J. Dhaka National Med. Coll. Hos. 2012; 18 (02): 58-60

Original article

Lung Function and Chronic Exposure to Air pollution

A Study on adolescent male of urban area.

Najneen Akhter[1], Noorzahan Begum[2], US Naima Begum [3], Dilruba Akther [4], Nasrin Habib[5], Mst. Humayra Parveen[6].

[1]Associate Professor Department of Physiology, Holy Family Red Crescent Medical College & Hospital, Dhaka. [2]Former Chairman, Department of Physiology BSMMU. [3]Professor & Head, Department of Physiology, Holy Family Red Crescent Medical College & Hospital, Dhaka. [4]Associate Professor Department of Physiology, Holy Family Red Crescent Medical College & Hospital, Dhaka. [5]Assistant Professor Department of Physiology, Holy Family Red Crescent Medical College & Hospital, Dhaka. [6]Lecturer,Department of Physiology, Holy Family Red Crescent Medical College & Hospital, Dhaka.

Abstract: Background

Chronic exposure to heavily polluted air affects the respiratory status.

Objectives: To observe the effects of air pollution on pulmonary functions of adolescent male living in urban areas of Bangladesh.

Methods: This cross-sectional study was done in the department of Physiology, BSMMU. For this purpose, 60 apparently healthy adolescent male of age 13 to 18 were selected from different slum areas of Dhaka city. Sex and age matched 55 subjects were taken as control from rural area of Bangladesh. All subjects were of low socio-economic status and living in the corresponding areas since birth. In the study, Forced vital capacity (FVC), Forced expiratory volume in first second (FEV_1), FEV_1 /FVC % and Peak expiratory flow rate (PEFR) were estimated by VMI ventilometer on standing position. Statistical analysis was done by using "Z" test.

Result: The mean measured values of FVC, $FEV_{1,}$ FEV_1/ FVC% and PEFR were lower in the experimental group than in the control group. FVC and FEV_1 were lowered significantly ($p<0.05$) but FEV_1 /FVC % and PEFR in experimental group though lowered , the result were not statistically significant.

Conclusion: The results of the study reveals that pulmonary functions were lowered in urban adolescent and it was of restricted lung function type.

Key words: Air pollution, FVC, $FEV_{1,}$ FEV_1/ FVC% and PEFR.

Introduction:

Air pollution is one of the serious health problems faced by the people in the developing country and significantly associated with lower lung function[1-5]. Decline in lung parameters FVC, FEV_1 and PEFR are observed in the population residing in the area with air pollution than those of the non- exposed population[6,7]. The main sources of air pollution are the transport vehicles, factories and developmental activities. The major causes of increased emission of pollutants in the urban areas include the use of poor quality fuel, traffic congestion and badly maintained motor vehicles[8]. Automobiles are 'necessary evil's on one hand they have made living easy and convenient, but on the other hand they have also made human life more complicated and vulnerable to both toxic emissions and increased risk of accidents. Urban people are most affected because motor vehicular pollution is predominant here and significantly contribute to air quality problems[8,9].

Most of the automobiles those move on the streets are either reconditioned or expired and worn out. Thus air in the urban area is polluted by the smoke emitted from the automobiles. High levels of air polluted are reported in the different residential area near highway passing through the city. The urban areas in Bangladesh are not only experiencing a rapid growth of population but also a growing number of vehicles. The population of such areas is continuously exposed to polluted air[9].

So it is important to assess the effect of air pollution on lung function of adolescents of urban population, because chronic exposure to air pollution can cause early developmental change in lung leading to various diseases in adult life. Therefore, this study aimed to find out lung functional status of adolescents in some urban area.

