A cross-sectional survey of participation of asthmatic children in physical activity

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Background: **Physical exercise has been proven to be beneficial to children with asthma, but the traditional view in China is that asthmatic children should not take part in sports. This study was undertaken to investigate the current status of children with asthma taking part in exercise in China.**

Methods: **One hundred and twenty-three asthmatic children (7-14 years old) who had visited our asthma control center between February 2009 and June 2009 were enrolled in this cross-sectional study. Each child had a pulmonary function test and his/her health-related quality of life was assessed. The children also finished a questionnaire about their physical activity. As a control group, 109 non-asthmatic children from a primary school were surveyed about their level of activity.**

Results: **Asthmatic children took part in less exercise than their healthy peers, and 62.6% (77/123) of the children with asthma never reached the criteria of exercise prescription for patients with asthma advised by the American College of Sports Medicine. The asthmatic children were divided into two groups based on the level of activity; compared with the group with a higher physical activity level, more children in the group with lower activity believed that exercise could make asthma worse, more parents and teachers restricted the children's exercise, and fewer doctors approved them participating in exercise. All of the parameters of basic lung function were higher in the group with higher activity level. Moreover, the children with a higher exercise level had a higher score on all parts of the pediatric asthma quality-of-life questionnaire. About 78.5% (96/123) of children ever experienced coughing, chest distress, dyspnea, or gasping during exercise, but 49.6% (61/123) had these symptoms occasionally.**

Conclusions: **Our study reveals that children with asthma do not have enough exercise in China. The concept that children, parents, teachers and doctors have about exercise for patients with asthma is urgent to be updated. We need to prescribe appropriate exercise for children with asthma.**

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Introduction

Asthma is a chronic inflammatory disease of the airways, which is associated with significant medical and social morbidity.[1,2] Physical activity is an important part of both a healthy lifestyle and a child's daily routine.[3] As vigorous exertion can increase postexercise airway resistance, the traditional view in China is that asthmatic children should not take part in sports. However, in recent years physical exercise has been proven to be useful in the management of asthma.[4] Thus, according to current treatment guidelines, a diagnosis of asthma should not deter a child from physical activity, inasmuch as normal physical activity is a recognized goal of optimal asthma control.[5]

Most studies conducted in other countries have shown that children with asthma have a lower physical activity level than healthy children. One recent study conducted in the United States reported that asthmatic children took part in fewer sports than their peers, and that 60.7% of asthmatic children's parents and 66.1% of asthmatic children thought that asthma was a barrier to exercise.[6] Lang's survey of children in USA showed that the mean amount of daily activity was 116 minutes in asthmatic children and 146 minutes in children without asthma,[7] and Chiang's study of children in Taiwan showed that asthma was the primary factor determining vigorous physical activity levels.[8] A study in Denmark also reported that asthmatic children spent less time on physical activity than non-asthmatic children.[9] In

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contrast, a survey in New Zealand found that children with asthma were more active than their peers and had favorable attitudes towards exercise.[10] Studies in Norway found no difference in the frequency of exercise between children with and without asthma.[11,12] In China, little is known about proportion and attitudes of children with asthma taking part in exercise.

A number of factors may influence an asthmatic's physical activity. First, the severity of asthma can influence a child's level of physical activity.[7] Second, the attitude of the asthmatic children towards activity,[6,13] parents' beliefs regarding exercise and asthma,[6,7] and the attitudes of asthmatic children's teachers towards exercise[14] are also important factors. Finally, doctors' attitudes and whether they encourage children to take part in physical activity can affect an asthmatic child's level of physical activity.[7]

This study was designed to ascertain the present status of children with asthma taking part in exercise in China and to determine which factors influence asthmatic children's level of physical activity.

Methods

Subjects

One hundred and twenty-three children (82 boys and 41 girls) who had visited the Asthma Control Center of the Children's Hospital of Chongqing Medical University between February 2009 and June 2009 were enrolled in the study. The diagnostic criteria for asthma were based on the National Guidelines for Asthma.[15] The inclusion criteria for this study were as follows: 7-14 years of age; diagnosis of asthma; no use of inhaled steroids the day before the visit; no administration of oral corticosteroids in 4 weeks before the visit; and no asthma attack in 2 weeks before the visit. Clinical data for these children included age, sex, and the course of asthma. For a control group, 109 healthy children (60 boys and 49 girls) who had never been diagnosed with asthma were selected randomly from a primary school; the age and gender composition of this group were similar to those in the asthmatic group.

