

## The relationship between contact to cat and the development of asthma in children

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### Abstract

**Background** Data suggesting history of direct or indirect contact to cats are either protective, has no effect or increase risk of sensitization and asthma development.

**Objective** To determine the relationship between childhood contact to cat and the development of asthma in children.

**Methods** A case control study was conducted in Denpasar since December 2006 until Juli 2008. In this study, subjects with asthma (cases group) were selected for comparisons to a series of healthy subjects without asthma (controls group). Forty-seven subjects (3-12 years) with asthma were recruited and matched (age and sex) with 47 healthy and non asthma controls. Data were collected using two kinds of questionnaires, i.e: ISAAC, ATS 78, and Robertson modification questionnaire from Medical School, University of Indonesia, which had been validated to determine asthma and asthma risk factors questionnaire. Data were analyzed as univariate by using chi-square or Fisher's exact test, and multivariate analysis by stepwise logistic regression model.

**Results** Result of univariate analysis showed that there were seven significant risk factors of asthma. Using multivariate analysis, contact to cat was significant risk factor for asthma [OR: 4.5 (95% CI 1.3 to 16.0), P= 0.020]. Other significant risk factors were; contact to cockroach [OR: 11.7 (95% CI 2.6 to 51.6), P= 0.001], use of kapok mattress [OR: 6.4 (95% CI 1.4 to 29.0), P= 0.015], passive smoker [OR: 4.7 (95% CI 1.3 to 17.0), P= 0.018], and atopic history [OR: 9.2 (95% CI 2.3 to 36.7), P= 0.002].

**Conclusions** There was a relationship between childhood contact to cat and the development of asthma in children. Risk factors that statistically significant were; contact to cockroach, use of kapok mattress, passive smoker, and history of allergy in study subject. [Paediatr Indones. 2009;49:379-6]

**Keywords:** asthma, contact to cat, risk, protective, children.

Many evidences have shown that allergy is an important factor in the development of asthma.<sup>1-4</sup> At least 75-90% children below 5 years old with asthma have been proved to suffer from allergy, both in developing and developed countries.<sup>5</sup> Several cat-derived proteins may cause allergy. Glycoprotein, known as *Fel d1*, is the main allergen of the cat.<sup>6-8</sup> *Fel d1* exist on skin surface and feather of cat. This protein was produced by cat's saliva gland, tear gland, sweat gland and anal gland.<sup>9-12</sup> Cat albumin (*Fel d2*) is intermediate allergen of cat. *Fel d2* can be found in the serum, feather and saliva of the cat. Cystatin (*Fel d3*) can also be found on the skin. *Fel d3* is very few.<sup>6,8,13-14</sup> Several recent studies showed that exposure to high dose of cat allergen may produce a response of IgG and IgG4 antibodies, therefore it will not provoke sensitization or risk of asthma. This Th2 cell-modification response may result in tolerance.<sup>15-16</sup>

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Risk factor for asthma have been widely well-known, therefore several prevention have been performed to reduce the prevalence of asthma. However, in last few years there were controversial studies associated to the prevention of asthma, which suggested that keeping a cat may able to prevent/protect oneself from asthma.<sup>16-21</sup> The purpose of this study was to determine the relationship between childhood contacts to cat and the occurrence of asthma in children.

## Methods

This study was an analytic observational study designed as case-control that has been conducted in Sanglah Hospital since December 2006 to July 2008. In this study, the subject (case group) were children with asthma based on doctor's diagnosis and based on ISAAC, ATS 78 and Robertson modification asthma prevalence questioners from Medical School of University of Indonesia, since December 2006 and eligible to inclusion and exclusion criteria. Expected subject for control group were healthy children and never been diagnosed with asthma by doctor or by ISAAC, ATS 78 and Robertson modification asthma prevalence questioner from Medical School of University of Indonesia since December 2006 and eligible to inclusion and exclusion criteria.

Inclusion criteria for study subject were children aged 3 to 12 years old, and willing to be enrolled in the study. Exclusion criteria were adopted children and parent had not lived together with their children through childhood, hence they did not know about the development of the children.

Subjects for case of asthma were obtained consecutively. Matched of age and sex have been done between the case and control group. The sample size was 94, obtained using the formula of hypothesis test for case-control study, with  $\alpha=5\%$  and power=80%.

Case group recruited from children aged 3-12 years admitted to Department of Child Health in Sanglah Hospital Denpasar, both in emergency room, outpatient clinic or nursing room, since December 2006. Parents were asked about their children's history and whether their children had been diagnosed with

asthma by doctor. Parent whose children had been diagnosed with asthma, furthermore were asked to complete the questioner I, that would be used to determine whether it was asthma or not. Parents, whose subjects had been diagnosed with asthma and confirmed by the questioner I, would be given an informed consent. Subjects, whose parents had approved the informed consent, then would be enrolled to the study as a case-group.

