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Original Article

Respiratory health status of rural and urban school children from Nagpur region.

A E Thakare[*a] , **Tajne Vijaya D** [b]

[a*] *Department of Physiology, LN Medical college, Bhopal*
[b] *Department of Physiology, Government Medical college , Nagpur*

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ABSTRACT

Background: Exposure to air pollution due to automobile exhaust has shown decrements in pulmonary function in school children. Levels of air pollution in the regions where the children live are predictors for their PFT parameters Methods: Present study was under taken to asses PFT parameters in 220 school children(110 boys and 110girls) of 6-to-15 years of age group randomly selected from urban school in Nagpur city and a rural school distant from Nagpur representing mixed socioeconomic group of Maharashtrian ethnicity living in differing levels of air pollution. Both groups were subjected to PFT after recording basic anthropometric parameters. Statistical analysis was done deriving mean SD and applying student's't' test where ever necessary. Results: The results indicated significantly higher FVC, FEV1, and PEFR in rural boys (1.891±0.93*, 1.752±0.805*, 3.962±1.762*) as compared to urban boys (1.466±0.737*, 1.353±0.657*, 3.162±1.708) and higher values for these parameters in rural girls (1.640±0.666*, 3.953±1.496*, 1.586±0.622*)than in urban girls (1.399±0.635, 1.240±0.548, 3.475±1.312) study subjects as compared to their urban counterparts. Conclusions: Thus it can concluded that Pulmonary function in school children is better in rural areas than in highly polluted urban areas because of less vehicular traffic in rural areas and better environmental condition. Residence in rural area has certain respiratory health advantage.

1. Introduction

Air pollution due to automobile exhaust is a major problem which affects lung function and lung health. The principle air pollutants in automobile exhaust are NO2, CO, SO2, PM, Hydrocarbons and Ozone formation.[1] Motor vehicles represent the principal source of air pollution in many communities, and concentrations of traffic pollutants are greater near major roads[2] Numerous epidemiological studies have shown that these pollutants on acute and chronic exposures cause increased respiratory symptoms and decrements in lung function.[3,4]There are larger number of studies on adult population showing adverse effect of air pollution,[5,6,7] however we have not come across any study showing adverse effect of air pollution on lung function of children from this geographical area. Children spend considerable amount of their time outdoors and hence are more susceptible to adverse effect of air pollution.[8] Children have increased exposure to many air pollutants as compared with adults because of higher minute ventilation and higher levels of physical activity and also because children spend more time outdoors than do adults.[9] Hence in this study, we tried to find whether there is any difference in Pulmonary function in children living in areas differing in levels of air pollution. In densely populated urban, children are exposed to higher levels of air pollutants due to high density of automobile vehicles as compared to rural areas where automobile density is less. The study was designed to asses PFT in rural and urban school children and to find out whether there was significant difference in PFT parameters in this two groups and also to know that residence in rural area has any beneficial effect on Lung health or not.

* Corresponding Author : Thakare Avinash Eknath
Assistant Professor
Department of Physiology
LN Medical college, Bhopal
Mob. No. 8109592755
Phone no. 07554225861
Email:dravinash1979@rediffmail.com

2.Materials and Methods

2 Schools from Nagpur district were randomly selected to obtain mix group of children belonging to varied socioeconomic status. 220 children (110 boys and 110 girls) from urban school in Nagpur city and same number of children from a rural school located 70kms from Nagpur city were the study subjects. Protocol of the study was approved by Institutional Ethical Committee of GMC, Nagpur. Consent for study was taken from school principal and informed consent was taken from parents of study subjects. Detailed medical history and clinical examination was carried out of the study subjects. Anthropometric measurements like Height, weight, and arm span were recorded in both groups. PFT parameters were recorded after 3 test readings using MIR-SPIROLAB II. PFT recordings were taken during morning hours 10-12 AM in both groups to avoid diurnal variations. Procedure were explained to study subjects, they were made familiar to Spirometry instrument .Appropriate demonstrations were given to subjects to undergo smooth test. PFT was carried out in comfortable sitting position and the subjects were encouraged to perform the test to their optimum level. Day to day calibrations of the machine was done regularly.

Inclusion criteria:

1) All subjects in the study were from age group of 6- 15 years.
2) No history of major airway diseases like Asthma, COPD
3) Absence of ARI, thoracic abnormality like Kyphosis, Scoliosis.
4) Non-smokers.
   FVC, FEV1, & PEFR were the PFT parameters which were used for comparison in both the groups.

2.1.Statistical Analysis

All results were mentioned as MEAN ±2SD for PFT parameters and anthropometric parameters. Also % predicted values were noted down. Statistical analysis of data was done using Student's test at 95% confidence level. Two tailed p values were used throughout and p value less than 0.01 were judged as statistically significant. Calculations were done using SPSS version 10.0.

3.Results

All the study subjects were in age group of 6-15 years. Rural and urban school children didn't differ significantly on the anthropometric parameters. Table I shows anthropometric parameters height, weight and arm-span of both study groups. All the anthropometric were higher in urban children. However these parameters were higher in boys than in girls in both the groups.

