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EFFECT OF BIOMASS FUEL EXPOSURE ON LUNG FUNCTION IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

Background: Chronic obstructive pulmonary disease (COPD), which is characterized by chronic bronchitis and emphysema, is a long-term lung disease that creates problems during breathing is often preventable and curable. It was the sixth most frequent cause of death in 1990. It is anticipated to overtake as the second most frequent cause in the near future.

Objective: This study was carried out to determine the Effect of biomass fuel exposure on lung function in patients with chronic obstructive pulmonary disease

Materials and Methods: This prospective and observational study was carried out at the department of Pulmonology, GMMMC hospital Sukkur. The study duration was six months From January 2023 to June 2023. A total of 87 individuals who had clinical and functional lung signs of COPD were included. Data was collected by using a proforma designed for this research. All the data was analyzed statistically by using SPSS version 23.

Results: Based on the stages of COPD, our results showed that 50.5% of patients were in Grades 3 and 4 and 49.4% were in Grades 1 and 2. The length of the symptoms was connected to their intensity. With a mean biomass index of 136.8 hour-years, the majority of the patients were subjected to biomass smoke. The severity of illness was not affected by the nature of exposure. **Conclusion:** Multiple risk factors other than smoking also play a major role in development of COPD. Biomass exposure is a major risk factor in individuals and duration of exposure links with severity of the disease**.**

Keywords: Biomass fuel, chronic obstructive pulmonary disease,

Introduction

Chronic obstructive pulmonary disease (COPD) is a disease with a significant worldwide impact and is both preventable and treated. It was the sixth most frequent cause of death in 1990. It is anticipated to overtake as the second most frequent reason in the near future. [1, 2] There hasn't been much discussion of how gender affects COPD. There may not have been much interest from women due to the widespread belief that it is mostly a male ailment.[3] In developing nations like Pakistan biomass (such as wood, animal dung, and agricultural wastes) is utilized as an alternative source of energy in

urban areas and the main cause of COPD, particularly in poorer nations, is exposure to biomass smoke. One-third of the global population relies on biomass burning for cooking and warmth. In the developing the countries, 75% of homes utilize this kind of energy, which results in significant levels of indoor air pollution and related health risks.[4) Due to traditional lives in rural regions, women in Pakistan are more exposed to biomass smoke than men. The byproducts of biomass smoke include carbon monoxide, nitrous oxide, sulphur oxide, formaldehyde, and polycyclic organic matter, which includes carcinogens like benzopyrene.(13) When these micro particulate materials enter the peripheral airways, the pulmonary functions are negatively impacted.(14) As in our country, the household activities are done by women. Therefore this study was carried out to determine the effect of biomass fuel exposure on lung function in women patients with chronic obstructive pulmonary disease

Material and methods

This prospective and observational study was carried out at the department of Pulmonology, GMMMC hospital Sukkur. The study duration was six months From January 2023 to June 2023. A total of 87 individuals who had clinical and functional lung signs of COPD were included. The sample size was calculated by using WHO sample size calculator. Sputum production, breathing difficulties and one or more exposure risk factors are need to be present in order for a woman to meet the inclusion criteria. Females who had a chronic cough for more than two months over the course of two or more years were also included. Inclusion criteria for the trial comprised patients with forced expiratory volume (FEV) 1.0/forced vital capacity (FVC) 70%, FEV 1.0 80% of predicted normal, and less than 12% and 200ml reduction in FEV1 following administration of bronchodilator. Following were the exclusion criteria:

Patients with above 12% FEV1 bronchoreversibility, 200 ml of FEV1, and a history of asthma, patients with active TB, patients with cardiovascular disease, volunteers who are unwilling to participate and who do not provide informed permission. Mahesh et al. employed a validated questionnaire to collect thorough historical data.[6] This covered the length of the cough and dyspnea, previous treatments, and any COPD or asthma in the family history. Dyspnea is measured using the modified Medica. The different risk variables that were recorded include tobacco use, passive smoking, previous lung TB, and contact with indoor air pollutants. Being exposed to biomass smoke and its measurement received special consideration. Based on history, the exposure to biomass fuel in hours/day times the number of years of exposure (hour/years) was calculated. The results of a thorough physical examination were used to determine the severity of the COPD. The aforementioned parameters were measured using an electronic spirometer: FVC, FEV 1.0, FEV 1.0/FVC, peak expiratory flow rate, and forced expiratory flow 25%–75%. These measures were repeated following inhaled ventolin given using a valve-triggered spacer’s apparatus in order to evaluate bronchoreversibility. At rest, room air was used to analyse arterial blood gases. All of the patients had chest skiagrams. Echocardiography was done on individuals with a cor pulmonale clinical diagnosis. The study's findings were examined using traditional statistical methods.

