EXERCISE -INDUCED BRONCHOSPASM IN MALE ATHLETES AT KARACHI

Abdul Ahad, M. Perwaiz Sandila, Nadeem Ahmed Siddiqui, Syed Tousif Ahmed

Department of Physiology, Ziauddin Medical University.

Background: Exercise is one of the most common precipitant of acute asthma encountered in clinical practice. To determine frequency of Exercise-induced Bronchospasm (EIB) in male athletes, who had represented or were aspiring to represent at national and/or international level. Athletes of different departments and institutes, district, provincial and national squad who were residing, practicing and attending training camps at Karachi during November 2000 to January 2002 were included. **Methods:** It's an observational study on the frequency of EIB in athletes. A 21-item structured and pre-tested questionnaire was given for personal, biological and environmental information and an acquaintance session was conducted with each athlete to explain the procedure. Six minutes of competitive field free running Peak expiratory flow (PEF) rate, pulse rate and oxygen saturation were measured at 5-min, 15-min and 30-min. A player was considered EIB positive based on a post exercise decrement in PEF rate $\geq$ 15% at any defined point of time. **Results:** The mean age of participating athletes was 27$\pm$6 years. Out of the one hundred and seventy-nine (n=179) athletes who participated in the study, 13 (7%) were found to be EIB positive. **Conclusion:** Our findings indicate that a significant number of our athletes suffer from EIB. It is suggested that either the department or national sports body should take the responsibility of screening for EIB making it a part of their training sessions.

Key Words: Exercise; Bronchospasm, Asthma, Athlete

INTRODUCTION

Exercise is one of many non-pharmacological and non-immunological stimuli that can produce acute episode of airway obstruction in patients with asthma.[1] National Heart Lung and Blood Institute and National Institute of Health in its consensus report on diagnosis and management of asthma defined Exercise induced bronchospasm (EIB) as the occurrence of airway obstruction immediately to 30-min after moderate exercise.[2] Athletes with asthma have a wide range of disability, allowing them restricted participation in sport.[3] A history of post-exercise signs and symptoms such as dyspnea, coughing, shortness of breath and wheezing usually manifest it. The intensity and duration of action necessary to produce bronchospasm is 5 to 8 min of maximum effort.[4]

EIB is a temporary narrowing of the airway or bronchospasm, which is induced by exercise[5] Many highly trained athletes of various events experience exercise induced bronchospasm (EIB).[6-8] In addition to genetic predisposition, social and environmental factors such as economic prosperity, western life style, and housing conditions are important determinants in the expression of asthma. Exercise induced bronchospasm is a common feature of asthma and exercise Challenge test provides a non–invasive tool for determining airway hyperresponsiveness in epidemiological studies of both children and young people.[1]

It is believed that this is the first study describing EIB in Pakistani athletes. Our objective was to determine frequency of Exercise-induced Bronchospasm (EIB) in athletes at Karachi, who had represented or were aspiring to represent Pakistan at national and international level.

MATERIAL AND METHODS

One hundred and seventy nine (179) athletes met our criteria and were included in the study. They played in-door and/or out-door games and performed exercise daily. This was a descriptive study on the frequency of EIB in athletes at Karachi. An athlete was defined as one who was trained or skilled in exercises, sports or games requiring physical strength, agility or stamina[9].

Male athletes of 18 to 40 years were included who represented national, provincial, district, departmental or institutional team. Athletes with asthma or taking medication for asthma, hypertensive or taking anti-hypertensive medications with history of cold, sore throat, runny nose, cough for the last 4 weeks smoker and/or tobacco chewer of any frequency or duration were excluded. Athletes with known diagnosis of cancer, diabetes mellitus, tuberculosis, ischemic heart diseases and history of abdominal or chest surgery or any medical condition(s) limiting their ability to participate in challenge exercise testing.

