

Presence of Domestic Pets and Respiratory Symptoms in Asthmatic Children

F T Chew,**BSc (Hons)*, J Teo,***M Med (Paed)*, S H Quak,****MBBS, M Med (Paed), FRCP*

G J Connett,†*MRCGP*, B W Lee,‡*MBBS, M Med (Paed), MD*

Abstract

The allergens of domestic pets such as cats, dogs and birds, have been known to sensitise predisposed individuals. In Singapore, approximately 25% to 35% of our atopic population are sensitised to cat, dog or bird feather allergens. It is not known, however, if the presence of such domestic pets would translate to higher rates of sensitisation, or more importantly, give rise to increased respiratory symptoms. This study evaluated the association between the presence of domestic pets at home and the prevalence of respiratory symptoms among asthmatic children in Singapore. The parents of 1517 doctor-diagnosed asthmatic children were interviewed using the American Thoracic Society-Division of Lung Diseases respiratory questionnaire. More than 20% were found to have domestic pets (cats, dogs or birds) at home. Of these, those with exposure to passive smoke in the home were excluded. A total of 188 current pet owners (cats, dogs and birds) were demographically-matched for sex, race and socio-economic status (type of housing) to those without pets, past or current. Compared to those without pets, asthmatic children with pets at home had a higher prevalence of coughing with cold [relative risk (RR) 1.30; 95% confidence interval (CI) 1.01 to 1.69]; wheezing with cold (RR 1.42; CI 1.07 to 1.90), wheezing with shortness of breath (RR 1.33; CI 1.00 to 1.82), exercise-induced wheezing (RR 1.68; CI 1.10 to 2.56); and increased phlegm production or congestion with cold (RR 1.38; CI 1.00 to 1.91). This study suggests that the presence of domestic pets increases the prevalence of respiratory symptoms in asthmatic children. Those with predisposition to these allergens should avoid having these pets in the home or take specific precautions in avoiding their allergens.

Ann Acad Med Singapore 1997; 26:294-8

Key words: Asthma morbidity, Exercise, Flu, Pet allergy

Introduction

Domestic pets such as cats, dogs and birds, have been known to produce allergens which may sensitise predisposed individuals. In Singapore, between 25% and 35% of our atopic population are sensitised to these allergens (unpublished data). It is not known, however, if the presence of such domestic pets would translate to higher sensitisation or cause the manifestation of increased respiratory symptoms. In Singapore, the results of a recent survey on asthma prevalence in the adult population suggested that the keeping of cats, dogs or birds may play a role in influencing the differences in asthma prevalence amongst the three racial groups.¹ The Malays and Indians, who were more likely to keep domestic pets (cats, dogs or birds) than the Chinese, also had a higher cumulative and period prevalence of asthma. However, studies on the relationship between pet-ownership and respiratory symptoms have been inconclusive, with reports ranging from a lack or negative association to a positive association with re-

gards to allergen sensitisation.²⁻⁴ These studies were mainly population-based, and confounding factors such as demography and lifestyle may have influenced their conclusions. In addition, these studies utilised the general population rather than specific groups of individuals (e.g. asthmatics), in whom the presence of pets would have the greatest effect. This study evaluated the association between the presence of domestic pets (cats, dogs and birds) in the home and the frequency of respiratory symptoms among asthmatic children in Singapore. The comparison was made using demographically-matched pet-owners and non pet-owners.

Materials and Methods

The parents of 1517 doctor-diagnosed asthmatic children, aged 6 to 12 years old, were interviewed using the American Thoracic Society-Division of Lung Diseases respiratory questionnaire.⁵ They were part of 6357 parents from a greater study which evaluated the risk factors for increased respiratory symptoms among chil-

* Research Assistant

** Consultant

*** Associate Professor

† Consultant

‡ Associate Professor

Department of Paediatrics

National University of Singapore

Address for Reprints: Dr Lee Bee Wah, Department of Paediatrics, National University of Singapore, 5

Kent Ridge Road, Singapore 119074.

