

Genetic and environmental risk for asthma in children aged 5-11 years

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Abstract

Objective To assess genetic and environmental risk factors of asthma among children aged 5-11 years.

Design A cross sectional analytical study.

Method Data were collected from children aged 5-11 years in 3 schools in Gampaha District. 441 children with asthma and 1510 without asthma were evaluated for following risk factors viz. family history of atopy, gender, duration of breast feeding, commencement of formula in infancy, dusty home environment, passive indoor cigarette smoking, presence of firewood smoke in bedroom when cooking, burning of mosquito coil and incense stick/powder and presence of pets at home. Data were analyzed using Epi info version 6 and SPSS package. Chi Squared test was used in bivariate analysis and forward logistic regression was used to adjust confounding factors.

Results Risk of asthma in child (on bivariate analysis) was increased when father has a history of asthma (odds ratio (OR) 6.4 (95% confidence interval (CI) 3.2 -13.2), mother has a history of asthma (OR 4.4, CI 2.6 -7.5), sibling has asthma (OR 4.3, CI 2.0 -9.7), father has a history of allergic rhinitis (OR 2.0, CI 1.5-2.8), mother has a history of allergic rhinitis (OR 2.5, CI 1.9-3.4) and sibling has allergic rhinitis (OR 3.4, CI 2.1-5.4). Asthma risk was significantly increased with following environmental factors: non continuation of breast feeding beyond first 6 months in infancy (OR 1.5, CI 1.2-1.9), presence of firewood smoke in bedroom when cooking (OR 1.4, CI 1.1-1.9), use of mosquito coil (OR 1.5, CI 1.2 -1.9) and dusty home environment (OR 1.8, CI 1.4-2.3). After adjusting for confounding factors, paternal history of asthma, maternal history of asthma, allergic rhinitis

in mother and sibling, non continuation of breastfeeding beyond first 6 months of life and dusty environment remained significant with increased risk of asthma ($p < 0.01$).

Conclusions This study reinforces that asthma has a multifactorial aetiology. Childhood asthma is influenced by paternal asthma more than maternal asthma. Significant modifiable environmental factors in this study were duration of breastfeeding in infancy and dusty home environment.

Introduction

Asthma in childhood is a common problem around the globe¹. Situation is similar in Sri Lanka where it remains a major cause of hospital admissions². Asthma is also a common cause of school absenteeism. Prevalence of childhood asthma in our country varies between 15-25%^{3,4}. The variation in prevalence of asthma from country to country and from area to area within the same country may be related to interaction between genetic and environmental factors in causation of asthma. Furthermore, significance of a given risk factor too, may vary among different communities. In addition, medical personnel and parents have certain myths regarding risk factors and these may affect the life style and control of asthma in the child. This study was carried out to evaluate the risk factors of asthma in a group of children aged 5-11 years.

Method

Data reported in study were collected as a part of the asthma prevalence study published in March 2003 issue of Sri Lanka Journal of Child Health⁴. Study population comprised 1951 school children, aged 5-11 years, in 3 schools of Gampaha District. Questionnaires were sent home with children, answered by their parents/guardians, returned to schools and collected by the researchers. Response rate was 93%. Questionnaires were filled by mothers in 66% of children, fathers in 30% and guardians in the rest.

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Questionnaire was aimed at identifying asthma in children using the clinical criterion adopted by the International Study of Asthma and Allergic Conditions (ISAAC)¹ (i.e. Has your child had wheezing or whistling noise in chest in past 12 months? When it had occurred in 2 episodes of illness or more we diagnosed it as asthma). We used the common terminology used by parents to describe the word "wheezing" and we tested the questionnaire amongst asthmatic children who attended the university paediatric clinic of North Colombo Teaching Hospital before commencement of the study.

