

To Assess the Degree of Lung Function Impairment Among School Children of Industrial Area.

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ABSTRACT

Background: Spirometry is an important method for evaluating lung functions in children and can identify the type and the pattern of respiratory dysfunction. Air pollution is strongly associated with human health, and the results of air pollution include an increased mortality rate, an increased number of patients with respiratory or cardiovascular diseases. Main objective is to assess the degree of lung function impairment among school children of Industrial Area. **Methods:** The present study was conducted at a school of industrial area i.e., Advani Arlicon Higher secondary School, Urla Road, Birgaon of Raipur city from April to August 2012. The subjects were evaluated through pulmonary function test by using Spirometry method. Permission from Institutional Ethics Committee was obtained. Initially informed individual consent was taken from all the patients included in the study. **Results:** In the study group of Cases (Industrial Area school children), amongst total 200 subjects; there were 56 subjects aged between 11 to 14 years and 144 subjects aged between 15 to 18 years. Mean FEF 25% - 75% (in liters/Sec) for Males was found to be 4.110 ± 0.6836 , Mean FEF25% -75% (in Liter/Sec) for Females was found to be 3.768 ± 0.6241 . Mean FEF50% (in liters/Sec) for Males was found to be 4.426 ± 0.6879 , Mean FEF50% (in Liters/Sec) for Females was found to be 4.085 ± 0.6787 . Mean Lung Age (in Years) for Males found to be 17.166 ± 2.368 , Mean Lung Age (in Years) for Females was found to be 17.929 ± 2.444 . **Conclusion:** To conclude, there is a definite association between chronic exposures to severe urban air pollution & reduced pulmonary functions. The strategies (use of mask, regular health checkup and awareness on health impacts of pollution) need to be adopted by high risk persons for betterment & for healthy lifestyle.

Keywords: Lung function Impairment, school children, Industrial area.

INTRODUCTION

Spirometry is an important method for evaluating lung functions in children and can identify the type and the pattern of respiratory dysfunction, assess its severity and help to establish a prognosis. Pulmonary functions in 600 normal school children in Age group of 6-15 Years in North India (Urban and Rural schools), found Coefficient of correlation of FEF25% with age, height and weight were 0.632, 0.694 & 0.652 respectively.^[1]

Rapid lung growth begins in utero and continues until the late teens in girls and early 20's in boys. Lung function reaches a maximum by 18 -20 years of age in females and 22 – 25 years in males.^[2]

For accurate interpretation of the lung function data on environmental and hereditary factors likely to

impact on lung growth, including the following: sex, ethnic group; family history of asthma and atopy; cigarette smoke exposure, both pre and postnatal; allergen exposure, including pets; and relevant current and past medical history and medication use.^[3]

Epidemiological studies have found a significant positive correlation between environmental pollution, decreased pulmonary functions and respiratory morbidity.^[4]

Many studies have shown that air pollution is strongly associated with human health, and the results of air pollution include an increased mortality rate, an increased number of patients with respiratory or cardiovascular diseases at outpatient departments or emergency rooms, the aggravation of asthma, the increase of respiratory symptoms or the decrease of pulmonary function.

Effects of Particulate Matter (PM10) on the Pulmonary Function, conducted in 368 middle school children in Incheon & Ganghwa city. Values of FVC were greater in December than in March for both male and female students, suggest that PM10, especially the particulate matter generated from

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yellow dust storms may have significant negative effects on the FVC values in normal children.^[5]

Annual average concentrations of SO₂ and suspended particulate matter (SPM) exceeding 180-250 µg/m³ are consistently associated with higher rates of acute and chronic respiratory diseases and are inversely related to lung function.^[6]

The alveolar walls are not solid but are perforated by numerous pores of kohn, which permit passage of bacteria and exudates between adjacent alveoli. Alveolar macrophages, mononuclear cells of phagocytic lineage, usually lie free within the alveolar space. Often these macrophages contain phagocytosed carbon particles.^[7]

