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ARAŞTIRMA RESEARCH ARTICLE

Prevalence of exercise-induced bronchospasm in 8-18-year-old amateur or professional football players in Trabzon, Turkey

Trabzon'daki 8-18 yaş grubu amatör ve profesyonel futbolcularda egzersize bağlı bronkospazm sıklığı*

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ABSTRACT

Objective: Exercise-induced bronchospasm (EIB) is a reduction of 10% or more in forced expiratory volume in one second (FEV_1), immediately to 30 minutes after exercise. EIB occurs in up to 56% of elite athletes, depending upon the sport examined. In this study, we aimed to investigate the prevalence of EIB in 8-18-year-old football players in Trabzon, Turkey.

Materials and Methods: Of the 1146 licensed football players, 246 were randomly selected, and 229 (93.1%) were exercise-tested. All participants were boys with a mean age of 14.4 ± 2.1 (8-18) years. FEV_1 was measured before the exercise test (basal), and FEV_1 measurements were repeated at 2, 5, 10,

ÖZ

Giriş: Egzersize bağlı bronkospazm (EBB), egzersizden sonraki 30 dakika içinde birinci saniyedeki zorlu ekspiratuar hacmin (FEV_1) %10 veya üzerinde azalması olarak tanımlanır ve araştırılan spor dalına göre seçkin sporculardaki sıklığı %56'ya kadar ulaşabilir. Bu çalışmada, Trabzon ilinde amatör ve profesyonel olarak futbol oynayan 8-18 yaş grubu çocuklarda EBB sıklığının araştırılması amaçlanmıştır.

Gereç ve Yöntem: İlimizdeki 1146 lisanslı futbolcu çocuktan rastgele seçilen 246'sı çalışmaya davet edildi ve bunlardan 229 (%93.1)'una egzersiz testi yapıldı. Katılımcıların hepsi erkekti ve ortalama ± SD yaşları 14.4 ± 2.1 (8-18) yıl idi. Egzersiz testinden önce (bazal) ve sonra 2, 5, 10, 15 ve 30. dakika-

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15, and 30 min after exercise. Parents/children were also asked to complete a modified version of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire form including questions on the atopic status of the family, food allergy, pet ownership, presence of cockroaches at home, heating methods of the house, and parental smoking.

Results: We observed a reduction in FEV_1 of 10% or more after exercise in 22 (9.6%) children. The prevalence of EIB was significantly high in children who reported having current dry night coughs when compared with children who did not (28.6% vs. 7.7%, p= 0.008) and in children who reported food allergy when compared with those who did not (28.6% vs. 8.4%, p= 0.034).

Conclusions: Our results indicate that a substantial rate of EIB exists among 8-18-year-old football players in Trabzon, and suggest that active screening for EIB in children playing football may be indicated to improve both their health and athletic performance.

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larda FEV_1 değeri ölçüldü. Çocuklardan ve ebeveynlerden Uluslararası Çocukluk Çağı Astım ve Allerjileri Çalışması (ISAAC) anket formunun ailenin atopik durumu, besin allerjisi, evcil hayvan sahipliği, evde hamamböceği varlığı, evin ısıtılma şekli ve ebeveynin sigara içme durumunu da içerecek şekilde kısaltılmış bir şeklinin doldurulması istendi.

Bulgular: Egzersiz sonrasında 22 (%9.6) çocukta FEV_1'de %10 veya üzerinde bir azalma oldu. Geceleri kuru öksürüğü olan çocuklarda olmayanlara göre (%28.6-%7.7 p= 0.008) ve besin allerjisi bildiren çocuklarda bildirmeyenlere göre (%28.6-%8.4, p= 0.034) EBB daha sık tespit edildi.

Sonuç: Futbolcu çocukların bir kısmında EBB vardır ve hem sağlık durumlarının hem de sportif performanslarının geliştirilmesi için sporcu çocukların EBB varlığı yönünden taranması gereklidir.

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Anahtar kelimeler: Egzersize bağlı bronkospazm; çocuk; futbol oyuncusu

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INTRODUCTION

Exercise-induced bronchospasm (EIB) is a transient reduction of 10% or more in forced expiratory volume in one second (FEV_1), immediately to 30 minutes after exercise[1,2]. EIB occurs in up to 90% of asthmatics and 40% of patients with allergic rhinitis; it occurs in up to 56% of elite athletes, depending upon the sport examined[3,4].

