

A Study on Biomass Exposure-Associated Chronic Obstructive Pulmonary Disease among the patients Visited at a Tertiary Care Hospital

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Abstract

Introduction: The leading environmental cause of death worldwide is household air pollution (HAP), and a major contributor to HAP is use of biomass and coal as fuels for cooking and heating. In recent years, in rural areas, the impacts and role of biomass fuels in the pathogenesis of COPD have received increasing attention. Biomass fuel causes a high degree of morbidity and mortality in humans. **Materials and method:** It was a prospective study conducted in Department of TB & Chest Diseases of a tertiary care hospital over a period of one year. 100 consecutive patients of stable COPD attending chest OPD were enrolled as cases. An equal number of healthy subjects with similar age and gender distribution were taken as controls. Informed consent was taken from all subjects. Routine spirometry was performed as per the recent ATS guidelines using SPIROLAB 6000 PC-based Spirometer. Postbronchodilator forced expiratory volume in 1 s (FEV1), forced vital capacity (FVC), and FEV1/FVC values were recorded based on which patients were categorized into four stages of airflow limitation as per recent GOLD guidelines. **Results:** A total of 100 patients were enrolled for the study. 60 were females and 40 were males. The reason being women are more involved in domestic tasks especially cooking and prolonged working hours in kitchen causing them more exposure to biomass smoke. **Conclusion:** Our study concludes biomass fuel exposure contributes substantially to the burden of disease in India. Many studies in this vein have discovered significant associations with diseases like COPD and ALRI.

Keywords: Biomass fuel, COPD, TB & Chest Diseases

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Introduction

The leading environmental cause of death worldwide is household air pollution (HAP), and a major contributor to HAP is use of biomass and coal as fuels for cooking and heating[1]. Chronic obstructive pulmonary disease (COPD) is a major and growing cause of morbidity and mortality worldwide[2]. WHO estimates COPD to be the tenth leading cause of disability-adjusted life-years in all countries[3]. In recent years, in rural areas, the impacts and role of biomass fuels in the pathogenesis of COPD have received increasing attention. Biomass fuel causes a high degree of morbidity and mortality in humans. This is especially true in the context of developing countries, which account for 99% of the world's biomass fuel use[4]. Biomass fuel consists of firewood, dung cakes, agricultural crop residues (such as straw, grass, and shrubs), coal fuels, and kerosene. Together, they supply 75% of the domestic energy in India. The rest of the country relies on cleaner fuels, namely liquified petroleum gas (LPG) and natural gas. The main harmful components of such smoke are oxycarbide, oxynitride, oxysulfide, incompletely burned hydrocarbon particles, and multicyclic organic compounds[5]. Evidence-based medicine indicates that exposure to smoke from biomass fuels is also an important risk factor for the pathogenesis of COPD. Currently, the clinical features of biomass fuel-induced COPD, especially the difference between COPD caused by exposure to smoke from biomass fuels and COPD by cigarette smoking in particular, is not clear.

Women in rural areas are predominantly affected because of long

exposure to biomass smoke while cooking. This associated with closed indoors without proper ventilation makes them prone for developing chronic obstructive pulmonary disease (COPD) associated with biomass smoke inhalation.

Materials and method

It was a prospective study conducted in Department of TB & Chest Diseases of a tertiary care hospital over a period of one year. 100 consecutive patients of stable COPD attending chest OPD were enrolled as cases. An equal number of healthy subjects with similar age and gender distribution were taken as controls. Informed consent was taken from all subjects. COPD patients with other pulmonary comorbidities such as obstructive sleep apnoea, interstitial lung disease, lung cancer, congestive heart failure, unstable angina, recent myocardial infarction, and acute exacerbation of COPD in the past 6 weeks were excluded from the study. Detailed clinical history and medical examination were done with an emphasis on number of previous exacerbations, previous hospitalizations, tobacco smoke exposure, and occupational exposures to dust and smoke. Routine spirometry was performed as per the recent ATS guidelines using SPIROLAB 6000 PC-based Spirometer. Postbronchodilator forced expiratory volume in 1 s (FEV1), forced vital capacity (FVC), and FEV1/FVC values were recorded based on which patients were categorized into four stages of airflow limitation as per recent GOLD guidelines. In addition, FEF25-75 was also recorded to check for small airway disease. Patients were labelled as BS-associated COPD only if exposure to biomass is present and no other confounding factors such as TB, Smoking, and other airway diseases are existing. Biomass index defined as number of hours of biomass smoke exposure per day multiplied by number of years of exposure was calculated in these patients. The prevalence of BS-associated COPD

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and clinical characteristics were evaluated, and its different parameters were compared with TS-COPD patients.