Data collection

The questionnaire for asthmatic children included questions about the following topics: (1) general demographic information; (2) participation in physical activity and views about the relationship between asthma and exercise in asthmatic children; (3) parents' and teachers' attitudes towards asthmatic children taking part in sports and whether these adults had restricted children's exercise; (4) doctors' attitudes towards asthmatic children exercising and whether they had discussed physical activity with the children; and (5) the possible clinical manifestations that could appear when children with asthma take part in sports. For the healthy children, the questionnaires only included questions about general demographic information and the frequency and duration of their physical activity.

For each of the 123 asthmatic children in the study, lung functions were tested 1-2 hours after dinner on the day of the visit to the asthma control center. Basic lung function was measured using a pulmonary function meter (MasterScope, Jaeger, Germany). The parameters included forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), peak expiratory flow (PEF), forced expiratory flow at 25% of forced vital capacity (FEF25), forced expiratory flow at 50% of forced vital capacity (FEF50), and forced expiratory flow at 75% of forced vital capacity (FEF75).

The pediatric asthma quality-of-life questionnaire (PAQLQ) outcome was assessed using a three-domain questionnaire.[16] The activity domain is composed of five questions, the symptom domain is composed of ten questions, and the emotional function domain is composed of eight questions. The response options of the PAQLQ consist of a seven-point scale, on which a lower score indicates maximum impairment and higher scores indicate no impairment. The interviewer reads the question and the child gives the response from a card that best describes his or her experiences during the previous week.

Statistical analysis

The data were analyzed using the SAS 8.1 statistical package. The criterion for statistical significance was set at $P<0.05$. Differences among the two groups were assessed using the Chi-square test and Fisher' exact test for categorical and continuous variables, respectively.

Results

Comparison between asthmatic children and their healthy peers

There were no significant differences in age and gender between asthmatic children and healthy children ($P>0.05$). The two groups differed significantly in the number of days per week on which they exercised and in the amount of time spent on exercise each day (Table 1). Asthmatic children spent fewer days per week and less time each day on exercise than healthy children of the same sex (Table 2). Moreover, asthmatic children who were 7-10 years old and 10-14 years old spent fewer days per week and less time each day on exercise than healthy children of similar age (Table 3). Children with asthma spent less time exercising than their healthy peers. In the 123 asthmatic children, 77 (62.60%) children exercised

fewer than three days per week or fewer than 20 minutes in each day.

Factors that influence asthmatic children's level of physical activity

We divided the 123 asthmatic children into two groups: lower (n=77) and higher (n=46) physical activity group. Compared with the group of asthmatic children who exercised <3 days per week or <20 minutes each day (lower physical activity group), the asthmatic children in the higher activity group were of similar age and gender and had a similar course of disease. In the lower activity group, significantly more children thought

Table 1. Comparison of the level of physical activity of asthmatic children *vs.* that of healthy children

Time	Asthmatic children *n* (%)	Healthy children *n* (%)	χ^2	*P*
Days per week				
<2	37 (30.08)	1 (0.92)	35.89	<0.0001
–3	34 (27.64)	26 (23.85)	0.43	0.5107
–5	35 (28.46)	39 (35.78)	1.42	0.2322
≥5	17 (13.82)	43 (39.45)	19.80	<0.0001
Minutes per day				
<20	44 (35.77)	5 (4.59)	33.73	<0.0001
–30	43 (34.96)	29 (26.61)	1.88	0.1699
–60	25 (20.33)	46 (42.20)	13.02	0.0003
≥60	11 (8.94)	29 (26.61)	12.63	0.0004

Table 2. Comparison of the level of physical activity of asthmatic children *vs.* that of healthy children by gender

Time	Male				Female			
	Asthmatic children *n* (%)	Healthy children *n* (%)	χ^2	*P*	Asthmatic children *n* (%)	Healthy children *n* (%)	χ^2	*P*
Days per week								
<2	22 (26.83)	0 (0.00)	19.05	<0.0001	15 (36.59)	1 (2.04)	18.22	<0.0001
–3	24 (29.27)	14 (23.33)	0.62	0.4300	10 (24.39)	12 (24.49)	0.0001	0.9913
–5	21 (25.61)	22 (36.67)	2.01	0.1566	14 (34.15)	17 (34.69)	0.003	0.9566
≥5	15 (18.29)	24 (40.00)	8.20	0.0042	2 (4.88)	19 (38.78)	14.33	0.0002
Minutes per day								
<20	27 (32.93)	3 (4.76)	16.21	<0.0001	17 (41.46)	2 (4.08)	18.73	<0.0001
–30	29 (35.37)	15 (25.00)	1.74	0.1870	14 (34.15)	14 (28.57)	0.32	0.5694
–60	18 (21.95)	20 (33.33)	2.29	0.1302	7 (17.07)	26 (53.06)	12.45	0.0004
≥60	8 (9.76)	22 (36.67)	15.06	0.0001	3 (7.32)	7 (14.29)	-	0.3361

