Parental Atopy and Exposure to Pets on Asthma: A Hospital-Based Case-Control Study

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ABSTRACT

Objectives: Studies of parental atopy, exposure to pets, and the risk of asthma have provided conflicting results. We aimed to assess the relationship between asthma among adults with parental atopy, pet keeping inside, and pet keeping outside the home. This study involved a total of 159 adults. The clinically diagnosed cases were 53 adults with asthma as per Global Initiative for Asthma (GINA) guidelines and 106 controls without asthma.

Methods: The study design was a hospital based case-control study. Information on parental atopy and exposure to pets was collected by using a self-administrated questionnaire. We used the exposure odds ratio and 95% confidence interval (CI) to quantify the relation between determinants of interest and the risk of asthma. These were estimated using logistic regression analysis with SPSS version 11.5.

Results: The paternal and maternal history of asthma were found to have significant effect on asthma among adults with adjusted odds ratio (OR) of 6.70 (1.92-23.33 95%CI) and 3.33 (1.25-8.89 95% CI) respectively. Parental history and parental atopy significantly increased risk of asthma among adults with adjusted odds ratios of 5.78 (2.38-14.05 95% CI) and 3.65 (1.58-8.43 95% CI) respectively. There was no significant association between asthma and exposure to pets. The adjusted odds ratios for pet keeping inside and outside the house were 1.61 (0.55-4.7395%CI) and 1.32 (0.61-2.87 95%CI) respectively.

Conclusions: Our results support the hypothesis that both parental history and parental atopy increase the risk of asthma among adults whereas pet keeping inside and outside the house during the previous 12-month period were not significantly associated with asthma among adults.

Keywords: Parental Atopy, Pets, Asthma, Case-Control Study.

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Original Article

INTRODUCTION

There has been a significant increase in the prevalence of asthma in both children and adults worldwide.[1-8] Current understanding of the determinants of asthma has been largely known through the role of environmental exposures, such as exposure to aeroallergens, indoor and outdoor air pollution, endotoxin, smoking, and viral infections.[9,10] More recently, this knowledge has been supplemented by considering genetic modifiers of environmental exposures on asthma expression.[11,12] Additionally, several researchers have suggested that family history of allergic diseases is associated with an increased risk of asthma, suggesting that genetic factors play a central role in the development of asthma.[13,14] Some genetic markers have found to be susceptible to the effects of environmental factors.[15]

In a recent Norwegian cohort study, the effect of exposure to environmental tobacco smoke on asthma was found to be stronger in children of atopic parents compared with children of nonatopic parents.[15] However, discrete parental influence on airway hyperresponsive-

ness was determined by the Childhood Asthma Management Program cohort.[16] Paternal history of asthma was shown to be the predominant determinant of airway responsiveness, independent of other factors. Its influence on airway responsiveness in children with mild to moderate asthma persisted over time.[16]

Although speculative, this association could be related to airway responsiveness–specific genes that are preferentially sex expressed.[17] However, the role of genetic predisposition in adult onset asthma is less clear than in child onset asthma.[18] It is possible that asthma appearing in childhood is different from asthma in adulthood as the genetic and environmental factors are believed to contribute to adulthood asthma.[19-21] The prevalence of atopic conditions is lower in less-developed areas of the world and higher in areas that are rapidly urbanizing or are modernized.[19] The reasons for these observed prevalence gradients are currently not well understood.

Several studies have investigated the role of pet exposure in the development of allergic diseases and asthma, but the results of these studies are controversial.[22-29] These findings on the relationship between pet keeping and asthma could be explained by both methodological issues and by the complexity of the phenomenon. Individuals with symptoms of asthma tend to remove pets from their homes as a means of alleviating conditions.[30] This could introduce a selection bias in cross-sectional and prevalent case control studies, masking or even reversing a relationship between pet exposure and risk of asthma.

