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The Prevalence of Exercise-Induced Bronchospasm in Soccer Player Children, Ages 7 to 16 Years

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ABSTRACT

This study represents an attempt to determine the prevalence of exercise-induced bronchospasm among soccer player children. A total of 234 soccer player boys of all soccer schools from Shahr-Rey enrolled in this study. They did not have any history of a recent or chronic respiratory tract disease, a history of allergic diseases, and history of bronchodilator drugs consumption during the 24 hours prior to the study.

Pulmonary function test (PFT) was performed for each participant before exercise and 6 and 15 minutes after playing soccer. The diagnosis of EIB was by a decrease in forced expiratory volume in 1 second (FEV1) by at least 10% and in peak expiratory flow rate (PEFR) by at least 15% with exercise challenge. If there was reduction in one parameter alone, the participants were considered as prone to EIB.

Considering both FEV1 and PEFR the prevalence of EIB was 2.1% and 18.4% were prone to EIB. If FEV1 or PEFR tests were used as criteria for diagnosis of airway obstruction, the prevalence of EIB would be 6% and 15.8%, respectively. There was no significant difference between the post of players, family history of allergic disease and EIB in soccer players.

This study suggests that at least 2.1% of soccer players will develop bronchospasm even if they do not have any history of asthma and allergy.

Key words: Asthma; Exercise; Exercise induced bronchospasm; Soccer

INTRODUCTION

Asthma is a chronic inflammatory condition of the lung airways resulting in episodic airflow obstruction.[1] One manifestation of this condition can be its increase rate during exercise. Exercise-induced bronchospasm (EIB) is a clinical syndrome characterized by a transient reversible airflow obstruction that usually follows a short vigorous physical activity.[1-3]. EIB may be the only clinical manifestation of asthma although in some cases it is associated with persistent asthma or asthma that is triggered by exercise.

The prevalence of EIB, as an isolated manifestation of asthma, is reported to be present in 6% up to 19% of the population.[1,4] Unfortunately, EIB remains undiagnosed because symptoms usually appear after exercise and except for moderate to severe asthma, the

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individual's performance is not limited. These conditions are important to recognize in children who exercise, as asthma may limit physical activity secondary to a decrease in pulmonary function.

The prevalence of EIB may be variable according to the type, duration or intensity of exercise, environmental factors, and diagnostic criteria.[5, 7] There are different opinions on diagnostic criteria based on spirometry results. The criteria varies from 10 to 20% reduction in FEV1 or 15 to 25% reduction in PEF or FEF_{25-75}.[1, 3, 4]

The highest reported prevalence of asthma is among elite cross-country skiers,[8] however the prevalence of EIB is not recognized in some sports. In the Summer Olympic Games of 1996, 50% of cyclists, 30% of swimmers, 25% of rowers, and 18% of track and field athletes reported that they had asthma.[9]

A few researchers compared the prevalence of asthma in athletes who participated in different sports.[9,10] Only, one study has shown the prevalence of exercise-induced bronchospasm among professional football players,[11] and there was a study indicating prevalence of exercise-induced bronchospasm among soccer player children.[12] In this study we attempted to determine the prevalence of reversible airway obstruction among soccer player children.

PATIENTS AND METHODS

During the summer of 2005 a total of 234 soccer player boys of all schools of Shahr Rey a town in the south of city of Tehran enrolled in this cross-sectional study. Exclusion criteria were: recent upper respiratory tract infection, a history of chronic lower respiratory disease, a history of allergic disease, and history of bronchodilator drugs consumption during the 24 hours prior to the study.

For every participant, pulmonary function tests (PFT) was performed before the game, as well as after 6 and 15 minutes after soccer playing. All subjects had a uniform exercise protocol including 5 min warm up and 15 min soccer playing.

PFT was assessed by a Spiro lab II spirometer calibrated daily with a 3 liter calibration Syringe and automatically by itself. All participants were trained for performing spirometry. From this procedure, FVC, FEV1, FEV1% and peak expiratory flow rate (PEFR) were determined based on the best of the three efforts.

The diagnosis of EIB was based by a decrease in FEV1 by at least 10% and in PEFR by at least 15% after exercise challenge. If there were reduction in one parameter alone, the participant was considered as prone to EIB. T-test and chi-square were used for comparing variables. Statistical analysis computations were performed by SPSS 11.5. P Value of <0.05 was considered significant.