Table 3. Comparison of the level of physical activity of asthmatic children *vs.* that of healthy children by age

Time	7-10 years				10-14 years			
	Asthmatic children *n* (%)	Healthy children *n* (%)	χ^2	*P*	Asthmatic children *n* (%)	Healthy children *n* (%)	χ^2	*P*
Days per week								
<2	24 (31.58)	0 (0.00)	23.01	<0.0001	13 (27.66)	1 (2.04)	12.64	0.0004
–3	18 (23.68)	14 (23.33)	0.002	0.9618	16 (34.04)	12 (24.49)	1.06	0.3033
–5	20 (26.32)	19 (31.67)	0.47	0.4933	15 (31.91)	20 (40.82)	0.82	0.3650
≥5	14 (18.42)	27 (45.00)	11.25	0.0008	3 (6.38)	16 (32.65)	10.43	0.0012
Minutes per day								
<20	27 (35.53)	3 (5.00)	18.17	<0.0001	17 (36.17)	2 (4.08)	15.56	<0.0001
–30	24 (31.58)	17 (28.33)	0.17	0.6821	19 (40.43)	12 (24.49)	2.79	0.0951
–60	16 (21.05)	26 (43.33)	7.80	0.0052	9 (19.15)	20 (40.82)	5.34	0.0208
≥60	9 (11.84)	14 (23.33)	3.15	0.0759	2 (4.26)	15 (30.61)	11.44	0.0007

Table 4. Univariate analysis of the effect of various factors on level of physical activity

Factors	Higher physical activity level (n=46)	Lower physical activity level (n=77)	t/χ^2	*P*
Sex (male/female)	33/13	49/28	0.85	0.3563
Course of disease (y)	2.24±2.0	2.41±2.03	0.44	0.6590
Believing that exercise can make asthma worse, *n* (%)	11 (23.9)	67 (87.0)	49.42	<0.0001
Parents restricted their exercise, *n* (%)	11 (23.9)	50 (64.9)	19.39	<0.0001
Teachers restricted their exercise, *n* (%)	4 (8.7)	40 (51.9)	23.44	<0.0001
Doctors approved them to exercise, *n* (%)	27 (58.7)	26 (33.8)	7.30	0.0069

that exercise might make their asthma worse, more children's parents and teachers restricted their exercise, and fewer doctors approved them participating in sports (Table 4).

Lung function and PAQLQ in asthmatic children with different levels of physical activity

We compared the lung function of the lower physical activity group with the higher physical activity group. The mean percent of predicted FEV1 in the lower activity group was significantly lower than that in the higher activity group. The mean percentages of predicted FVC, predicted PEF, predicted FEF25, predicted FEF50, and predicted FEF75 in the higher physical activity group were all higher than those in the lower activity group, but the differences were not significant between the two groups. The results of the PAQLQ assessment indicated that asthmatic children with a higher level of physical activity had significantly higher scores than those with a lower physical activity on all three aspects and the total score of quality-of-life (Table 5).

Table 5. Lung function and quality-of-life in asthmatic children with higher and lower physical activity levels

	Higher physical activity level (n=46)	Lower physical activity level (n=77)	t	P
Lung function (predicted percentage)				
FVC	91.90±15.81	86.94±15.33	1.72	0.0882
FEV1	103.46±18.93	96.15±19.01	2.07	0.0409
PEF	98.30±20.61	92.11±20.98	1.59	0.1136
FEF25	97.40±25.40	89.29±25.44	1.71	0.0895
FEF50	95.33±30.49	88.46±31.84	1.18	0.2414
FEF75	97.57±33.09	93.23±38.91	0.63	0.5286
Quality-of-life				
Activity	23.89±4.19	20.30±5.41	3.86	0.0002
Symptoms	54.76±9.62	44.83±11.28	4.98	<0.0001
Emotional function	45.59±7.65	39.44±9.01	3.87	0.0002
Total	124.24±19.87	104.57±23.54	4.75	<0.0001

FVC: forced vital capacity; FEV1: forced expiratory volume in 1 second; PEF: peak expiratory flow; FEF25: forced expiratory flow at 25% of forced vital capacity; FEF50: forced expiratory flow at 50% of forced vital capacity; FEF75: forced expiratory flow at 75% of forced vital capacity.

