A study on the physical activity issues in asthmatic children and it's significance to school education

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Abstract

Asthma and physical activity in children are major health issues. The incidence and prevalence of asthma have increased considerably over the last few decades, particularly for children. And the level of physical inactivity in children has also increased in the worldwide. Therefore, the burden on health services from asthma and physical activity are extensive and increasing now.

Physical activity is important. It has <<an 사제>> advantages for children in terms of skeletal development, improve cardiorespiratory fitness, lowered body fat and elevated self-esteem. Of course, physical activity is also very important for children with asthma. But there seem to be a common perception that asthmatic children have reduced an exercise capacity and have been discouraged from physical activity. We are afraid that many children and young people with asthma believe the limitations on their activity are an inevitable part of having asthma.

This paper presents a review of the literature in which habitual physical activity and fitness levels including obesity and investigate of 2007 KYRBS(Korea Youth Risk Behavior Survey) in order to provide an overview of evidence and argument in this issue, and inform decisions about the future direction of empirical studies and therefore help to making systems/or programs for them.

Key words : physical activity, asthmatic children, school education

I. Introduction

Children with chronic disease have traditionally been discouraged from physical activity. Most of all, asthma remains the most common chronic disease in children. Physical activity or exercise has marked physical and psychological benefits for children with chronic disease. In spite of many advantages, a considerable proportion of asthmatic children is affected by exercise-induced asthma(EIA), with the prevalence believed to be 70-80%. So they tend to avoid participating physical activity. Asthma or EIA does not inevitably prevent participation in sporting activities. It is well documented that asthmatic individuals have done successfully at the elite level of sport. However, the fear of breathlessness associated with EIA might be expected to deter many asthmatic children from participating regular physical activity. Several studies have identified asthma-related benefits such as reduced hospital admissions, reduced absenteeism from school, fewer consultations with health professionals, reduced medication use, protecting against the potential increased risk of osteoporosis associated by the prolonged steroid therapy and improved ability to cope with asthma.

Although direct evidence of protecting osteoporosis is currently lacking for asthma, evidence exists to show that weight-bearing physical activity can increase bone mineral content and reduce osteoporosis risk later in life among children.

In addition, it remains clear that being able to participate in physical activity, particularly at school, is an important contributing factor for psychological health. For example, dissatisfaction of body image that can be associated with asthma. It is therefore feasible that physical activity that is conducive to weight loss might be helpful for obese children and young people with asthma.

So, one thing we should think about is that children spend more than half of the day at school. Teachers are responsible for managing students with asthma during school hours. Thus, the teacher's knowledge and attitude of physical activity toward asthma as well as parents and themselves are very important for

care of asthmatic children.

Therefore, this paper reviews and discusses the growing problem of physical inactivity among children with asthma. The main questions of this review are as follows: (1) Do children with asthma have lower levels of physical activity and physical fitness than those with non-asthmatic children? (2) Particularly, is there (a) difference between asthmatic children and non-asthmatic children in the prevalence of physical activity and sedentary behavior in Korea? (3) What are the barriers to activity in children with asthma? (4) What's the significance to school education and teachers in these issues?

II. Asthma in childhood

A. Characteristics and types of asthma

Asthma is a respiratory disease characterized by reversible narrowing of the airways in response to one of a multiplicities of stimuli. It is episodic, characterized by acute exacerbations interspersed with symptom-free periods. Each episode is usually short-lived, resolving either spontaneously or following therapy with bronchodilators or anti-inflammatory drugs.

There are two broad categories of asthma. Extrinsic asthma is associated atopic disease and often begins in childhood or adolescence and may be self-limiting. Attacks after exposures to particular allergens are common. The other is intrinsic asthma, it tends to begin in adulthood and to be more often persistent. There may not be any obvious provoking stimuli other than upper respiratory tract infection.

B. Epidemiology in asthmatic children

The incidence and prevalence of asthma reported depends in the age of the population studied, the nature of the population and the criteria used for diagnosis. Over the past few decades, prevalence of childhood asthma has increased worldwide. There is worldwide concern about the increasing burden of asthma as a major health problem. Prevalence varies widely, with higher

rates of 17-30% reported in the United Kingdom, Australia, and New Zealand. Some Asian countries have relatively low prevalence compared to western countries, but increasing prevalence was found in several countries, such as Japan, Hong Kong, Taiwan and Korea. When asthma diagnosed on the basis of sustained or recurrent symptoms, the prevalence in Korea is thought to be around 13.3% in aged 6 to 7 and 7.7% in aged 13 to 14 according to ISAAC(International Study of Asthma and Allergy in Childhood). It is more common in children than adults and increasing fast in childhood.

