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Relationship between Parental Smoking and Children's Pulmonary Function

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ABSTRACT

Purpose: To Study/Understand the Exposure-response Relationship between Parental Smoking and Children's Pulmonary Function
Materials and Method: Participants were selected randomly who fit into the inclusion criteria. Selected participants to be then made understood for the nature of study. Subjects were asked to seat upright on table / stool facing the Spirometer machine. Spirometer was done with the RMH Helios computerized Spirometer. Subjects were asked use nose clip and exhale complete and maximum air for long duration then immediately take deep inspiration followed by complete and maximum expiration for long time. Out of 3 or 4 manoeuvres the best manoeuvre was selected and % predicted of FEV^1, FVC, FEV_1/FVC, PEFR, FEF_{25-75} was documented.
Results: Statical analysis was done by using Parametric (unpaired t test) and or nonparametric (Mann Whitney) statical test with 95 % class interval (one tailed p). Spearman's correlation test was obtained to check the relationship between variables.
Conclusion: There is a significant reduction in PEFR due to obstructive effect of parental smoking (passive smoking) on pulmonary function of the children. And with increase in number of packs per years, there is a reduction in FEV_1, FVC, PEFR and FEF_{25-75} of children.

Keywords: Passive Smoking, Pulmonary Function, children

INTRODUCTION

Cigarette smoking is highly prevalent and causes serious health problem globally.[1] There are approximately 1.1 million smokers worldwide, out of which 182 million of them live in India[2].Exposure to smoking often begins with maternal smoking in utero. From maternal, household or contacts in community, early life exposure may increase the susceptibility of infant to develop lung disease and reduce lung function. [3, 4]The effects of passive smoking on many pathophysiological mediators of coronary artery disease are nearly as large as those of active smoking, including impaired platelet function, damage to vascular endothelium and its associated repair mechanisms, a rise in inflammatory molecules, and dysfunctional.[1]Smoking by parents is associated with a wide range of adverse effects in their children which includes exacerbation of asthma, increased frequency of colds, ear infection & sudden infant death syndrome.[5]

A meta-analysis analysed 79 studies and reported that increased risk of asthma in children by 20-85% due to exposure to smoking, which shows the significant burden of pulmonary diseases due to exposure to passive smoke during childhood.[6] According to Wang et al, an annual follow up report on exposure of children and adults, showed that there is decrease in FEV_1, FEV_1/ FVC and FEE_{25-75} of FVC. Another study by He et al, found deficits in FEF but not in FEV_1 and FVC, and effect in FEF might be functional and

not structural, and due to temporary narrowing.[7, 8]

Research on passive smoking provides strong evidence of smoking's negative impact on pulmonary function, but relatively few reports are available, on the effect of parental smoking and its effects on children's lung function.

MATERIALS AND METHOD

30 Children were randomly selected as per the inclusion and exclusion criteria after finding their suitability. Out of which 15 children whose parents were smoker and 15 children's parents were non-smokers. The inclusion criteria were age ≥ 8 and 15 ≤ years, parents were smoker, child has never smoked, any family members except parent have never smoked and coal was not used for either heating of cooking at the home. The exclusion criteria were any known cardio respiratory, musculoskeletal disease mainly involving thorax and upper limb, and neurological conditions. Children and their parents were briefly stated about the nature of study and intervention after their enrolment. Written consent was taken from their parents.

Procedure

On the day of intervention, physical examination was done and vitals were noted and anthropometric measurements were done with calibrated measure. History of smoking from parents were taken. Subjects were asked to seat upright on table / stool facing the Spirometer machine. Spirometer was done with the RMH Helios computerized Spirometer. Subjects were asked use nose clip and exhale complete and maximum air for long duration then immediately take deep inspiration followed by complete and maximum expiration for long time. Out of 3 or 4 manoeuvres the best manoeuvre was selected and % predicted of FEV1, FVC, FEV1/FVC, PEFR, FEF25-75 was documented.