dren in the general population (unpublished data). The operational definition used to define asthma was based on doctor's diagnosis of asthma. This definition was used as it has been validated in various other studies to be highly specific and moderately sensitive in categorising true cases with asthma.^{6,7}

More than 20% of these asthmatics were found to have domestic pets (cats, dogs or birds) at home. Since smoking, both passive or active, is a positive risk factor leading to the development of increased asthma symptoms and exacerbation,^{8,9} those with home exposure to passive smoke, past or current, were excluded from the study. Hence, only children without exposure to cigarette smoke at home were considered. In addition, only "current" asthmatics were included. This was evaluated by a positive response to the question, "Does your child still have asthma?" and "Does your child currently take medicine or treatment for asthma?".

One hundred and eighty-eight children who were current pet-owners with current asthma were demographically-matched for sex, race and socio-economic status (type of housing) to current asthmatics who never had pets. Pet-ownership was defined as households with current pet cats, dogs or birds, or any combination of these, while the matched individuals were from households without any pets, past or present. The children were matched in this manner to correct for possible confounders, as our previous childhood asthma survey revealed that there were significant sex, race and socio-economic differences in asthma prevalence and severity among Singapore schoolchildren.¹⁰ Other unmatched parameters, such as the size of the child's peer group in school or childcare, household size, parents' education and parents' atopic status, were also evaluated to determine if there were significant differences between pet-owners and non pet-owners with respect to these parameters. There was, however, no verification of "pet allergy" by skin-prick test or other objective measurements in this population. In addition, no information were obtained pertaining to the length of time the pet-owners have had their pets.

The statistical analysis was done by cross tabulation using the PROC FREQ procedure of the statistical package SAS (version 6.08) for personal computers." The following indexes of respiratory symptoms were evaluated between the two groups:

- a) Coughs with colds/flu, apart from colds/flu, chronic (more than 4 times a week), and cough after playing or exercise;
- b) Congestion or phlegm production with colds/flu, apart from colds/flu, and chronic (more than 4 times a week); and
- c) Wheezing with colds/flu, apart from colds/flu, wheeze day and night, with shortness of breath, and with exercise.

The Cox's proportional hazards model (PROC PHREG procedure), with the assumption of a constant risk period, was adapted to estimate and determine the statistical significance of the prevalence rate ratios (relative risk) between pet-owners (exposed group) and non pet-owners (unexposed group).

Results

Table I summarises the demographic characteristics of the asthmatic children in this study. Both populations were over-represented by males by an average of 60:40 ratio, had higher proportion of Chinese compared to the national percentage of approximately 78%, and also had a greater proportion of non-HDB (Housing Development Board subsidised flat) dwellers compared to the national average.¹² Due to prior exclusions and matching, there were no differences in the age, sex, race and socio-economic profiles between pet-owners and non pet-owners. Unmatched parameters such as the children's peer group size in school or childcare, household size, parents' education and parents' atopic status were also found not significantly different between these two groups. The selected pair-matched population did not differ significantly from the initial baseline population of 1517 asthmatic children (data not shown).

TABLE I: DEMOGRAPHIC CHARACTERISTIC OF THE STUDY POPULATION

Covariate	Pet-owners n = 188	Non pet-owners n = 188	χ^2 statistics (P value)?
Sex			
Male	117 (62.2)"		
Female	71 (37.8)		
Race			
Chinese	175 (93.1)		
Malay	9 (4.8)		
Indian	4 (2.1)		
Housing			
HDB (Subsidised Flats)	134 (71.3)		
Private Apartments	29 (15.4)		
Landed Property	25 (13.3)		
Mean age ($\pm$ SD) (y)	8.6 ($\pm$ 1.6)	8.2 ($\pm$ 1.7)	
Peer Group Size			
<30	78 (41.5)	91 (48.4)	
$\geq$ 30	110 (58.5)	97 (51.6)	$\chi^2= 1.55$; NS
Household Size			
$\leq$ 4	128 (68.0)	114 (60.6)	
>4	60 (31.9)	74 (39.4)	$\chi^2= 1.96$; NS
Parent's Education			
Tertiary	64 (34.0)	54 (28.7)	
Non-tertiary	124 (66.0)	134 (71.3)	$\chi^2= 1.00$; NS
Parent's Atopic Status			
Yes	27 (14.4)	29 (15.4)	
No	161 (85.6)	159 (84.6)	$\chi^2= 0.02$; NS

* Values in parenthesis are percentages unless otherwise stated.