An acquaintance session was conducted to introduce the athletes to the study. All questions were answered during the session to increase co-operation of athletes. Peak expiratory flow meters (Pocketpeak – Hudson Respiratory Care Inc.)[10] were shown to the athletes and the instructions related to the use of PEF meters were explained. The field investigator showed them how to record the peak respiratory flow rate. Under supervision each player practiced till his three consecutive readings with a difference of not more than 5% between each reading was recorded. To minimise the technical sources of variation athletes through out the study used same PEF meter. To minimize the biological sources of variations of lung function, PEF reading were recorded according to the guidelines laid down by American Thoracic Society[11].

Athletes were advised not to perform any exercise, stretching or warm-up on field testing day prior to exercise and following pre-exercise readings were measured:

- Pulse rate by pulse oximeter (Pulse oximeter Model 305, Palco labs, Inc.)[12]
- PEF rate; three readings were recorded out of which one with maximum value was selected
- Blood pressure by mercury desk type sphygmomanometer.
- Weight without shoes by bathroom scale after calibration.
- Height without shoes by placing scale against a wall.
- Temperature of the ground by dry and wet bulb and relative humidity of the ground by Stevenson Screen Hydrometric Tables were measured.[13]

Athletes ran competitively for six minutes on track or ground where they practised in batches of two at a time. Pulse rate was measured by pulse oximeter at 0, 5, 15 and 30 minutes. Those athletes who achieved 70% of the target heart rate at 0-minute post exercise were included.

Three readings of PEF rate at 5, 15, and 30 minutes were taken and the one with maximum value was selected from each of the three readings.An athlete was considered EIB positive based on a post exercise decrement in PEF rate $\geq$ 15%. [1,14-16]

The data was fed on computer package "Microsoft Excel" and analysis was done on computer package "EPI-info" ver 6.0 software of CDC (Centre for Disease Control, Atlanta, USA). The results were given in the text as number for qualitative variables like personal, biological and environmental characteristics, mean and standard

deviation (S.D.) for quantitative variables like age, Peak Expiratory Flow (PEF) rate. Mean, Standard Deviation of PEF rate pre and post exercise between groups (EIB –ve and EIB +ve athletes) by Student t-test (paired) were compared , and odd ratio calculated. In all statistical analysis, only p-values <0.05 were considered significant.

RESULTS

The number of athletes who suffered from EIB in various sports is given in table 1. The mean age of athletes was 27± 6 years. The pre-exercise mean PEF rate was 552 ± 77 L/min at 5-min post exercise it was 547 ± 79 L/min, at 15-min post exercise 543 ± 79 L/min and at 30-min post exercise 541 ± 79 L/min. The pre and post exercise PEF rate in athletes with and without EIB is given in table 2. The post-exercise PEF rate was compared with pre exercise value to diagnose the presence of EIB. Thirteen athletes had ≥ 15% decreased in PEF rate. Five athletes developed EIB at 5-min while one continued it till 15-min and one continued till 30-min. Seven athletes developed EIB while three continued it till 30-min. EIB continued from 5-min to 30-min only in one player.

Table 3 shows univariant analysis of environmental and biological risk factors for EIB.

Table-1: Games of athletes who suffered from EIB

Games	No.
Swimming	1
Boxing	4
Foot Ball	1
Hockey	6
Basket Ball	1
Total Athletes:	**13**

