An Association Of Bio Mass Fuel Exposure From Indian Traditional Cook Stove On Respiratory Function Of Healthy Adult Women

Dr. Shrinesh Agrawal*, Dr. Jigna Dave*, Dr. Yesha Patel**, Dr. Abhi Mukharya***

*****Resident Doctor, **Senior Resident Doctor, ***Professor & HOD, Department Of Respiratory Medicine, Government Medical College, Bhavnagar, India

Abstract: Background: Most of the households in developing countries burn biomass fuel in traditional stoves with incomplete combustion that leads to high indoor air pollution and acute respiratory infections. The use of Biomass fuels in household cooking contributes to indoor air pollution and is the cause of more than 4 million deaths around the world annually. Three billion people (more than 40% of the global population) are still dependent on Biomass fuels like firewood, dung cakes, coal, wood and agricultural residues in these countries. Material And Methods: Observational cross sectional study design was employed among Healthy adult Female relatives of new patient comes in Pulmonary medicine department between age of 20 to 60. A total of 120 healthy adult female were included in the study. Aim of the study is to evaluate Association between biomass fuel exposure and Respiratory function. Objectives of study are to assess respiratory function among women using biomass fuel & To Assess various types & severity of respiratory disorders among women using biomass fuel. Result: Of total 120 female participants, maximum number of participants belong to low to medium socioeconomic status and live in Rural areas. Almost 31% participants from High Biomass Index group of this study found Obstructive respiratory disorders. Present study revealed that approximately 55% participants had various respiratory complaints. Cough, Dyspnoea, Headache and wheeze were highly found in High Biomass exposure index group. Contrary to this, running nose and Sneezing were more commonly found in the Low biomass exposure index group. Conclusion: Exposure to Biomass fuels for cooking increases the potential risk of TB, COPD and bronchial asthma. Access to clean and efficient fuels for cooking is essential to reduce the burden of respiratory disease. Measures are needed to increase the availability of clean fuels for households, especially among socially disadvantaged and marginalized groups, to reduce the burden of respiratory diseases in India. [Agrawal S Natl J Integr Res Med, 2023; 14(1): 16-20, Published on Dated: 20/01/2023]

Key Words: Air Pollution, Biomass Fuel, Obstructive Respiratory Disorder, Pulmonary Function Test, Smoking

Author for correspondence: Dr. Shrinesh Agrawal, Resident Doctor Department of Respiratory Medicine, Government Medical College, Bhavnagar, India. E-Mail: shrineshagrawal@live.com Mobile: 9409542785

Introduction: Cooking is an indispensable part of our daily activities. Various agents used for combustion include electricity, liquefied petroleum gas (LPG), and biomass fuel (BMF) (dung cake, crop residues, wood, charcoal, and coal). The majority of the developing world uses LPG and biomass agents for cooking. Nearly half (41%) of the world's population uses BMFs as the combustion agent for cooking, as they are cheap and easily accessible.

Combustion of BMFs produces toxic compounds including particulate matter (PM), carbon monoxide, sulfur dioxide, nitrogen oxides, benzene, and formaldehyde. Indoor air pollution has been identified by the WHO as the second largest cause of morbidity; second only to unsafe drinking water and sanitation. Biomass combustion has been associated largely with respiratory morbidity[1].

Recent estimates[2,3] attribute 1.5 to 2 million deaths per year worldwide to indoor air pollution, most of them (1 million) occurring in children younger than 5 years due to acute respiratory infections (ARI), but also in women due to chronic obstructive pulmonary disease (COPD) and lung cancer[4].

Forty-one percent of households in India use some type of solid fuel for cooking, with virtually all being wood or dung cakes. Exposure to cooking smoke is greater when cooking takes place inside the house rather than in a separate building or outdoors. In 25 percent of households, someone smokes inside the house on daily basis[5].

This article presents information about the evidence linking exposure to biomass fuels to respiratory diseases and the burden of disease

attributable to that exposure. Physicians and authorities may be acquainted with this knowledge to intervene properly and reduce the exposure and the connected risks.

Material & Methods: The study was an Observational cross-sectional study conducted on a total of 120 Healthy adult Female relatives of a new patient visiting the Respiratory medicine department between age of 20 to 60. All participants have biomass fuel gas exposure for >1hr/day for more than 3 Years. Female with a recent history of thoracic, abdominal, and eye surgery; a recent myocardial infarction and females with aneurysms; past history of pulmonary Koch's; pregnant/ lactating females were excluded from this study. Ethics Committees' approval was obtained before the commencement of this study.