† NS: not significant ($P > 0.05$).

Table II shows the univariate relative risk (RR) and 95% confidence interval (CI) of respiratory symptoms associated with current pet-ownership amongst asthmatic children in Singapore. Asthmatic children with pets at home had significantly higher prevalence of coughing with cold or flu; wheezing with cold/flu, wheezing with shortness of breath, exercise-induced wheezing; and increased phlegm production or congestion with cold/flu compared to those without pets. These children also had higher prevalence of coughing with exercise but this was not significantly different from non pet-owners.

The respiratory symptoms associated with current pet-ownership showed an interesting clustering pattern. In general, there were significant differences in respiratory symptoms which were associated with cold or flu and with exercise (Table II). On the other hand,

chronic symptoms and those apart from cold or flu were not found to be associated with pet-ownership. When analysed as groups of symptoms, asthmatic children with pets had significantly higher prevalence of symptoms associated with cold or flu and with exercise compared to non pet-owners (Table III). Respiratory symptoms apart from cold/flu and chronic (>4/week) symptoms were not found to be associated with pet ownership (Table III).

Discussion

This study showed that current pet-ownership was associated with increased prevalence of respiratory symptoms in asthmatic children, in particular, in association with cold or flu and with exercise. There is, however, a general impression that pet ownership is more closely associated with chronic asthma symp-

TABLEII: PREVALENCE RATE RATIO AND 95% CONFIDENCE INTERVAL OF RESPIRATORY SYMPTOMS ASSOCIATED WITH CURRENT PET-OWNERSHIP AMONGST ASTHMATIC CHILDREN IN SINGAPORE

Covariate	Pet-owners n = 188	Nonpet-owners n = 188	Prevalence rate ratio (95 % Confidence interval)
Respiratory symptoms			
Coughs			
with colds/flu	116 (61.7)*	89 (47.3)"	1.30 (1.01 - 1.69)
apart from colds/flu	78 (41.5)	69 (36.7).	1.13 (0.82 - 1.56)
chronic (>4/week)	34 (18.0)	38 (20.2)	0.90 (0.56 - 1.42)
with exercise	76 (40.4)	58 (30.9)	1.31 (0.93 - 1.84)
Congestion/phlegm production			
with colds/flu	87 (46.3)	63 (33.5)	1.38 (1.00 - 1.91)
apart from colds/flu	43 (22.9)	32 (17.0)	1.34 (0.85 - 2.12)
chronic (>4/week)	23 (12.2)	23 (12.2)	1.00 (0.56 - 1.78)
Wheezing			
with colds/flu	111 (59.0)	78 (41.5)	1.42 (1.07 - 1.90)
apart from colds/flu	61 (32.4)	45 (23.9)	1.36 (0.92 - 1.99)
day and night	28 (14.9)	24 (12.8)	1.17 (0.68 - 2.01)
with shortness of breath	97 (51.6)	73 (38.8)	1.33 (1.00 - 1.82)
with exercise	57 (30.3)	34 (18.1)	1.68 (1.10 - 2.56)

*Values in parenthesis are percentages.

Symptoms showing significant differences between the two groups are in bold.

TABLEIII: PREVALENCE RATE RATIO AND 95% CONFIDENCE INTERVAL OF A COMBINATION OF RESPIRATORY SYMPTOMS ASSOCIATED WITH CURRENT PET-OWNERSHIP AMONGST ASTHMATIC CHILDREN IN SINGAPORE

Covariate	Pet-owners n = 188	Non pet-owners n = 188	Prevalence rate ratio (95% Confidence interval)
Respiratory symptoms associated with†:			
colds/flu	152 (80.9)*	112 (59.6)"	1.36 (1.06 - 1.73)
apart from colds/flu	110 (58.5)	98 (52.1)	1.30 (0.98 - 1.77)
chronic (>4/week)	55 (29.3)	56 (29.8)	0.98 (0.68 - 1.43)
exercise	90 (47.9)	68 (36.2)	1.32 (1.01 - 1.76)

* Values in parenthesis are percentages.