The relation between keeping pets and asthma differs depending on the age of pet keeping and the age of asthma onset. Information on the role of pet keeping in adult onset asthma is limited. We identified only 3 cross sectional studies on pet keeping and the risk of asthma in adults and the results were conflicting.[28,31,32] In an Italian study, the age of the study population ranged from 0 to 69 years and it was found that the occurrence of asthma was not related to pet keeping.[31] In a Canadian study of 20 to 44 years old adults, the risk of asthma was related to current pet ownership, with an OR of 1.6 for cats (95% CI, 1.1-2.4) whereas in dogs and other pets it was not significant.[32] It was also found that the presence of pets in childhood had no influence on risk of asthma in adulthood. The European Respiratory health Survey of 20 to 44-year old adults in 35 centers in 16 countries found an increased risk of asthma in communities in which the average level of cat specific IgE was elevated.[28] Traditionally, pets have been considered a major promoter of allergic diseases and several studies showed an increased risk of asthma while keeping pets inside and outside the house.[32,33] Apelberg et al performed a systematic review to synthesize the evidence of the effect of exposure to pets in the home on the risk of asthma and related symptoms.[33] However, a study from Finland showed that the risk of asthma was lower among adults who kept pets.[20]

In India, to the best of our knowledge, not many epidemiologic studies have addressed adulthood asthma and its relationship between parental atopy as well as exposure to pet keeping. We carried out this study to investigate the relationship between asthma among adults with parental atopy, pet keeping inside and pet keeping outside the home.

METHODS

This case-control study involved a total of 159 adults. The cases were 53 outpatients for which asthma was diagnosed by the clinician based on the standard guidelines,[34] enrolled from the outpatient clinic of Department of Tuberculosis and Chest Diseases of PSG Hospitals in July 2009. The controls were 106 outpatients enrolled from the Department of Ear, Nose and Throat (ENT), and Department of Ophthalmology of PSG Hospitals who were free of the condition of interest. The Institutional Human Ethics Committee approved all subject recruitment and data collection procedures. A written informed consent was obtained from all the subjects.

Inclusion criteria were as follows: 1) Patients with documented diagnosis of persistent asthma (according to GINA guidelines) for a period of at least 6 months prior to visit; 2) Male and Female patients aged ≥ 20 years; and 3) Patients demonstrating an increase in FEVI of ≥ 12% and ≥ 200 ml/s within 30 minutes after administration of Short Acting Beta Agonist (SABA). Alternatively, patient may have documentation of reversibility within the last 12 months.

Exclusion criteria were as follows: 1) Pregnant or nursing women; 2) Patients who had smoked more than 10 pack years; and 3) Patients with a previous diagnosis of chronic obstructive pulmonary disease (COPD).

We measured the Socio Economic Status (SES) based on Modified Prasad's classification based on Consumer Price Index (Industrial Work) [CPI (IW)] for the month of May 2009

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after rounding off to the nearest Rs.10. Those with per capita income per month Rs.3330 and above, were classified as Class 1.[35,36] Physical activity levels were assessed based on the hours of physical exercise in a week.[37] Exposure to environmental tobacco smoke was assessed based on the amount of cigarette smoking by any member in the household and in the work place. Parental history was defined as a history of maternal or paternal asthma. Parental atopy was defined as a history of maternal or paternal asthma, hay fever, allergic eczema, allergic rhinitis and allergic conjunctivitis.[20] Exposure to pets was assessed based on information on the presence of cats, dogs, birds, or other hairy animals during the past 12 months as well as more than 12 months.

Statistical analysis

We used the exposure odds ratio and 95% confidence interval to quantify the relation between determinants of interest and the risk of asthma. These were estimated using logistic regression analysis with SPSS version 11.5 software (SPSS Inc., Chicago, IL). Age, education, occupation, socio economic status, physical activity, Environmental Tobacco Smoke (ETS) at work place and ETS at home were used as potential covariates in this study. The unadjusted and adjusted odds ratios were calculated to assess the relation between asthma and parental atopy and also the relation between asthma and pet keeping inside and outside the house. P-value < 0.05 was considered as statistically significant.

RESULTS

Demographic and clinical characteristics of adults with and without asthma are presented in Table 1. Comparison between cases and controls revealed no sufficient difference in terms of age, socio economic status, eating patterns, level of physical activity and ETS exposure. Briefly the mean age (standard deviation) of cases (n = 53) was 46.72 (14.06) years and in controls (n = 106) it was 42.75 (13.57) years. The mean (standard deviation) duration of physical exercise for cases was 1.75 (4.85) hours and in controls it was 1.71 (4.11) hours.