As many of the reported severe episodes of asthma provoked by exercise that have led to morbidity and mortality have occurred in competitive athletes that were less than 21 year of age, this population is of particular interest[5]. To our knowledge, there was no study on the prevalence of EIB in competitive young athletes in Turkey. In the present study, we aimed to investigate the prevalence of EIB in 8-18-year-old football players in amateur and professional sports clubs in Trabzon, Turkey.

MATERIALS and METHODS

Patients

Of the 1146 licensed football players of 26 amateur football clubs, 246 were randomly selected for the study.

The lung function entry criterion on the exercise test days was an FEV_1 above 80% of predicted. The study was undertaken during 1 April-30 June 2008. During the study period, the children had no medical condition that was likely to interfere with the evaluation of the airway responses to the exercise. No children had taken oral steroids in the past three months. None was using inhaled corticosteroids, cromolyn sodium, short-acting beta-2 adrenergic agonists, long-acting beta-2 adrenergic agonists, or theophylline. Children were excluded if they had symptoms or physical signs suggestive of pulmonary, renal, hepatic, or cardiovascular disease.

Study Design

Exercise testing: Airway responses were assessed by measuring FEV_1 with spirometer (V Max 20, Sensor Medics, Yorba Linda, California, USA), and were determined based on the best of the three efforts. All participants were trained for performing spirometry. All participants were tested by the same investigator (EAA).

Exercise testing consisted of running on an inclined motor-driven treadmill (5.5°) for 6-8 minutes. Speed was adjusted during the run to achieve a steady state heart rate of at least 85% of calculated maximum age-related heart rate for the last 4-6 min of the running time. FEV_1 measurements were repeated at 2, 5, 10, 15, and 30 minutes after exercise. EIB is defined as a fall in FEV_1 of 10% or more after exercise compared to baseline FEV_1[6].

Heart rate was monitored throughout the exercise and before/after blood pressure measurements were performed. Room temperature and relative humidity were measured on the study days. Children were observed in the laboratory one hour following the end of the exercise challenge. Any symptoms (i.e., cough, wheezing, chest tightness) during and/or after exercise were recorded.

Questionnaire: All the children in the study group were questioned about allergic diseases, such as asthma, allergic rhinitis and atopic dermatitis, using the International Study of Asthma and Allergies in Childhood (ISAAC) phase II questionnaire, which was previously validated for the Turkish population[7-10]. Parents were asked if a doctor had ever diagnosed asthma, hay fever or eczema in their child. Children were defined as having asthma, allergic rhinitis or atopic dermatitis if the diagnosis was previously made by a doctor. The questionnaire included questions about current wheezing, ever wheezing and night cough. Current wheezing was defined as wheezing occurring within the past 12 months. All face-to-face interviews and allergy investigations were performed by two doctors.

Children were also asked to answer questions on the atopic status of the family, presence of symptoms (cutaneous, respiratory, cardiovascular, gastrointestinal, and anaphylactic) after food intake, pet ownership, presence of cockroaches at home, heating methods of the house, and parental smoking.

The study was approved by the Karadeniz Technical University Ethics Committee, and a written informed consent was obtained from all participants' parents. The study was supported by the Research Fund of Karadeniz Technical University.

Statistical Analysis

Statistical analysis computations were performed by SPSS 10.0. Descriptive statistics are presented as mean and standard deviation. The chi-squared test with Yates correction and nonparametric test of Wilcoxon was used for percentage comparisons, and the t test for means comparisons. A value of $p< 0.05$ was considered significant.

RESULTS

Of the 246 randomly selected football players, 229 (93.1%) (mean ± SD age, 14.4 ± 2.1) were accepted to be involved in the study. All 229 children were exercise-tested and all of them completed the ISAAC questionnaire. The pre-exercise mean ± SD percent FEV_1 and forced vital capacity (FVC) were 102.2 ± 12.3 and 102.4 ± 13.4, respectively (Table 1).