Following questions were asked to identify risk factors for asthma: history of having asthma, allergic rhinitis and eczema in father, mother and siblings, gender of child, duration of breastfeeding and commencement of formula in infancy, passive indoor cigarette smoking, presence of firewood smoke in bedroom when cooking, frequent burning of mosquito coil and incense stick/powder (5 days or more per week), living in a dusty home environment, presence of pets (dogs and cats) at home and presence of ceiling in house. Dusty home environment was assessed

subjectively. Number of parents with a history of eczema was small and hence eczema was not analyzed as a risk factor in study. Data were analyzed using Epi info version 6 and SPSS package. Chi Squared test was used to determine significance of each risk factor in bivariate analysis. Forward logistic regression was used to adjust confounding factors. Results in bivariate analysis are given as odds ratio (OR) so as to obtain uniformity in results since logistic regression model expresses its results as odds ratio. Ethics Committee of the Faculty of Medicine, University of Kelaniya granted ethical clearance for study.

Results

In study sample, 40% gave a positive family history of atopy (66% of asthmatic and 32% of non-asthmatic children). Results on bivariate analysis of genetic risk factors for asthma are given in Table 1.

Table 1
Genetic risk factors of asthma/allergic rhinitis - bivariate analysis

Variable	Number of cases		Number of controls		OR (95% CI)	p value
	Yes	No	Yes	No		
<i>Asthma</i>						
Father	25	416	14	1496	6.4(3.2-13.2)	<0.001
Mother	35	406	29	1481	4.4 (2.6-7.5)	<0.001
Sibling	16	425	13	1497	4.3 (2.0-9.7)	<0.001
<i>Allergic rhinitis</i>						
Father	78	363	144	1366	2.0(1.5-2.8)	<0.001
Mother	100	341	157	1353	2.5(1.9-3.4)	<0.001
Sibling	41	400	44	1466	3.4(2.1-5.4)	<0.001

Accordingly parents having asthma and allergic rhinitis, sibling having asthma and allergic rhinitis were found to be associated with increased risk for asthma. Risk for asthma in males was not significantly different from that in females (p>0.05).

Results on bivariate analysis of environmental risk factors are given in Table 2.

Table 2
Environmental risk factors of asthma - bivariate analysis

Variable	No. of cases	No. of controls	OR (95%CI)	P value
<i>Breastfeeding in infancy</i>				
6 months or less	121	316	1.5(1.2-1.9)	<0.01
more than 6 months	295	1153		
<i>Formula feeding in infancy</i>				
Yes	368	1201	1.4(1.0-1.9)	>0.05
No	57	257		
<i>Passive indoor smoking</i>				
Yes	122	384	1.1(0.9-1.4)	>0.05
No	288	1010		
<i>Firewood smoke in bed room</i>				
Yes	78	202	1.4(1.1-1.9)	<0.05
No	346	1265		
<i>Frequent use of mosquito coil</i>				
Yes	181	487	1.5(1.2-1.9)	<0.001
No	219	892		
<i>Frequent use of incense stick/powder</i>				
Yes	242	839	1.0(0.8-1.2)	>0.05
No	181	622		
<i>Dust at home</i>				
Yes	213	593	1.8(1.4-2.3)	<0.001
No	116	570		
<i>Pets at home</i>				
Yes	209	766	0.9(0.7-1.2)	>0.05
No	213	698		
<i>Presence of ceiling in the house</i>				
Yes	148	492	1.1(0.8-1.3)	>0.05
No	289	1008		

Non continuation of breast feeding beyond first 6 months of life, presence of firewood smoke in bedroom when cooking, burning of mosquito coil and dusty home environment were found to be associated with increased risk for asthma in child.

Results on logistic regression analysis after adjusting for confounding factors are given in Table 3.

Table 3
Significant risk factors of asthma -Logistic regression analysis

Variable	Adjusted OR (95%CI)	P value
<i>Asthma</i>		
Father	4.2(1.7-10.1)	<0.01
Mother	3.8(2.1-6.7}	<0.001
<i>Allergic rhinitis</i>		
Mother	1.8(1.2-2.5)	<0.01
Sibling	2.5(1.4-4.4)	<0.01
<i>Breast fed in infancy for 6 months or less</i>	1.5(1.1-2.1)	<0.01
<i>Dusty home environment</i>	1.5(1.1-1.9)	<0.01

Parental history of asthma, history of allergic rhinitis in mother and sibling, non continuation of breastfeeding beyond first 6 months of life and dusty home environment remained significant.