In controls, 37.7% of participants had higher education (college and above) and in cases it was 17%. In cases, 54.7% were in the category of professionals, landlords or home makers and in controls it was 35.8%. In cases, 86.8% of them had per capita income per month Rs 3330 and above and in controls it was 85.8%. In both cases and controls, 90.6% of them were non vegetarians.

The percentage of environmental tobacco smoke at work place for cases and controls were 30.2% and 37.7% respectively. The percentage of environmental tobacco smoke at home for cases and controls were 32.1% and 25.5% respectively. In case group, 24.5% had parental history of asthma and among controls it was 5.7%. The percentage of maternal history of asthma for cases and controls were 32.1% and 11.3% respectively. The percentage of parental history of asthma for cases and controls were 50.9% and 17% respectively. The percentage of parental atopy of asthma for cases and controls were 54.7% and 25.5% respectively. The percentage of pet keeping inside the house for cases and controls were 15.1% and 11.3% respectively. In both case and control groups, 45.3% of participants were keeping pets outside the house.

Table 1. Demographic and clinical characteristics of adults with and without asthma

Variable	Cases (n = 53)	Controls (n = 106)	P-value
Age [Mean (SD)]	46.72(14.06)	42.75(13.57)	0.09
Education (College and above, %)	17.0	37.7	0.02
Occupation (Professionals, land lord, home maker, %)	54.7	35.8	0.02
Socio-economic status (Class I, %)	86.8	85.8	0.87
Non vegetarian (%)	90.6	90.6	1.0
Hours of physical exercise in a week [Mean (SD)]	1.75(4.85)	1.71(4.11)	0.95
Environmental tobacco smoke at work place(%)	30.2	37.7	0.35
Environmental tobacco smoke at home (%)	32.1	25.5	0.38
Paternal history (%)	24.5	5.7	0.001
Maternal history (%)	32.1	11.3	0.001
Parental history (%)	50.9	17	< 0.01
Parental atopy (%)	54.7	25.5	< 0.01
Pet keeping inside the house (> 12 months) yes (%)	15.1	11.3	0.50
Pet keeping outside the house (> 12 months) yes (%)	45.3	45.3	1.0

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Table 2 shows association of various risk factors with asthma. Higher education significantly reduced the risk of asthma with OR = 0.338 (0.149-0.764 95% CI). Home makers had 2.51 times risk of asthma (1.13, 5.57 95% CI). In contrast, age, socio economic status, eating habits, environmental tobacco smoke at home and environmental tobacco smoke at work place were not significantly associated with asthma.

Table 3 presents association of parental atopy with asthma. The paternal history of asthma was found to have significant effect on asthma among adults with adjusted OR = 6.70 (1.92-23.33 95%CI). The maternal history was also found to have a significant effect on asthma with adjusted OR = 3.33 (1.25-8.89 95% CI).

Parental history and parental atopy were found to have significant effect on asthma among adults with adjusted odds ratios 5.78 (2.38-14.05 95% CI) and 3.65 (1.58-8.43 95% CI) respectively.

Table 4 shows the association of asthma with pet keeping inside and outside the house more than 12 months. There was no significant association between asthma and exposure to pets. The adjusted odds ratios for pet keeping inside and outside the house were 1.61 (0.55-4.73 95%CI) and 1.32 (0.61-2.87 95%CI) respectively.

DISCUSSION

Our results are consistent with the hypothesis that parental history increased the risk of asthma among adults.[38] The paternal asthma is found to be stronger determinant of asthma compared to maternal asthma. These findings support strongly that genetic background is an important determinant of asthma among adults.[14,19-21] Genetic

Table 2. Association of various risk factors on asthma

Variables	OR	95%CI
Age (years)	P = 0.111	
20-29	1	
30-39	0.64 (P = 0.45)	0.20-2.04
40-49	2.38 (P = 0.12)	0.797-6.79
50-59	1.70 (P = 0.38)	0.525-5.48
+60	1.70 (P = 0.38)	0.525-5.48
Education	P = 0.009	
Up to secondary *	1	
College and above	0.338 (P = 0.009)	0.149-0.76
Occupation	P = 0.016	
Skilled labours *	1	
Clerk, teachers.	0.447 (P = 0.15)	1.47-1.35
Professionals, landlords.	0.689 (P = 0.56)	0.198-2.39
Home maker	2.51 (P = 0.02)	1.13-5.57
Socio Economic Status	P = 0.871	
Class II,III, IV *	1	
Class I	1.083	0.413-2.84
Higher physical activity in hours in a week	1.002 (P = 0.94)	0.93-1.08
Eating habits	P = 1	
Vegetarian *	1	
Non vegetarian	1	0.32-3.09
Environmental tobacco smoke Exposure at Work	P = 0.34	
No *	1	
Yes	0.714	0.35-1.45
Environmental tobacco smoke Exposure at home	P = 0.38	
No *	1	
Yes	1.38	0.67-2.85