The biomass Exposure Index was calculated utilizing the average hours spent on cooking per day multiplied by the number of years of cooking[6]. Severity of the Biomass Exposure Index was further divided in two Groups Low & High, in which biomass exposure index is <60 and >= 60 respectively[7]. Peak Expiratory Flow Rate were Graded in Normal PEFR and Low PEFR groups based on the Height, Weight, Age, and sex of the Participant. According to spirometry test value of each participant, all participants were divided into further six groups: Normal, Obstructive pattern (mild, moderate & severe), Restrictive pattern, Mix pattern. All of the data obtained thereby were recorded systematically and analyzed using standardized statistical methods. Categorical variables were compared using the Chi-square test. Statistical significance was set at 5% (corresponding to a $P < 0.05$).

Results: Total of 120 healthy adult female participants were studied. The age of the participants was ranging from 20 to 60 years and mean age was 46.67 year. 54% of total 120 participants residing in the kachha house. In this study, maximum number of participants were using Dung Cake (39.17%) and Crop residue (29.17%) as primary source of fuel for Cooking. Other participants were also using wood (25%) and charcoal (6.67%) for fuel source. Biomass index of all participants were calculated and divided in two groups.

Table 1: Biomass Exposure Index

Biomass Exposure Index	Number	Percentage
High	67	55.83%
Low	53	44.17%
Total	120	100.00%

Pulmonary Function Test Findings: In this study, 60% of participants performed normal spirometry test. Approx 16% participants was having mild to moderate obstructive spirometry findings. 8% adult female diagnosed with severe obstructive airway disease via performing spirometry test. PEFR was measured separately via use of Peak Expiratory Flow Meter. In this study, 65 participants (54.17%) had low PEFR value; rest 55 participants (45.83 %) had Normal PEFR value.

PFT Finding VS Severity of Biomass Exposure: According to this study, PFT Findings were classified in two sub group according to Biomass Exposure index group. Of Total, 53 participants who had low Biomass exposure index, 43 participants (81%) had normal spirometry value. While, 67 participants who had High Biomass exposure index, only 29 participants (43%) had normal spirometry value.

Figure 1: PFT Findings Vs Severity Of Biomass Exposure

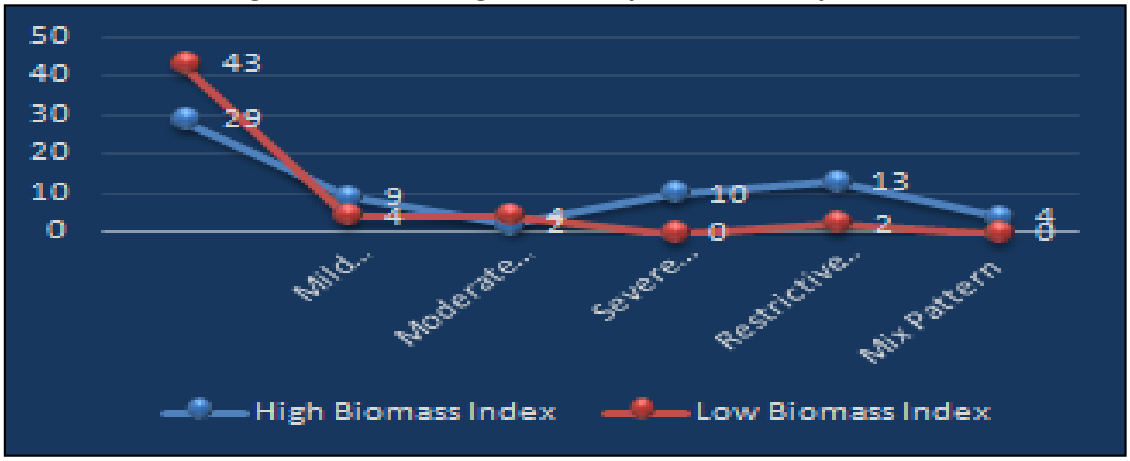


Table 2: Variables Associated With Abnormal PFT Findings

Variables Responsible For Abnormal PFT	PFT Findings		ODDS RATIO
	Normal	Abnormal	
Age	44+-11	50+-9	
BMI	25+-5	27+-7	
Type of Family			
Joint	51	36	1.23
Nuclear	21	12	
Type of House			
Kachha	39	26	1
Pakka	33	22	
Cross Ventilation			
Yes	42	19	2.13
No	30	29	

Symptoms: In the Study Group, most common symptoms were Cough, which is present in almost 30% participants, Followed by Dyspnea, which is present in the around 25% participants in the study group. Data was analyzed to see symptoms distribution between participants according to Biomass fuel exposure index.