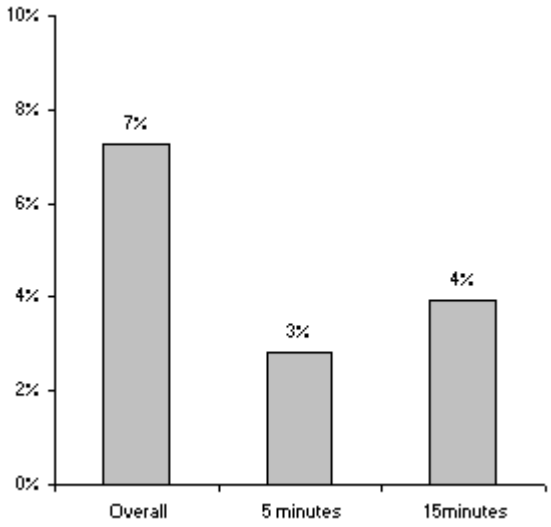

Figure-1:Frequency of EIB in athletes

DISCUSSION

Exercise testing is often used as an objective method for the diagnosis of asthma in epidemiological studies.[17-22] It is probably the first study to determine the frequency of EIB in athletes in Pakistan.The goal of our study was to screen athletes for EIB using a protocol that tested the athletes in the environment of their training at an exertion level at which they are commonly trained. These reports and our finding of a 7% incidence of EIB suggest that EIB may be common and warrant extensive screening of athletes at risk. The frequency reported herein is comparable to what has been found previously in young athletes and Air Force personnel .[4,14,23-27]

The estimates of frequency of EIB in other studies using similar methodology have varied greatly between studies in different locations. In a study of 12 years old children in Cardiff the frequency of a 15% or more fall in PEF rate following six minutes free running was approximately 7% in 1973 and 8% in 1988.[22]

Our exercise protocol was developed to test for EIB in the context of a typical practical session in the standard training environment. The standard testing protocol for EIB has been to test athletes with an exercise load of 70% of maximum heart rate. Our protocol did not control running speed, minute ventilation or the distance except the time (6–min). The athletes who were found to have not achieved the 70% of the maximum heart rate intensity were again asked to run for 2 to 4 minutes. The levels of exertion pace and effort were accordingly athletes dependent. The heart rate monitor function on a pulse oximeter is faster, easier and more accurate than manually counting the heart rate for a given time. The groups of athlete who ran were not more than 2 and would run during the time when one athlete was being checked.

Table-2: Comparison of Peak Expiratory Flow in Athletes with and without Exercise Induced Bronchospasm(n=179) Mean ± SD

	Pre Exercise PEF (Liters/ minute)	**Post Exercise PEF(Liters/ minute)**		
		at 5 min	**at 15 min**	**at 30 min**
EIB +ve (n=13)	548 ± 105	479* ± 98.0	459* ± 89	472* ±100.0
EIB –ve (n=166)	552 ± 75	552 ± 75	549 ± 75	547 ± 74

* p<0.001 significance compared with pre-exercise value

Table-3: Univariate Analysis of Risk Factors for EIB

Variables	**Responses**	**No.**	**EIB +ve**		**EIB -ve**		**OR**	**95%CI**
			Yes	**%**	**No.**	**%**		
Personal Risk Factors								
Allergy (Dust, Pollen & Animal hair)	Yes	28	3	11	25	89	0.38	0.09-1.44
	No	151	36	24	115	76	-	-
Breathlessness	Yes	0	0	-	0	-	NA	-
	No	179	13	7	166	93	-	-

Had Asthma as a child	Yes	1	0	-	1	100	NA	-
	No	178	13	7	165	93	-	-
Nocturnal Cough	Yes	6	0	-	6	100	NA	-
	No	173	13	8	160	93	NA	-
Ever had wheezing	Yes	2	0	-	2	100	NA	-
	No	177	13	7	164	93	NA	-
Pneumonia diagnosed by doctor	Yes	2	0	-	2	100	NA	-
	No	177	13	7	164	93	NA	-
Difficulty in breathing after running 1 Km.	Yes	5	1	20	4	80	20.25	0.28-444
	No	17	12	7	162	93	-	
Breathing gets worse while resting	Yes	3	1	33	2	67	6.83	0.11- 137
	No	176	12	7	164	93	-	
Chest gets tighter while resting	Yes	4	1	25	3	75	4.53	.08-60.67
	No	174	12	7	163	93	-	
Biological Risk Factors								
Any one in your blood relation had asthma	Yes	21	1	5	20	95	0.61	0.01-4.56
	No	158	12	8	146	92	-	
Environmental Risk Factors								
Pet animal at home	Yes	19	1	5	18	95	0.68	0.02-5.11
	No	158	12	8	146	92	-	
Family members (crowding) n=170	>5	118	12	10	106	90	5.77	0.81-251.56
	5 & less	52	1	2	51	98	-	
No. of rooms n=174	3 & less	77	4	5	73	95	0.54	0.12-2.02
	>3	97	9	9	88	91	-	
Passive smoker at home	Yes	42	2	5	40	95	0.57	0.06-2.80
	No	137	11	8	126	92	-	
Carpet in bed room	Yes	53	4	8	49	93	1.06	0.23-4.03
	No	126	9	7	117	93	-	