RESULTS

The mean age, weight and BMI of the participants were 11.7±1.6 year, 41.1±10.2 kg and 17.8±2.6 kg/m^2, respectively. Table 1 shows the mean value of PFT before and after exercise in our subjects. PEFR was decreased significantly in the second step when it was compared to the first step.

Table 1. Mean value of PFT before and after exercise in soccer players

Step of PFT / Parameter	First step	Second step	Third step	P. value
FEV1	2.49±1.25	2.51±0.60	2.50±0.60	Non-sig
PEFR	5.16±1.25	4.98±1.30	5.16±1.30	0.000*

* between the first step and the second step (paired t-test)

Table 2. Frequency of PFT parameters decrement: Comparison between different steps

Decrement & statistics / parameters and Steps		11-15%		More than 15%	
		Frequency	CI	Frequency	CI
FEV1	First compared to second step	7 (3%)	0.01-0.5	4 (1.7%)	0.00-0.03
	First compared to third step	7 (3%)	0.01-0.5	7 (3%)	0.01-0.5
PEFR	First compared to second step	24 (10.3%)	0.06-.14	34 (14.5%)	0.10-0.20
	First compared to third step	16 (6.8%)	0.04-0.10	15 (6.4%)	0.03-0.10

Table 2 presents the frequency of PFT parameters decrement in our subjects. The prevalence of EIB was 2.1% (5 boys) and 43/234 boys (18.4%) were prone to EIB. If FEV1 or PEFR tests were used as criteria for diagnosis of airway obstruction, the prevalence of EIB would be 6% (14/234) and 15.8% (37/234), respectively.

There was no significant difference between the post of the players, family history of allergic disease and EIB in the soccer players (P>0.05). Moreover there was no significant difference between history of smoking in parents and EIB (P>0.05).

DISCUSSION

The strongest factor of this study was the large sample size and investigation of soccer players.

In many studies the diagnosis of EIB was confirmed by a significant fall in the FEV1 or PEFR after a bronchial provocation test (exercise or hyperventilation). These criterion are logical in symptomatic patients, but in normal population and in the absence of clinical symptoms, we need stronger criteria. Our study showed EIB in 6 to 15.8 percent of children soccer players. This dissociation is due to cut off point of diagnostic of EIB. The combination of these two tests will lead to a prevalence of EIB of 2.1%. Considering FEV1 alone as a diagnostic criterion, this rate is less than the rates reported in other studies[4,13] but based on PEFR 15.8% of subjects showed EIB. This rate (15.8%) is higher than or equal rates to reported by other studies performed on children.[5,14] However, there are researchers who found high prevalence of EIB, about 30% and higher, in children.[12,15]

Although there is no universally accepted post-exercise lower limit of pulmonary function between EIB positive and normal individuals, many researchers used the criteria of 10-20% reduction in FEV1 or 15-25% reduction in PEFR or FEF_{25-75} to diagnose EIB.[3]

We selected non asthmatic and non allergic children in our study. Similar studies, have reported higher prevalence in asthmatic and allergic patients versus normal population.[5,12] If a similar study was performed in non selected children, the prevalence of EIB would have been higher than the present study. Although, American football players have a very high incidence of bronchial hyperreactivity compared to volleyball players,[16] however soccer players do not seem to have a high prevalence of bronchial obstruction compared to other medium intensity players such as volleyball or handball players. Bisschop et al showed that warm up reduced the decrease in peak flow in most of the children during exercise, thus reducing subsequent post-exercise deep bronchoconstriction.[17] In this study, players had 5 min warm up before exercise. This factor and the fact that non-allergic patients were selected may have been the cause of the low prevalence of EIB in this study. Sidiropoulou et al performed a study on EIB in children soccer players aged 8 to 13 years. They showed a decline in FEV_1>15% in 40% of soccer players aged 8 to 13 years.[12] This prevalence was 11% in children with free personal medical history, 25% with allergies, and 89% in children with asthma.[12] Our study was performed in actual field after 5 min warm up, but Sidiropoulou's investigation was performed after 6 min free running exercise.[12] One study considered that free running is more asthmogenic than cycling, swimming, or the treadmill.[18,19] Whereas Rubia et al.[20] showed that if we control the environmental conditions and exercise intensity, there would be no difference in asthmagenecity between treadmill and free running. However, soccer is an outdoor sport and control of environmental factors in soccer is very difficult. Warm and low humid weather, grass pollen and air pollution are trigger factors for EIB. In study location, there was much air pollution due to petroleum and other manufactures, and our subjects played on grass ground, which is important in triggering EIB. According to our criteria, 18.4% of our subjects were prone to EIB. Although a decrease in FEV1 or PEFR is considered EIB in some studies, we defined these criteria as prone to EIB and this method increases the liability of our study. We suggest these group subjects should be considered EIB, if they showed clinical manifestations.