Discussion

Very few studies have been done in this country on genetic and environmental risk factors in childhood asthma. This population-based study shows that 40% of children have a positive family history of atopy. It is therefore necessary to differentiate between hereditary risk factors of asthma in children. In this study, as in others, parental asthma is a risk factor for a child having asthma^{5,6,7}. The finding that paternal asthma has more influence on asthma in child is consistent with that of previously reported study here⁷. However, this is in contrast to the finding of Rusconi et al. where mother having asthma has a greater impact on asthma in child⁶.

The finding that allergic rhinitis in mother and sibling increased the risk of child having asthma re-confirms the hypothesis that rhinitis is an independent risk factor for asthma^{7,8,9}. In contrast to findings of the previous study done in Sri Lanka, this study shows that paternal allergic rhinitis was not associated with increased risk for asthma in child. This finding could be influenced by the fact that two third of questionnaires were filled by mothers in the study and allergies of the mother and in siblings are probably over represented and allergies of fathers may include more of the recent and severe type. A simple hereditary model cannot explain the proved independent relationship between asthma in child and allergic rhinitis in sibling. Concordance rate for

asthma of monozygotic twins reared apart is quite similar to those of twins reared together, suggesting substantial genetic component for development of asthma¹⁰. But twin studies are unable to identify pattern of transmission. Although family history of atopy is a stronger risk factor for asthma in child, 34% of asthmatic children in this study did not have a positive family history, implying that environmental factors are also important in causation of asthma in the child.

Role of breastfeeding on subsequent development of asthma has been a controversial subject for many years. Some studies have proved that breast feeding protects children from getting asthma, while others disprove this^{6,7,11,12,13,14}. This study, as well as the previous Sri Lankan based study, showed that breastfeeding more than 6 months in infancy has a protective effect on development of asthma in child. Most studies on breastfeeding and asthma, including present one, are observational epidemiological studies. In some or them, exposure and outcome data are collected retrospectively. Hence, selective recall would have induced parents of children with wheezing to over or underreport conditions that they believed to be associated with wheezing. It is a popular myth amongst our mothers that breastfeeding may be harmful if mother has asthma and this could also have influenced the results in this study. Therefore, a prospective birth cohort would be required to evaluate duration of breastfeeding on subsequent development of asthma.

As observed by us and others, exposure to dust at home is known to be associated with an increased risk of asthma^{7,15}. We found that certain other

previously known risk factors for asthma such as passive cigarette smoking and pets^{8,15} were not associated with increased risk of asthma. One reported review shows that passive smoking is likely to increase the severity and frequency of asthma¹⁶. Thus, findings of our study could be explained if environmental cigarette smoke is considered as a factor, which would precipitate an attack, rather than a cause for underlying asthmatic tendency.

Our study was a population based one and included a sufficiently large group of subjects to ensure adequate statistical power. However, the retrospective design could have resulted in a biased recall on both diagnosis and risk factors. We used the clinical criterion adopted by ISAAC to diagnose asthma to get a uniformity of the diagnosis with world literature. We may have included in the control subjects a number of children who had asthma in the early years of their lives and who did not have wheezing in the previous 12 months at the time of data collection. In order to reduce selective recall bias with regard to the risk factors, we requested parents to select one of three responses under risk factor in the questionnaire; i.e. yes, no or cannot remember. The category that answered as "do not remember" was not included in the statistical analysis.

In conclusion, our study shows the effect of atopy in the family on development of asthma in the child. We also identified that breastfeeding longer than 6 months in infancy has a protective effect on development of asthma in children. Hence, recommendation of breastfeeding at least until one year by WHO should be reinforced.

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