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Correlation Between Years Of Exposure And Age With Peak Expiratory Flow Rate In Women Exposed To Biomass Fuel In Rural Parts Of Jalgaon District.

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Abstract
Background: *In India, about 80% of rural homes use biomass fuel as their cooking and heating energy source. Many women in rural homes use closed kitchen for cooking without exhaust. Biomass fuel contains hundreds of chemical compounds that include particles, polycyclic aromatic hydrocarbons and carbon monoxide[2].Biomass fuel is one of the most important risk factor for developing airflow limitations and subsequent Chronic Obstructive Pulmonary Disease (COPD) in women of rural area[2].COPD is characterized by poorly reversible airflow obstruction secondary to an abnormal host response to noxious environmental stimuli like biomass fuel. COPD is important cause of mortality, it is fourth leading cause of death[3].Early detection of airflow limitation is essential to prevent the continuous deterioration of lung function[3].The peak flow meter is a simple, easy & portable tool that measures peak expiratory flow rate (PEFR) and detects airflow limitations. Hence the present study was undertaken to find the correlation between the years of exposure and age with PEFR by using peak flow meter.*
Materials and methods: *304 rural women were included in this study as per selection criteria and they were provided preliminary information about this study. Then they were asked about their duration of work with of biomass & other demographic details. Then a demonstration about the correct use peak flow meter was given to them. 3 readings of PEFR were taken and the best of 3 was considered as the final value of PEFR. Data was statistically analysed for the correlation between years of exposure and age with PEFR*
Result: *PEFR was found to be decreased in women with exposure for 30-40 years and more than 40 years as compared to those women with years of exposure less than 20 years. Women with age group of 51-60 years were found to have least PEFR.*
Conclusion: *Exposure to biomass fuel can lead to airflow limitation as significant decrease in the Peak expiratory flow rate (PEFR) was found in rural women who were exposed to it for prolong duration. PEFR decreases as the age & years of exposure increases. Hence this study concludes that the correlation exists between the duration of exposure & age with Peak expiratory flow rate in rural women among Jalgaon district of Maharashtra.*
Key word*: Biomass fuel, PEFR, Airflow limitation, Years of exposure, Rural women*

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I. Introduction

In India about 80% of Rural homes use biomass fuel as their cooking and heating energy source[1]leading to high level of indoor air pollution. This resource is available free of cost and has easy availability at huge quantity[1].People living in the regions of biomass use have higher incidence of respiratory diseases. Many women in rural homes use closed kitchen for cooking without exhaust.This has significant impact on respiratory health of women[1].Biomass fuel contains hundreds of chemical compounds that include particles, polycyclic aromatic hydrocarbons and carbon monoxide[2].

WHO has ranked indoor air pollution as 10th preventable risk factor contributing to Global burden of disease[13]. Biomass fuel is one of the most important risk factor for developing airflow limitations and subsequent COPD in women of rural area[2].Globally 50% deaths from COPD in developing countries are contributed by biomass exposure and 75% women are suffered[13].

COPD is characterized by poorly reversible airflow obstruction secondary to an abnormal host response to noxious environmental stimuli like biomass fuel[1].COPD is important cause of mortality, it is fourth leading cause of death[3].

Early detection of airflow limitation is essential to prevent the continuous deterioration of lung function[3].The peak flow meter is a simple, easy & portable tool that measures peak expiratory flow rate (PEFR) and detects airflow limitations as it has good sensitivity and specificity[8].Hence the present study needed to be carried out to find the correlation between years of exposure and age with PEFR in rural women by using peak flow meter.

II. Material and Methods

After obtaining the ethical clearance from the institutional ethical committee, 304 rural women of Jalgaon district of Maharashtra, aged more than 35 years and using biomass fuel for more than 10 years were included in this study.

