during childhood. Others include age, male gender and low socioeconomic status[5].

In severe and very severe COPD patients, systemic inflammation and skeletal muscle wasting as a result of weight loss and anorexia are commonly seen It contributes to limitation of the exercise capacity of patients, affecting the quality of life and worsens the prognosis irrespective of the severity of airflow obstruction[6]. The seriousness of dyspnea reported by the patients is usually correlational

to the severity of lung function. COPD is confirmed by spirometry when the FEV1/FVC ratio is < 0.70. Although there is some controversy regarding the cut-off values, both the GOLD guidelines and the combined American College of Physicians, American College of Chest Physicians, American Thoracic Society and the European Respiratory Society COPD guidelines recommend using the fixed cut off of <0.70. To simplify the diagnosis of COPD, the above criterion is set regardless of age and gender. Slow Vital Capacity may be used as a tool of diagnosis in elderly patients who are unable to perform a Forced Vital Capacity (FVC) test without cough[7,8,9].
So, this study is conducted to study the clinical profile of COPD and the associated risk factors in non-smokers.

Aims and objectives:
1. To determine the prevalence of COPD among non-smokers who have been exposed to environmental and socio demographic factors.
2. To analyse the demographic and clinical characteristics of non-smokers with COPD.
3. To find the association between environmental and socio demographic factors with the development of COPD in non-smokers.
4. To compare the respiratory health outcomes of non-smokers exposed to environmental factors with those of non-smokers who have not been exposed.

Materials and methods
Study Design: An observational cross-sectional study.
Study Setting: The research is conducted at the esteemed Government Hospital for Chest and Communicable Diseases, which serves as a prominent teaching hospital associated with Andhra Medical College in Visakhapatnam, Andhra Pradesh, India.
Study Period: The study spans over a duration of two years, commencing from June 2017 and concluding in May 2019.
Sample Size: The sample size was calculated based on a previous study in Uttar Pradesh, India[14], which found a 56.5% prevalence of COPD in non-smokers, we took confidence level 95%, allowable error 18%, the final sample size was 29, and it was rounded up to 30.
Sampling technique: purposive non probability sampling method.

Inclusion Criteria:
1. Participants aged 40 years and above.
2. Individuals who have never smoked.
3. Patients clinically diagnosed with COPD based on spirometry (FEV1/FVC ratio < 0.70 post-bronchodilator).
4. Individuals with significant exposure to firewood smoke (e.g., using firewood for cooking or heating for a certain number of hours per day over the years), other environmental factors and passive smoking.

Exclusion Criteria:
1. Individuals who are current smokers and also who smoked 100 or more cigarettes in their lifetime but have quit.
2. Co-morbidities: Patients with severe comorbid conditions (e.g., heart failure, advanced cancer) that could confound the study outcomes.
3. Incomplete Data: Participants whose records do not provide complete data required for the study parameters.

Study procedure:
Following verification of eligibility, patients were enrolled in the study, and written informed consent was obtained either from the patient or their immediate relative. Baseline assessments were conducted, including recorded age, socioeconomic status (based on monthly per capita income using

the Revised Modified B.G. Prasad Socioeconomic Classification as of January 2019), literacy status, and place of residence (rural/urban).

Pulmonary function testing was performed in accordance with the Joint American Thoracic Society and European Respiratory Society (ATS/ERS) guidelines using the Cosmed Quark PFT. Three satisfactory respiratory efforts were recorded, and the best effort was considered for analysis. Bronchodilation was achieved using 200µg of inhaled salbutamol via a metered dose inhaler with a spacer, and the test was repeated after

15 minutes to assess the bronchodilator response by calculating the percentage change in FEV1.

A comprehensive history was obtained for each case, covering:

- Age, Sex, Socioeconomic Status, Rural/Urban Address
- History of biomass fuel usage and exposure to environmental tobacco smoke, including duration of exposure in years and hours per day
- Considered Presenting Complaints
- Past Medical History, Family History, and Tuberculosis Treatment History
- Comorbidities, Previous Exacerbations, Previous Hospitalization
- Clinical Examination findings were documented in detail to provide a comprehensive patient profile.

Data analysis: Data was entered in MS Excel and analysed in SPSS 23 version, Chi- square test was applied, with P value <0.05 considered as statistically significant.

Ethical Considerations:

This study was approved by the Institutional Ethical Review Board of Andhra Medical College, Visakhapatnam. Written informed consent was obtained from all the participants. Confidentiality and anonymity were maintained throughout the study.

