

**Chronic Occupational Biomass Smoke Exposure as a Risk Factor for COPD: A Study of Traditional Tandoor Bakers in Kashmir**Varun Gupta<sup>1</sup>, Baleekhudin Mohd Osman Dawar<sup>2</sup>, Sabah Manzoor<sup>3</sup>, Sobia Nisar<sup>4</sup>, Masood Tanvir<sup>5</sup>, Umar Muzaffer<sup>6</sup>, Ozaifa Kareem<sup>7</sup><sup>1,2,3</sup>Senior Resident, Department of Medicine, GMC, Jammu, India<sup>4</sup>Associate Professor, Department of Medicine, GMC, Srinagar, India<sup>5</sup>Professor, Department of Medicine, Government Medical College, Srinagar, India<sup>6</sup>Postdoc Fellow Young scientist fellow at Govt. Medical College and Associated Hospitals, Srinagar, India<sup>7</sup>Doctor of Philosophy, Scientist, Government Medical College, Srinagar, India

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Corresponding author: Dr. Sabah Manzoor

Conflict of interest: Nil

**Abstract**

**Background:** Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide. Although tobacco smoking is the principal risk factor, chronic exposure to biomass fuel smoke is increasingly recognized as an important contributor, particularly in low- and middle-income countries. Traditional tandoor bakers are occupationally exposed to firewood smoke for prolonged durations under poorly ventilated conditions.

**Objectives:** To evaluate lung function impairment and the prevalence of COPD among traditional tandoor bakers exposed to firewood smoke in Jammu and Kashmir.

**Materials and Methods:** This cross-sectional observational study was conducted over 18 months across multiple districts of Jammu and Kashmir. Adult tandoor bakers with at least one hour of daily occupational exposure to firewood-fueled tandoors were enrolled. Spirometry was performed according to standard guidelines. COPD was defined as post- bronchodilator FEV<sub>1</sub>/FVC <0.7.

**Results:** A total of 49 tandoor bakers were evaluated, with a marked male predominance (93.9%). Pre-bronchodilator airflow obstruction was observed in 38.7% of participants, while 28.6% had confirmed COPD following bronchodilator testing. COPD prevalence was higher among smokers; however, a substantial proportion of non-smokers also demonstrated airflow obstruction. Increased duration of occupational exposure and higher daily firewood consumption were associated with reduced lung function parameters.

**Conclusion:** Traditional tandoor bakers exposed to chronic firewood smoke demonstrate a high prevalence of COPD and impaired lung function. Occupational exposure to biomass smoke represents a significant and preventable risk factor, highlighting the need for targeted occupational health interventions.

**Keywords:** Biomass fuel, COPD, Tandoor bakers, Firewood smoke, Spirometry.

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**Introduction**

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality worldwide and is currently ranked among the top three causes of death globally. While cigarette smoking remains the most important etiological factor, exposure to biomass fuel smoke has emerged as a major and under-recognized contributor to COPD, particularly in low- and middle-income countries. [1]

Biomass fuels such as firewood, charcoal, agricultural residues, and animal dung are widely used for domestic and occupational purposes. Combustion of these fuels generates high levels of

particulate matter, carbon monoxide, and other toxic compounds, resulting in chronic airway inflammation, oxidative stress, and progressive airflow limitation. [2] Prolonged exposure under poorly ventilated conditions significantly increases the risk of chronic respiratory diseases, even among never-smokers. [3]

In India, biomass smoke exposure is commonly associated with household cooking; however, occupational exposure remains an important but less studied risk factor. Traditional tandoor baking is a prevalent occupation in North India, including Jammu and Kashmir. Tandoor bakers are exposed

to dense firewood smoke for prolonged hours in enclosed spaces with inadequate ventilation, often beginning at a young age. Despite this, limited data exist regarding the respiratory health consequences in this occupational group.

Although several Indian and international studies have established an association between biomass smoke exposure and COPD, data focusing specifically on traditional tandoor bakers are scarce, particularly from the Kashmir region. This study was therefore undertaken to assess lung function impairment and the prevalence of COPD among traditional tandoor bakers exposed to chronic firewood smoke in Jammu and Kashmir.