Method: This cross-sectional study was conducted in department of Physiology, BSMMU from January,1999 to January,2000. For this, the pulmonary function tests by spirometry were analyzed in 60 apparently healthy adolescent male of age 13-18 years living in slum areas of Farmgate, Eskaton and other nonindustrial areas of Dhaka city (Urban group). For comparison Age matched 55 apparently healthy adolescent male were taken as control from the villages Debidder thana of Comilla District of Bangladesh (Rural group). All subjects were from low socio-economic status and living in the corresponding areas since birth. Subjects suffering from any obvious cardio-respiratory diseases or any other illness were excluded from the study. A systematic randomized home to home visit was made to collect the subjects. The study protocol was approved by the departmental ethical committee. The subjects were briefed about the aim & objectives of the study. Written informed consent was taken from each subject. A through physical & clinical examination of all subjects was recorded in a prefixed data schedule. The detail procedure of the spirometry was explained and demonstrated to ensure best performance. The FVC, $FEV_{1,}$ FEV_1/ FVC% and PEFR were done by VMI ventilometer[10]. The tests were carried out in the morning during the post absorptive phase and in resting condition. Measurements were measured in standing position. The highest value of the three test reading was recorded. The values of all spirometric variables were expressed as percentage of predicted values. Statistical analysis was done by using Z test. P value less than 0.05 was accepted as significant.

Results: The mean age, height, weight and body surface area in both groups were almost similar which shown in table-I.

Table I: General characteristics of the target groups.

Parameter	Urban(n=60)	Rural(n=55)
Age(Year)	15.3 (13-18)	15.4(13-18)
Height (Cm)	152.4(137-166)	152.1(130-170)
Weight (Kg)	43.7(30-55)	42.4(30-57)
Body Surface Area (Sq.m)	1.41(1.12-1.66)	1.39(1.1-1.71)

n= number of subject.

Mean measured value of all the pulmonary variables (FVC, $FEV_{1,}$ FEV_1/ FVC% and PEFR) were lowered in the experimental group than in the control group. FVC and FEV_1 were lowered significantly ($p<0.05$) and both the values were well below the lower limit of normal range. FEV_1 /FVC % and PEFR in experimental group though lowered, the results were not statistically significant (Table-II).

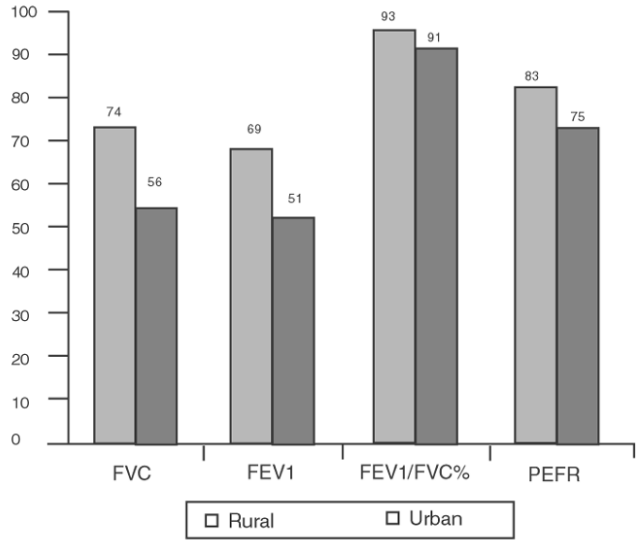
Table-II: Pulmonary Function Test (PFT) of target groups

	Rural		Urban		Statistical analysis with P value
	Measured value	Predicted value	Measured value	Predicted value	
FVC (L)	2.92	3.96	2.25	3.99	2.06*($p<0.05$)
FEV_1(L)	2.48	3.61	1.86	3.62	2.00*($p<0.05$)
FEV_1/FVC%	89	96	87	95	0.07^{NS}
PEFR(L/min)	471	565	427	567	1.06^{NS}

NS=not significant

The values of all spirometric variables were expressed as percentage of predicted values as shown in figure.

Figure 1: Mean % of predicted values of FVC, FEV_1, FVC/FEV_1% and PEFR in Different target groups.



Discussion: The mean measured pulmonary variables such as FVC, $FEV_{1,}$ FEV_1/ FVC% and PEFR were lower than those of their predicted values both in urban adolescent male (experimental) and those of rural area (control groups). It has been suggested that poor nutritional status lead to poor growth of muscle and development of lungs and consequently decrease lung function[11]. The subjects of the present study belong to low-socioeconomic class and likely to have poor nutrition and thereby associated with lower lung function.