Figure 2: Symptoms Distribution According To Biomass Fuel Exposure Index

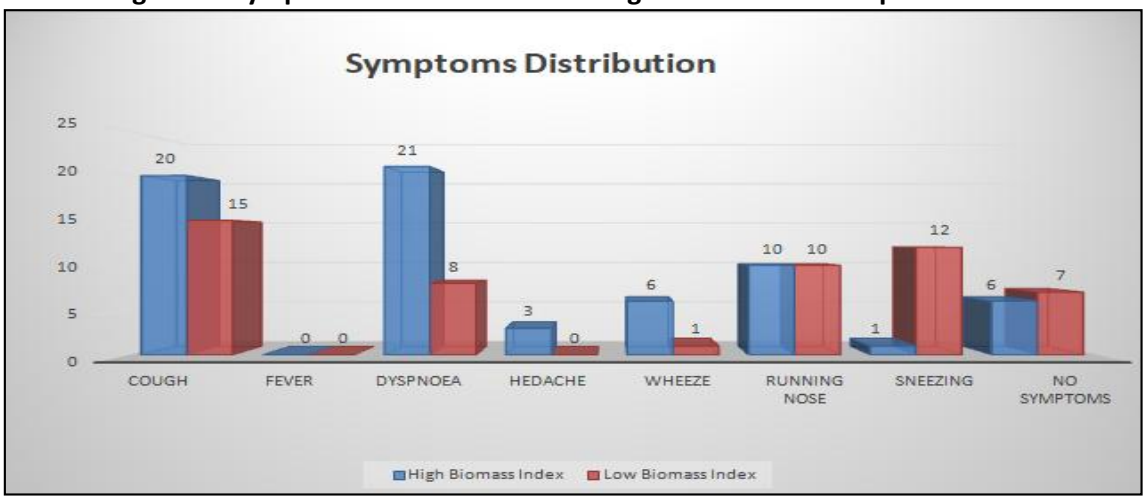


Figure 3: Flowchart Representing Pulmonary Function Test Findings In High Biomass Exposure Index Group