Study Design: Observational
Method of sampling: Convenient sampling
Study place: women from the different rural parts of Jalgaon district
Study duration: 6 months
Materials required: Pen, Paper, Peak flow meter, gloves, mask, sanitizer
Selection and selection method:
Inclusion criteria:

1. Rural women with age >35 years.
2. Rural women using biomass for > 10 years

Exclusion Criteria:
Subjects with

1. Previous history of thoracic surgery
2. Previous medical history of any respiratory disorder
3. Previous history of cardiovascular disease

Procedure methodology:

All the Subjects were provided the preliminary information about this study. Peak flow meter was used to measure the PEFR. Standard instructions were given to perform forced expiration through peak flow meter as per the guidelines of American Thoracic society. Then they were asked to sit in upright position. Later they were asked to hold the peak flow meter horizontally into the mouth through the mouthpiece closing the lips around it. The marker of peak flow meter was set at the bottom line. After a deep inspiration, they were asked to exhale as hard as possible in a single & forceful blow through the peak flow meter. The same procedure was repeated 3 times & the best of the them was considered as the final value of PEFR. The mouthpiece of peak flow meter was sanitized after every use of peak flow meter. Then data was collected and statistical analysis was done.

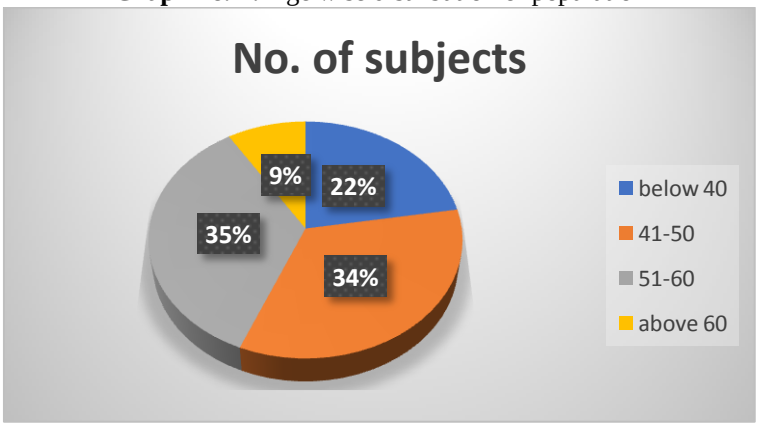
Statistical analysis:
Data was analyzed using one-way ANOVA to find statistical difference among the means of two or more groups

III. Result

Table no.: 1 Age wise distribution of population.

Age groups	No. of subjects	Percentage
35-40	68	22.37
41-50	103	33.88
51-60	106	34.87
60-65	27	8.88

Graph no. 1: Age wise distribution of population

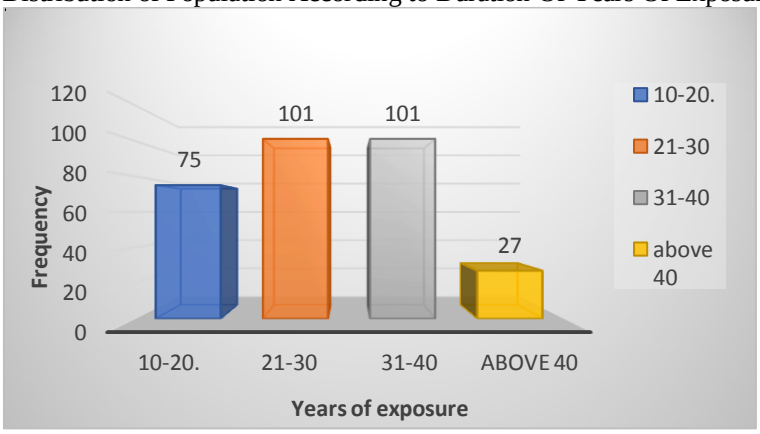


Interpretation: Out of total no. of population, 68 (22.37%) subjects were below 40 years of age, 103(33.88%) subjects were from age group of 41-50 years, 106(34.87%) subjects were from age group of 51-60 years, and 27 (8.88%) subjects were above 60 years of age.