Statistical procedures

The spreadsheet program Excel (Windows 7; Version 2007) was used to input the data, and the Statistical Package for the Social Sciences for Windows program (version 23.0; SPSS Corporation, Chicago, IL, USA) was used to conduct the analysis. For categorical data, frequencies and percentages were computed, as well as descriptive statistics like mean and standard deviation for continuous variables. For categorical variables, comparisons between groups were analyzed using the Chi-square test of independence and Fisher's test (where needed), while analysis of variance was employed to compare quantitative variables with more than two groups. The Pearson's correlation coefficient between the two quantitative variables was determined. The significance level was set at 0.05.

Results

4160 women were hospitalized to our wards throughout the time under study, 87 of whom had COPD (2.09%). Comparatively, 150 males had COPD (M:F ratio: 1.72:1).

Table 1: Clinical presentation	
Presentation (%)	N
Cough (100)	87
Dyspnea (100)	87
Sputum (98.9)	86
Fever (8.0)	7
Pedal edema (14.9)	13

Analysis was done on the relationship between dyspnea severity and GOLD (Global Initiative for Severe Obstructive Lung Disease) staging. Table 2 shows this information.

Table 2: **Association between grade of dyspnea and GOLD staging**					
Grade of dyspnea	**GOLD stage**			**P**	
1	**2**	**3**	**4**		
1	21	0	0	0	<0.001
2	1	21	0	0	<0.001
3	0	1	20	0	<0.001
4	0	0	7	16	<0.001
Total (%	22 (25.3)	22 (25.3)	27 (31)	16 (18.4)	

GOLD: Global Initiative for Chronic Obstructive Lung Disease

A substantial (P 0.001) association between the dyspnea grade at presentation and the FEV 1.0 was found via analysis. Similar to this, the relationship between the length of episodes and GOLD staging revealed that the grade increased as the length of symptoms increased (P 0.001). We mentioned the importance of the burden of biomass index, which is the total number of hrs of exposure times the number of years. Naturally, we observed a relationship between the mean biomass exposure index and the GOLD stage. These statistics are shown in **Table 3.**

Table 3: Association between GOLD stage and Mean Biomass index		
GOLD stage	**Mean biomass index**	**P**
1	**71.5 (19.54)**	**<0.001**
2	**105.0 (32.2)**	**<0.001**
3	**168.1 (37.5)**	**<0.001**
4	**202.5 (31.7)**	**<0.001**

GOLD: Global Initiative for Chronic Obstructive Lung Disease

We made an effort to categories the types of fuel utilized among the individuals who had a history of exposure to biomass into wood, crop waste, cow dung, kerosene stoves, and gas stoves. We made an

effort to determine if the exposure type was associated with FEV 1.0. But (P = 0.0816) there was no such association. Evaluation of the biomass exposures index and the FEV 1.0 demonstrated that there was negative association amongst these two (P < 0.001). Table 4 illustrates these statistics

Table 4: Biomass exposure index and decline in FEV1

Biomass exposure index (hours-years)	$FEV_{1.0}$ (SD)	P
<40	1.81 (0.57)	<0.001
40-80	1.76 (0.34)	<0.001
80-120	1.27 (031)	<0.001
120-160	0.78 (0.15)	<0.001
160-200	0.50 (0.18)	<0.001
>200	0.52 (0.22)	<0.001

SD: Standard deviation, FEV: Forced expiratory volume

Discussion and conclusion

In this prospective observational study we sought to determine the incidence of COPD among women and also determine the effect of biomass fuel exposure on lung function in patients with chronic obstructive pulmonary disease. We found a male:female ratio of 1.72 and a frequency of 2.09% among hospitalized women. This is comparable to earlier research done in India. [7] In the current research, the average age was 64.1 10.4. This is a little bit more than Jain et al.'s estimate (58.34 9.99 years). [2] In our research, 14.9% of participants had previous instances of chronic asthma. Additionally, they had a history of exposure to biomass fuels later in life. We had not old documents demonstrating these women's bronchoreversibility. We found a direct link between the length of stay of asthma and the onset of COPD. The exposure to biomass was a confusing factor in our situation. It is noteworthy that Mahesh et al. reported that the development of COPD requires at least 60 biomass index hours.[8] Other researchers have also looked at the relationship between the biomass index and the development of COPD .What steps may be made to lessen the impact of this disease? . In the early stages of a course, doctors should be more proactive in their diagnosis of airflow restriction. Clinicians will be more able to identify airflow restriction early with the use of objective measurements of lung function using the simple instruments of a spirometer and peak flow meter. It is crucial to have proper and effective treatment in the latter stages of the disease if you want to stop the gradual loss of lung function. Given the financial restrictions, it doesn't appear like switching to biomass fuel is a possibility.[9-12] Some of the patients we treated showed signs of cor pulmonale related to COPD. Our clinical experience has shown that women get subpar care even when they are noticeably unwell. This may help to explain why the GOLD Stages 3 and 4 in our study and other ones like it had such significant functional impairment. Although smoking is not widespread among Pakistani women, passive exposure to tobacco smoke may increase the burden of indoor pollution on these women. This may be a factor in the complicated of asthma/COPD overlap syndrome, which is becoming more difficult to treat. On the aforementioned concerns, there has to be more proof and investigation.

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