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TO EVALUATE THE EFFECT OF PASSIVE SMOKING ON THE LUNG FUNCTIONS OF HEALTHY CHILDREN BY PEFR (PEAK EXPIRATORY FLOW RATE)

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ABSTRACT

Background: Peak expiratory flow rate is an effective measure of effort dependent airflow. It is relatively a simple procedure, and may be carried out in the field using portable instruments. Environmental passive smoke exposure especially from household significantly impairs PEFR, but the extensive literature has not been available on impact of household smoking on children. **AIM:** The aim of this prospective study was to evaluate the effect of household passive smoking on the PEFR of children. **Material and method:** Two hundred healthy children of age group between 5-16 years with a history of passive smoking were recruited for the study. The PEFRs was measured by mini Wright Peak Flow Meter and compared with similar 200 children of same age and sex group. **Results:** There was significant difference between two groups. **Conclusion:** Stopping of household parental smoking can significantly improve respiratory health of children.

KEYWORDS: Household, Passive smoking, Peak Expiratory Flow Rate.

INTRODUCTION

PEFR as a measurement of ventilatory function was introduced by Hadorn in 1942, and was accepted in 1949 as an index of spirometry.[1] By definition, it is "The largest expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration, expressed in liters/min (BTPS).[2] The PEFR is an effort dependent parameter emerging from the large airways within about 100–120 ms of the start of the forced expiration.[2] It remains at its peak for about 10 ms.[1] It may be reliably recorded using portable equipment, and thus can be used in field studies. Even in normal subjects the values may be variable as the parameter is entirely effort dependent resulting in a high intra subject variability. Nevertheless it remains an effective tool for assessing a limited aspect of ventilatory function.

Passive smoking is the inhalation of smoke, called Second Hand Smoke (SHS) or Environmental Tobacco Smoke (ETS), from tobacco products used by others. It occurs when tobacco smoke permeates any environment, causing its inhalation by people within that environment. Exposure to second hand tobacco smoke causes disease, disability, and death.[3] Currently, the health risks of second hand smoke are a matter of scientific consensus, and these risks have been a major motivation for smoking bans in workplaces and indoor public places, including restaurants, bars and night clubs, as well as some open public spaces.

Health effects of passive smoking in children are sudden infant death syndrome (SIDS)[4], Asthma[5], Lung infections[6], more severe illness with bronchiolitis[7], increased risk of developing tuberculosis if exposed to a carrier[8], and Crohn's disease.[9]

603,000 deaths in 192 countries were attributable to second-hand smoke in 2004, which was about 1.0% of worldwide mortality.[10] Doctor-diagnosed asthma is more common among non-smoking adults exposed to SHS than those not exposed. Among people with asthma, higher SHS exposure is associated with a greater risk of severe attacks. The children are most susceptible population in household environment for passive smoking, as members in family are smoking actively (mostly father & grandfather). Healthy as well as asthmatic children have increased bronchial hyper-reactivity when exposed to passive smoking. The most significant disturbance in the lung function of the asthmatics is the variable airway resistance, which can be gauged by the peak expiratory flow rate (PEFR). Peak expiratory flow rate (PEFR) is a simple and reliable way of following patients with bronchial asthma and other obstructive airway diseases[11,12], response to a bronchodilator in the assessment of asthmatic subjects even in the specific forms such as occupational asthma.[13,14] Peak expiratory flow rate is easily measured by using a mini-Wright's peak flow meter (mWPFM) which is easy to use, reliable and can be recorded even by the patients or by the parents at home. So, using the mini-Wright, the present study aims to evaluate effect of household smoking on the healthy children.

MATERIAL AND METHODS

Inclusion criteria

This prospective study included a total of apparently healthy 200 (group A) children of age group between 5 to 16 years with a history of passive smoking from Pediatric OPD at Bhandari hospital and research center, a tertiary care hospital from Indore from 2011 to 2013. These were compared with 200 (group B) similar age and sex matched controlled children. A written informed consent was taken from parents of respective children before including them into the study.

Exclusion criteria: Children below 5yrs of age, those having any form of respiratory tract infection, asthma, recurrent wheezing, (at start of study/in the past), those having history of aero-allergens exposures e.g. dust mite /cockroaches / pollens, those having exposure to environmental tobacco smoke (ETS) other than household environment e.g. school, those exposed to other significant air pollutant e.g. wood/coal burning, any particulate matter and cold/dry air, having history of aero-allergens exposures e.g. dust mite /cockroaches / pollens, Those having having history of chronic respiratory diseases e.g. cystic fibrosis/chronic lung, bronchitis were excluded from the study.

Exposure information had been obtained by comparable questionnaires, recording personal data, body measurements, past history of respiratory diseases, immunization, socio-economic status, evaluation of asthma provocating risk factors, peak expiratory flow rate (PEFR) and respiratory system examination of children.

A detailed proforma was filled which included children’s age, sex, height, weight of child, number of smokers in a family, frequency of smoking and type of smoke.

