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"A comparative study of lung functions of non-smoker persons using biomass fuels with that of persons using LPG gas in cooking."

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Abstract:
Objective: To compare lung functions of non-smoker persons using biomass fuels with that of persons using LPG gas in cooking.
Method(s): The study is field based and conducted in rural area of Rajasthan represents Indian field population.184 non smoker healthy persons aged between 16 to 30 years and using LPG or Biomass fuel for more than 10 years were recruited in this study. Out of them, 88 were LPG users and 96 were BIOMASS users. Personss who were smoker, non-healthy, age <16 Yr's or >60 Yr's, Unwillingness to participate in study, Previous or present respiratory, cardiovascular or other major illness, Seriously ill patients, Passive smoking, Dusty occupation, who were not able to perform spirometry were excluded from study. All demographic variables and vitals were recorded. A through physical examination carried out and recorded. Lung function of these subjects was evaluated via spirometry. Data was tabulated and concerned values were calculated.
Result(s): In BIOMASS group FEV1/FVC ratio range from 0.43 to 0.97. Mean FEV1/FVC ratio was0.806. In LPG group FEV1/FVC ratio range from 0.67 to 0.99. Mean FEV1/FVC ratio was0.849. FEV1/FVC ratio was lower in BIOMASS user group. It was statistically significant (p value 0.002). In females of both groups, the difference between FEV_1/FVC was statistically significant (p value <.000).
Conclusion(s): Our study showed that BIOMASS users had a lower FEV_1/FVC. Female of BIOMASS users had lower FEV_1 and FEV_1/FVC as compared to LPG users. Thus BIOMASS use might causes obstructive respiratory pathology.

Keywords: BIOMASS, LPG, forced expiratory volume, Forced vital capacity Spirometry, COPD.

I. INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease with some significant extra pulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases. Chronic obstructive pulmonary disease (COPD) is an important cause of morbidity and mortality throughout the world especially Asian countries. COPD is fourth leading cause of death in world. It has been predicted that its prevalence and mortality will be going to increase further in

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coming decades. Tobacco smoking is the most important cause of COPD

Many epidemiological studies on COPD are available from Europe and America, but data are limited on its prevalence in Asia, especially in India. COPD arises from an interaction between host factors and environmental factors. Advanced age, male sex, cigarette smoking, occupational dust exposure and low socioeconomic status are well known independent risk factors for COPD. Considerable attention has been given to the associations between uses of biomass and decreased pulmonary function in COPD. Studies of women in developing countries exposed to various levels of indoor pollutants emitted from biomass, have suggested that chronic exposures are associated with chronic airflow obstruction in adults and acute respiratory infection. However, these studies are mainly based on a few case reports, limited clinical data and small-scale epidemiological surveys. The effect of the biomass as a risk factor for the prevalence of COPD has not been adequately assessed in India.

While rural communities in developing countries use exclusively biomass fuels such as wood, agricultural crop residues, animal dung or charcoal, families in urban areas increasingly use kerosene, liquid petroleum gas (LPG) or electricity as the major source of domestic energy. Evidence from a limited number of studies suggests that the smoke from biomass fuel combustion may be associated with functional and structural pathological changes in the respiratory system and COPD.As saying earlier there are many other causes of COPD other than tobacco smoking .One of them is using biomass(wood & dung) or chulha for cooking and heating needs. Biomass is defined as the group of biologic materials (living organisms, both animal and vegetable, and their derivates) present in a specific area.

The use of wood and other biomass as a cooking fuel is common in developing countries. In rural areas of Rajasthan, biomass is used as the primary cooking fuel in majority of households. Wood smoke contains hundreds of chemical compounds. Components present in wood smoke include particles, polycyclic aromatic hydrocarbons, and carbon monoxide. Exposure to biomass smoke has an important global impact on mortality and morbidity. Reported respiratory effects of chronic exposure to wood smoke and other biomass in adults from developing countries include an increased prevalence of chronic Obstructive pulmonary disease.

In a cross sectional study conducted in U.S.A, China & Turkey, biomass fuel was found to be associated with decline in lung function. Though biomass fuel is proposed to cause COPD but field studies in India are limited. Primary goal of this study is to find out COPD and poor pulmonary functions in subjects using Biomass fuel.

Therefore we plan to undertake this comparative study to evaluate spirometric lung functions in non-smoker subjects using biomass fuels and LPG (LIQUID PETROLEUM GAS) gas in Indian rural population.

II. METHODS

The study is field based and conducted in rural area of Rajasthan represents Indian field population.184 non smoker healthy persons aged between 16 to 30 years and using LPG or Biomass fuel for more than 10 years were recruited in this study. Out of them, 88 were LPG users and 96 were BIOMASS users. Subjects who were smoker, non-healthy, age <16 Yr's or >60 Yr's, Unwillingness to participate in study, Previous or present respiratory, cardiovascular or other major illness, Seriously ill patients, Passive smoking, Dusty occupation, who were not able to perform spirometry were excluded from study. All demographic variables and vitals were recorded. A through physical examination was carried out and recorded. Lung function of these subjects was evaluated via spirometry. Data was tabulated and concerned values were calculated.

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III. RESULTS

A total of 184 subjects were included in this study. 88 subjects were in LPG user group while 96 were in BIOMASS user group. Among LPG users group 50 subjects were female while 38 were males. In BIOMASS user group females were 43 in comparison of 53 male subjects. Mean age of LPG user was 28.14 years and Mean age of BIOMASS was 31.43 years. In LPG users mean FEV 1 was 2.570 and mean FVC was 3.04. FEV1/FVC ratio was lower in BIOMASS user group. It was statistically significant (p value 0.002). In females of both groups, the difference between FEV_1/FVC was statistically significant. p value was <.000. Among males it was not significant.