The goals of respiration are to provide oxygen to the tissues and to remove carbon dioxide. To achieve these goals, respiration can be divided into four major functions: Pulmonary ventilation, which means the inflow and outflow of air between the atmosphere and the lung alveoli; Diffusion of oxygen and carbon dioxide between the alveoli and the blood Transport of oxygen and carbon dioxide in the blood and body fluids to and from the body's tissue cell's and Regulation of ventilation and other facets of respiration.^[8]

MATERIALS AND METHODS

The present study was conducted a school of industrial area i.e., Advani Arlicon Higher secondary School, Urla Road, Birgaon of Raipur city. Total numbers of children in the present study were 200 of age between 11 to 18 years. The study conducted for a period of five months (from April to August 2012.) Permission from Institutional Ethics Committee was obtained. Initially informed individual consent was taken from all the subjects included in the study.

Data was collected in questionnaire. Detailed history of children was taken. Detailed history included age, sex, socioeconomic status, address, past history, present history, was taken. General examination of patient was done. The subjects included in the study were school children residing in their respective residence for a period of 10 years of age between 11 – 18 years. Subjects having past history of chronic diseases viz. Pul. T.B. or other respiratory tract infections or pulmonary diseases % students having previous history respiratory tract infections 2-4wks prior to spirometry & students <11 yrs. & >18 years were excluded from the study. . The subjects were evaluated through pulmonary function test by using Spirometry method. The primary instrument used in pulmonary function testing is the spirometer. It is designed to measure changes in volume and can only measure lung volume compartments that exchange gas with the atmosphere. Pulmonary function test was recorded with the spirometer – HELIOS -501, a turbine based device manufactured by recorders and Medicare systems (RMS) Pvt Ltd, Chandigarh, India.

The spirometer HELIOS-501 is a device of physiological signals acquisition and information processor, which provides the signal for the lung function.

Finally evaluation of pulmonary functional status and assessment of the degree of lung function impairment amongst school children of industrial area.

RESULTS

Table 1: Age wise Distribution of Cases

Age in years	Cases	
	No Of Cases	Percent
11 to 14	56	28%
15 to 18	144	72%

[Table 1] shows Age wise Distribution of Cases. In the study group of Cases (Industrial Area school children), amongst total 200 subjects, there were 56 subjects aged between 11 to 14 years and 144 subjects aged between 15 to 18 years.

Table 2: Sex wise Distribution of Cases

Sex	Cases	
	No Of Cases	Percent
Males	72	36%
Females	128	64%
Total	200	100%

[Table 2] shows Sex wise Distribution of Cases. In the study group of cases (Industrial Area school children), amongst total 200 subjects, there were 72 Male(36% of total) subjects & 128 Female(64% of total) subjects.

Female subjects are more as compared to Males.

Table 3: Correlation of Mean FEF 25%- 75 % (in L/sec) in Cases FEF - (Forced Expiratory Flow when 25% of the FVC has been expired)

	Cases
	Males
Females	3.768±0.6241(N=128)

In the study group of Cases (Industrial Area school children), amongst total 200 subjects, Mean FEF 25% - 75% (in Litres/Sec) for Males was found to be 4.110 ±0.6836 (More as compared to Females), Mean FEF25% -75% (in Litre/Sec) for Females was found to be 3.768±0.6241(Less as compared to Males).

Table 4: Correlation of Mean FEF 50 % (in L/sec) in Cases FEF - (Forced Expiratory Flow when 50% of the FVC has been expired)

	Cases
	Males
Females	4.085±0.6787(N=128)

In the study group of Cases (Industrial Area school children), amongst total 200 subjects, Mean FEF50% (in liters/Sec) for Males was found to be

4.426±0.6879(More as compared to Females), Mean FEF50% (in Liters/Sec) for Females was found to be 4.085±0.6787 (Less as compared to Males).