Control-group obtained from healthy and non asthma children aged 3-12 years from playgroup, kinder-garten or elementary school were selected to obtain the subject of study. The selected school was near Sanglah Hospital and their bureaucracy quite simple. Out of this reason some schools in Denpasar Regency were selected randomly.

Parents, whose children were healthy and never been diagnosed with asthma, were asked to complete questioner I. If from the history or questioner I the subject was healthy and never been diagnosed with asthma, parents would be given an informed consent. Subjects, whose parents had approved the informed consent, then would be enrolled to study subject as a control group. Parents from case or control group therefore would completed questioner II.

Questioner I was a questioner used to determine asthma or non asthma, which is a modification of ISAAC, ATS 78 and Robertson questioner developed by Medical School of University of Indonesia and had already been validated. Conclusion of this validated questioner was that it may be used to identify asthma because of its sensitivity is 85.7% and specificity is 79.19%. Questioner of risk factors for asthma (Questioner II) that already been tested in focus group discussion previously, is a questioner containing several questions related to risk factor for the development of asthma, including age, sex, contact with cat, contact with dog, contact with cockroach, the use of kapok mattress, firewood smoke, cigarette smoke, birth weight, history of getting flu, history of pneumonia, history of aspirin consumption and history of allergy either in the subject and parents.

The study conducted after ethical clearance was obtained from the research ethical committee of Medical School of Udayana University licensed from Director of Sanglah Hospital and also from the

head-master of selected playgroups, kindergartens, and elementary schools.

## Definitions

Asthma was confirmed if the subjects were diagnosed with asthma by the doctor and matched the diagnostic criteria for asthma in modification of ISAAC, ATS 78 and Robertson questioner provided by Medical School of University of Indonesia. Questioner of asthma prevalence consisted of three question groups, i.e.; history of asthma, dyspnea, and wheezing. Each question group will be followed by question of any former symptoms and the prominent time of the attack. Diagnostic criteria for asthma based on the latest of asthma attack and distinguished as 2; if the asthma attack occurred in the last six-months and if the asthma attack occurred earlier than the last six-months.

Subject suggested asthma if minimally 1 of 3 question groups complied with “yes” conclusion, meaning that there was a history of asthma or dyspnea or wheezing attack in the last six-months associated with minimally 1 “yes” conclusion for the question about prominent time of the attack. When the last attack occurred in a period of more than the last six-months, the answer from the three groups’ questions should be comply with “yes” conclusion accompanied by at least 1 “yes” answer for the questions of any previous symptoms and minimal 1 answered “yes” for the question about prominent time of the attack.

Contact with cat was defined as daily existence of one or more cat, from any type, living in the house of the study subject, either inside the room, terrace or garage, at least for seven hours a week and for six months or more afterwards.

## Data analysis

The data base include the diagnosis of asthma or non asthma, age, sex, contact with cat, contact with dog, contact with cockroach, the use of kapok mattress, the use of carpet, firewood smoke, cigarette smoke, birth weight, history of flu, pneumonia, aspirin consumption and history of allergy either in subject or parents.

Two kinds of statistic method, descriptive statistic and inference statistic, were used for data analysis in this study. Data analyzed by computer program. Univariate analysis used chi-square test or Fischer’s exact test. Stepwise logistic regression was used in multivariate analysis. The power of relationship asserted as odd ratio (OR). The precision of OR asserted as the 95% confident interval and significance level  $P < 0.05$ .

## Results

Number of whole study subjects was 94 consisting 47 cases and 47 controls subjects. The characteristics of study subjects showed in **Table 1**. Some of the characteristics were much different (atopic in study subject, atopic father, atopic mother, flu  $\geq 5$  times/year, passive smoker, use of kapok mattress, contact to cockroach).

**Table 2** showed the history of allergy in case group was more than in control group, either in study subject or in parents. It also showed that more fathers in case group suffered from asthma compared to fathers in control group (27.7% versus 0%) whereas number of mothers in case group that suffered from asthma were also more than mothers in control group (14.9% versus 0%).