The mean percentages of predicted values of FVC and FEV_1 were 56% & 51%, which are lowered significantly, but FEV_1 /FVC % is 91% in experimental group, and the difference is not statistically significant. Lowered FVC and FEV_1, with high FEV_1 /FVC % indicate moderate impairment of lung function and it is of restrictive type of pulmonary function[12].

In this present study lower FVC, FEV_1, FEV_1/ FVC% and PEFR in experimental group in comparison to control group is most likely due to pollutants present in air[3]. However, from the present type of study it is difficult to comment on the mechanism involved for lower lung function in urban adolescent male but it may be due to chronic exposure to increased levels of respirable particles is associated with increased respiratory symptoms and decrease in lung function[8,9]. Air pollution in the residence area may be a part of the causal chain of reactions leading to retardation in pulmonary function growth during the preadolescent years[2, 4, 13]

The strategies (use of mask, regular health check up and awareness of health impacts of pollution) need to be adopted for protection from air pollution. Moreover, time to time check up of pulmonary function should be arranged so that proper treatment can be done if any deviation from normal function is detected.

Conclusion: Pulmonary function may be reduced in urban adolescent male.

Acknowledgement: My sincere thanks to Prof. Fatema Khanam, MBBS, MPhil, Professor & Head , Department of Physiology, Ibrahim Medical College & Hospital, Dhaka for allowing me to use the VMI ventilometer**.**

References:

1. Peters JM. Avol E, Gauderman WJ, Linn WS, Navidi W, Stephanie JL, " A study of Twelve Southern California Communities with Different levels and types of Air Pollution. Am. J. Respir. Cirt. Care Med. 1999; 159 (3): 768-75
2. Jedrychowski W, Flak E, Mroz E. " The adverse Effect of Low levels of Ambient Air Pollutants on Lung Function Growth In Pre Adolescent children." Environ Health Perspect.1999; 107(8): 669-74.
3. Brunkreef B, Holgate ST. " Air Plooution & Health." Lancet. 2002; 360: 1233-42.
4. He QC, Lioy PJ, Wilson WE, Chapman RS. "Effects of Air Pollution on children's Pulmonary Function in Urban and Suburban Areas of Wuhan, People's Republic of China. " Arch Environ Health. 1993: 48(6): 382--91.
5. Schwartz. "Lung function and chronic exposure to Air Pollution: A cross sectional Analysis of NHANES II." Environ Research. 1989-50: 309-91
6. Jalani Z. Shafiq A. Tanki SMI. " Status of Peak Expiratory flow rate (PEFR) and Forced expiratory Volume (FEV_1) In kashmiri Population ." Indian J. Pharmacol. 1992;24:169-70
7. Das B, Ghosh T, Gangopadhyay S. "Peak Expiratory Flow rate among child Laborers In West Bengal, India." Indian Pediatr. 20011;48(6): 487-8.
8. Ingle ST, Pachpande BG, Wagh ND, Patel VS, Attarde SB. "Exposure To Vehicular Pollution and Respiratory Impairment of Traffic Pollicement in Jalgaon City, India." Industrial Health 2005:43: 656-62
9. Hosain MA. Hassan MR, Chakraborthy R. " Efffects of air pollution on Pulmonary function Between Smokers and Non Smokers in the capital of Bangladesh " JAFMC Bangladesh . 2006; 2(2): 17-26
10. American Thoracic Society Standardization of Spirometry: 1995 update Am J Respir Crit Care Med. 1995; 152: 1107-36
11. Gaultier C. "Malnutrition and lung Function" Peditr Pulmonol. 1991; 10: 278-86
12. Glady CA. Aaron SD, Lunau M, Clinch J. Dales RE. " A spirometry based alogorithm to direct lung function testing in the pulmonary function Laboratory" Chest 2003; 123:1939-46
13. Asgari MM. Dubois A. Asgari M. Gent J, beckett WS. " Association of ambient air Quality with childrens lung function In Urban And Rural Iran. " arch Environ Health 1998; 53(3) 222-30