A STUDY OF EXERCISE-INDUCED BRONCHOSPASM IN URBAN AND RURAL SCHOOL CHILDREN OF SINDH

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Background: Asthma is the most common chronic disease of childhood; asthma prevalence and incidence have been increasing in children in developed countries during the past few decades. The rapid increase of asthma in developed and urban environments is more likely explained by changes in environment and life style. The purpose of this study was to know the prevalence and comparison of Exercise-Induced Bronchospasm (EIB) positive urban and rural school children by simple free running test. **Methods:** This study was conducted at Department of Physiology BMSI, JPMC Karachi with collaboration of urban and rural schools of Sindh. A total number of 498, apparently healthy study subjects of either sex, age ranging from 9–16 years were selected for this study. Subjects exercised for 6 min by simple running at 80% of their maximum heart rate recorded by pulse oximeter, and Peak Expiratory Flow Rate was measured by using PEF meter. **Results:** In this study the prevalence of EIB+ve in urban school children was 39.35% and in rural school children it was 31.72%. **Conclusion:** It is concluded that the prevalence of EIB is higher in urban school children when compared with the prevalence of rural schoolchildren of Sindh.

Keywords: Exercise, Bronchospasm, Peak Expiratory Flow Meter, Urban, Rural, School children

INTRODUCTION

Asthma is one of the most common chronic diseases world-wide, and its prevalence is known to be increasing, particular among children.[1] Asthma prevalence and incidence have been increasing in children in developed countries during the past few decades. Causes for this epidemic are unknown, although changes in frequency and severity of early life infections, diet, and exposure to indoor allergens to indoor and outdoor air pollutants have all been linked with asthma.[2] Mechanism of exercise-induced asthma is undetermined; however eosinophils have been suggested as playing a role in its occurrence. The influx of eosinophils to the airways in patients who develop exercise-induced asthma can be partially explained by the leukotrienes in the airways of those patients.[3] The cysteinyl leukotrienes (LT) C4, D4, and E4 may partially mediate eosinophilic airway inflammation in patients with asthma. High-intensity exercise by patients with asthma can result in exercise-induced bronchoconstriction, partly due to leukotrienes production.[4] It is possible that asthma is caused by a combination of environmental factors that are influenced by allergens, pathogenic agents, climate, eating habits, lifestyle, and air, water, and/or food pollution.[5–7] An epidemic rise in childhood asthma has occurred widely.[8] Asthma can, direct or indirect cause physical limitations in asthmatic patients affecting their quality of life.[9] Exercise-induced asthma is a common aspect of a prevalent disease that warrants proper diagnosis and treatment. With appropriate therapy, children with EIA should be able to participate in sports and maintain normal activity. They should strive to compete in the same playing field as their peers and have the same goals as those children and athletes who do not have exercise-induced asthma.[10] Therefore, the purpose of this study was to observe the prevalence of exercise-induced bronchospasm in urban and rural school children of Sindh.

MATERIAL AND METHODS

The propose study was conducted in the Department of Physiology at BMSI, JPMC, Karachi with the collaboration of urban and rural schools of Sindh from August 2003 to November 2003.This study was performed on apparently normal and healthy school children of either sex, age ranging from 9–16 years. For the selection of study subjects questionnaires were distributed in more than 500 school children of urban and rural areas and from these 500 school children only 250 rural and 250 urban school children were selected who fulfilled the inclusion criteria. Those children who were suffering from asthma, wheezing, upper and lower respiratory tract infection, anaemia, epilepsy, gross abnormality of vertebral column or thoracic cage, neuro-muscular disease, and intake of any medications to affect their pulmonary function were excluded from this study. Two children, one from urban and one from rural school were absent because of illness on the day of exercise test and were excluded from the study. The school children were instructed to record their Peak Expiratory Flow Rate (PEFR) before and at 5, 10, 15, and 30 minutes after maximum voluntary running for at least 6 minutes to reach 80–90% of the predicted maximum heart rate recorded by pulse oximeter to standardized the exercise. The fall in PEFR of greater than or equal to (≥) 15 percent were defined as abnormal.[11] The percent change in PEFR was calculated by using the formula:

$$\text{Percent change in PEFR} = \frac{\text{PEFR Maximum} - \text{PEFR Minimum}}{\text{PEFR Maximum}} \times 100$$

The statistical significance of difference between the mean values of the two groups was evaluated by the student *t*-test.

RESULTS

Table–1 shows the comparison of demographic measurements in urban and rural school children. We have found significant results in BMI of urban school children with more height in urban than rural school children.

Table-2 gives the comparison of peak expiratory flow rate before and after exercise in total number of urban and rural school children. The resting value before exercise, 5 minutes and 10 minutes after exercise were significantly higher in urban school children.

Table-3 Summarizes the comparison of PEFR before and after exercise in EIB+ve urban and rural school children. Here we found the only significant result (p<0.001) in the PEFR of 5 minutes after exercise, being higher in urban children. No other significant results were found.

Table-4 and Figure-1 comparing the percent change in PEFR before and after exercise in EIB+ve urban and rural school children. The mean PEFR value of 5 minutes after exercise was significantly higher (p<0.001) in rural children. Urban children on the other hand showed a significant rise (p<0.001) after 15 minutes. Other results were insignificant.

Table-5 shows the prevalence of EIB+ve in urban 39.3 percent which is higher when compared with the 31.7 percent in rural school children. Table also shows the cumulative prevalence 35.5% of EIB+ve children age ranges from 9–16 years of both, urban and rural school children.

