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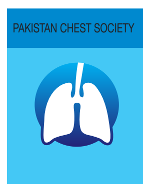
Editorial



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Biomass Fuel and the Burden of COPD in Pakistani Women: Time for Cleaner Solutions

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Millions of Pakistani women spend hours daily in smoke-filled kitchens burning biomass fuels (wood, dung, crop residues). This exposure causes COPD, chronic bronchitis, and impaired lung function even in non-smokers. Evidence shows household PM2.5 is strongly associated with wheeze, cough, and sputum production, with women bearing the greatest burden. Cleaner fuels, improved ventilation, community education, and early screening are urgently needed to address this preventable crisis.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) has long been associated with tobacco smoking, yet a silent epidemic is unfolding across Pakistan's rural landscapes, disproportionately affecting women who have never smoked a cigarette in their lives. These women, the primary cooks in their households, spend hours each day in smoke-filled kitchens, inhaling toxic emissions from burning wood, dung cakes, crop residues, and other biomass fuels.

Globally, about 2.4 billion people which or one-third of the population of the world rely on unprocessed solid fuel for cooking and heating, most of them living in low- and middle-income countries. In Pakistan, biomass fuel use remains deeply entrenched in rural areas, where access to cleaner alternatives like liquid petroleum gas (LPG) or natural gas is limited by economic constraints and infrastructure gaps. The health consequences are devastating, with women bearing the brunt of this exposure due to their traditional role in food preparation.

The association between biomass fuel exposure and respiratory disease in Pakistani women is well-documented. In a study from rural Peshawar which included over 2,500 women found that chronic bronchitis was present in 7.01% of women which exposed biomass fuels compared to just 2.92% among those using natural gas, with an odds ratio of 2.51 (95% CI, 1.65 to 3.83). This study also showed significant correlations with use of different kinds of fuel, like those used wood for their routine works experience odds ratio of 2.38, dung cake (odds ratio, 2.01), rice straws (odds ratio, 3.32) and kai grass (odds ratio, 1.96). It was noteworthy that cooking in living room was significantly correlated with bronchitis (odds ratio, 2.5; 95% confidence interval, 1.94 to 3.66), highlighting the role of poor housing and ventilation in exacerbating exposure.[1]

Different studies also showed that physiological effects go even further, including not only chronic bronchitis but also decreased pulmonary function.[2,3] Recent global evidence further strengthens this association. The landmark PURE-AIR study, published in Environmental Research in 2022, analyzed 48-hour household and personal PM2.5 and black carbon (BC) measurements for 870 individuals using different cooking fuels from 62 communities in 8 countries, including Pakistan,

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Bangladesh, India, China, and Zimbabwe. The study found median household PM2.5 levels of 73.5 μg/m³ and personal PM2.5 levels of 65.3 μg/m³—far exceeding WHO safe limits. Critically, researchers documented strong associations between household PM2.5 and wheeze (OR: 1.25; 95% CI: 1.07-1.46), cough (OR: 1.22; 95% CI: 1.06-1.39), and sputum production (OR: 1.26; 95% CI: 1.10-1.44) per interquartile range increase . Exposure to household black carbon was similarly associated with wheeze (OR: 1.20; 95% CI: 1.03-1.39) and sputum (OR: 1.20; 95% CI: 1.05-1.36). Notably, associations between household PM2.5 and BC were significantly stronger for females compared to males, reflecting their greater exposure burden from cooking activities.[4]

The term "hut lung disease" or Domestic Air Pollution-related Lung Disease (DAPLD) has been used to describe this condition, with an estimated prevalence of up to 20% in at-risk women. In advanced stages, bronchoscopic findings may reveal anthracotic pigmentation and interstitial changes that mimic pneumoconiosis, yet the exposure history is environmental rather than occupational. Radiological imaging, particularly HRCT, can identify early abnormalities such as reticulation, peribronchovascular thickening, and ground-glass opacities, even in asymptomatic individuals. These findings highlight the importance of early detection and intervention.

This burden is not limited to Pakistan alone. An important study by Fez et al., from Morocco, conducted within the BOLD (Burden of Obstructive Lung Disease) project, showed that the main risk factor responsible for COPD was a high Cooking Biomass Exposure Index, with an adjusted odds ratio of 7.2 (95% CI: 1.7 to 30.0).[5] Similar findings from India reported a COPD prevalence of 18.4% among women with >10 years of biomass exposure, with a strong dose-response relationship: OR 1.2 for 10-15 years and OR 2.9 for >25 years of exposure ($p < 0.001$).[6,7] In Tunisia, women exposed to traditional 'Tabouna' ovens for baking presented with COPD at an older age (median 75.4 years) and were characterized by delayed diagnosis, yet their outcomes were similar to tobacco-related COPD.[8] These studies collectively underscore that biomass-related COPD is a distinct phenotype with significant morbidity.

The pathophysiology of biomass-related lung disease is complex. The burning process of biomass generates different toxic substances, such as PM2.5, carbon monoxide, nitrogen oxides, and VOCs. Studies on dosimetry modeling of people living in rural areas of India found that for healthy adult females, roughly 40-45 percent of the inhaled particles get deposited in the head region, while 20-30 percent are deposited in the tracheobronchial region and 25-35 percent in the pulmonary/alveolar region. Women with COPD exhibit substantially greater pulmonary deposition, with predicted alveolar region burdens 20-30% higher than their healthy counterparts, suggesting impaired clearance and deeper particle penetration.[6,7] Children have even greater susceptibility, where the deposition doses are two times higher than those for women because of higher inhalation rate and smaller airways compared to their body weight.