C. Clinical features and precipitating factors

Asthma may be easily recognized when develop wheeze, shortness of breath, cough, and chest tightness and have a family history of asthma. However, not all these symptoms may be present and the diagnosis may be less clear. In athletes presenting with shortness of breath, the diagnosis may be missed. However, the asthmatic athlete is not common in elite sport.

Airway inflammation appears to be an important factor leading to the development of increased airway reactivity. Bronchial hyperreactivity may occur in response to specific stimuli, such as house dust mite or fungal spores. It may also in response to non-specific stimuli such as cold, dust, smoke and exercise. Several studies have shown asthmatic children may experience exercise induced asthma up to 80%. Neurological factors, possibly mediated by the autonomic nervous system via the action of neuropeptides, have also been shown to play a role. This bronchial hyperreactivity may persist and become perpetual. Drugs may be caused in the production of asthma. Beta-blocker and prostaglandin inhibitors such as aspirin have been responsible for provoking bronchoconstriction. Psychological factors also can induce asthmatic episodes. Therefore, stress and emotional disturbance need to be important in the overall management of asthmatic patients.

III. Prevalence and patterns of physical activity in asthmatic children

A. Prevalence of physical activity in other countries

There is contradictory evidence regarding physical activity levels of asthmatic children. The studies are below. Nystad (year?) assessed the physical activity leveled in a pediatric cohort of asthmatic and non-asthmatic children by administrating the ISAAC(International Study of asthma and Allergies in Childhood) questionnaire to 4012 school students in three different areas of Norway. No differences were found between the activity frequency in children who reported ever having asthma or those with current asthma when compared with non-asthmatic controls. Wang et al. (year?) were unable to establish any significant association between physical inactivity and respiratory disease, including asthma. Wehsh et al. found no differences in the physical activity level of 28 stable mild to moderate asthmatic children and 200 controls. On the contrary, Vahlkvist et al. (year?) studied that physical activity measured using accelerometer, cardiovascular fitness and body composition were measured in 57 children with newly diagnosed, untreated asthma and in 157 healthy age- and sex-matched controls. Percent body fat correlated negatively to overall daily physical activity and to time spent in high or vigorous activity. And Ford et al. (year?) found less active in 12,489 asthmatic children compared to 147,742 controls and 4892 former asthmatic children. According to these studies, it is not possible to establish a definitive conclusion about issues of physical activity frequency between asthmatic and non-asthmatic children.

B. Investigations of Korean children

Kim et al. (year?) analyzed prevalence for meeting guidelines of physical activity(PA), sedentary behavior(SB) in Korean adolescents uses 2007 KYRBS(Korea Youth Risk Behavior Survey) data. A cross-sectional design was used to assess 73392 middle-high school students. This survey is measured by self-reported questionnaire using computer at school.

PA(moderate physical activity ≧ 5times/week, or vigorous ≧ 3times/week), SB(viewing time for TV, computer, DVD, video, etc < 3hr/day) were categorized into two levels(meeting guidelines or not). Students meeting guidelines for PA and SB were 31.0%(boys 42.6%, girls 18.0%), 74.7%(boys 75.4%, girls 74.0%), respectively.

Using 2007 KYRBS data, we analyzed regular physical activity participation of asthmatic children compared to non-asthmatic children. The number of asthmatic children is 6320. It is around 10% of all subjects. The results are described as a Table 1-6 in below.

Table 1. Prevalence of vigorous physical activity participation

	Vigorous physical activity participation						Total	X^2(df)	p-value
	1*	2	3	4	5	6			
Asthmatic children	1994 (31.6)	1321 (20.9)	1030 (16.3)	856 (13.5)	314 (5.0)	805 (12.7)	6320 (100.0)	28.469	p<.0001
Non-asthmatic children	23486 (34.3)	14063 (20.6)	11030 (16.1)	8569 (12.5)	3479 (5.1)	7751 (11.3)	68378 (100.0)		

values mean n(%)

* 1 means no vigorous activity participation per week
2 means one vigorous activity participation per week
3 means two times vigorous activity participation per week
4 means three times vigorous activity participation per week
5 means four times vigorous activity participation per week
6 means more than five times vigorous activity participation per week

There was significant difference between asthmatic children and non-asthmatic children in vigorous physical activity participation pattern(X2(5)=28.469, p<.0001).