Statistical Methods

The data was analysed using Graph pad Prism. Based on normality appropriate Parametric (unpaired t test) or nonparametric (Mann Whitney) statical tests with 95 % class interval (one tailed p)

RESULT

Demographic data of Group A and Group B were given in Table 1.

Table 1

Demographic Data		
	Parental smoking / Group -B	**Control Group / Group - A**
Total	15	15
Male	6	9
Female	9	6
Age (Mean ± SD)	12.4 ± 1.76	11.73 ± 2.09

Table 2(a)

Parameters (% Predicted)	Paternal smoking group (Mean ± SD)	Control group (Mean ± SD)	P Value	Unpaired t – value	Significance (NS / S)
FEV_1	76.6 ± 14.68	80.4 ± 13.80	0.3099	0.501	NS
FEV_1 / FVC	111.33 ± 3.74	111.2 ± 5.29	0.4985	0.0037	NS
FFF_{25-75}	101.33 ± 25.22	98.67 ± 18.68	0.3723	0.329	NS

According to Table 2 (a), The mean of difference between Parental smoking group and Control group for FEV1, FEV1 / FVC and FEF25-75 was analysed by using Unpaired t-test with 95 % of CI. ($p < 0.005$)

Table 2(b)

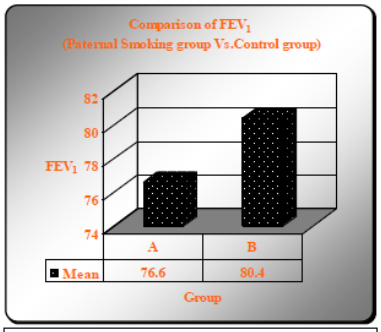
Parameters % Predicted	Paternal smoking group (Mean ± SD)	Control group (Mean ± SD)	P Value	Unpaired t - value Mean Whitney U (U')	Significance (NS / S)
FVC	68.8 ± 13.21	72.47 ± 14.75	0.4505	109 (116)	NS
PEFR	71.6 ± 14.81	89 ± 19.50	0.015	60 (165)	S

The mean of difference between Parental smoking group and Control group for FVC and PEFR was analysed by using Mann Whitney U test with 95 % of CI. ($p < 0.005$), which shows significant reduction in PEFR in Parental smoking group.

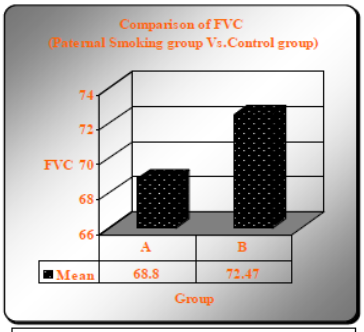
Table 3

Pack per Year	Significance
Correlation of pack per year with Paternal smoking Group Parameters % Predicted	r value
FEV_1	-0.2013
FVC	-0.2453
FEV1 / FVC	0.2913
PEFR	-0.4291
FEF_{25-75}	-0.0502

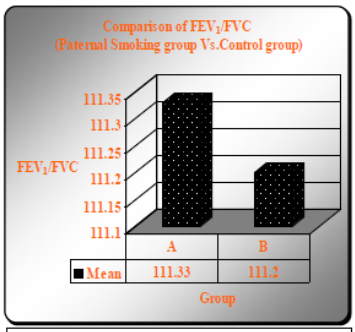
Correlation of pack per year with FEV_1, FVC, FEV_1 / FVC, PEFR and FEF_{25-75} was analysed by using Spearman's correlation test.