**Table 1.** Characteristics of case and control

Variable	Case n (%)	Control n (%)
Age, years, mean (SD)	6.85 (2.4)	6.85 (2.4)
Gender		
Male	33 (70.2)	33 (70.2)
Female	14 (29.8)	14 (29.8)
Allergy in study subject	23 (48.9)	8 (17)
Allergy in parents		
1. Father	31 (66.0)	12 (25.5)
2. Mother	20 (42.6)	11 (23.4)
Low birth weight	5 (10.6)	4 (8.5)
Respiration Tract Infection		
Flu ( $\geq 5$ times/year)	29 (61.7)	12 (25.5)
2. Pneumonia	12 (25.5)	12 (25.5)
Aspirin consumption	7 (14.9)	5 (10.6)
Passive smoker	31 (66.0)	15 (31.9)
Use of firewood	1 (2.1)	1 (2.1)
Use of kapok mattress	23 (48.9)	4 (8.5)
Use of carpet	19 (40.4)	12 (25.5)
Contact to cockroach	42 (89.4)	24 (51.1)
Contact to dog	23 (48.9)	15 (31.9)

**Table 2.** Characteristics of case and control based on history of atopic types in study subject and parents

Atopy	Case n (%)	Control n (%)
1. Study subject		
- Atopic Dermatitis	3 (6.4)	0 (0)
- Allergic Rhinitis	12 (25.5)	5 (10.6)
- Allergic Conjunctivitis	6 (12.8)	1 (2.1)
- Urticaria	14 (29.8)	5 (10.6)
- Anaphylaxis	1 (2.1)	0(0)
2. Father		
Asthma	13 (27.7)	0 (0)
- Atopic Dermatitis	0 (0)	0 (0)
- Allergic Rhinitis	20 (42.6)	8 (17.0)
- Allergic Conjunctivitis	7 (14.9)	1 (2.1)
- Urticaria	9 (19.1)	7 (14.9)
- Anaphylaxis	2 (4.3)	0 (0)
3. Mother		
Asthma	7 (14.9)	0 (0)
- Atopic Dermatitis	2 (4.3)	0 (0)
- Allergic Rhinitis	6 (12.8)	6 (12.8)
- Allergic Conjunctivitis	4 (8.5)	4 (8.5)
- Urticaria	8 (17.0)	7 (14.9)
- Anaphylaxis	3 (6.4)	0 (0)

In univariate analysis (Table 3), there were seven risk factors that significantly related to the development of asthma, i.e.; contact to cat [OR: 4.8 (95% CI 1.9 to 12.1), P= 0.001], contact to cockroach [OR: 8.1 (95% CI 2.7 to 23.9), P= 0.001], the use of kapok mattress [OR: 10.3 (95% CI 3.2 to 33.3), P= 0.001], passive smoker [OR: 4.1 (95% CI 1.7 to 9.8), P= 0.001], flu  $\geq$  5 times/year [OR: 4.7 (95% CI 1.9 to 11.3), P= 0.001], history of allergic fathers [OR: 5.7 (95% CI 2.3 to 13.8), P= 0.001], and history of allergy in study subject [OR: 4.7 (95% CI 1.8 to 12.1), P= 0.001].

In Table 4 appeared that contact to more than one cat has higher risk to develop asthma comparing with contact to one cat [OR: 6.5 (95% CI 1.9 to 22.0), P= 0.010 versus OR: 3.5 (95% CI 1.1 to 1.4), P= 0.036].

Table 5 showed that subjects who had history of cat contact in the first year of life had a higher risk

**Table 3.** Risk factors of asthma in study subject

Risk Factors of Asthma	Case (n)	Control (n)	P	OR	95% CI
Atopy in study subject (Yes)	23	8	0.001	4.7*	1.8 to 12.1
Atopy in father (Yes)	31	12	0.001	5.7*	2.3 to 13.8
Atopy in mother (Yes)	20	11	0.048	2.4*	0.9 to 5.9
Low Birth Weight (Yes)	5	4	1.001	1.3 <sup>F</sup>	0.3 to 5.1
Flu ( $\geq$ 5 times/year)	29	12	0.001	4.7*	1.9 to 11.3
Pneumonia (Yes)	12	12	1.001	1.0*	0.4 to 2.5
Aspirin consumption (Yes)	7	5	0.536	1.5*	0.4 to 5.0
Passive smoker (Yes)	31	15	0.001	4.1*	1.7 to 9.8
Smoke of firewood (Yes)	1	1	1.001	1.0 <sup>F</sup>	0.1 to 16.5
Use of kapok mattress (Yes)	23	4	0.001	10.3*	3.2 to 33.3
Use of carpet (Yes)	19	12	0.125	2.0*	0.8 to 4.8
Contact to dog (Yes)	23	15	0.093	2.0*	0.9 to 4.7
Contact to cockroach (Yes)	42	24	0.001	8.1*	2.7 to 23.9
Contact to cat (Yes)	25	9	0.001	4.8*	1.9 to 12.1

\*Analysis using chi-square test    <sup>F</sup> Analysis using Fischer's exact test

**Table 4.** Relationship between number of contact to cat and occurrence of asthma

Number of cat	Case	Control	P	OR	95% CI
0	22	38	Reference	1	
1	10	5	0.036	3.5*	1.1 to 11.4
$\geq$ 2	15	4	0.010	6.5*	1.9 to 22.0

\* Analysis using chi-square test

Table 5. Relationship between onset of contact to cat and the occurrence of asthma