Table 2. Prevalence of moderate physical activity participation

	Moderate physical activity participation						Total	X2(df)	p-value
	1*	2	3	4	5	6			
Asthmatic children	1933 (30.6)	1379 (21.8)	1097 (17.4)	839 (13.3)	363 (5.7)	709 (11.2)	6320 (100.0)	57.215	p<.0001
Non-asthmatic children	22683 (33.2)	15756 (23.0)	11835 (17.3)	8608 (12.6)	3092 (4.5)	6404 (9.4)	68378 (100.0)		

values mean n(%)

* 1 means no moderate activity participation per week
2 means one moderate activity participation per week
3 means two times moderate activity participation per week
4 means three times moderate activity participation per week
5 means four times moderate activity participation per week
6 means more than five times moderate activity participation per week

There was significant difference between asthmatic children and non-asthmatic children in moderate physical activity participation pattern(X2(5)=57.215, p<.0001).

Table 3. Comparison of appropriate vigorous physical activity participation between asthmatic children and non-asthmatic children

	Vigorous physical activity participation		X^2(df)	p-value
	Inappropriate	Appropriate*		
Asthmatic children	4345 (68.8)	1975 (31.3)	14.751	p<.0001
Non-asthmatic children	48579 (71.0)	19799 (29.0)		

values mean n(%)

* Appropriate means more than three times vigorous physical activity per week

There was significant difference between asthmatic children and non-asthmatic children in appropriate vigorous physical activity participation pattern(X2(1)=14.751, p<.0001).

Table 4. Comparison of moderate physical activity participation between asthmatic children and non-asthmatic children

	Moderate physical activity participation		X^2(df)	p-value
	Inappropriate	Appropriate*		
Asthmatic children	5611 (88.8)	709 (11.2)	23.051	p<.0001
non-asthmatic children	61974 (90.6)	6404 (9.4)		

values mean n(%)

* Appropriate means more than five times moderate physical activity per week

There was significant difference between asthmatic children and non-asthmatic children in appropriate moderate physical activity participation pattern(X2(1)=23.051, p<.0001).

Table 5. Prevalence of sedentary behavior(SB) in weekdays

	Sedentary behavior(SB)					Total	X^2(df)	p-value
	1*	2	3	4	5			
Asthmatic children	1597 (25.3)	1630 (25.8)	1466 (23.2)	739 (11.7)	888 (14.1)	6320 (100.0)	17.709	p<.001
Non-asthmatic children	16541 (24.2)	19233 (28.1)	15210 (22.2)	8132 (11.9)	9262 (13.5)	68378 (100.0)		

values mean n(%)

* 1 means less than 1 hour per day
  2 means 1 to 2 hours per day
  3 means 2 to 3 hours per day
  4 means 3 to 4 hours per day
  5 means more than 4 hours per day

There was significant difference between asthmatic children and non-asthmatic children in appropriate moderate physical activity participation pattern(X2(4)=17.709, p<.001).

Table 6. Prevalence of appropriate sedentary behavior(SB) in weekdays

	Sedentary behavior(SB) participation		X^2(df)	p-value
	Inappropriate	Appropriate*		
Asthmatic children	1627 (25.7)	4693 (74.3)	0.285	p<.05
Non-asthmatic children	17394 (25.4)	50984 (74.6)		

values mean n(%)

* Appropriate SB means less than 3 hours sedentary behavior(SB) per day

There was no significant difference between asthmatic children and non-asthmatic children in appropriate moderate physical activity participation pattern(X2(1)=0.285, p<.05).

In this investigation, we found asthmatic children to be more physically active than non-asthmatic children. Although it is cross-sectional study, asthmatic children follow physical activity and sedentary behavior recommendation in Korean data. In the future, we should research this outcome is really true or the reason why the results are different from other countries.

IV. Barriers to physical activity in asthmatic children

Many studies suggest that several factors affect participation in physical activity by children and young people with asthma. These are the disease perceptions of children, parental perception, and the knowledge and attitudes of teachers and the organizational system in schools. Based on all of these are the problems of interpretation of asthma symptoms. Each of these issues is discussed in below. And some studies suggest that availability of facilities might be regarded to be important as a predictor of engagement in activity.

A. Disease perception of asthmatic children

Many children with asthma believe that limitations on their

physical activity are inevitable. A study of 24 US adolescents with asthma showed that they perceived that despite their best efforts they were unable to participate to the level they wanted. Consequently, there may be low levels of self-efficacy.