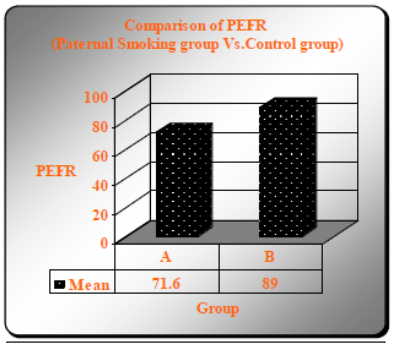
Graph 1: Mean of Control Group and Paternal Smoking Smoking Group for FEV_1



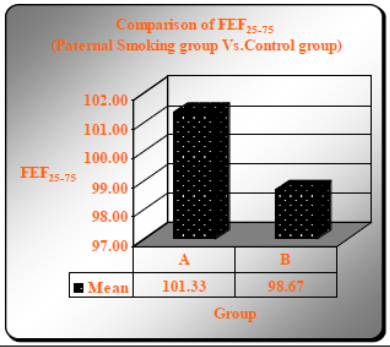
Graph 2: Mean of Control Group and Paternal Smoking Group for FVC



Graph 3: Mean of Control Group and Paternal Smoking Group for FEV_1 / FVC



Graph 4: Mean of Control Group and Paternal Smoking Group for PEFR



Graph 5: Mean of Control Group and Paternal Smoking Group for FEF_{25-75}

DISCUSSION

The current study "Relationship between Parental Smoking and Children's pulmonary function" was conducted to access the effect of passive cigarette smoking on lung function of children. Pulmonary function tests in form of office spirometry were performed on total 30 subjects, who were divided into two groups with 15 subjects in each group.15 in Control Group and 15 in paternal smoking Group. All the subjects were in between the age group of 8 -15 years.

The differences in the mean value of FEV_1, FVC, FEV_1/FVC, PEFR and FEF_{25-75}% between Parental smoking group and Control group and the difference in each parameter in Paternal smoking group based on the number of cigarettes smoked per year were analysed.

FEV_1

In the current study there was no statically significant difference in the mean value of FEV1 (p=0.3099) between the Control Group and Parental Smoking Group. Here correlation of Pack per Year with FEV1was negative (r=-0.2013) but not significant.

Above results are also supported per study report of Nuhoglu C, Gurul M et al (2003) conducted their study by taking 33 children, who were exposed to environmental tobacco smoke inside their homes. The FEV_1, FEV_1/FVC and FEF_{25-75}% were found significantly lower than the

non-smoker control group. [8] [9]Hogg and his colleagues (1994) studied the lung structure and function in cigarette smokers and observed a decline in FEV_1 associated with an increase in residual volume and a decrease in diffusing capacity in smokers and concluded that this reduction in FEV_1 can be partially explained by loss of lung elastic recoil pressure.[10]Alan Smyth et al (1994) conducted a study on 57 children with cystic fibrosis and 51 in control group. In cystic fibrosis group, when the parents smoked the child's FEV1 decreased by 4% and FVC by 3% for every 10 cigarettes smoked in the house each day.[11]

FVC

In the current study there was no significant difference in FVC (p=0.45) between both the group. FVC (r=-0.24) was not significant and negatively correlated with the pack year in parental smoking group.

Beijing Respiratory Health Study (1994) on 1,618 male and 1,669 female adults, aged 40-69 yrs found that female smokers had reduced FEV_1 and FVC compared with male smokers, after adjusting for smoking year, smoking status, and other related confounding factors.[12] MMHaby, JK Peat, AJ Woolcock (1994) studied effects on lung function of passive smoking, current asthma, past asthma, and a current respiratory infection with the Children age 8 -11 years. They found that Passive smoking was associated with reduced FEV_1, PEFR, and FEF_{25-75}% and FVC was reduced in respiratory infection.[13]A cross sectional study done by Corbo GM et al (2007) to evaluate the effect of parental smoking on lung function of adolescents observed subjects with smoking parents had higher FVC and significant lower FEV_1/FVC ratios than subjects without smoking parents. [14]

FEV_1 / FVC

Mean value of FEV_1/FVC (p = 0.4985) there was no statistical difference between control group and parental smoking group. Correlation of FEV_1 / FVC (r = 0.2913) with pack year in parental smoking group was positive and not significant.