Every child was able to perform the exercise test at the targeted level of workload. None of the children examined suffered from cough, wheezing or chest tightness, during or after exercise. A reduction in FEV_1 of 10% or more after exercise (prevalence of EIB) was observed in 22 (9.6%) children.

Among the 22 subjects with EIB, the maximal fall in FEV_1 was recorded 2 minutes after the exercise in 11, 5 minutes after the exercise in three, 10 minutes after the exercise in four, 15 minutes after the exercise in one and 30 minutes after the exercise in three children.

Table 1. Characteristics of the study group

	Whole group	EIB (+)	EIB (-)	p*
Age (years), mean ± SD	14.4 ± 2.1	14.5 ± 1.7	14.4 ± 2.2	0.061
FEV_1 before exercise (% of predicted), mean ± SD	102.2 ± 12.2	102.2 ± 9.9	102.2 ± 12.7	0.117
FVC before exercise (% of predicted), mean ± SD	102.4 ± 13.4	104.4 ± 10.6	102.2 ± 13.6	0.157
Maternal smoking, n (%)	36 (15.7)	2 (9.1)	34 (16.4)	0.554
Paternal smoking, n (%)	117 (51.1)	9 (40.9)	108 (52.2)	0.435
Pet ownership, n (%)	30 (13.1)	2 (9.1)	28 (13.5)	0.747
Cockroaches at home, n (%)	43 (18.7)	7 (31.8)	36 (17.4)	0.145

* Significance was compared between EIB (+) and EIB (-) groups.
EIB: Exercise-induced bronchospasm, FEV_1: Forced expiratory volume in 1 second, FVC: Forced vital capacity.

The prevalence of EIB was significantly high in children who reported having current dry night coughs when compared with children who did not (28.6% vs. 7.7%, p= 0.008) and in children who reported food allergy when compared with those who did not (28.6% vs. 8.4%, p= 0.034) (Table 2). In children who reported symptoms after food intake, only two could specify a food (beef and strawberry in one each). The remaining 12 reported symptoms after a meal at a restaurant or in the school canteen, but could not report a specific food item. Reported symptoms were cutaneous only; none reported respiratory, cardiovascular, gastrointestinal, or anaphylactic reactions. The prevalence of EIB was not different between children who reported or did not report ever wheezing (3/18, 16.7% and 9/211, 9.0%, respectively, p= 0.290), current wheezing (1/8, 2.5% and 21/221, 9.5%, respectively, p= 0.777), a whistle

Table 2. Prevalence of EIB in children according to "yes" or "no" responses on the questionnaire

	Prevalence of EIB			
	n/Yes (%)	n/No (%)	OR (CI)	p
Asthma questions				
History of ever wheezing	3/16 (16.7)	19/211 (9.0)	2.02 (0.42-8.40)	0.290
History of current wheezing	1/8 (12.5)	21/221 (9.5)	1.36*	0.777
Current dry night cough	6/21 (28.6)	16/208 (7.7)	4.8 (1.43-15.7)	0.008
Current whistle in the chest after running and playing	2/22 (9.1)	20/207 (9.7)	0.94 (0.0-4.62)	1.000
Doctor-diagnosed asthma	0/2	22/227 (9.7)		
Rhinitis questions				
Ever had allergic rhinitis symptoms	5/45 (11.1)	17/184 (9.2)	1.23 (0.37-3.83)	0.778
Doctor-diagnosed allergic rhinitis	0/5	22/224 (9.8)		
Eczema questions				
Ever had atopic dermatitis	0/0	22/229 (9.6)		
Doctor-diagnosed atopic dermatitis	0/0	22/229 (9.6)		
Familial atopy	3/39 (7.7)	19/190 (10.0)	0.75 (0.17-2.88)	1.000
History of food allergy	4/14 (28.6)	18/214 (8.4)	4.36 (1.03-17.3)	0.034

* Confidence limits were invalid.

in the chest after running and playing in the last 12 months (2/22, 9.1% and 20/207, 9.7%, respectively, p= 1.000), and symptoms of allergic rhinitis (5/45, 11.1% and 7/184, 9.2%, respectively, p= 0.778) (Table 2). The prevalences of doctor-diagnosed asthma and allergic rhinitis were 0.9% and 2.1%, respectively. EIB was not diagnosed in any of the children with doctor-diagnosed asthma or allergic rhinitis (Table 2). None of the children reported symptoms of atopic dermatitis or had doctor-diagnosed atopic dermatitis.