In one UK study around 80% of students in primary school felt that the result of not being able to participate in sport was the worst thing about having asthma and was potentially stigmatizing.

The desire to meet socially defined forms of normalcy, therefore avoiding stigma or social exclusion, is important for children. For example, a study of 24 US 14?18 year old asthma adolescents found that for boys, being normal involved participating in physical activity, and a desire not to be last in competitive games. It meant that some boys discounted what they knew about asthma management and pushed themselves too hard. For girls this normalcy was less likely to include activity. However, both boys and girls recognized that there was a risk of potential stigma or labeling and they did not want to be identified as having asthma.

Parents, teachers and coaches play important roles in providing normalizing and gratifying opportunities for children with chronic illness who struggle to be competent and accepted by peers. However, many parents and teachers are concerned about the risks of physical activity in children and young people with asthma and instead deter them from activities.

B. Parental perception

The influence of family factors on the activities of children is well documented. For example, a survey of around 4000 US teenagers without asthma found teenage girls with higher academic rank or expectation and girls whose mothers had a parenting style that balanced responsiveness and control was more likely to have higher levels of activity and lower sedentary leisure habits. Putting a high value on health, appearance and achievement was associated with higher activity levels and reduced sedentary behavior.

Several studies of physical activity in children with asthma

suggest that parental and family belief play a key part in both enabling children and young people to manage their asthma effectively, and sometimes hindering effective management. For example, a comparative study of exercise among asthmatic and non-asthmatic children, and their parents, found that more parents in the asthma group identified the child's health as a barrier to exercise(60.7% vs 11%). Similarly, a US focus group study of 47 parents of children with asthma found that their beliefs about asthma and its treatment led them to modify asthma treatment plan made by a health professional, and that many of them unnecessarily restricted their child's physical activity because of lack of information or misinterpretation of advice gives. Other parents did not restrict activity as they were concerned about the psychological consequences of such restriction, but many of them were concerned that they were thereby increasing their child's symptoms.

A study of parents of children with asthma in Hong Kong identified a range of fears and misconceptions. They thought that asthma might be infectious. They were concerned that swimming and other forms of exercise would make it worse. And they believed that inhaled steroids should be avoided. These studies underline the extent to which parental knowledge and beliefs about asthma in many countries may be founded on misconceptions and may inhibit children's participation in physical activity. Problems may also arise when the perceptions of children with asthma differ markedly from those of parents or teachers.

C. Knowledge and attitudes of teachers and school system

Surveys of teachers in a range of countries including the US, Germany, Hong Kong, the UK and Korea have consistently found lack of knowledge and understanding of asthma, exercise effect on asthma and asthma management when provoked. Although some teachers recognize that exercise is important for children with asthma, many are unaware that medication may be taken before exercise to effectively prevent acute attacks and those children with asthma can be as competent as healthy

children in sports. Studies show that many teachers may have outdated beliefs, for example that those with asthma should avoid physical education lessons. One UK study of primary school teachers, 93% said that they did not know enough about asthma and 94% said that they had no training on this issue. Similarly high levels were seen in a US survey of 291 primary school teachers in which 78% said they did not feel adequately prepared to teach children with a chronic illness, and 77% did not feel confident to deal with asthma. A survey of 159 Korean teachers(included 46 nurse teacher) in primary and middle school were asked to fill out questionnaire on their knowledge about asthma. The teachers who experienced asthma students were 23.6%. They had knowledge about precipitating factor of asthma roughly, but it was not correct in detail. Only 34% teachers knew what to do and where to contact in case of asthma attack.

Given the widespread evidence that school staff have a limited knowledge and understanding of asthma, it is likely that many are unaware of the importance and feasibility of physical activity for children with asthma. Even if teachers are aware that physical activity is important for students with asthma, the school system may not support adequate participation by students with asthma. For example, many schools do not keep adequate diagnostic registers and cannot therefore accurately identify students with asthma, many do not allow students to be responsible for their own inhalers and some require parents to administer inhalers. Thus school systems may not afford to asthma management around exercise.

D. Symptom perception/interpretation

The studies suggest that child, parental and school beliefs about asthma are likely to influence engagement in physical activity. These beliefs are likely to originate both in a socially derived stock of knowledge about asthma and through past experience of asthma itself.

Consequently, how children, parents and teachers interpret signs such as breathlessness may result in inappropriate coping strategies. For example, symptoms that may not be

asthma-related may be misinterpreted as asthma resulting in exercise avoidance. On the contrary, if breathlessness is misinterpreted to lack of fitness when in fact it is asthma then young people may fail to use their medication appropriately.