Results

A total of 100 patients were enrolled for the study. 60 were females and 40 were males. The reason being women are more involved in domestic tasks especially cooking and prolonged working hours in kitchen causing them more exposure to biomass smoke.

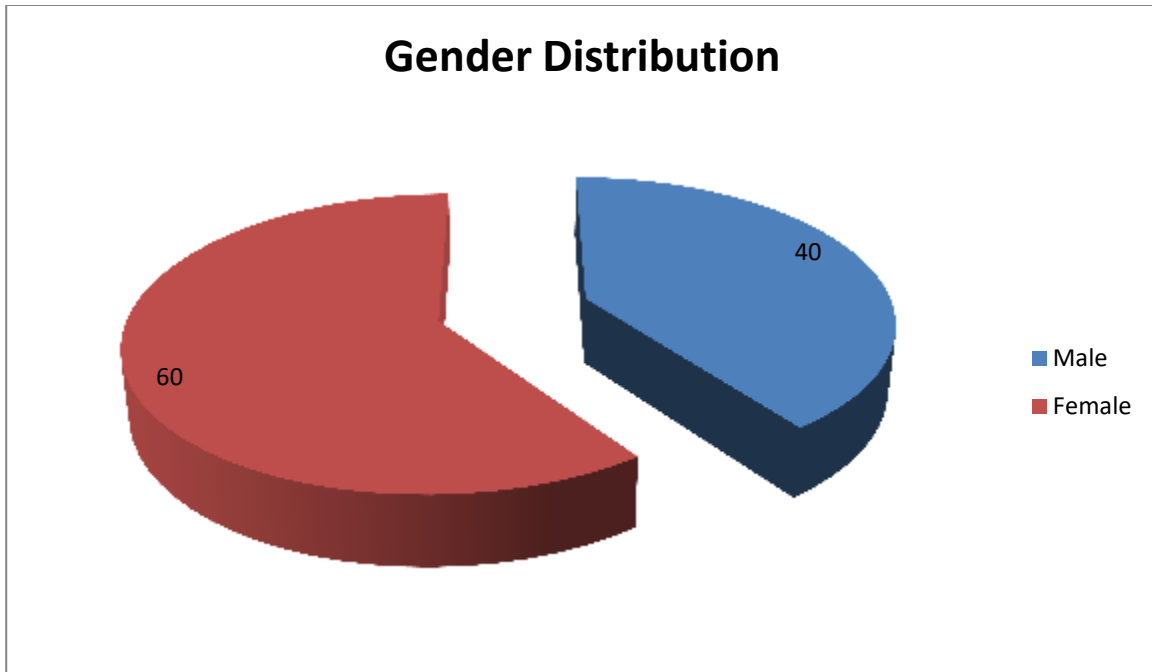


Figure: 1 distribution of gender

Table: 1 Comparison of features between biomass-associated chronic obstructive pulmonary diseases with other chronic obstructive pulmonary disease.

| | COPD (N=50) | Biomass (N=50) | P Value |
|-------------------------|----------------|----------------|---------|
| Age (Mean ± SD) | 52.18 ± 10.74 | 48.28 ± 13.13 | 0.1205 |
| BMI | 21.59 ± 5.36 | 22.48 ± 5.10 | 0.3926 |
| Cough | 26.23% | 70.81% | 0.0002 |
| Dyspnoea grades (MMRC) | | | |
| GRADE1 | 10 | 23 | 0.8701 |
| GRADE 2 | 18 | 20 | |
| GRADE 3 | 13 | 7 | |
| GRADE 4 | 12 | 4 | |
| POST BD FEV1 | 1.8251 ± 0.593 | 1.671 ± 0.924 | 0.1219 |
| POST BD FVC | 2.697 ± 0.985 | 2.783 ± 1.563 | 0.8914 |
| POST BD FEF 25-75 | 2.362 ± 1.061 | 2.258 ± 1.213 | 0.8127 |
| COPD grades | | | |
| MILD | 14 | 18 | 0.9125 |
| MODERATE | 20 | 15 | |
| SEVERE | 10 | 10 | |
| VERY SEVERE | 6 | 7 | |
| No. of hospitalizations | 1.847 ± 0.631 | 1.615 ± 0.683 | 0.2847 |