Table 5: Correlation of Mean Lung Age (in Years) in Cases and Controls

	Cases
Males	17.166±2.368(N=72)
Females	17.929±2.444(N=128)

In the study group of Cases (Industrial Area school children), amongst total 200 subjects, Mean Lung Age (in Years) for Males found to be 17.166±2.368 (Less as compared to Females), Mean Lung Age (in Years) for Females was found to be 17.929±2.444 (More as compared to Males).

DISCUSSION

Arlene A Hutchison 1981 studied intrasubject variability of pulmonary function testing in 20 healthy subjects, 11 Females and nine Males aged 10 to 16 years.^[9]

A.Srivastava et al studied pulmonary function tests in normal Indian children and changes in Respiratory disorders in 95 healthy controls.^[10]

E.von Mutius et al studied Air pollution and Upper respiratory symptoms in children from East Germany, found Mean Height 143±0.3 in Males Height 143±0.3 In Females.^[11]

Ksenia Eroshina et al studied respiratory dysfunction due to Environmental and social factors in 539 junior school children aged 6-12 years children in Moscow, found Median value of FVC was 1.69,1.71 &1.65 in Low pollution, Medium pollution & High pollution districts respectively.^[12]

Wioletta Dziubek et al studied Influence of Industrial Environments on the development of respiratory systems in 213 boys (Industrial area) & 98 boys (rural area).Analysis of respiratory revealed significantly better development of respiratory systems in boys from the rural region. Analysis of respiratory parameters revealed significantly better development of respiratory systems in boys from the rural region.FEF25%-75% was found to be significantly high when parameter compared with that of industrial area.^[13]

Neeta Kulkarni et al studied carbon in Airway Macrophages and Lung Function in 114 healthy children, found FEV1-% of predicted value is 100.1±11.1 in Healthy children (N=64) and 71.8±13.0 in children with asthma(N=9) .There is inverse association between the carbon content of airway macrophages and FEV1 in healthy children.^[14]

Amandeep Singh et al studied Under N.A.M.P (National Air Quality Monitoring Programme), four air pollutants viz., Sulphur Dioxide (SO₂), Oxides of Nitrogen as NO₂, Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM/ PM₁₀) have been identified for regular

monitoring at all the locations. Carbon Monoxide is produced as a result of incomplete combustion of fuel. Vehicles and industries are major sources of CO emissions. Due to its high affinity for hemoglobin, Carbon Monoxide displaces oxygen, leading to progressive Oxygen starvation and severe health effects. Impairs oxygen- carrying capacity of blood and effects central nervous system, high blood pressure, heart disease. In greater concentration, the effect of Carbon Monoxide could sometimes even be fatal. More than 3% concentration by volume in respired air can lead to sudden death.

Hydrocarbons can consist of fine particles of un-combusted liquid fuel. Hydrocarbons may be carcinogenic and some of the compounds are strong irritants of the eyes, nose and throat.^[15]

Pulmonary function testing is an increasingly important part of the assessment of lung disease in children. These tests are a sensitive and objective way of detecting and measuring the severity of lung dysfunction, of monitoring the progress of disease, and of assessing treatment.

Types of Lung Function Tests Most tests are in one of three major categories:

- 1) Measurement of lung volumes
- 2) Measurements of air flow and airway resistance.
- 3) Measurements of gas exchange, gas mixing and diffusion.^[16]

CONCLUSION

Female subjects are more as compared to Males. Mean FEF 25% - 75% (in Litres/Sec) for Males was found to be more as compared to Females.

Mean FEF50% (in liters/Sec) for Males was found to be more as compared to Females.

Mean Lung Age (in Years)) for Females was found to be more as compared to Males.

To conclude, there is a definite association between chronic exposures to severe urban air pollution & reduced pulmonary functions. We have found a mixed Ventilatory defect (combination of both obstructive & restrictive pattern) and deficit in Spirometric Indices & Parameters esp. FVC, FVC in subjects, who are chronically exposed to hazardous environment of industrial areas, of Raipur city. The strategies (use of mask, regular health checkup and awareness on health impacts of pollution) need to be adopted by high risk persons for betterment & for healthy lifestyle.

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