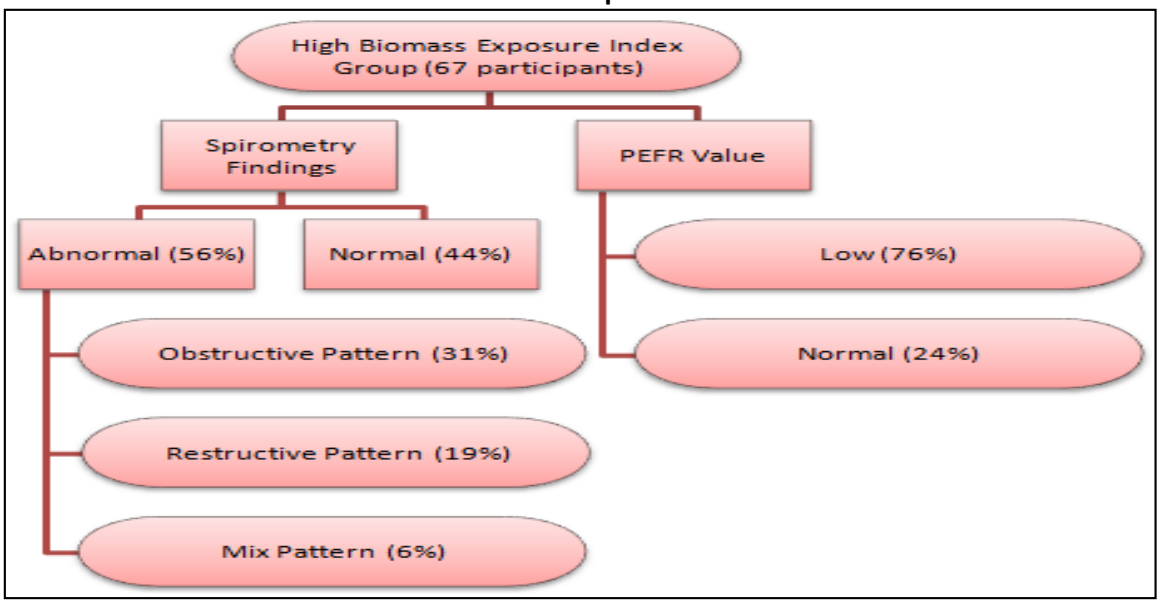
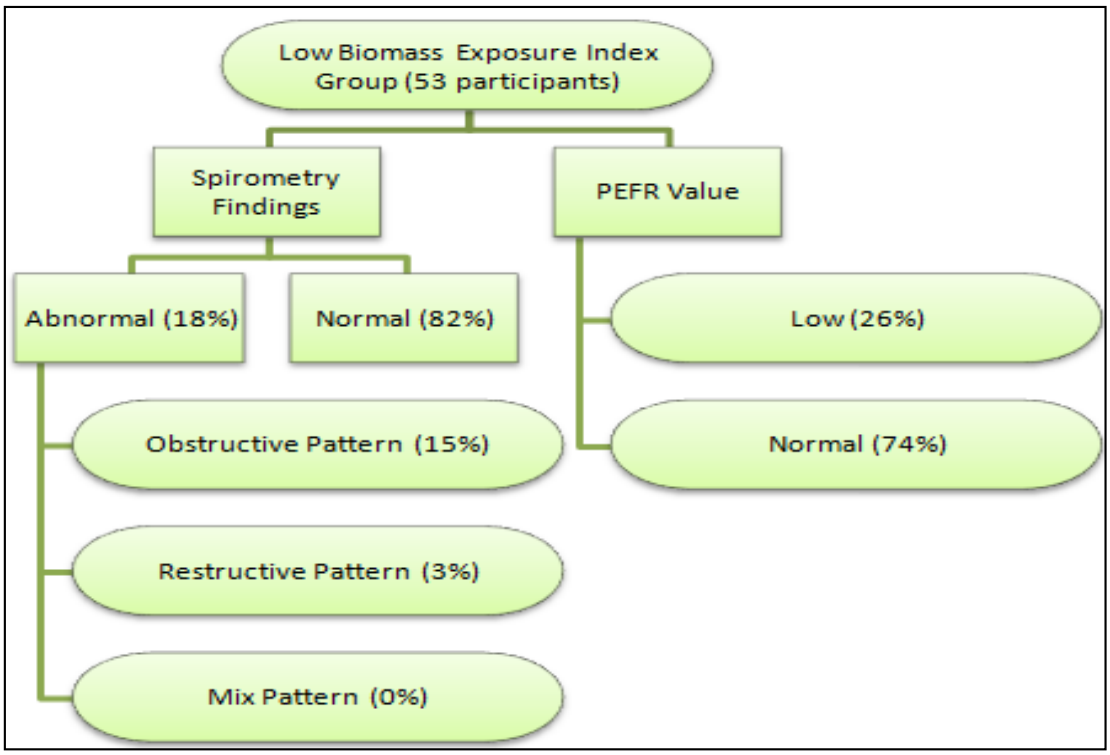


Figure 4: Flowchart Representing Pulmonary Function Test Findings In Low Biomass Exposure Index Group



Discussion: The current population-based cross-sectional study showed the increased prevalence of respiratory symptoms and lower pulmonary function among the women cooking on traditional chulhas using BMF with a longer duration of exposure. It was also seen that women exposed to BMF had higher odds of having an abnormal lung function test. The pollutants generated during the incomplete combustion of the BMFs have been thought to be the culprit. We studied 120 Healthy adult females who were using biomass fuel exposure for cooking attending Respiratory Medicine department, Sir T Hospital & Government medical college, Bhavnagar.

In our study of 120 female participants, exposure to biomass fuel exposure was the most important risk factor for reduction in pulmonary function. Almost 31% of participants from High Biomass Index group of this study found Obstructive respiratory defect. This data is comparable to a similar study done by Kumar et al8 and Pathak U et al9, Obstructive Respiratory disorders were found in 61% and 46% respectively.

The present study revealed that approximately 55% of participants had complaints of cough and dyspnea. Cough, Dyspnea, Headache, and wheezing were highly found in the High Biomass exposure index group. Contrary to this, running nose and Sneezing was more commonly found in Low biomass exposure index group.

Similar observations were made in the studies from countries outside Asia. In a study among Nigerian women by Etete et al[10], biomass smoke exposure was associated with chronic bronchitis and reduced lung functions in women engaged in fish smoking.