Katten et al established that PEF rate and FEV_1 were the most sensitive tests and were abnormal in 83% and 84% respectively, of those asthmatic children who had a positive exercise test response. The use of peak flow meter was chosen for its practical usage for a large group of athletes in the field environment. We noted that evaluating the FEV_1 , is an accepted value but full spirometry evaluation was not practical and the PEF rate can give reasonable indicator of broncho-constriction as suggested in other studies .[1,14-16,28] The importance of performing testing instead of relying on symptoms, lack of symptoms or surveys as a method of EIB diagnosis or exclusion has been emphasised because of a lack of correlation between subjective symptomatic parameters and testing positive for EIB. [7,14,24, 25,29-31] In analysing the survey results to correlate those testing positive for EIB and giving a positive response to survey questions we found no correlation it confirms the findings of others workers.[14,24, 25,29-31] It demonstrates the lack of specificity of reported EIB symptoms. Recent studies regarding the screening and diagnosis of EIB have focused on testing the athletes in the environment of competition. Performing the exercise challenge in the environment was of specific interest in our study population of athletes. The temperature of the ground was measured by dry and wet bulb and later on converted into relative humidity of the ground by Stevenson Screen Hydrometric Tables .[13] The result presented in this report increase the need for assessment and therapeutic control. Pulmonary function testing is easily carried out at training and competition sites and under these conditions probably yield the most useful information concerning EIB in competitive athlete. It is suggested that either the department or national sports body should screen for EIB making it a part of their training sessions, so that performance of athletes with EIB could be enhanced. Diagnosed cases should then be treated as per the guidelines laid down by International Olympic Committee Medical Commission.

REFERENCES

1. McFadden FRJr. Exercise and asthma. N Engl J Med 1987;317(8):502-4.

2. National Heart, Lung and Blood Institute, National Asthma Education Program, Expert panel on the management of asthma: Guidelines for the diagnosis and management of Asthma: Expert Panel Report. Bethesda, MD: National Asthma Education program, office of prevention Education and Control National Heart Lung and blood Institute of Health , US Dept of Health and Human Services, Public Health and Human Services , Public Health Services; 1991 Publication 91- 3042

3. Clark CJ, Cochrane LM. Assessment of work performance in asthma for determination of cardio-respiratory fitness and training capacity Thorax 1988; 43(2) 745-9.

4. Voy RO. The US Olympic Committee experience with exercise-induced bronchospasms. Med Sci Sports Exerc 1986;18:328-30

5. Ganong WF. Review of medical physiology. 20th ed. San Francisco, McGraw Hill; 2001.

6. Storms WW, Joyner DM. Update on Exercise induced Asthma. A report of the Olympic Exercise Asthma Summit Conference; The Physician and Sports medicine 1997; 25:3.

7. Mannix ET, Farber MO, Palange P, Galassetti P, Manfradi F. Exercise induced asthma in figure skaters. Chest 1996; 109:312-5.

8. Thole RT, Robert E S, Aaronl R, Smith GN. Exercise–induced bronchospasm prevalence collegiate cross-country runners. Med Sci Sports Exerc 2001;33(10) 1641-6

9. Webster's encyclopedic unabridged dictionary of the English language. New revised edition, Random house New York; 1994.

10. Operating and cleaning instructions Pocket peak – Hudson Respiratory Care Inc., Temcula, CA 92589 U.S.A

11. American Thoracic Society Medical section of the American lung association. lung function testing. selection of reference values and interpretative strategies. Am Rev Respir Dis 1991; 144:1202-18.

