RESEARCH PAPER | Medical Science | Volume : 5 | Issue : 4 | April 2015 | ISSN - 2249-555X

Study of Pulmonary Function Tests in Women Exposed to Biomass Fumes

KEYWORDS: Cooking , Biomass fumes exposure , Pulmonary function tests

Ms. Pagadala Pravallika	Dr. Nerella Sharvani	Mr. R. Nasar Ahamed
Tutor, Dept. of Physiology Sambhram Institute of Medical Sciences & Research D.K. Halli Plantation, K.G.F, Karnataka	Associate Professor, Dept. of Physiology, Sri Padmavathi Medical College for Women, S.V.I.M.S. Tirupati-517 507 Chittore District Andhra Pradesh	Tutor, Dept. of Physiology, Rajiv Gandhi Institute of Medical Sciences, Putlampalli, Kadapa-516 001 Y.S.R. District ,Andhra Pradesh

ABSTRACT *According to WHO report, indoor air pollution is ranked as the 10th preventable risk factor1.Although many people think of air pollution as an outdoor urban phenomenon, some of the highest concentrations occur in the inverse situation, i.e. rural and indoors.. Indoor air pollution mainly occurs by utilization of biomass fuels for cooking. Research has also shown that there is derangement of pulmonary function of women who are exposed to these fumes.*

About 2 million children under 5 die from pneumonia. Exposure to indoor air pollution doubles the risk of pneumonia and other acute lower respiratory infections (ALRIs), contributing to >800 000 deaths in children under 5. In adults, chronic obstructive pulmonary disease (COPD) and chronic bronchitis(CB) are becoming major causes of chronic morbidity and mortality in developing countries.

The present study was aimed to assess the pulmonary function status in woman exposed to biomass fumes in Tirupathi and compare the findings with normal healthy individuals.

To estimate the FVC,FEV1, FEV1/FVC ratio,FEF25-85%,PEF by electronic spirometer in women exposed to biomass fumes.

To compare PFT in women exposed to biomass fumes and women who are not exposed to biomass fumes.

To study effect of exposure of biomass fumes on lungs in relation to age exposure in women. Exposure to biomass fumes during cooking causes lung dysfunction in women.

Introduction

Air pollution is the introduction of particulates, biological materials, or other harmful materials into the Earth's atmosphere, possibly causing disease, death to humans, damage to other living organisms such as food crops, or the natural or built environment.

Effect of chronic exposure to pollutants present in biomass fumes:

The symptoms are broadly classified into 2 groups:

upper respiratory symptoms:

- Runny nose, Sinusitis.
- Sore throat, wet cough, Dry cough.
- Cold,head ache,red eyes, Fever.

lower respiratory symptoms:

- Wheezing, phlegm.
- Chest discomfort.
- Shortness of breath.

The structural and functional damage of respiratory system, very often the symptom of multifactor respiratory diseases like asthma and chronic obstructive pulmonary diseases are aggrevated following exposure to biomass fumes pollutants.

Twisha Lahiri and Manas Ranjan Ray studied HEALTH IMPACTOF BIOMASS FUEL USE IN RURAL INDIA. Respiratory health was evaluated from questionnaire survey, clinical examination, spirometry and sputum cytology. Systemic effects were evaluated by hematology, immunology and genotoxicity tests. Respiratory symptoms like cough, sore throat, and wheeze and chest pain were more prevalent in women using biomass fuels, and lung function was impaired in 82% of biomass users compared with 38% of controls. Sputum cytology of a large majority of biomass users revealed inflammatory and hypersensitivity reactions, and their blood samples showed anemia, low antioxidant levels, depletion of CD4+ T helper cells and significant increase in CD8+cytotoxic T cells and CD56+ natural killer cells, indicating altered immunity. Biomass users had thrombocytosis, platelet P-selectin overexpression and increased micronucleus frequency in exposed cells, suggesting greater risk for cardiovascular problems and genotoxicity.

MATERIALS AND METHODS

Selection of groups:

Data source:

The present study was carried out in Tirupathi, Urban areas like Leela mahal &M.R. Palle regions. The subjects were selected based on inclusion criteria. The study population included 80 female individuals. The period of study duration is 3 months.

GROUP 1- LPG users (controls age group 25-35years) – 20 subjects.

GROUP 2-women exposed to biomass fuels (cases age group 25-35years) – 20 subjects.