† The covariates in this analysis refer to those with positive responses to coughs, congestion/phlegm production or wheezing (all or any one combination) which were associated with cold/flu, not associated with cold/flu, chronic or with exercise as tabulated.

Symptoms showing significant differences between the two groups are in bold.

toms, than with acute asthma symptoms associated with flu or exercise, such as those seen in this study. Various studies have reported an absence or inverse association between respiratory symptoms and having pets at home.^{2,3} These studies, however, included families which had given up their pet after developing allergic symptoms,⁴ and allergic subjects who consciously avoided having pets at home in their comparisons. These inclusions could have biased the results. To overcome this, all asthmatic children in the non pet-owner group of this study had never had a pet in their home, thus, removing the problem of previous pet-ownership as a confounding factor.

From our survey of 6357 families in the general population, cats were found to be present in 1.5% and dogs in 10.5% of these homes (unpublished data). Despite the low frequency of these domestic animals in our homes compared to other countries where pets were reported to be in approximately 70% of homes,¹³ both the major cat and dog allergens, Fel d I and Can f I were found to be widely distributed in Singapore, with detectable levels of allergen in more than half of the dust samples surveyed in our previous study on the distribution of indoor allergens.¹⁴ This phenomenon of the presence of contaminating allergens in areas without pets has been well documented.¹⁵ Nevertheless, our previous study on indoor allergens has shown that homes with current pets had significantly higher levels of animal dander allergens compared to those without pets¹⁴ and may be the reason for the differences in symptomatology seen in this study.

In the overall study on risk factors for increased respiratory symptoms among asthmatic children (unpublished data) from where the data for this study was derived, increased asthma morbidity was observed to be associated with age (younger age groups), sex (males) and higher socio-economic status. The Malays and Indians childhood asthmatics were also found to suffer more severe asthma than asthmatic Chinese children. Further concurrent allergies and active smoking were found to be strongly associated with increased asthma morbidity, while premature birth and a history of prior childhood respiratory illnesses and infections were predictive of greater asthma severity. Other factors such as early onset of asthma, season of birth or birth order, childcare attendances and household size were not found to be associated with or predictive of increased asthma morbidity. It was therefore imperative that the factors identified in the overall risk study were controlled for this study by case matching. Demographic variables (age, sex, race and socio-economic status) were case-matched and children with exposure to active or passive smoke were excluded from the study. Additionally, very few of the selected children in both the exposed and unexposed groups had premature births

and as such was unlikely the cause of any differences seen. In contrast, a high proportion of children in both groups reported having allergy to dust (74.5% versus 70.7% in the exposed and unexposed groups respectively), while an equivocal distribution of prior childhood illnesses and infections (56.9% versus 51.6%) were found among the children within both groups. Their parental history (of atopy) were also not significantly different. Having taken into account the risk factors identified in the overall study, it is thus highly suggestive that any difference in respiratory symptoms seen between the two groups in this study would be due to the presence of domestic pets in the home.

The mechanism by which pet allergens predispose asthmatic children to increased respiratory symptoms cannot be precisely elucidated via questionnaire surveys. Studies on allergen avoidance however, have shown that several modes of avoidance measures can be used and are effective in reducing pet allergen exposure,¹⁶⁻¹⁸ resulting in reduced bronchial hyperreactivity.¹⁹ In this study, the increase in asthma symptoms associated with a cold or flu in pet owners, also supports the notion that viral infections of the upper respiratory tract induce bronchial hyperresponsiveness by predisposing allergic subjects late asthmatic responses when challenged with allergen.²⁰

This study suggests that the presence of domestic pets increases the prevalence of respiratory symptoms in asthmatic children, in particular with the presence of flu or exercise. Those with predisposition to these allergens should avoid having pets in the home or take particular precautions in avoiding their allergens.