* Reference Category

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Table 3. Unadjusted and adjusted odds ratios of asthma in relation to parental atopy

Parental atopic diseases.	Unadjusted		Adjusted *	
	OR	95% CI	OR	95% CI
None	1		1	
Paternal history of asthma	5.42 (P = 0.001)	1.93-15.24	6.70 (P = 0.003)	1.922-23.33
Maternal history of asthma	3.70 (P = 0.002)	1.61-8.51	3.33 (P = 0.016)	1.25-8.89
Parental history of asthma	5.88 (P < 0.001)	2.43-14.21	5.78 (P < 0.001)	2.38-14.04
Parental atopy			3.65 (P = 0.003)	1.58-8.43

* Adjusted for age, education, occupation, social economic status, physical activity, Environmental Tobacco Smoke at work place and Environmental Tobacco Smoke at home, Pet keeping inside the house and Pet keeping outside the house.

markers could impose susceptibility to the effects of environmental factors. We used paternal history of allergic diseases as well as maternal history of allergic diseases as the measure of the genetic propensity of asthma. In our study, parental atopy was found twice as frequently among subjects with asthma as compared to the subjects without asthma. In a previous twin family study from Finland, 87% of the variation in liability to adolescent asthma was explained by genetic factors, which suggested that a family history of asthma was stronger than other risk factors.[14] However, it is difficult to target asthma prevention efforts based on parental atopy. In our study only 55% of the asthmatics had parental history of atopy. If the intervention target only families with history of atopy, then 45% of the subjects with proved cases of asthma will be neglected.

In the present study, we found that pet keeping inside and outside the house does not increase the risk of asthma among adults. There were two previous cross-sectional studies which assessed the role of pet exposure in the cause of adult onset asthma, which supported our findings.[31,32] Our finding contradicts the earlier findings of Jaakkola et al.[20] that keeping pets increased the risk of asthma in adulthood.

Our study had several limitations. The period of the study was only one month and we could study only 53 cases and 106 controls and the issues of sample size and power are important in generalizing our findings. We studied only hospital outpatient asthma cases which do not represent the life time asthma patients in the general population. Selection factors relating to the study protocol may created a fairly homogenous study group and for these reasons our findings may not be generalized to other socioeconomic strata and to other cultural and ethnic groups. We could not measure the physical activity based on any validated physical activity questionnaire, since the interview was conducted at the out patients department of hospital. This study also had some information bias. Information on exposures was collected from cases and controls in a similar way. We cannot exclude the possibility that cases and controls provide differential information on current and previous pet keeping.

Table 4. Unadjusted and adjusted odds ratios of asthma in relation to current and previous pet keeping (>12 months).

Pet keeping (duration >12 months)	Unadjusted		Adjusted *	
	OR	95% CI	OR	95% CI
Any pets inside the house:				
No	1		1	
yes	1.39 (P = 0.56)	0.53-3.65	1.61 (P = 0.38)	0.55-4.73
Any pets outside the house:				
No	1		1	
yes	1 (P = 1)	0.52-1.93	1.32 (0.48)	0.61-2.87

* Adjusted for age, education, occupation, social economic status, physical activity, Environmental Tobacco Smoke at work place and Environmental Tobacco Smoke at home.

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Despite these limitations, our study had several strengths. The diagnosis of asthma was based on the standard guidelines by the physician and not based on the reported information. The collected information for age, occupation, education, socio economic status, physical activity, environmental tobacco smoke at work place and home were allowed us to examine the effects of parental history and pet keeping on asthma while controlling the effects of these variables.

In conclusion, our results supports the hypothesis that both parental history and parental atopy increase the risk of asthma among adults whereas pet keeping inside and outside the house during the previous 12-month period were not significantly associated with asthma among adults. Further studies are warranted to identify the relative contributions of environmental stimuli and genetic propensity in various types of asthma.

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