According to the Corbo G M (2003) Study done on 441 subjects were found to be heterozygotes. There was a reduction in lung function in sixty-one subjects exposed to parental smoking in the overall sample and FEV_1 / FVC ratio, FEF_{25-75}, and FEF_{75}. In subjects exposed to parental smoking the decrement in lung function in heterozygotes tended to be greater than in homozygotes.[15] Study by Sherrill DL, Martinez FD (1992) done on children to see the effect of smoke exposer on lung function included age 9-15 years in utero exposure from mothers who smoke during pregnancy, passive smoke from parents, and active smoking by the children. No significant negative effects were seen for absolute FEV_1 or FVC in either sex, related to active or passive smoke exposures. Parental smoking was associated with persistent but mild and non-progressive impairment of the FEV_1 /FVC ratio in males.[16]

PEFR

Mean value of PEFR (p = 0.015) was found to be significant for both the groups and was significantly lower in parental smoking group and there was also negative but non-significant correlation of PEFR (r=-0.4291) with pack year in Parental Smoking Group.

Predisposition to airway narrowing and decreased lung recoil may vary between men and women given sex differences in lung characteristics.[82] In addition, experimental evidence suggests that the distribution of particle deposition in the airways is likely to be more proximal in women compared to men.[17]

Since airway caliber is smaller in size in women, it could be hypothesised that the same reduction in airway diameter would result in a relatively more impact on the reduction in flow rates in women compared to men.[18,19] KenanBek and Nazan Tomac (1999) studied that Paternal smoking was associated with reduced levels of FEF

between 25-75% of vital capacity, PEFR, and flow rates after 50% and 75% of vital capacity expired. Maternal smoking did not have statistically significant adverse effects on children's pulmonary function.[20] Nancy NR et al (1981) done a study found that all outcome measures FEV_1, FVC and FEV_1/FVC were not statically significant, but PEFR was statically significant (p =0.015) this is because smoking causes inflammation and narrowing of the airways that is going to increase resistance to the airflow.[23]

FEF_{25-75}

Difference of FEF_{25-75} (p =0.3723) between Parental smoking group and control group was found to be non-significant for both the group and there was negative correlation of FEF_{25-75} (r = -0.0502) with pack year in Parental smoking group.

Nuhoglu C, Gurul M et al (2003) in their study by taking 33 children who were exposed to environmental tobacco smoke inside their homes, having decrease in $FEF_{25–75}$% was significantly correlated inversely with the number of cigarettes smoked per day.

Mehmet Polatly (2000) studies the early effect of smoking on spirometry and transfer factor of carbon monoxide in asymptomatic smokers. It was carried out in a men (39 non-smokers and 93 smokers) aged 22 to 45 years. A significant correlation was found between smoking pack year and FEF_{75}% was found to be under 75% of the predicted value in 22 smokers with a history of smoking over 20 pack years. So, lower values may indicate the early destruction of the lungs and transfer factor may be used as an additional parameter to spirometry.[24]

Dr. Francisco Javier Gonzalez Barcala (2007) did a cross-sectional study on healthy children and adolescents between 6 and 18 years of age, found that Children whose fathers were smokers presented a 30% higher risk of reduced FEF25%-75% and a Children whose mothers were smokers presented a 30% higher risk of reduced FEV_1.

Finally, children of parental smoking group live in their home with at least one smoker, so every effort should be made to reduce passive exposure to children and give them a chance to grow up in a healthier environment.

CONCLUSION

The study reveals that there is a significant reduction in PEFR due to obstructive effect of parental smoking (passive smoking) on pulmonary function of the children. With increase in number of packs per years, there is a reduction inFEV_1, FVC, PEFR and FEF_{25-75} of children. Further research with duration of exposure is needed to see the impact of smoking on pulmonary function.

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Conflict of Interest: None

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Ethical Approval: Approved

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