

Spirometric Studies in Women of Two Population Samples from Rural and Urban Area in Punjab-Effect of Biomass on Lungs

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Abstract: Inhalation of Biomass Fumes over a long time leads to proliferation and fibrotic changes in Lungs. Early recognition of this damage provide, an important clue to insure good health. Spirometry is an invaluable screening test to identify patient with air flow obstruction. The study has been conducted as 100 Rural and 100 Urban Punjabi females using Biomass fuel and LPG respectively between 20-50 years of age. The ventilatory tests like PEFr, FEV measured by computerized spirometer (Med-Spiror) showed a highly significant decline in Rural women, While in rest of the parameters there is statistically non-significant decrease in rural women. The cause of decrease in the flow volume in the rural women using Bio-mass fuel is due to respirable suspended Particulate matter like SO_2 , NO_2 , CO_2 , CO etc. Which lead to decreased lung function and increased prevalence of chronic bronchitis and COPD. The cause of better preserved lung function in urban women is due to use of other fuels for cooking i.e., LPG gas and well ventilated homes and because of non exposure to indoor pollution as in case of using biomass fuels. So chronic Exposure to biomass smoke is associated with chronic bronchitis and reduced lung function in rural women.

Keywords: Biomass fuel, PEFr, FEV₁, Rural women, COPD, Indoor Air Pollution

I. Introduction

Spirometry is vital in Screening, diagnosing and monitoring of patients in clinical respiratory medicine. The Interpretation of these results depends on comparison with reference values derived from a pool of normal healthy Population. PFT parameters were mainly influenced by body height and weight in both sex¹. PFT's are affected by factors including diet, obesity, air pollution and physical activity level. In the last two decades, rapid economic growth and development worldwide has resulted in an improvement in peoples nutritional status. At the same time, air pollution levels have increased and peoples physical activity levels have decreased². Pulmonary function tests (PFT's) are widely used to measure the performance of lungs during physiological and pathological conditions. PFT's determine lung capability of holding air, amount of air moving in and out and how well Lungs take in Oxygen and remove carbon-dioxide from blood. These tests also measure pathology in Lungs if any present and hence used as diagnostic tests for lung disease. Spirometry being the most commonly performed Lung function test is considered as first choice in diagnosis of lung pathology. It measures amount of air that can be moved in and out of one's lungs³.

The majority of indoor air pollutions e.g., the respirable suspended particulate air matter, sulphur dioxide, carbon dioxide, carbon monoxide and Nitrogen dioxide for all seasons have showed that respiratory problems for women and children in urban slums occur mostly in winter⁴.

There is increasing evidence for a possible association between chronic obstructive pulmonary disease (COPD) and the use of biomass fuels for cooking and heating in developing countries. Indoor pollutants from biomass fuels may be an important risk factor for COPD in rural south china^{5,10}. Indoor pollution exposures were associated with the Presence of acute respiratory symptoms and mild lung functions in a rural and an urban area⁶. Biomass (organic) fuels cause exposed to biomass fumes are more likely to suffer from chronic bronchitis (CB) and COPD than urban women, although from chronic prevalence of smoking is high among the later groups⁷.

Prevalence of asthma was more in cases having positive family history of atopy and in those staying in poorly ventilated thatched houses. No Significant difference was found in asthma prevalence between urban and rural population⁸. It has been suggested that poor nutritional status lead to poor growth of muscle and development of lungs and consequently decreased lung function⁹.

Prevalence of chronic bronchitis was significantly associated with heating source, age, area of residence and lower socioeconomic status¹¹. Height showed the greatest effect on the predicted value of FEV₁ and FVC in males and females. Height has the greatest effect on the predicted value of FEV₁ % in females where as weight has the least effect¹².

II. Material and Methods

This study was conducted among 100 rural females using organic fuel (biomass) as sole fuel in their kitchen as cases and 100 urban funds as controls not using the biomass fuel but using natural gas i.e. LPG in and around Patiala, Punjab between 20 -50 year of age.

Judged to be healthy or the criterion of no exertional dyspnea/general disability, h/o current/ past cardio respiratory disorder or frequent cold, obvious sign of malnutrition, no obesity, h/o smoking and a detailed physical examination was carried out and Hb concentration was done. The lung function test were suggested by Gandevia and Hugh Jones and cotes. the procedures were quite simple from patients. Point of view only two maneuver were required to accumulate all test data i.e. a forced vital capacity and maximum voluntary ventilation. All gas volumes are corrected to B.T.P.S (body temperature ambient pressure and Saturated with water Vapour) automatically by the instrument. Pulmonary function terms were carried out in standing position, height was measured in centimeters, weight was measured in Kilograms, body surface area was read from "Nomogram" Dobous and Dobous.

In the Procedure of lung function a nose clip was attached to the subject and a clean mouth piece was inserted into the breathing tube two maneuver were performed.

- 1) **Forced vital capacity test:-** subjects were instructed to take maximum inspiration and then place mouth piece firmly in mouth and performed, maximum expiration.
- 2) **Maximum voluntary ventilation test procedures:-** After rest of five minutes the subject was asked to breathe as rapidly and deep as possible in and out from the mouth piece. MVV test was run for 12 seconds. Results were taken on the built in printer containing all the patients information and calculated values of all the 14 parameters.

III. Statistical Analysis

The various statistical consideration used were mean, standard deviation, correlation Coefficient and regression equation was evaluated by constructing ANOVA table.