### Materials and Methods

This cross-sectional observational study was conducted over a period of 18 months under the Department of General Medicine, Government Medical College, Srinagar, across multiple districts of Jammu and Kashmir.

**Study Population:** Traditional tandoor bakers using firewood-fueled tandoors were enrolled.

#### Inclusion Criteria

- Age  $\geq 18$  years
- Occupational exposure to tandoor smoke for  $\geq 1$  hour per day

#### Exclusion Criteria

- Refusal to provide informed consent
- Active respiratory infection
- Known chronic lung disease
- History of chest wall trauma
- Neuromuscular or neurodegenerative disorders

#### Data Collection:

A detailed history including duration of occupational exposure, daily quantity of firewood

burned, and smoking history (pack-years) was obtained. Spirometry was performed using a standardized spirometer. Individuals with  $FEV_1/FVC < 0.7$  underwent bronchodilator reversibility testing with inhaled salbutamol (200  $\mu\text{g}$ ), followed by repeat spirometry after 10–15 minutes.

**Definitions:** COPD was defined as post-bronchodilator  $FEV_1/FVC < 0.7$ . Preserved ratio impaired spirometry (PRISm) was defined as  $FEV_1/FVC \geq 0.7$  with  $FEV_1 < 80\%$  predicted.

**Statistical Analysis:** Data were analyzed using SPSS version 23. Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables as percentages. A p-value  $< 0.05$  was considered statistically significant.

**Ethical Considerations:** Approval was obtained from the Institutional Ethics Committee, Government Medical College, and Srinagar. Written informed consent was obtained from all participants.

### Results

A total of 49 tandoor bakers were included in the study, with a marked male predominance (93.9%). Smoking prevalence among bakers was 49%. Pre-bronchodilator airflow obstruction was present in 38.7% of participants, while 28.6% had confirmed COPD after bronchodilator testing. Most COPD cases were classified as GOLD stage I or II.

The mean duration of occupational exposure and the mean daily quantity of firewood burned were higher among individuals with COPD compared to those without COPD. Although COPD prevalence was higher among smokers, a considerable proportion of non-smokers also demonstrated airflow obstruction, suggesting an independent effect of biomass smoke exposure.