Figure I & II shows value of PFT parameters in urban and rural school children. Among boys highest values for FVC(1.891±0.93 litres), FEV1(1.752±0.805)and PEFR(3.962±1.762) were observed in rural boys. Among girls, rural girls have higher FVC(1.640±0.666), FEV1(1.586±0.622) and PEFR(3.953±1.496).While in urban children we observed significantly lower values in all three PFT parameters, urban girls have higher PEFR values than urban boys. All the three PFT parameters-Forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV1) & Peak Expiratory Flow rate (PEFR) were found to be significantly decreased(P<0.01) in urban children as compared to rural children.

Table. 1 Sexwise distribution of anthropometric parameters in rural and urban school children

Anthropometric parameters	Rural Boys	Rural Girls	Urban Boys	Urban Girls
Height	131.19±16.34cms	132.19±14.69cms	137.51±19.40cms	134.89±15.05cms
Weight	25.55±9.14 kgs	26.35±8.54kgs	30.85±19.12kgs	29.56±11.95kgs
Arm span	133.99±17.10cms	134.4±15.00cms	139.08±19.12cms	136.46±16.53cms

Figure I: PFT parameters in rural and urban girls.

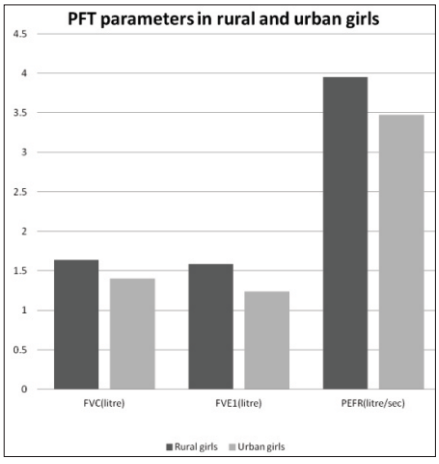
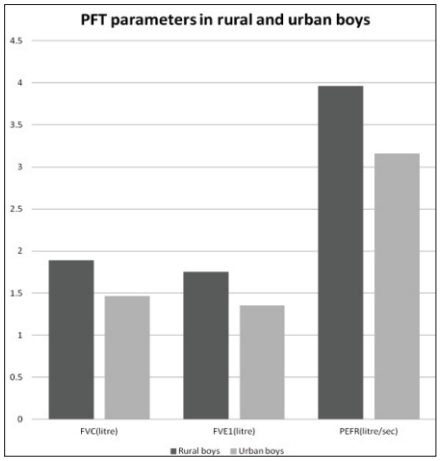


Figure II: PFT parameters in rural and urban boys



4.Discussion

In present study all PFT parameters were decreased significantly in urban children as compared to rural children. Similar results were obtained by Chattopadhyay BP[10] who studied PFT in school children in Kolkata and a rural school near Kolkata and observed decreased flow rates and lung volumes in urban children and increased respiratory symptoms in these children. Also Benigno Linares[11] et al found that spirometric abnormalities were more frequent in the school closer to the most polluted area and also the children has more respiratory symptoms than the children from distant school.

Various epidemiological studies found significant difference in PFT parameters and in respiratory symptoms in school children living in areas of high pollution and low pollution[12,13,14,15,16,17]Observed difference in PFT parameters cannot be due to difference in the anthropometric parameters because these children don't differ significantly on anthropometric parameters.(Table1) So this observed difference in two groups seems to be valid. The highest value for FVC is observed in rural boys (1.891±0.93) and in rural girls(1.640±0.666). We observe higher PEFR values in urban girls than in urban boys while all other values were less in girls as compared to boys. FVC is determined by lung dimension, compliance and respiratory muscle power whereas PEFR is determined by alveolar caliber , alveolar elastic recoil and respiratory muscle efforts.

Automobile pollutants like NO2 caused irritation of respiratory tract and oedema[18].Ozone is high energy molecule which cause damage to upper and lower airways and also cause direct damage to alveoli[8] It causes decrement in lung function, increased respiratory tract symptoms, and asthma exacerbations in children on days with higher levels of ambient ozone[19,20,21] Particulate Matter PM from the auto exhaust are also incriminated for lower PF levels due to their damaging effect on respiratory tract[22,23,24] These may be the reasons for the results we get in this study. Earlier studies have observed decrease in Pulmonary function following long term exposure to diesel exhaust in adults[25]Particulate Matter (PM) cause chronic inflammation of respiratory tract and lung parenchyma leading to decrements in Pulmonary function. However results of our study suggest an influence of air pollution on pulmonary function in urban school children which can be held accountable for the observed decrements in PFT parameters. Also possible effects of sedentary life style can also contribute to this decrements because urban children are more engaged in watching TV, playing video- computer games. While rural children are more involved in physical exertion like farm works and ground sports activity It has been found earlier that PFT is better among persons engaged in sports activities (sports person)than that in persons with sedentary life style.[26]

5.Conclusion

From this study it can be concluded that Pulmonary function in school children from rural area is better than school children living in high pollution urban area. This difference can be attributable to levels of air pollution in respective areas. We can suggest certain preventive measure for reducing the effect of air pollution such as prohibition of entry of heavy vehicles near school premises. Diversion of heavy traffic away from school areas. Use of protective mask for school children. Creating green zone by tree plantation in school campuses. Regular health checks-ups of school children. Early diagnosis and treatment of respiratory problem so as to preserve lung health.

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