Limitations:

- Cross-sectional design limits the ability to establish causation.
- Small sample size may affect the generalization of findings.
- Potential recall bias in self-reported exposure to risk factors.
- Non-random sampling technique also affect generalization of results.

Results

Table-1: Socio-Demographic Distribution of COPD Non-smokers (N=30)

Variable		Number of patients	Percentage
Gender	Females	25	83.3
	Males	05	16.7
Age group (years)	41 – 50	05	16.7
	51 – 60	15	50.0
	61 – 70	08	26.7
	71 – 80	02	06.6
Place of living	Rural	22	73.3
	Urban	08	26.7
Socio-Economic Status	Upper	00	00.0
	Upper middle	03	10.0
	Middle	09	30.0
	Lower middle	16	53.3
	Lower	02	06.7
Literacy status	Illiterates	26	86.7
	Literates (primary class)	04	13.3

Out of the 30 cases studied, 25 were female and 5 were male, constituting 83.33% and 16.7% of the cohort, respectively. The mean age of the study population was 58.9

± 9.532 years, with half falling within the 51 – 60 years age group, and the smallest proportion (6.66%) in the 71-80 years age group. Three-fourths (73.33%) of the study population resided in rural areas, while a quarter (26.66%) lived in urban areas. According to the Revised Modified B.G. Prasad socioeconomic classification scale (January 2019), over half (53.33%) belonged to the lower-middle class, with 30% in the middle class and 10% in the upper-middle class; 6.66% were classified in the lower class (V), and none were in the upper class (I). In terms of literacy, the majority (86.6%) were illiterate, while 13.33% had completed education up to primary school level.

Table-2: Based on Occupational, Environmental Tobacco Smoke exposure and Duration of Exposure

		Number of patients	Percentage
ETS exposure	Exposure present	18	60.0
	No exposure	12	40.0
Duration	> 20 years	12	66.7
	≤20 years	06	33.3
Occupational exposure	No exposure	26	86.7
	Husk	03	10.0
	Rice mill	01	03.3

Among the COPD risk factors observed, 20% had exposure to Environmental Tobacco Smoke (ETS) alone, while 26.66% were exposed to Biomass fuel alone. Additionally, 33.33% had combined exposure to Biomass fuel and ETS. Occupational exposures were reported in 13.33% of subjects, with specific exposures including agricultural husk (10%) and rice mill dust (3.3%).

Table-3: Based on exposure to Pulmonary Tuberculosis and duration of illness (Morbidity)

		Number of patients	Percentage
History of pulmonary tuberculosis	Present	04	13.3
	Absent	26	86.7
Duration of illness	≤ 5 years	19	63.3
	> 5 years	11	36.7

Tuberculosis was an independent risk factor in 13.3% of patients.