IV. Results

Anthropometric parameters in cases and controls are shown in Table 1 showing mean standard deviation 't' value 'P' and significance. The value of PEFR, FEV₁ shows statistical significant difference between cases and controls. PEFR Table 2. Shows Mean 'SD' and 't' value significance in the cases and controls and show that it is statistically significant.

FEV₁ Table 3. show mean 'SD' and 't' value significance in the cases and control and show that it is statistically significant.

Table 1: Comparison Of Anthropometric Parameters In Cases And Controls Population

Para meters	M e a n ± S D	M e a n ± S D	T V a l u e	P V a l u e	S i g .
A g e	33.18±9.37	31.54±9.45	1.75	>0.05	N S
W e i g h t	60.33±11.81	61.22±10.38	0.84	>0.05	N S
H e i g h t	167.90±6.21	167.28±6.79	0.91	>0.05	N S
F V C	3.12±0.57	3.20±0.57	0.32	>0.05	N S
E F V _{0.5}	1.91±0.58	1.98±0.57	1.28	>0.05	N S
F E V ₁	5.33±1.90	5.77±1.88	2.31	<0.05	S
F E V ₃	3.11±0.68	3.18±0.60	1.34	>0.05	N S
P E F R	6.97±2.70	7.52±2.76	2.22	>0.05	S
F E F _{2.5-7.5}	3.19±1.17	3.18±1.14	0.11	>0.05	N S
F E F _{0.2-1.2}	2.66±0.53	2.73±0.61	1.40	>0.05	N S
F E F _{2.5%}	2.87±0.43	2.35±1.41	1.68	>0.05	N S
F E F _{5.0%}	3.74±1.37	3.83±1.40	0.61	>0.05	N S
F E F _{7.5%}	1.66±0.89	1.77±0.96	1.23	>0.05	N S
FEV _{0.5} /FVC	0.61±0.51	0.61±0.74	0.21	>0.05	N S
FEV ₁ /FVC	0.85±0.09	0.852±0.10	0.39	>0.05	N S
FEV ₃ /FEC	99.40±2.41	99.28±2.83	0.83	>0.05	N S
M V V	108.34±337.87	113.54±31.43	0.80	>0.05	N S

S- Significant

NS- Non Significant

Table – 2 Mean \pm SD, t value and significance of PEFR

	M e a n \pm S D	T v a l u e	S i g
U r b a n	6 . 9 7 \pm 2 . 7 0	2 . 2 2	S
R u r a l	7 . 5 2 \pm 2 . 7 6		

Table-3 Mean \pm SD, t value and significance of PEFR

	M e a n \pm S D	T v a l u e	S i g
U r b a n	5 . 3 3 \pm 1 . 9 0	2 . 3 1	< 0 . 0 5
R u r a l	5 . 7 7 \pm 1 . 8 5		

V. Discussion

This study was done with an aim to collect more data on women using biomass fuels in rural population and LPG using urban female population as there was marked difference between urban and rural areas and to bridge the gaps in our knowledge.

In this study, was found that rural women (20-50 yrs of age) were of low socio economic status living in small congested houses using solely the biomass (organic) fuels for cooking or heating purposes for 6-7 hours daily and urban women were using fuels other than the biomass fuels i.e. LPG gas and were of good socio economic status and living in non congested, " well ventilated houses"

This study showed that the women using biomass fuels (case) for the cooking even with a chimney as compared to the use of LPG (controls) have significant lower values for the PEFR & FEV₁. This probably because of indoor particle concentration were higher in houses using biomass flues⁷. It has been observed that the Peak indoor particulate matter (PM₁₀, Particles with a diameter of 10mm or less) often exceeded 2mg/m³ compared with those cooking with gas. Current use of stove burning (Chula) biomass fuels was associated with increased reporting of phlegm and reduced lung function, levels of FEV₁, were lower with higher PM₁₀ concentration. The respirable particulate matter like No₂, Co₂, Co were found in high concentrated especially in winters and cause chronic bronchitis and COPD^{2,8}.

VI. Conclusion

The study of lung function parameters conducted on 100 Rural women using biomass fuels (cases) and 100 urban women using LPG (controls). The cases as of low socio economic status use to dwell in small congested houses and use the biomass fuels because they are cheap and easily available and moreover cannot afford the other means for cooking and controls using LPG for cooking and heating purposes and have better socioeconomic status living in well ventilated houses have showed that decline in the 2 parameter in cases was due to respirable suspended particulate matter in the smoke produced by the biomass fuels and caused the noxious effect of indoor air pollution on the lungs. The cause of better preserved lung function of controls is due to lesser exposure to the respirable suspended particulate matter Co₂, Co, No₂, So₂ etc. and better living standard in well ventilated houses. More phlegm production in women using biomass fuels than LPG using women. Chronic bronchitis and airflow obstruction were increased in women who had been exposed to wood smoke.

Solid fuels are a major source of indoor air pollution but in developing countries the short term effects of indoor air pollution are poorly understood compared with other fuel types, coal was associated with a lower health status including negative impacts on exhaled carbon monoxide level, forced vital capacity, life time prevalence of chronic obstruction pulmonary disease and asthma and health care utilization. Decreasing household coal use (solid fuels) increasing are of improved stove technology and increasing kitchen ventilation may decrease the short term health effects of indoor air pollution.

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