DISCUSSION

Exercise testing is often used as an objective method for the diagnosis of asthma in epidemiological studies. There is need to identify the children who may suffer from asthma but not know it. Most known asthmatic children have EIB and for this reason we studied the feasibility of screening children at school for EIB as a marker of child asthma.[12]

The free running exercise test was created as a standardized test that can be performed in a normal school environment and which is a good chance of detecting unrecognized asthma.[13] The choice of 5, 10, 15 and 30 minutes as the time for measuring PEFR after exercise was based on previous work of Anderson SD *et al.*[14]

Table-1: Comparison of Demographic Measurements in Urban and Rural School Children. (Mean±SEM)

Physical characteristics of study subjects	Urban (n=249)	Rural (n=249)	*p*-VALUE
Age (years)	13. 33± 0.12	13. 05± 0.10	NS
Gender Male (n)	181	147	-
Female (n)	68	102	
Weight (kilogram)	44. 29±0.52	43. 54± 0.53	NS
Height (meter)	1. 54±0.01	1.50±0.01	<0.001
BMI=kilogram/meter^2	18. 55±0.14	19. 33±0.15	<0.001

BMI= Body Mass Index, NS=Non significant, Figure in parentheses indicates total number (n=249) of urban and rural school children.

Table-2: Comparison of PEFR Before and After Exercise in Urban and Rural School Children. (Mean±SEM)

Groups	Before exercise PEFR (l/m)	After exercise PEFR (l/m)			
	Resting	5 Min.	10 Min.	15 Min.	30 Min.
Urban (n=249)	346.16±2.84	365.90±3.73	328.76±3.74	323.53±3.43	334.18±3.12
Rural (n=249)	335.38±2.56	318.37±3.34	314.72±3.07	319.15±2.97	326.81±2.79
P Value	<0.01	<0.001	<0.01	NS	NS

NS=Non significant, Figure in parentheses indicates total number (n=249) of urban and rural school children.

Table-3: Comparison of peak expiratory flow rate (PEFR) before and after exercise in exercise-induced bronchospasm positive (EIB+ve) urban and rural school children. (Mean±SEM)

Groups	Before Exercise PEFR (l/m)	After exercise PEFR (l/m)			
	Resting	5 Min	10 Min	15 Min	30 Min
Urban (n=98)	342.60±4.26	336.43±5.56	286.54±3.85	288.06±4.15	313.78±4.77
Rural (n=79)	333.04±4.50	286.84±4.37	280.01±3.98	289.36±4.79	310.25±5.03
p-value	NS	<0.001	NS	NS	NS

NS=Non significant. Figures in parentheses indicates number of EIB+ve subjects from total (n=249) of urban (n=98) and rural (n=79) children.

Table-4: Comparison of percent change in PEFR in EIB+ve urban and rural school children. (Mean±SEM)

Groups	Percent change in PEFR in EIB+ve			
	5 Min	10 Min	15 Min	30 Min
Urban (n =249)	1.78±1.07	16.34±0. 46	16.00± 0.49	8. 61±0.59
Rural (n =249)	13.75±0. 79	15.80±0.60	13.19± 0.74	6.97±0. 71
P Value	<0.001	NS	<0.001	NS

NS=Non-significant, Figures in parentheses indicates number of EIB+ve subjects from total (n=249) of urban (n=98) and rural (n=79) children.

Table-5: Prevalence of EIB+ve in urban and rural school children.

Age (09-16) years	No. of EIB positive	Percentage
Urban (n=249)	98	39.35%
Rural (n=249)	79	31.72%
	Cumulative percentage:	35.54 %

In this study of exercise–induced bronchospasm testing, measurements of peak expiratory flow rate was significantly higher (*p*<0.001) in urban population when compared with rural school children. The decrease in the volume of PEFR was observed within 5 minutes after exercise as compared with the resting level. When we compare the results of exercise in terms of percent change in PEFR, we found that the maximum fall in PEFR was observed in urban school children having mean fall of 16.3% percent and 16.0% percent in 10 minutes and 15 minutes respectively, when compared with rural school children 15.8% and 13.2% in 10 minutes and 15 minutes respectively. Although the values for both urban and rural children are more than our criteria of 15% fall in PEFR for the diagnosis of exercise-induced bronchospasm (EIB). The rural children in our study also exhibited an early recovery as evident from their lower mean values for PEFR at 10 and 15 minutes when compared with the values for urban children. As suggested by Yobo EOD *et al*[11]; these differences in values for urban and rural children could be due to social and environmental factors such as wealth, lifestyle, and housing in addition to genetic predisposition. The over all prevalence of EIB positive in the two areas combined in our study was 35.5%. The cumulative prevalence of asthma in the study of Penny ME *et al*[15], was 20.7% in a survey of 8–10 years of age young children living in a deprived urban area of Lima, Peru which was lower than the (28.0%) reported in international study of asthma and allergies in childhood (ISAAC).[6] Our results are comparatively higher (35.5%) than the (28.0%) reported by ISAAC (1988).

CONCLUSIONS

It is concluded the cumulative prevalence estimated in urban and rural population was 35.5% comparing urban population prevalence (39.3%) with rural population(31.7%), it seems evident that urban school children are susceptible to multiple factors which are already described make more EIB+ve as compared to rural children. We found an unexpectedly striking higher prevalence of EIB in our school population. This needs to be supported or contradicted by future trial in our population. Changes in the policy environment and reconfiguration of health services are needed to increase preventive services to children.

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