Table no. 2: Distribution of Population According ToDuration Of Years Of Exposure To Biomass

Years of exposure	No. of subjects	Percentage
10-20	75	24.67
21-30	101	33.22
31-40	101	33.22
above 40	27	8.88

Graph no. 1: Distribution of Population According to Duration Of Years Of Exposure To Biomass

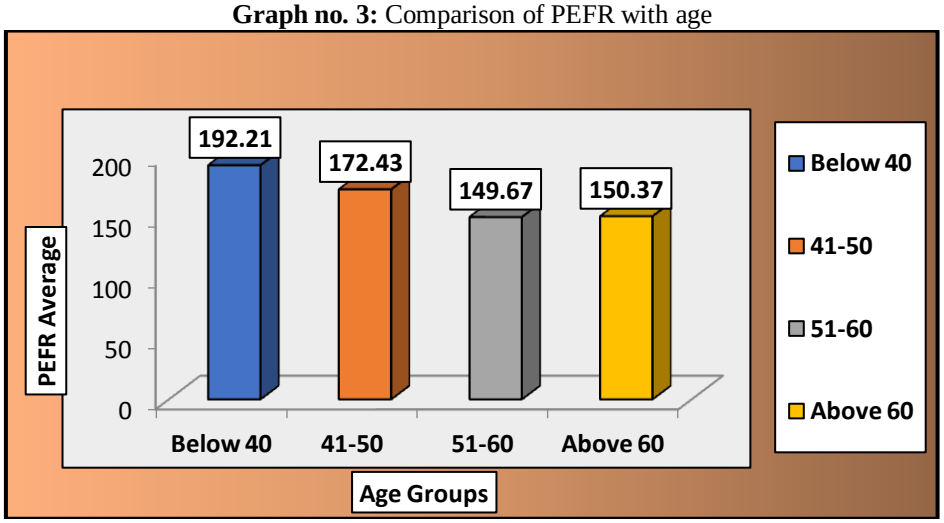


Interpretation: Out of total no. of population, 75 (24.67%) subjects were exposed to biomass fuel for 10-20 years, 101(33.22%) subjects were exposed to biomass fuel for 20-30 years, 101(33.22%) subjects were exposed to biomass fuel for 31-40 years and 27(8.88%) subjects were exposed to biomass fuel for more than 40 years

Table no. 3: Comparison of PEFR with age

Age Groups	PEFR		F value	P value	significance
	Mean	SD			
35-40	192.2	25.16	50.64	0.000	significant
41-50	172.43	21.68			
51-60	149.67	26.17			
61-65	150.37	15.99			