Room temperature that was supplied by an air conditioner was constant at 22 degrees Celcius and relative humidity was between 50-55% during the study period.

DISCUSSION

In the present study, we found the prevalence of EIB in 8-18-year-old football players in Trabzon, Turkey to be 9.6%. The prevalence of EIB in athletes varies between studies from 1.3% to 56.0%[11-19]. This wide variation in the prevalence of EIB in athletes might be due to the type of challenge [i.e., indirect test (exercise, eucapnic voluntary hyperventilation, adenosine monophosphate, hypertonic saline, or mannitol challenge), or direct test (histamine or methacholine)], type of exercise testing (i.e., cycle, treadmill, free running, or challenge in the specific venue in which the subject participates), intensity (i.e., a workload of 85% to 95%) or duration of exercise, environmental conditions [i.e., humidity and temperature of the inspired air), diagnostic criteria (i.e., a reduction in FEV_1 of 10 to 20%, in peak/forced expiratory flow (PEF or FEF %25-75) of 15% to 25%], and study population (i.e., elite vs. recreational athletes)[20-25].

A correlation between asthma-related symptoms and bronchial responsiveness to exercise has been shown in the previous studies[26,27]. Busquets et al. found a significant association between bronchial responsiveness to exercise and all asthma items of the ISAAC questionnaire in 13-14-year-old schoolchildren[26]. Ponsonby et al. demonstrated a significant fall in FEV_1 in response to exercise in 7-year-old children whose parents responded positively to ISAAC questions on a history of wheeze or asthma, recent wheeze, sleep disturbance due to wheeze, or exercise-induced wheeze, but not in children with a history of recent dry cough at night, apart from a cold or chest infection[27]. In our study, the exercise challenge results related only with a history of recent dry cough at night, other than from cold or chest infection, but not with questions related to wheezing. The type of exercise, definition of EIB and study population of the present study are quite different from those of the aforementioned studies. Both Busquets et al. and Ponsonby et al. used free running as the type of exercise, whereas we used a treadmill running test in the laboratory[26,27]. Busquets et al. defined EIB as a fall in PEF rate of 15% or more and determined PEF rate measurements at 1, 5, 10 and 15 min after exercise[26]. Ponsonby et al. instead of defining EIB, determined the relation between the mean fall in FEV_1 (measured after exercise at 5, 10 and 15 minutes) and the items of ISAAC questionnaire[27]. Lastly, both Busquets et al. and Ponsonby et al. performed their studies in a general pediatric population, whereas our study was conducted in a selected population (i.e., amateur football players)[26,27].

In our study group, the prevalence of EIB was not different between children who reported or did not report current whistle in the chest after running and playing (9.1% and 9.7%, respectively). Diagnosis of EIB on the basis of history alone is reported to be unreliable in many studies[14,15,28-30]. In a cross-sectional study of 256 adolescent athletes conducted by Hallstrand et al., the screening history identified symptoms or a previous diagnosis suggestive of EIB in 39.5% of the participants, but only 12.9% of these adolescents actually had EIB; among adolescents with a negative review of symptoms of asthma or EIB, 7.8% had EIB[28].

The prevalence of a history of doctor-diagnosed asthma or allergic rhinitis was very low

in our study group (0.9% and 2.1%, respectively). This may be due to a belief that a child with a chronic respiratory disease such as asthma should avoid any activities including strenuous exercise.

We found a significantly high rate of EIB in children in our study group who reported food allergy. A limitation of our study is that children who reported symptoms due to suspected food allergy were not evaluated by an objective method such as skin tests, serum food-specific IgE or oral food provocation. An increased frequency of bronchial hyperresponsiveness in non-asthmatic patients with food allergy has been documented in previous studies[31-33]. However, Penard-Morand et al. in a large group of 9-11-year-old children, found no relationship between EIB and food allergy as determined using a standardized questionnaire completed by parents[34].

In conclusion, our results indicate that a substantial rate of EIB exists among 8-18-year-old football players in Trabzon, and suggest that active screening for EIB in children playing football may be indicated to improve both their health and athletic performance.

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