IV. DISCUSSION

COPD is a leading cause of morbidity and mortality worldwide and results in an economic and social burden that is both substantial and increasing.COPD prevalence, morbidity, and mortality vary across countries and across different groups within countries. COPD patients are directly related to the prevalence of tobacco smoking, although in many countries, air pollution resulting from the burning of wood and other biomass fuels has also been identified as a COPD risk factor. The Purpose of the study was to compare lung functions of non-smoker subjects using biomass fuel with that of subjects using LPG gas in cooking. A total of 184 subjects were included in this study. 88 subjects were in LPG user group while 96 were in BIOMASS user group.

Among LPG user group 50 subjects were female while 38 were males. In BIOMASS user group females were 43 in comparison of 53 male subjects. Among LPG user group out of 88 subjects 57 were in 16-30 years age group. Minimum age was 16 while maximum was 60 years. Mean age was 28.14 years in LPG groups while 31.34 in BIOMASS user. In LPG group FEV1/FVC ratio range from .67 to .99. Mean FEV1/FVC ratio was 0.849. In BIOMASS group FEV1/FVC ratio was in range of 0.43 to 0.97. Mean FEV1/FVC ratio was 0.806.FEV1/FVC ratio was lower in BIOMASS user group. It was statistically significant [p value 0.002]

In a similar study done by Seppo T. Rinnea, Edgar J. Rodasb, Brooke S. Benderc, Mikael L. Rinned, Joshua M. Simpsone, Regina Galer-Untif, Larry T. Glickman from USA showed no significant differences in FEV1/FVC or FEF25–75% were noted between children in different cooking categories or children exposed to passive tobacco smoke. Furthermore, there were no significant differences in pulmonary function among women in different cooking fuel categories. These results are contradictory to our study.

Ekici and colleagues case-control study of 596 never smoking women in Turkey reported the prevalence of COPD due to biomass smoke to be 23% (95% CI 13–33) after adjustment for possible confounding factors. For these women, probability of COPD was twice as high if they cooked with biomass fuel than with liquefi ed petroleum gas (28·5% vs 13·6%), which is similar to results from China. Findings from another Turkish study reported that the odds of COPD were increased by 6·6 times (95% CI 2·2–20·2) for women exposed to biomass smoke for at least 30 years, and 4·5 times (1·7–14·9) for women exposed to environmental tobacco smoke. Sood and colleagues studied the association between exposure to wood smoke and the prevalence of COPD (defined as post bronchodilator FEV1/FVC,(<0.70) in 2012 adult living in New Maxico,USA. In the Mid-Antolia region of Turkey, adults that used biomass fuel for cooking or heating had significant functional deficiencies (FVC, FEV1, FEV1/FVC, FEF 25–75%) when compared with adults that did not use biomass fuel. These results are similar to our study showing decreased pulmonary function among biomass users when compared to LPG users.

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Females of LPG group had a higher FEV 1/FVC as compared to BIOMASS user. Mean FEV_1/FVC in LPG & BIOMASS group was 0.852 and 0.769 respectively. This difference was significant statistically (p value <.000). Among males the difference of FEV_1/FVC was not significant statistically (p value .722). Above shown difference of FEV_1 & FEV_1/FVC among females of BIOMASS and LPG user might be due to direct contact of females with house hold BIOMASS.

CONCLUSION

Our present study showed that BIOMASS user had a lower FEV_1/FVC. Female of BIOMASS user had lower FEV_1 and FEV_1/FVC as compared to LPG user. Thus BIOMASS use might causes obstructive respiratory pathology. Females are more commonly affected as they come in contact directly with house hold BIOMASS. We should make efforts to decrease use of biomass and increase use of LPG.

Table no. 1

Comparison of spirometric function of both groups:

Spirometric function	Group	N	Mean	Std. Deviation	Std. Error Mean	P valuea
FEV1	LPG user	88	2.5702	.61141	.06518	.704
	BIOMASS user	96	2.5269	.89376	.09122	
FVC	LPG user	88	3.0431	.72673	.07747	.681
	BIOMASS user	96	3.0949	.95260	.09722	
FEV1/FVC Ratio	LPG user	88	.8478	.07471	.00796	.002
	BIOMASS user	96	.8065	.09652	.00985	

FEV1: The volume after 1second of forced expiration; FVC: Volume exhaled after forced expiration.FEV1/FVC ratio was lower in BIOMASS user group. It was statistically significant. p value was 0.002.

Comparison of spirometric function among both sexes:

Table no. 2

FEV1 & sex

Sex	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
F	LPG user	50	2.2486	.39439	.05578	.002
	BIOMASS user	43	1.9272	.56152	.08563	
M	LPG user	38	2.9934	.59100	.09587	.898
	BIOMASS user	53	3.0135	.81607	.11210	

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Difference between FEV1 among females in both groups was statistically significant. p value was .002

Table no. 3

FVC & sex

Sex	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
F	LPG user	50	2.6530	.49727	.07032	.123
	BIOMASS user	43	2.4767	.59401	.09059	
M	LPG user	38	3.5563	.66196	.10738	.816
	BIOMASS user	53	3.5964	.89471	.12290	

FVC was not statistically significant in both sexes among both groups.

Table No. 4

FEV_1/FVC and sex:

Sex	**Group**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**P value**
F	LPG user	50	.8521	.07963	.01126	.000
	BIOMASS user	43	.7698	.10424	.01590	
M	LPG user	38	.8420	.06832	.01108	.722
	BIOMASS user	53	.8364	.07888	.01083	

Among females of both groups, the difference between FEV_1/FVC was statistically significant (p value was <.000). Among males it was not significant.

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