Fig-I(a): Based on Clinical Presentation with symptoms

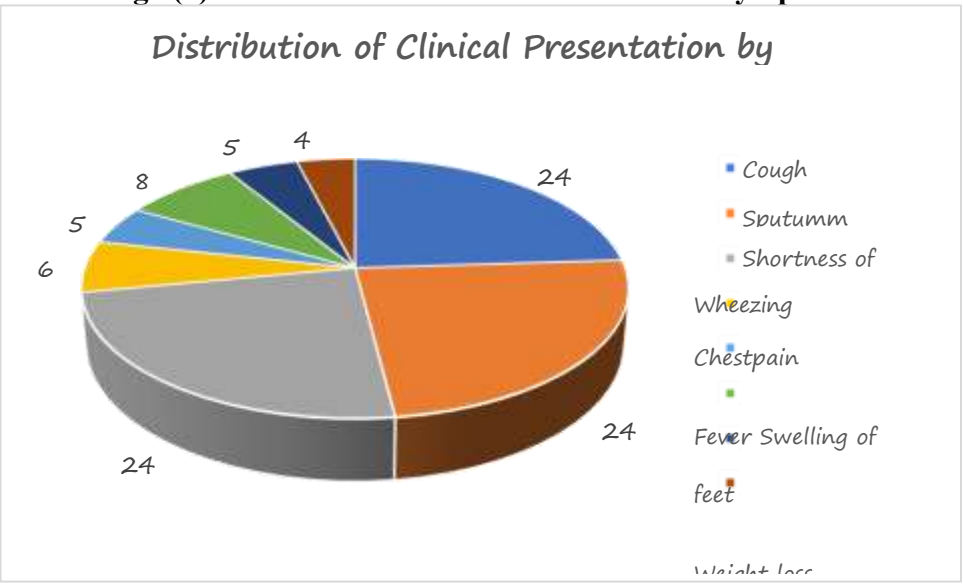
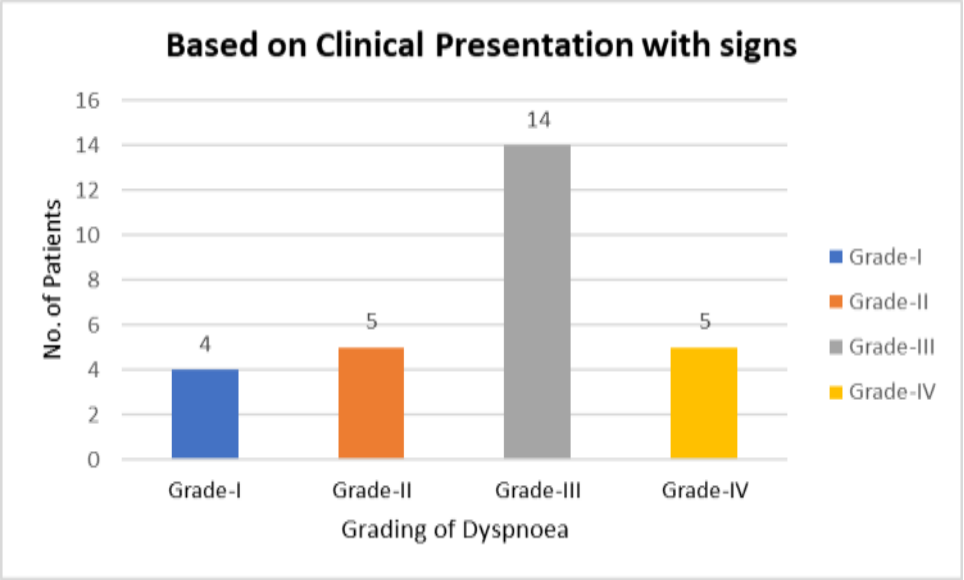
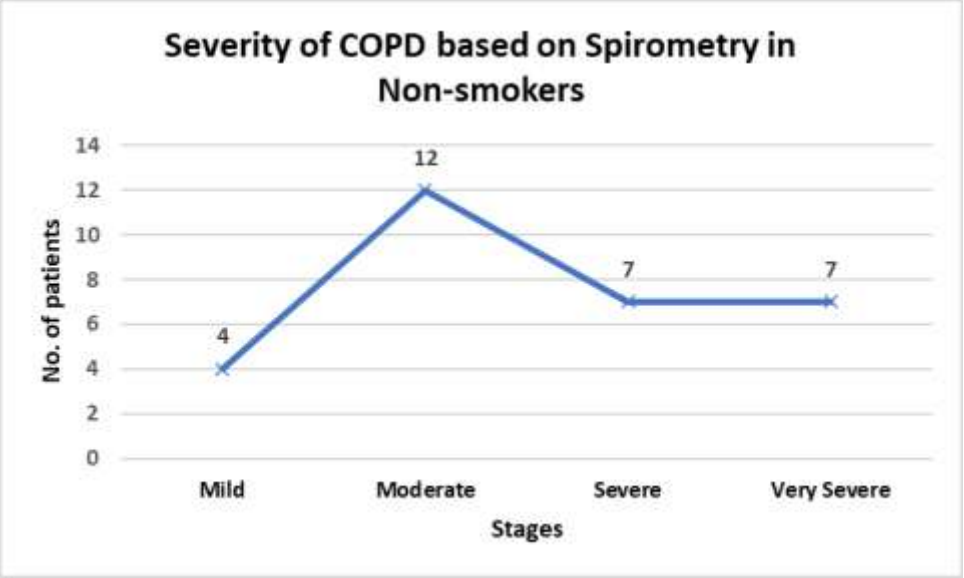


Fig-I(b): Based on Clinical Presentation with signs



Among COPD subjects, the most common features, in descending order, were Crepitations (26), Barrel chest (14), Raised JVP (11), Rhonchi (09), Cyanosis (07), Pedal edema (06), prominence of accessory muscles (04), and Flapping tremors (03). Based on chest radiographic findings, 46.7% showed chronic bronchitis + emphysema, 23.3% had chronic bronchitis alone, 16.7% had emphysema alone, and 13.3% had a normal lung picture.

Fig. 2: Severity of COPD based on Spirometry in Non-smokers (GOLD criteria)



Above Fig 2 GOLD severity staging showed that majority of patients (40%) were in GOLD stage II, while 23.3% were in GOLD stage III, 23.3% in GOLD stage IV and the least 13.3% were in GOLD stage I.