REFERENCES

1. Ng T P, Hui K P, Tan W C. Prevalence of asthma and risk factors among Chinese, Malay, and Indian adults in Singapore. *Thorax* 1994; 49:347-51.
2. Clifford R D, Radford M, Howell J B, Holgate ST. Prevalence of respiratory symptoms among 7 and 11-year-old school children and association with asthma. *Arch Dis Child* 1989; 64:1118-25.
3. Hosein H R, Corey I', Robertson J McD. The effect of domestic factors on respiratory symptoms and FEV₁. *Int J Epidemiol* 1989; 18:390-6.
4. Abdulrazzaq Y M, Beber A, DeBuse P. Pet ownership in the UAE: its effect on allergy and respiratory symptoms. *J Asthma* 1995; 32:117-24.
5. Ferris B G. Epidemiology standardization project. *Am Rev Respir Dis* 1978; 118(6 pt 2):1-53.
6. Shaw R A, Crane J, O'Donnell T V, Porteous L E, Coleman E D. Increasing asthma prevalence in a rural New Zealand adolescent population: 1975-89. *Arch Dis Child* 1990; 65:1319-23.
7. Shaw R A, Crane J, O'Donnell T V. Prevalence of asthma in children. *BMJ* 1990; 300:1652-3.
8. Burchfiel C M, Higgins M W, Keller J B, Howatt W F, Butler W J, Higgins I T. Passive smoking in childhood. Respiratory conditions and pulmonary function in Tecumseh, Michigan. *Am Rev Respir Dis* 1986; 133:966-73.
9. Leeder S R, Colley J R T, Corkhill R, Holland W W. Respiratory symptom prevalence in adults: the comparative importance of smoking and family factors. *Am J Epidemiol* 1977; 105:530-3.

10. Goh D Y T, Chew F T, Quek S C, Lee B W. The prevalence and severity of asthma, rhinitis and eczema in Singapore schoolchildren. *Arch Dis Child* 1996;74:131-5.
11. SAS Institute Inc. SAS/STAT user's guide, Version 6. 4th ed. Vols. 1 & 2. SAS Circle, Box 8000, Cary MB, 27512-80000. 1991:1686.
12. Census of Population Office. Singapore Census of Population in 1990: Households and Housing, Statistical Release 2. Singapore: Department of Statistics, 1992.
13. Brunekreef B, Groot B, Hoek G. Pets, allergy and respiratory symptoms in children. *Int J Epidemiol* 1992; 21:338-42.
14. Zhang L, Chew F T, Soh S Y, Yi F C, Law S Y, Goh D Y T, et al. Prevalence and distribution of indoor allergens in Singapore. *Clin Exp Allergy* (In print).
15. Custovic A, Taggart S C O, Woodcock A. House dust mite and cat allergen in different indoor environments. *Clin Exp Allergy* 1994; 24:1164-8.
16. Warner J A, Marchant J L, Warner J O. Allergen avoidance in the homes of atopic asthmatic children: the effect of Allersearch DMS. *Clin Exp Allergy* 1993;23:279-86.
17. Corey J P. Environmental control of allergens. *Otolaryngol Head Neck Surg* 1994; 111:340-7.
18. Bessot J C, deBlay F, Pauli G. From allergen sources to reduction of allergen exposure. *Eur Respir J* 1994; 7:392-7.
19. Valletta E A, Comis A, Del-Col G, Spezia E, Boner A L. Peak expiratory flow variation and bronchial hyperresponsiveness in asthmatic children during periods of antigen avoidance and reexposure. *Allergy* 1995; 50:366-9.
20. Lemanske R F, Dick E C, Swenson C A, Vrtis R F, Busse W W. Rhinovirus upper respiratory tract infection increases airway hyperreactivity and late asthma reactions. *J Clin Invest* 1989; 83:1-10.