Volume : 5 | Issue : 4 | April 2015 | ISSN - 2249-555X

GROUP 3- LPG users (controls age group 36-45years) – 20 subjects.

GROUP 4- women exposed to biomass fuels (cases age group 36-45years) – 20 subjects.

Inclusion criteria:

- Healthy individuals aged between 25-35 years with history of using biomass fuel for cooking 3-4 hours per day (subjects).
- The controls were age matched healthy individuals using only LPG for cooking.

MATERIALS:

Weighing Machine
Inch tape
Stethoscope
Sphygmomanometer

METHODS:

BMI calculation
Pulse rate
Blood pressure

Statistical analysis:

It is done by the paired t-test in Microsoft excel.

RESULTS

Table no-1: It shows the MEAN, SD and p- values of BMI, BP, and PULSE of 25-35 age group of subjects and controls, and its graphical representation.

		subjects		Control		p-value
		MEAN	SD	MEAN	SD	
BMI		26.55	4.57	23.43	5.76	0.07
BP	SBP	118.50	9.33	117.50	8.51	0.73
	DBP	74.50	5.10	77.00	5.71	0.15

Table no-2: It shows the values of MEAN, SD and p-values of FVC, FEV1, FEV1 / FVC, FEF 25-75%, FEF 75-85%, and PEF of 25-35 age matched subjects and controls, and its graphical representation.

	Subject		control		p-value
	MEAN	SD	MEAN	SD	
FVC	1.34	0.36	2.90	0.39	0.00
FEV1	1.26	0.30	2.72	0.45	0.00
FEV1 / FVC	95.97	12.70	96.35	6.84	0.91
FEF 25-75%	3.13	1.21	4.15	1.53	0.03
FEF 75-85%	2.27	0.82	3.07	1.25	0.03
PEF	3.67	1.47	5.79	1.60	0.00

Table no-3: It shows the MEAN, SD and p- values of FVC, FEV1, FEV1 / FVC, FEF 25-75%, FEF 75-85%, and PEF of 36-45 age matched cases and controls, and its graphical representation.

	subject		Control		p-value
	MEAN	SD	MEAN	SD	
FVC	1.20	0.48	2.27	0.31	0.00
FEV1	1.12	0.39	2.14	0.35	0.00
FEV1 / FVC	98.30	3.79	93.93	8.72	0.05
FEF 25-75%	2.62	0.86	3.36	1.00	0.02
FEF 75-85%	1.96	0.92	2.02	0.48	0.77
PEF	3.51	0.88	4.33	1.55	0.05

DISCUSSION

Subjects were selected randomly. The age group of subjects should be 25-45 years and are using biomass fuel for at-least 3-4 hours/day. To know BMI, height and weight of an individual should be known. B.P and Pulse should be noted. The averages of 3 values are taken for all the parameters.

BMI, B.P & pulse of the study group. The difference in values among subjects & control groups are not statistically significant.

It indicates the values of FVC are compared between subjects statistically. The mean values of FVC are much less in subjects with age group 25-35(1.34lts±0.36). FVC indicates ability of lungs and thorax to take maximum amount of air in and out. Decreased values indicate obstruction in the air passage or restriction in lung parenchyma.

FEV_1 value was less in subjects with age group 25-35(1.26lts±0.30). $FEV_{1\ indicates}$ the expiratory capacity of larger airways. So the results in biomass fuel user are decreased due to obstruction of larger airways. This can be done due to spasm of bronchial smooth muscle either due to irritants or hyper sensitive responses.

FEV_1/FVC ratio was also much less in subjects in the age group 25-35(95.97lts±12.70). FEV_1/FVC indicates the percentage of vital capacity of air i.e. is exhaled in one second. This indicates the increased residual volume of lungs.

$FEF_{25-75\%}$ and $FEF_{75-85\%}$ were less in subjects in the age group 25-35(3.13lts±1.21), (2.27±0.82). $FEF_{25-75\%}$ and $FEF_{75-85\%}$ indicates the capacity of smaller bronchioles containing a large amount of smooth muscle in their walls. These changes in bronchi are due to decreased bronchial smooth muscle tone.

PEFR was also less in subjects (3.67lts± 1.47). It is the simplest indicator that indicates the total capacity & velocity of airflow from respiratory tract.

It indicates the values of FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$, $FEF_{75-85\%}$, and PEFR were compared between subjects in the age group 36-45 statistically. The mean values ofFVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$, $FEF_{75-85\%}$, and PEFR are less in subjects(1.20±0.48) (1.12±0.39) (2.62±0.86) (1.96±0.92) (3.51±0.88). FEV_1/FVC is more in subjects (98.30±3.79).