The treatment strategies were distributed as follows Out of 30 patients 40.0% of patients were treated on an outpatient basis, 50.0% were treated in the ward, and 10.0% received treatment in the ICU. Regarding the duration of hospital stay, 33.3% of patients were discharged in less than one week, while 26.6% required hospitalization for more than one week. In terms of outcomes, 87.0% of patients showed significant improvement.

Table 4 Association between Socio-economic status, place of living and COPD in non- smokers

Variables		Fuel used			p-value	Chi-square value
		Biomass fuel	Kerosene	liquefied petroleum gas		
Socio- economic status	Upper middle	3	0	0	0.059	12.118
	Middle	2	3	4		
	Lower middle	13	1	2		
	Lower	2	0	0		
Place of living	rural	18	2	2	0.012	8.864
	urban	2	2	4		

The table 4. From the above table, it is clear that significant association was not found between socioeconomic status and type of fuel used for cooking (P>0.05).Additionally, the Pearson chi-square test ($\chi^2 = 8.864$, df = 2, p = 0.012) showed a statistically significant association between place of residence (urban/rural) and bio mass fuel type used . Rural regions exhibit higher usage of biomass fuel, while urban areas tend to favor liquefied petroleum gas.

Discussion

The demographic characteristics of our study population provide valuable insights into the epidemiology of Chronic Obstructive Pulmonary Disease (COPD). With a mean age of 58.9 years and a predominant rural background comprising 73.3% of subjects, our findings resonate with established patterns observed in COPD research. These demographics closely align with studies by N.K. Jain et al[10], underscoring the consistent association of older age and rural living with higher COPD prevalence. The aging population's vulnerability to respiratory diseases is compounded by environmental and occupational exposures, such as the significant prevalence of biomass fuel exposure in 66.66% of our study participants. This high prevalence reaffirms biomass smoke as a significant risk factor for COPD, consistent with findingsfrom comparable studies. The contrast between rural and urban backgrounds observed in our study, akin to findings by Goel S et al[11]. but divergent from smaller sample representations like Celli B et al[12]., highlights regional variations in COPD risk factors. The higher representation of rural subjects in our study likely correlates with increased exposure to biomass fuel, a known respiratory hazard. This regional context underscores the importance of tailored interventions and public health policies addressing specific environmental and occupational risks contributing to COPD burden. Furthermore, the consistency in biomass exposure percentages across studies by Bajpai J et al[13]. and Goel S et al[11]. emphasizes the widespread impact of this environmental risk factor across diverse geographical settings. Pulmonary tuberculosis (TB) emerged as another significant risk factor in our study, affecting 32.74% of non-smoker COPD patients. This finding corroborates earlier research by Mahmood T et al[14]. and Pazare AR et al[15], highlighting the enduring influence of TB history on COPD development. The association between past TB and COPD underscores the importance of considering infectious diseases in the context of chronic respiratory conditions, independent of traditional risk factors such as smoking or biomass exposure. These insights are crucial for developing targeted screening and management strategies, particularly in regions where TB remains endemic.

Comparative analysis with global studies, such as those by Lam KBH et al [16]. and Per S Bakke et al[17]., provide further context to our findings and highlight common challenges and universal trends in COPD research. Our study contributes to this understanding by reaffirming the clinical relevance of symptoms such as cough, expectoration, and breathlessness, which are consistent with global presentations of COPD. Addressing these symptoms effectively through early diagnosis and personalized treatment approaches is essential for improving patient outcomes and reducing disease burden.

Future research directions should prioritize larger, multicenter studies to validate these findings across diverse populations and explore emerging risk factors and preventive measures to mitigate the global impact of COPD. By expanding our understanding of COPD epidemiology and its associated risk factors, healthcare providers can implement targeted interventions that address the specific needs of populations at risk. This approach includes integrating comprehensive strategies for biomass fuel reduction, enhancing TB detection and treatment programs, and promoting respiratory health education in both rural and urban settings. By doing so, we can collectively work towards reducing the global burden of COPD and improving the quality of life for affected individuals worldwide.

Conclusion

COPD manifests at a younger age in women. Health education is crucial for reducing COPD morbidity, especially in rural areas. Early recognition of COPD as a cause of breathlessness in non-smokers with risk factors aids in timely management. Biomass fuel combined with environmental tobacco smoke poses a higher risk for COPD development than biomass fuel alone, emphasizing preventive strategies.

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