Appearance of exercise-induced asthma symptoms

The percentage of asthmatic children who ever experienced symptoms like coughing, chest distress, dyspnea, or gasping during exercise was 78.5% (96/123). However, 49.6% (61/123) of the children had these symptoms only occasionally and the symptoms did not prevent them from continuing to exercise, 22.0% (27/123) had these symptoms more frequently, and only 6.5% (8/123) had these symptoms almost every time they exercised. No child needed to go to the emergency room when symptoms appeared during physical activity. For all 123 asthmatic children, none had inhaled β2 agonist before exercise.

Discussion

Our study demonstrated that Chinese children with asthma were less likely to participate in physical activity than their healthy peers. This result is broadly consistent with that reported in other countries.[6,7,17] The American College of Sports Medicine[18] recommends the following exercise regimen for patients with asthma: the optimal frequency of exercise is 3-5 days each week and the optimal duration is 20-30 minutes. In this study, 62.60% of asthmatic children did not reach this activity level. Thus, it is essential that most children with asthma increase their level of physical activity.

Our results indicated that the level of physical activity for asthmatic children in China is not associated with age, gender, or course of disease. The health beliefs of children played an important role in their level of physical activity. We found that 87% of asthmatic children who exercised little believed that exercise can make their asthma worse; in contrast, in the group of asthmatic children who exercised more, only 23.9% thought exercise could make their symptoms worse. The beliefs of parents and teachers also influence children's physical activity level. The attitude of doctors also influences children's activity level: children whose doctor approves of participation in physical activity are more likely to reach the activity level recommended by The American College of Sports Medicine. The results of this study confirm those of previous studies[6,7,14] describing the factors that might affect asthmatic children's level of physical activity.

Children may refrain from exercise because of the unpleasant symptoms that can occur during exercise; parents and teachers may not encourage children to take part in sports or may even restrict their participation; and many doctors are not aware of the importance of exercise for asthmatic children and thus do not give them advice about exercise. Therefore, to promote more physical activity for asthmatic children, doctors need to have accurate knowledge about the relationship between exercise and asthma so that they update the perceptions of children, parents, and teachers about physical activity and asthma.

Physical activity is advantageous to young children in terms of bone development, motor skill improvement, cardiovascular fitness, and self-esteem.[19,20] Physical activity is also important to children with asthma. In recent years, research has shown that taking part in sports can help reduce hospital admissions, reduce absenteeism

from school, and medication in asthmatic children.[21] Moreover, being able to participate in sports, particularly at school, is an important contributor to psychological well-being.[22] Physical activity can also help improve the quality of life of asthmatic children.[23] In this study, we found that the children in the higher activity group had significantly higher scores, both in total and for every single aspect of quality of life.

The literature contains variable results about the effect of exercise on children' lung function. Farid et al[24] reported that aerobic exercises in asthmatic children led to an improvement in FEV1, FVC, PEF, and FEF25%-75%. However, Ram et al[25] showed that exercise had no effect on lung function. In our study, all of the pulmonary function indexes were better in the higher physical activity group than in the lower activity group, but only FEV1 differed significantly between the two groups. The effect of physical activity on asthmatic children's lung function needs to be studied further.

In recent years, a large number of studies have shown that physical activity is beneficial to children with asthma. However, exercise can potentially trigger an asthma attack, so the safety of asthmatic children taking part in sports has always been a concern. In our study, 78.5% of the asthmatic children had ever experienced coughing, chest distress, dyspnea, or gasping during exercise, but in 49.6% these symptoms appeared only occasionally and they did not prevent the children from continuing to exercise. Although in 6.5% of the children these symptoms occurred during almost every exercise session, none of them needed to go to the emergency room. Thus, it is safe for asthmatic children to take part in physical activity. As reported by the European Respiratory Society, the use of certain kinds of medicine before exercise for children with poor lung function can protect them against exercise-induced asthma, and β2-agonist is commonly used.[26] In our study, no children reported the use of a β2 agonist before exercise. So if children take some medicines before exercise, the incidence of exercise-induced asthma symptoms may be lowered. According to a prospective research conducted in recent years,[18] it is safe for asthmatic children to participate in sports if medicines are used properly. Meanwhile, exercise prescription has been recommended as another important component of asthma management in children in some countries.

Currently, the perception in China about children with asthma participating in physical activity appears to be cautious. This study found that the physical activity level of asthmatic children was lower than peers with no asthma. Doctors need to update their understanding and awareness of the importance of physical activity in asthmatic children and to prescribe exercise as an important component of asthma management in children. Simultaneously, doctors need to educate children, parents, and teachers about the importance of physical activity so that they can realize that physical activity in asthmatic children is not only safe but also beneficial to children when managed appropriately. This study conducted in China is not representative of the situation in other countries. Similar studies in other countries are needed.

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