Discussion

COPD is a systemic and chronic inflammatory disease associated with lungs' abnormal inflammatory response to noxious gases or particles such as tobacco smoke[6]. Currently, tobacco smoking is considered as the main pathogenic factor for COPD, while recently, the role of smoke from biomass fuels in the pathogenesis of COPD has been emphasized. Increasing evidence indicates that, in developing countries, smoke from biomass fuels is the main source of indoor air pollution and also an important risk factor for the pathogenesis of COPD. Our research investigated the differences in clinical features between COPD caused by exposure to tobacco smoke and smoke from biomass fuels. Our findings indicate that COPD caused by

exposure to smoke from biomass fuels are mostly seen in women with the presence of lower BMI and more clinical symptoms, and the comorbidities are mostly allergic rhinitis and bronchial asthma and the COPD classification are mostly Grades B and D. In addition, COPD caused by tobacco smoke is mostly seen in men and its comorbidity is mostly lung cancer. There is moderately strong and consistent evidence to support associations between domestic use of solid biomass fuels (wood, crop residues, animal dung and coal) and the development of COPD. Studies have shown links between these indoor exposures with the diagnosis of COPD as well as symptoms of the disease. However, whether indoor air pollution is associated with

COPD progression or worse morbidity including exacerbations among patients with COPD remains unclear.

Ramirez-Venegas et al. conducted a study on both the entities and found many similarities and important differences. In contrast to their study, which asserted that airflow obstruction was less severe in BS-COPD than TS-COPD, we found that it was of same degree[7]. Padmavati et al. identified co-pulmonale and pulmonary artery hypertension as important complication of biomass exposure. Mild to moderate PAH was found in many patients in their study. Abnormalities of small pulmonary arterioles with intimal thickening was concluded as possible hypothesis in causing PAH in these patients[8]. Jordi Olloquequi et al. compared TS-COPD, BS-COPD and patients with exposure to both the factors. They found physiological and inflammatory differences between both groups. BS-COPD group had elevated IgE levels in blood suggesting a role for Th2 response in the pathogenesis[9]. Indian women generally have low lung cancer rates[10]. Lung cancer in women is amply demonstrated outcome of cooking with open coal stoves in China[11]. This may be attributed to the minimal use of coal for cooking in Indian households. Nevertheless, a few studies in India have suggested an association with lung cancer even after adjusting for active and passive smoking.

Many other studies conducted on biomass revealed its status as an important risk factor in causing COPD. Lin-ling Cheng et al[12]. evaluated clinical characteristics, co-morbidities and exacerbation risk in both groups and concluded there was no statistically significant difference in between these groups. Our research preliminarily observed the clinical feature difference between patients with COPD caused by exposure to tobacco smoke and smoke from biomass fuels and revealed the clinical feature of different COPD phenotypes (smoking-caused or biomass fuel-caused) and provided new theoretical basis for future prevention and clinical treatment of these subtypes pertinently. In keeping with this study, we found similar grades of airway obstruction though we didn't evaluate other parameters mentioned.

Conclusion

Our study concludes biomass fuel exposure contributes substantially to the burden of disease in India. Many studies in this vein have discovered significant associations with diseases like ALRI and COPD. More studies with well-designed lung function measurement methods are needed to further highlight the causal link between lungs function-diagnosed COPD and indoor exposure to biomass. Many low-income, middle-income countries face an important energy transition geared towards energy substitution. Modern fuels such as LPG are more and more used but mostly used alongside traditional ones, mainly in urban areas. Larger observational and epidemiological studies are need of hour to establish it as a risk factor for COPD and thereby educating people towards need of clean energy.

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