Measuements:

Peak expiratory flow rate (PEFR) measured by same instrument by three readings with mean of three were taken compared between both groups:

All Children were demonstrated how to use mini Wright Peak Flow Meter (mWPFM) correctly. For each determination the child was instructed to make a maximal inspiratory effort and then to make the maximum and most rapid expiratory effort possible in standing position. Serial 3 maximal expiratory blows for PEFR were registered in individual sheet after the child had become familiar with the technique and best of three readings were accepted in each case for data analysis. Paired sample t test was used to see the effect of quitting of passive smoking on PEFR. Linear regression analysis was also performed to see the effect of age, sex, type of smoke, frequency of passive smoking. The data obtained from study was then analysed by using IBM SPSS 20.0 (IBM Corp, USA).

RESULTS

The children were divided into two groups depending upon the exposure to passive smoking Group A (N=200) 120 male and 80 females with expousure to smoking at household or at home and Group B, (N=200) 120 male and 80 females with no household smoke exposure.

There was no significant difference between demographic or base line variables of two groups including age, sex ratio and BMI etc. Mean age of group A and B were 9.6±2.9 and 8.5±2.3 years respectively. Mean BMI(kg/m2) of both group was 15.0±1.2 and 15.5±1.8 respectively.

We found significant difference in baseline PEFR in two groups. Passive smoking in our cohort of cases includes smoke of standard cigarette, bidi and both. Bidi is popular in rural parts of India and are made of crude sun-dried tobacco wrapped in a dried Tendu (*Dyospyros Melanoxylon*) leaf. The mean baseline PEFR was lower in children with passive smoke of both bidi and cigarette than bidi followed by cigarette alone. The cigarette smoking was common than combined smoke followed by bidi.

Using paired sample t test, we observed a significant increase in PEFR between two groups A and B. (Table 2). With significant p value(< 0.001)

TABLE 1 Demographic variables of two groups

Parameter	Group A	Group B	P value
Age(Years)	9.6±2.9	8.5±2.3	0.698
Sex(male: female)	120:80	120:80	0.302
BMI(Kg/m2	15.0±1.2	15.5±1.8	0.105

TABLE 2 Comparison of mean PEFR between two groups

GROUPS	Mean PEFR(L/min)
A	2o6.5±67.89
B	282.7±68.28

DISCUSSION

Passive smoking was recognised as a cause of lower respiratory infection in children in the US Surgeon General report of 2006[15] and also in the UK Government SCOTH report.[15,16] But besides this it may affect lung function in healthy children.

Children have been identified as a population sensitive to the effects of environmental tobacco smoke, since exposure during childhood can be high and the children may be particularly vulnerable to noxious stimuli during the period of growth and development.

Expousure to different types of smokes has different impact on lung function. We observed that mean baseline PEFR was lower in children with passive smoke of bidi alone than that of Cigarette alone. This may be due to the fact that amount of nicotine and tobacco alkaloids present in the mainstream smoke (MS) of bidi products is likely to be different from those present in the MS of standard cigarettes because of the differences in their design as no filter exists in most bidis. The side-stream (SS) smoke released from such products is also likely to be different from the side-stream of standard cigarettes due to differences in tobacco processing, burning rateand temperature, and the use of additives for burning tobacco. In a study from Mumbai, the bidi, an Indian cigarette and a brand of American cigarette were analyzed by gas chromatography-flame ionization detection for the levels of nicotine and minor tobacco alkaloids in the MS and SS smoke.[17] The analysis demonstrated higher total nicotine and minor tobacco alkaloids in tobacco from bidi (37.7 mg/g) compared to Indian or American cigarettes (14-16 mg/g). This study also demonstrated higher delivery of nicotine and alkaloids by bidi as evidenced by higher concentration of nicotine in the MS smoke (MS/SS) compared to that released by a regular cigarette.

The effect of passive smoking on PEFR of children of similar age groups was studied by other investigators.[18-30] There are very few studies to study the effect of household or parental smoking on children. Wilson et al 2001 conducted a similar type of study on 44 asthmatic children but they did not find any significant difference on percent predictive FEV1 after cessation of passive smoking even after one year.[29]

The frequency of smoking has been found to be one of major contributory factors in children's lung function. We found that PEFR values were lower in children with passive smoking of more than 15 cigarettes and or bidi. Similar study by Venners *et al.*,[14] showed >30cigarattes/day have largest lung deficits, decrease in FEV_1 by -79 ml & FVC by -71 ml, Dold *et al.*,[27] concluded >20 cigarettes/day at home decrease PEFR by 4.9%.

CONCLUSION

the peak expiatory flow rate (PEFR) measurement is a very simple, reliable and reproducible pulmonary function test which can be performed by using mini-Wright peak flow meter (a cheap & portable instrument). Modifications of the smoking behavior of parents can result in lower deterioration in the lung function (PEFR) or may improve PEFR of their children. So, Healthcare providers should interact with parents at key times, such as during pregnancy, at birth, at well child visits, as well as on visits for illness so as to produce smoke free environment in household premises for all the children.

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