The present study was undertaken to evaluate the effect of biomass fuel combustion on pulmonary function tests. In this study the effect of biomass fuel on pulmonary function showed that, Forced vital capacity% (FVC), forced expiratory volume in one second% (FEV1), flow expiratory flow rate 25-75% (FEF 25-75%), Peak Expiatory Flow Rate% predicted (PEFR) values in the biomass group were statistically decreased ($p<0.01$) when compared to that of LPG groups The decrease in lung function in biomass fuel users may be due to the chronic inhalation of particulate matter and

Volume : 5 | Issue : 4 | April 2015 | ISSN - 2249-555X

toxic gases emitted during biomass combustion leading to inflammatory changes. It can be explained as if cooking index is increased the pulmonary functions are also much affected. Cooking index indicates number of hours of cooking per day is multiplied with number of years of cooking.

FVC reduction could be due to the changes in the lungs by the chronic irritation of biomass combustion products. PEFR and FEV1 reduction in the pulmonary function can be due to the obstruction of airways during expiration. FEF 25-75% reduction shows that there is narrowing of the small airways due to chronic inflammation. The FEV1/ FVC% ratio in biomass group was above normal which indicated restrictive type of lung disorder, but was not statistically significant. Approximately three billion people worldwide use biomass and coal as their primary source of energy for cooking and heating. According to the Indian National Census (2001), 75% of households use solid fuels, with the prevalence of solid fuels, with the prevalence of solid fuel use as high as 90% in rural areas. Currently about 70% of Indian population lives in rural areas (estimated to decline to 55% by 2030). In India an estimated 400,000 deaths from acute lower respiratory infection(ALRI) in children younger than five and 34,000 deaths from COPD in women are attributed annually to house hold solid fuel use, making this the third leading risk factor amongst all risk factors contributing to the national burden of disease and exceeding the burden attributable to outdoor air pollution[34].

Multivariate analysis showed a positive association between COPD and urban/rural area(surrogate for fuel type and local exhaust local ventilation in kitchen) after adjustment for sex, age group, body mass index, education, occupational exposure, respiratory disease in family, smoking status, life quality and cough in child hood; similar results were found in non smoking women. Pollutants measurements showed that concentrations of carbon monoxide, particulate matter with an aerodynamic diameter ≤10μm, sulphur dioxide and nitrogen dioxide in the kitchen during biomass fuel combustion were significantly higher than those during LPG combustion.

CONCLUSION

This study shows that healthy non smoking women using biomass fuel for cooking had sub clinical respiratory impairment mainly in early stage small air way obstruction. This could be identified by pulmonary function tests, which are sensitive and simple tests to identify early respiratory impairment. The adverse effects of biomass fuel on lung function could be due to exposure to high concentration of pollutants like carbon monoxide, sulphur dioxide, nitrogen dioxide, particulate matter, polyhydroxy aromatic hydrocarbons liberated by biomass fuel combustion and inadequate ventilation. It is also found that degree of dysfunction or lung impairment correlates with duration of exposure. Hence by improving ventilation, outdoor cooking may prevent the adverse effects of biomass fuel combustion on lungs.

REFERENCE

1. Revathi M, T Karthiyanee Kutty and Nachal Annamalai. Pulmonary function tests in rural women exposed to biomass fuels. J Pulmon Resp Med 2012; 2: 7 | 2. Salvi S, Barnes PJ (2010) Is exposure to biomass smoke the biggest risk factorfor COPD globally? Chest 2010; 138: 3-6. | 3. Twisha Lahari and Manas Ranjan Ray studied Health impacts of biomass fuel use in rural India. IJMR 2001;62:625-628. | 4. Ankit Agarwal and Shrirang N.Patil. Pulmonary function tests in rural women exposed to biomass fumes. Indian Journal of Basic & Applied Medical Research. June 2013; Issue-7, Vol.-2: P. 673-678. | 5. Smith K, Samet J, Romieu I, Bruce N. Indoor air pollution in developingcountries and acute lower respiratory infections in children. Thorax 2000; 55: 518-532. | 6. Rinne ST, Rodas EJ, Bender BS, Rinne ML, Simpson JM, et al. Relationship of pulmonary function among women and children to indoor airpollution from biomass use in rural Ecuador. Respir Med 2006; 100: 1208-1215.