Graph no. 3: Comparison of PEFR with age

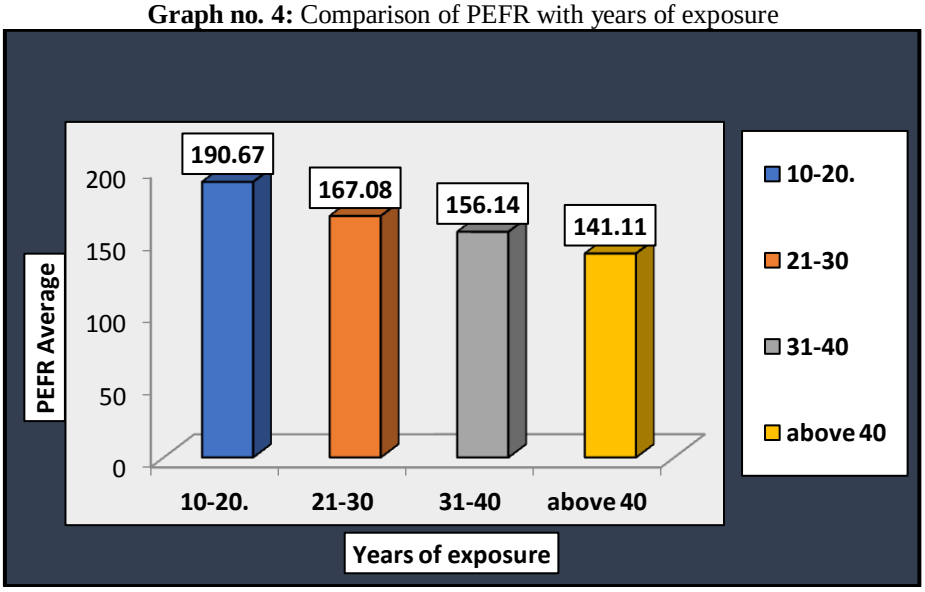


Interpretation: Subjects with age group of 51-60 years were found to have least mean PEFR as compared to other age groups

Table No. 4: Comparison of PEFR With Years of Exposure

Years of exposure	PEFR		F value	P value	Significance
	Mean	SD			
10-20	190.67	25.76	39.48	0.000	significant
21-30	167.08	25.95			
31-40	156.14	23.47			
Above 40	141.11	20.44			

Graph no. 4: Comparison of PEFR with years of exposure

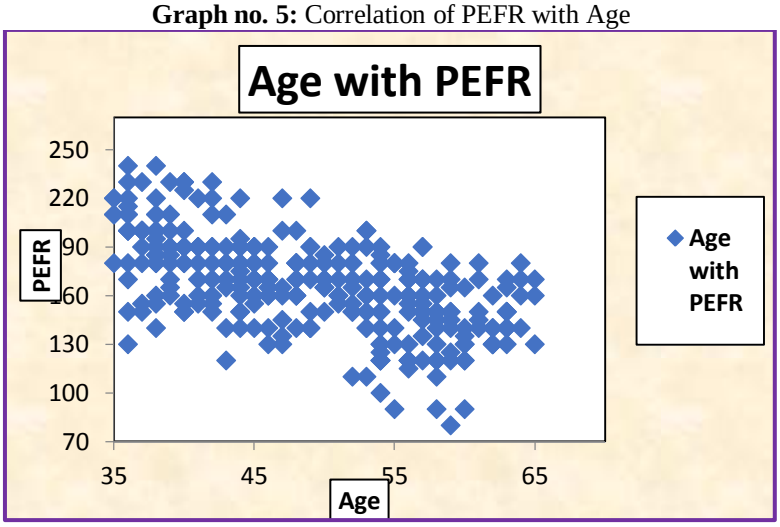


Interpretation: The graph shows least mean PEFR in women who were exposed to biomass for more than 40 years.

Table No.5: Correlation of PEFR With Age

Age with PEFR	
Correlation	-0.59
P value	0.000

Graph no. 5: Correlation of PEFR with Age

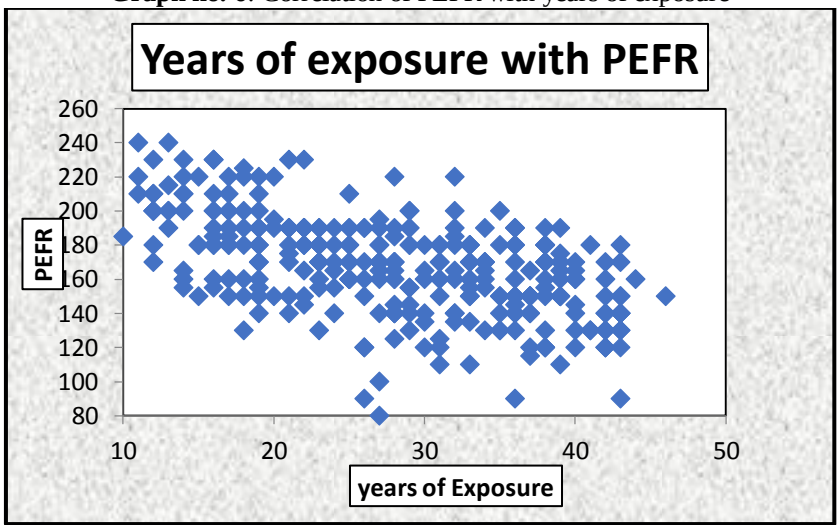


Interpretation: -The above graph shows negative correlation between PEFR & age. PEFR was found to be reduced with increasing age.