A study by Desalu et al[11] to evaluate the effects of biomass smoke on lung function among women in South-West Nigeria demonstrated a reduction in lung function among women who predominantly used biomass fuels for cooking.

Among rural Mexican women study done by Regalado et al[12] who use solid fuels for cooking, have increased respiratory symptoms, including chronic cough and phlegm and a decrease in lung function.

In a study in Guatemala by Smit-Sivertsen et al[13], Central America household wood smoke exposure from cooking was a risk factor for chronic obstructive lung disease among women.

Conclusion: The current study shows that household using Biomass fuel for cooking have more respiratory complaints and reduced lung function.

This study provides data that suggest, as the biomass exposure index increases in participants, they were more prone for obstructive respiratory disorders. Participants with high biomass exposure index had high chances of getting respiratory complaints & infections.

This study observes that significant reduction in the Peak Expiratory Flow Rate in the High biomass exposure index group. Our study also concludes that respiratory symptoms like cough, Dyspnea and headache are more commonly found in the high biomass exposure index group.

The use of liquefied petroleum gas as a fuel, separate kitchen with adequate ventilation, prevention from environmental tobacco smoke exposure along with health education to the rural population are the measures that will prevent the rise in respiratory illnesses in females from the rural background in India.

References:

1. World health organization. Household air pollution and health. WHO, Geneva 2018. http://www.who.int/news-room/fact-sheets/ detail/ household-air-pollution-and-health.
2. Bruce N, Perez-Padilla R, Albalak R. Indoor air pollution in developing countries: a major environmental and public health challenge. Bull World Health Organ 2000; 78:1078–1092.
3. Hong C. Global burden of disease from air pollution. Geneva, Switzerland: World Health Organization; 1995.
4. Ezzati M, Kammen DM. The health impacts of exposure to indoor air pollution from solid fuels in developing countries: knowledge, gaps, and data needs. Environ Health Perspect 2002; 110:1057–1068.
5. National Family Health Survey 5: 2019-2021
6. Behera D, Jindal SK. Respiratory symptoms in Indian women using domestic cooking fuels. Chest. 1991; 100:385–8. [PubMed] [Google Scholar]
7. Mahesh PA, Jayaraj BS, Prabhakar AK, Chaya SK, Vijaysimha R. Identification of a threshold for biomass exposure index for chronic bronchitis in rural women of Mysore district, Karnataka, India. Indian J Med Res. 2013 Jan; 137(1):87-94. PMID: 23481056; PMCID: PMC3657904.
8. Kumar, Raj & Singh, Kamal & Nagar, Sumit & Kumar, Manoj & Mehto, Kumar & Rai, Ganpat & Gupta, Nitesh. (2015). Pollutant Levels at Cooking Place and Their Association with Respiratory Symptoms in Women in a Rural Area of Delhi-NCR. The Indian journal of chest diseases & allied sciences. 57. 10.5005/ijcdas-57-4-225.
9. Pathak U, Kumar R, Suri TM, Suri JC, GuptaNC, PathakS. Impact of biomass fuel exposure from traditional stoves on lung functions in adult women of a rural Indian village. Lung India 2019; 36:376-83.
10. Etete Peters, Victor AU. The relationship between lung function and indoor air pollution among rural women in the Niger Delta region of Nigeria. Lung India 2014; 31:110–15.
11. Desalu OO, Adekoya AO, Ampitan BA. Increased risk of respiratory symptoms and chronic bronchitis in women using biomass fuels in Nigeria. J Bras Pneumol 2010; 36:441–6.
12. Regalado J, Perez-Padilla R, Sansores R, Ramirez JIP, Brauer M, Paré P, et al. The effect of biomass burning on respiratory symptoms and lung function in rural Mexican women. J Am Respir Crit Care Med 2006:174:901–5.
13. Smith-Sivertsen T, Diaz E, Pope D, Lie RT, Díaz A, McCracken J, et al. Effect of reducing indoor air pollution on women's respiratory symptoms and lung function: the Respire Randomized Trial, Guatemala. J Am Epidemiol 2009; 170:211–20.

Conflict of interest: None
Funding: None
Cite this Article as: Agrawal S, Dave J, Patel Y, Mukharya A. An Association Of Bio Mass Fuel Exposure From Indian Traditional Cook stove On Respiratory Function Of Healthy Adult Women. Natl J Integr Res Med 2023; Vol.14(1): 16-20