V. Physical fitness and obesity in asthmatic children

Many studies identified that aerobic fitness is significantly lower in asthmatic children compared non-asthmatic children. Such as, investigations of Council et al. (year?), Riedler et al. (year?), Strunk et al. (year?), Varray et al. (year?) and Wong et al. (year?) found reduced aerobic fitness in asthmatic children. But Bevegard et al., Boas et al. (year?), Fink et al. (year?) and Sauntus et al. (year?) studies described in no differences between them. Therefore, it is not concluding whether significant differences exist between them. There are some problems, sample selection, methodological variation and statistical analysis. Because most studies measured small sample sizes and selected subjects non-randomly. Particularly, it was impossible to be measured more severe patients. Another important issue is relation between asthma and obesity. The prevalence of both obesity and asthma has quite increased in recent decades, giving rise to speculation that they may be related. Many Studies have found that obesity precedes and predicts the onset of asthma, that increased obesity leads to more severe asthma, that weight reduction improves asthmatic symptoms. In the light of that evidence, we can finally suggest a causal relationship between obesity and asthma. Various biological mechanisms(immunologic and inflammatory, hormonal, genetic, nutritional, mechanical, and others related to physical activity) have been explained the relationship. Studies have shown several biological mechanisms between obesity and asthma. The followings are the biological mechanisms of this relationship. First, direct effects on functional respiratory mechanics. Obesity produces decreased a tidal volume and functional residual capacity, both of which reduce the stretch of smooth muscle. Thus the ability to respond to natural stress,

such as exercise, is hampered by small tidal volumes. Consequently, smooth muscle contraction is altered and lung function is impaired. Second, changes in immune and inflammatory responses. Tumor necrosis factor is a proinflammatory cytokine that is increased in asthma and is expressed by adipocytes. This raises the possibility that asthma and obesity could have additive or even synergistic proinflammatory effects. And Interleukin-1, 6 and leptin is also known to be related.

Third, activation of common genes. We know about genetic pleomorphism, that is, that gene have many effects, for which reason it is biologically possible that genes associated with one disease could also be associated with another. In fact, specific regions of the human genome(such as chromosomes 5q, 6, 11q13, and 12q) have been identified as related to both asthma and obesity.

Fourth, the influence of hormones and sex. It is remarkable that right from the first longitudinal studies the effect of obesity on asthma was observed more often in females than in males. We know that adipose tissue contains the enzyme aromatase, which is responsible for converting androgens into estrogens. Obesity generally increases the production of estrogens, which are associated with early menarche in girls and delayed puberty in boys.

Fifth, the influence of diet, physical activity, and "fetal programming." Diet and physical activity are main factors that influence obesity and, apparently, asthma. It has been postulated that factors at work in pregnant women may also effect the development of fetuses by affecting birth weight and genetic programming. Such in utero events would have a repercussion on the subsequent onset of asthma and obesity. The soundness of this hypothesis is based on the recognition that most cases of asthma occur early in childhood, before the age of 6 years.

Thus, there exists a potential spiral of disadvantage for children with asthma, whereby obesity increases the risks of asthma, and asthma exacerbates obesity by restricting exercise. Prevention of obesity is, therefore, an important goal for asthma

management.

VI. Conclusion

Both Asthma and physical activity are common problems which impact on individuals, their families and society. There seems to be a common sense that asthmatic children have reduced fitness level and have been discouraged from physical activity participation. The literature from many countries including Korea over several decades shows as follows. It shows a pattern of short term barriers to increased physical activity preventing children with asthma attaining long term physical fitness with all its consequent benefits to lung health, general health, social and psychological health. The way young people perceive and respond to physiological symptoms such as shortness of breath on exercise requires attention. Actually, lower fitness in asthmatic children is related more to how capable they perceive themselves than to asthma severity. And unlike our suggestion, it is not possible to establish a clear conclusion about prevalence of physical activity participation and difference of physical fitness between asthmatic and non-asthmatic children. Therefore, activity and physical fitness deserve a place in goal setting for generic and individual asthma management plans. A lot of survey results demonstrated that teacher's knowledge and attitude about asthma were not enough to take good care of the asthmatic students at school. And there is lack of organizational arrangements at school. Asthma education for teachers is needed and efficient programs for them should be developed and extend it systematically. And further research with well designed methodologies is needed in order to determine whether asthmatic children have different physical activity levels and fitness levels compared to non-asthmatic children in Korea.

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