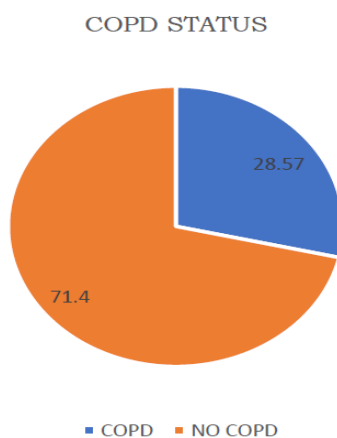


Figure 1: COPD Status

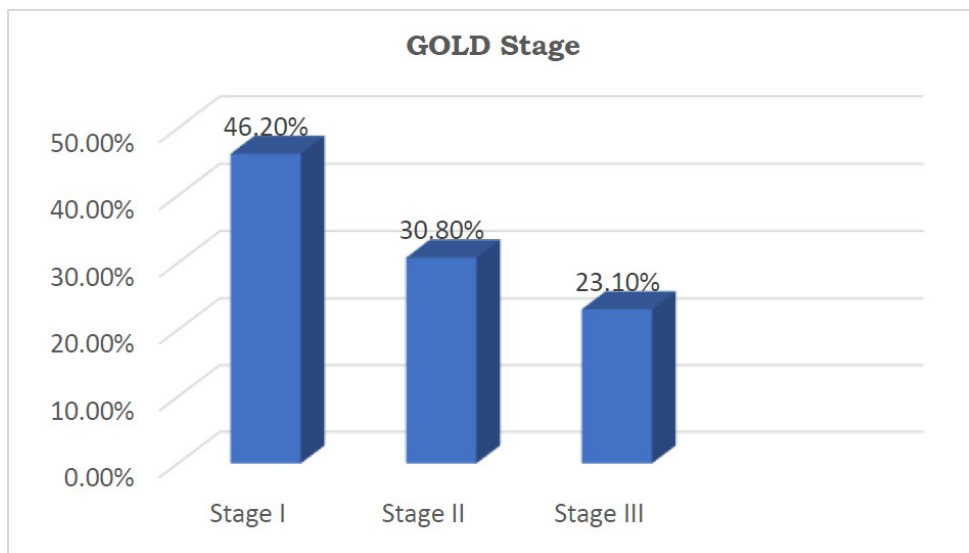


Figure 2: GLOD Stage

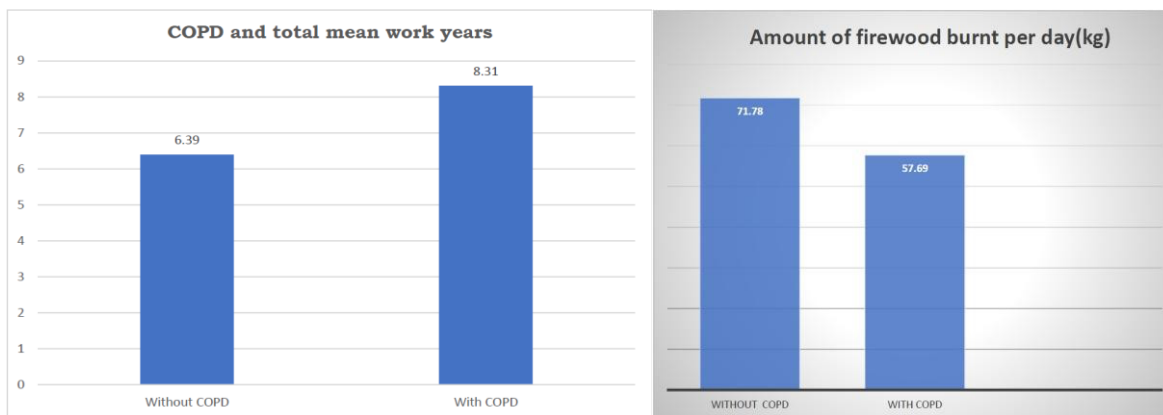


Figure 3:

**Discussion**

This study demonstrates a high prevalence of COPD and lung function impairment among traditional tandoor bakers exposed to chronic firewood smoke in Jammu and Kashmir.

Nearly one-third of the study population had spirometry-confirmed COPD, highlighting occupational biomass exposure as a significant respiratory risk factor.

The prevalence of COPD observed in this study is comparable to that reported in Indian studies evaluating biomass-exposed populations. Salvi et al. reported COPD prevalence ranging from 20–30% among individuals exposed to biomass smoke, including non- smokers. [4] Behera and Jindal similarly demonstrated reduced lung function parameters in individuals exposed to firewood smoke in rural India. [5] Unlike domestic exposure studies, which predominantly involve women, the present study highlights male-predominant occupational exposure. Data on occupational biomass exposure in Kashmir are limited. However, previous regional studies have reported a high

burden of chronic respiratory diseases attributed to biomass fuel use and environmental pollution. [6] The present study adds novel evidence identifying traditional tandoor baking as an important occupational risk factor for COPD in this region.

International studies from Latin America, China, and sub-Saharan Africa have consistently demonstrated an association between biomass smoke exposure and airflow obstruction. [7,8] The findings of the present study are in agreement with these reports, supporting the global relevance of biomass smoke as a risk factor for COPD.

**Limitations**

The study has certain limitations, including a relatively small sample size and a cross- sectional design, which limits causal inference. Ambient air pollution levels were not objectively measured.

**Conclusion**

Traditional tandoor bakers exposed to chronic firewood smoke are at increased risk of COPD and lung function impairment. Occupational biomass smoke exposure represents a significant yet

preventable cause of chronic respiratory disease. Improved workplace ventilation, adoption of cleaner fuels, and periodic spirometric screening are essential preventive strategies.

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