Table no.6: Correlation of PEFR With Years Of Exposure

Years of Exposure with PEFR	
Correlation	-0.55
P value	0.000

Graph no. 6: Correlation of PEFR with years of exposure



Interpretation: -The above graph shows negative correlation between PEFR and years of exposure. PEFR was found to be reduced with increasing years of exposure.

IV. Discussion

The present study shows that the correlation between years of exposure and age with PEFR is significant by using peak flow meter. A study done byYogesh T. Thorat et al showed that peak flow meter with a cut-off value of Peak expiratory flow (PEF) <80% predicted had good sensitivity of 91% -75% and 75% of specificity[4]. A study also reported 83-84% sensitivity of peak flow meter to detect airflow limitations by measuring PEFR [4].

Table no.3 shows comparison of mean PEFR with 4 different age groups. Subjects with age group of 51-60 years were found to have least mean PEFR as compared to other age groups. According to the study done

by Juraj sprung et.al, both peak expiratory flow and maximal inspiratory flow rates decrease with ageing[14]. The possible reason behind the decrease in maximal expiratory flow is attributed to the loss of static lung elastic recoil pressure, decreased respiratory strength, increased residual volume and impaired gas exchange. Stiffness of chest wall and diminished alveolar surface area leads to reduction in vital capacity. This may cause increase in residual volume, reduction in expiratory flow, increase in ventilation-perfusion heterogenicity &decreases respiratory muscle strength[14]

The statistical analysis of this study showed least mean PEFR in women who were exposed to biomass for more than 40 years (Table 4). Om P. Kurmi et.al and Johnson P et.al also showed the significant association between biomass fuel exposure and development of COPD in rural women of Nepal [9,10] And in rural areas, women exposed to dust and organophosphate pesticides from agriculture activities which can also be another recognized risk factor for airway inflammation[9]

The studies done by Dr. Iqbal Singh et al[12] and Rajwinder Kaur et al[13] found that the women using biomass fuel for cooking even with a chimney as compared to the use of LPG have significant lower values for the PEFR and FEV1. This is probably because of indoor particle concentration is higher in houses using biomass fuel[12,13].

Table no. 5 shows significant correlation between PEFR and age which indicated a reduction in PEFR with growing age. Similar results were found by P.H. Quanjer et al.[15]The factors like decreased muscle strength with increasing age, impaired elastic recoil, stiffening of lungs and narrowing of airways can increase resistance to air flow which decreases PEFR[15]. Rajendra prasad et.al found a decline in PEFR by 29.2 lit/min per decade[16]

Table no. 6 shows significant correlation between PEFR and years of exposure. The PEFR was found to be reduced with increased number of years of exposure to the biomass. It is possible due to Repetitive exposure to biomass. This prolong exposure causes irritation of small airways because of the carbon monoxide present in biomass smoke[2]**.** Studies from Turkey, Nepal, china, Spain, and Columbia have reported positive association between biomass exposure and COPD, although the quantified risk varies across wide range of effect size[10].

V. Conclusion

Exposure to biomass fuel can lead airflow limitation as significant decrease in the Peak expiratory flow rate (PEFR) was found in rural women who were exposed to it for prolong duration. PEFR decreases as the age & years of exposure increases. Hence we conclude that the correlation exists between the duration of exposure & age with Peak expiratory flow rate in rural women among Jalgaon district of Maharashtra.

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