CONCLUSION

EIB among soccer players with non asthmatic and allergic history is at least 2.1%. This value suggests that a significant percentage of soccer players will develop bronchospasm even if they do not have any history of asthma and allergy. For more accuracy, we suggest FEV1 and PEFR, as diagnostic criteria for EIB in asymptomatic individuals.

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REFERENCES

1. Liu AH, Spahn JD, Leung DYM. Childhood Asthma. In: Behrman RE, Kliegman RM, Jenson HB. Nelson Textbook of Pediatrics. Philadelphia: Saunders, 2004: 760-73.
2. McFadden ER, Gilbert LA. Exercise-induced asthma. N Engl J Med 1994; 330(19):1362-7.
3. Cummiskey J. Exercise-induced asthma: an overview. Am J Med Sci 2001; 322(4):200-3.
4. Massie J. Exercise-induced asthma in children. Paediatr Drugs 2002; 4(4):267-78.
5. Storms WW. Exercise-induced asthma: diagnosis and treatment for the recreational or elite athlete. Med Sci Sports Exerc 1999; 31(Suppl 1):S33-8.
6. Rundell KW, Jenkinson DM. Exercise-induced bronchospasm in the elite athlete. Sports Med 2002; 32(9):583-600.
7. Rundell KW, Wilber RL, Szmedra L, Jenkinson DM, Mayers LB, Im J. Exercise- induced asthma Screening of elite athletes: field versus laboratory exercise challenge. Med Sci Sports Exerc 2000; 32(2):309-16.
8. Larsson K, Ohlsén P, Larsson L, Malmberg P, Rydstrom PO, Ulriksen H. High prevalence of asthma in cross country skiers. BMJ 1993; 307(6915):1326-9.
9. Weiler JM, Layton T, Hunt M. Asthma in United States Olympic athletes who participated in the 1996 Summer Games. J Allergy Clin Immunol 1998; 102(5):722-6.
10. Ross RG. The prevalence of reversible airway obstruction in professional football players. Med Sci Sports Exerc 2000; 32(12):1985-9.
11. Ford ES, Heath GW, Mannino DM, Redd SC. Leisure-time physical activity patterns among US adults with asthma Chest 2003; 124(2):432-7.
12. Sidiropoulou M, Tsimaras V, Fotiadou E, Aggelopoulou-Sakadami N. Exercised-induced asthma in soccer players ages from 8 to 13 years. Pneumologie 2005; 59(4):238-43.
13. Debrock C, Menetrey C, Bonavent M, Antonini MT, Preux PM, Bonnaud F, et al. Prevalence of exercise-induced asthma in school children Rev Epidemiol Sante Publique 2002; 50(6):519-29.
14. Sudhir P, Prasad CE. Prevalence of exercise-induced bronchospasm in schoolchildren: an urban-rural comparison. J Trop Pediatr 2003; 49(2):104-8.
15. Sano F; Solé D, Naspitz CK. Prevalence and characteristics of exercise-induced asthma in children. Pediatr Allergy Immunol 1998; 9(4):181-5.
16. Weiler JM, Metzger J, Donnelly AL, Crowley ET, Sharath MD. Prevalence of bronchial responsiveness in highly trained athletes. Chest 1986: 90(1):23-8.
17. de Bisschop C, Guenard H, Desnot P, Vergeret J. Reduction of exercise-induced asthma in children by short, repeated warm ups. Br J Sports Med 1999; 33(2):100-4.
18. Anderson SD, Connolly NM, Godfrey S. Comparison of bronchoconstriction induced by cycling and running. Thorax 1971; 26(4):396-401.
19. Matsumoto I, Araki H, Tsuda K, Odajima H, Nishima S, Higaki Y, et al. Effects of swimming training on aerobic capacity and exercise induced bronchoconstriction in children with bronchial asthma. Thorax 1999; 54(3):196-201.
20. Garcia de la Rubia S, Pajaron-Fernandez MJ, Sanchez-Solis M, Martinez-Gonzalez Moro I, Perez-Flores D, Pajaron-Ahumada M. Exercise-induced asthma in children: a comparative study of free and treadmill running. Ann Allergy Asthma Immunol 1998; 80(3):232-6.