12. Product information. Pulse oximeter Model 305, Palco labs, Inc. Soquel Ave., Santa Cruz, CA 95062 U.S.A.

13. Hygrometric Tables. Stevenson Screen Reading, Director General Meteorological Services Karachi 1994; p.4-43.

14. Kukafa DS, Lang DM, Porter S, Rogers J, Ciccolella D, Polansky M, D'Alonzo GE. Exercise-induced bronchospasm in high school athletes via a free running test Incidence and Epidemiology. Chest 1998;114:1613-22.

15. Mellion MB. Sports medicine secrets. 2nd ed. New Delhi , Jaypee brothers; 2001.

16. Robergs RA, Roberts SO. Exercise physiology, exercise performance, and clinical application. St Louis: Mosby; 1997.

17. Emanuel OD, Addo Y, Adnan C, Simon CO, Taggart AP, Asafo-Agyei, Ashley W. Exercise induced bronchospasm in Ghana: differences in frequency between urban and rural school children Thorax 1997;52:161-5.

18. Keeley DJ, Neill P, Gallivan S. Comparison of the prevalence of reversible airway obstruction in rural and urban Zimbabwean children. Thorax 1991;46:549-53.

19. Van Niekerk CH, Wiebers EG, Shore SC, Heese HV, Van Dhalkyk DJ. Prevalence of asthma: a comparative study of urban and rural Ghana children. Clin Allergy 1979;9:319-24.

20. Burr ML, Eldridge BA, Borysiewicz LK. Peak expiratory flow rates before and after exercise in school children Arch Dis Child 1974;49:923-6.

21. Kattan M, Keens TG, Mellis C.M, Levison H. The response to exercise in normal and asthmatic children. J Pediatr 1978;92:718-21.

22. Burr ML, Butland BH, Kings S, Vaughan-Williams E. Changes in asthma frequency: Two surveys 15 years apart. Arch Dis Child 1989; 64:1452-6.

23. Pierson WE, Voy RO. Exercise-induced bronchospasm in the XXIII summer Olympic games. N Engl J Med1979; 301:763-7.

24. Rice SG, Bierman CW, Shapiro GG, Furukawa CT, Pierson WE. Identification of exercise–induced asthma among inter collegiate athletes Ann. Allergy 1985;55:790-3.

25. Rupp NT, Brundo DS, and Guill MF. The value of screening for risk of exercise-induced asthma in high school athletes. Ann. Allergy 1993; 70:339-42.

26. Larry AS, Karen CA, Marilyn AS, Joseph JK, Patton John FP, Lilly CM. The prevalence of Exercise-induced Bronchospasm Among US Army Recruits and its Effects on Physical Performance Chest 2001; 119:1676-84.

27. O' Donnell AE, Fling J. Exercise-induced airflow obstruction in a healthy military population. Chest 1993; 103:742-44.

28. Kattan M, Keens TG, Mellis CM, Levison, H. The response to exercise in normal and asthmatic children. J Pediatr 1978; 92:718-21.

29. Feinstein RA, Larossa J, Wang-Dohlman A, Bartolucci AA. Screening adolescent athletes for exercise-induced asthma. J Clin Sports Med 1996; 6:119-23.

30. Mannix ET, Manfredi F, Farber MO. A comparison of two challenge tests for identifying exercise-induced bronchospasm in figure skaters. Chest 1999; 115:649-53.

31. Rundell KW, Wilber RL, Szmedra L, Jenkinson DM, Myaers LB, Im J. Exercise-induced asthma screening of elite athletes: field versus laboratory exercise challenge. Med Sci Sports Exerc 2000; 32:309-16.

Correspondence Address :

Dr Abdul Ahad, Department of Physiology, Ziauddin Medical University, St-4 Block 6, Shahrah-e-Ghalib, Clifton, Karachi, 75600 Pakistan.

Email: draahad@hotmail.com