There are several reasons that add to the vulnerability of Pakistani women. The first reason is that exposure begins early in life and continues over decades, with cumulative dose playing a critical role. The second reason is that women in colder months cook in closed kitchens where all the smoke accumulates and inhalation is maximal. The third reason is that co-factors like malnutrition, anemia, and lack of medical services contribute to the progress of the disease. The fourth reason is the poor diagnosis of COPD in women because of low awareness, lack of spirometry availability, and other reasons.

Addressing this crisis requires a multi-pronged approach that encompasses policy, infrastructure, community engagement, and healthcare system strengthening. The best way forward would be for the households to transition from biomass energy sources to other forms such as LPG, natural gas, and even electric energy. While this is an economic challenge, subsidized programs and micro-financing models can make cleaner fuels accessible to rural communities. This measure is also backed by scientific research as a study on improved cooking stoves in Sindh and Punjab showed reduced levels of PM2.5 and CO, along with reduced instances of cough (aRR 0.27), phlegm (aRR 0.27), shortness of breath (aRR 0.16) and chest tightness (aRR 0.23).[2]

In settings where biomass use is unavoidable, improving kitchen ventilation can dramatically reduce exposure. Basic steps like constructing chimneys, opening windows while cooking, and maintaining separate cooking sites outside the living or sleeping zones could save lives. There is sufficient evidence indicating that cooking in the living room greatly enhances the chances of getting bronchitis.

Awareness campaigns should target women and their families about the health risks of biomass smoke. Educational initiatives can also promote behavioral changes such as drying fuel to reduce smoke production and minimizing time spent near the stove.

A more accessible spirometry test must be performed at the primary care level to aid in the early detection of COPD among women. Healthcare professionals should learn how to conduct a comprehensive environmental history, with special attention given to the use of biomass even if one does not smoke. Screening campaigns for high-risk populations will help detect asymptomatic cases.

The burden of COPD in Pakistani women due to biomass fuel exposure is a national health crisis that has been neglected for too long. While tobacco smoking remains the dominant narrative in COPD, we must not overlook the

millions of women who are silently suffering from a disease that is entirely preventable. The evidence is compelling, the human cost is immense, and the time for action is now. Cleaner cooking solutions are not a luxury, they are a necessity for the respiratory well-being of Pakistani women. As a pulmonologists, public health experts, and advocates, we must lend our voices to demand policy change, resource allocation, and community-level interventions. The lungs of our mothers, sisters, and daughters depend on it. Let us make cleaner solutions a reality, not just a vision.

References

1. Hamid S, Nausheen S, Ahmed N, Kadri S, Mohammad AG, Hussain N, et al. Hut lung disease in Pakistani rural female population secondary to domestic pollution - Comparison and correlation of HRCT with bronchoscopic findings. ECR 2018; C-2717. DOI: 10.1594/ecr2018/C-2717.
2. Jamali T, Fatmi Z, Shahid A, Khoso A, Kadir MM, Sathiakumar N. Evaluation of short-term health effects among rural women and reduction in household air pollution due to improved cooking stoves: quasi experimental study. Air Qual Atmos Health. 2017;10(7):809-819. DOI: 10.1007/s11869-017-0481-0.
3. Akhtar T, Ullah Z, Khan MH, Nazli R. Chronic bronchitis in women using solid biomass fuel in rural Peshawar, Pakistan. Chest. 2007;132(5):1472-1475. DOI: 10.1378/chest.06-2529.
4. Wang Y, Shupler M, Birch A, Chu YL, Jeronimo M, Rangarajan S, et al. Personal and household PM2. 5 and black carbon exposure measures and respiratory symptoms in 8 low-and middle-income countries. Environ Res. 2022;212(Pt C):113430. doi:10.1016/j.envres.2022.113430.
5. EL Harch I, Garcia-Larsen V, Benmaamar S, Nejjari C, E l Biaze M, Benjelloun MC, Rhazi KE. Association between biomass exposure and COPD occurrence in Fez, Morocco: results from the BOLD study. BMJ Open Respir Res. 2024;11(1):e002409. DOI: 10.1136/bmjresp-2024-002409.
6. Gopika IN, Nagendra SS. Lung Deposition of Biomass Smoke in Women, Children, and COPD Cases in Rural India: MPPD Modelling Insights. InHealthy Environment and Lives (HEAL) Conference 2025: Weaving diverse knowledges into climate action for better health 2025 Nov 6.
7. Kumar R, Singh K, Mavi AK, Nagar JK, Raj S, Kumar M, Nagaraja R. Combustion of biomass fuel and chronic obstructive pulmonary disease in rural population of India. Indian J Chest Dis Allied Sci. 2024;66(1):1-6.
8. Hamdi B, Louhaichi S, Jebali MA, Schlemmer F, Maitre B, Hamzaoui A. COPD after “Tabouna” Exposure: A Distinct Phenotype in Tunisian Women?. J Clin Med. 2023 30;12(23):7424. DOI: 10.3390/jcm12237424.