Onset of cat contact	Case	Control	P	OR	95% CI
Onset (-)	22	38	Reference	1	
$\leq$ 1 year of age	15	5	0.003	5.2*	1.7 to 16.2
>1 year of age	10	4	0.018	4.3*	1.2 to 15.4

\* Analysis using Chi-Square test

**Table 6.** Relationship between contact to cat and the occurrence of asthma after adjust to other several risk factors#

Risk Factors of Asthma	B	P	OR	95% CI
Contact to cat	1.506	0.020	4.5	1.3 to 16.0
Contact to cockroach	2.456	0.001	11.7	2.6 to 51.6
Use of kapok mattress	1.861	0.015	6.4	1.4 to 29.0
Passive smoker	1.550	0.018	4.7	1.3 to 17.0
History of atopy in study subject	2.216	0.002	9.2	2.3 to 36.7

# Has been adjusted to age, sex, contact to dog, contact to cockroach, use of kapok mattress, use of carpet, firewood smoke, cigarette smoke, flu, pneumonia, low birth weight, aspirin, atopy of father, atopy of mother and history of atopy in study subject.

to develop asthma than subjects who had history of cat contact after first year of age [OR: 5.2 (95% CI 1.7 to 16.2), P= 0.003 versus OR: 4.3 (95% CI 1.2 to 15.4), P= 0.018].

Data in **Table 6** obtained after adjusted for all risk factors investigated in this study. By using stepwise logistic regression model there was five risk factors found with significant relationship with the development of asthma in children, i.e.; contact to cat [OR: 4.5 (95% CI 1.3 to 16.0), P= 0.020], contact to cockroach [OR: 11.7 (95% CI 2.6 to 51.6), P= 0.001], use of kapok mattress [OR: 6.4 (95% CI 1.4 to 29.0), P= 0.015], passive smoker [OR: 4.7 (95% CI 1.3 to 17.0), P= 0.018], and history of allergy in study subject [OR: 9.2 (95% CI 2.3 to 36.7), P= 0.002].

## Discussion

Results of both univariate and multivariate analysis in this study showed that contact to cat related to the risk of occurrence of asthma in children. Result of univariate analysis showed that children with contact history to cat had almost five times higher to develop asthma than that of children without any contact history. After multivariate analysis, children with contact history remain to have risk factor up to four times higher to develop asthma, than children without any contact history. We also found the fact that the more often the child contact to cats or had contact to cats in the very first years of life, the higher risk for the children to develop asthma. This result was similar to several result of previous studies.<sup>22-32</sup>

However, several studies related to the association of contact history to cat in the early years and the occurrence of asthma suggesting contradictive result with this study. Platts-Mills et al<sup>15</sup> in 2001 performed

a cross-sectional study to children of 12-14 years old, found that sensitization to cat allergen has six times higher risk to develop asthma significantly. However, the extremely high level of cat allergen was associated with the decrease of sensitization to cat. Exposure to high dose of cat allergen may produce response of IgG and IgG4 antibody, hence the sensitization would not be provoked afterwards neither risen up the risk of asthma. Modification response of this Th2 cell may result in tolerance. This may explain how the existence of any animal in the house may reduce the risk of asthma. However, Platts-Mills et al<sup>17</sup> mentioned about the result of his contradictive study was not related to the exposure to endotoxin. They found that the endotoxin level in the air was not as high as in the house with an animal. Endotoxin level in the air was significantly lower in the house with cat than that in the house with dog. Their latter study showed that cat ownership did not increase the exposure to endotoxin.

Study performed by Hesselmar et al<sup>33</sup> in Sweden among children in school age also found that children who had history contact with any pet in the first year of life, infrequently developed asthma after 12-13 year of age. Similar result also found by Ownby et al<sup>34</sup> in a birth cohort prospective study for 6-7 years in Detroit, concluding that exposure to two or more cats or dogs in the first year of life would significantly reduce the risk of allergic sensitization while the children aged 6-7 years.

The difference between our result and previous studies is probably due to several factors, such as the difference in the study design and subject's personal habits. Apelberg et al<sup>19</sup> in 2001 made a systemic review of 32 scientific studies since 1991 until the end of 1999 related to asthma/wheezing and domestic animal including cats and dogs. From all of those studies, he found a high variety design and result of study, some studies only examined children with high

risk, some studies were performed in areas where the community cares of several pets, some examined the exposure in early age, and many studies had not assessed the allergic sensitization. This varieties cause difficulties to make conclusions. Conclusions were focused in exposure to cats and dogs in the early age which may or may not have benefits to primary prevention. This systematic review concluded that exposure to pets in the first two years of life would significantly increase the risk of asthma and wheezing in children of more than six-years old [OR: 1.19 (95%CI 1.02 to 1.40)].

Prescott and Tang's <sup>20</sup>(in ASCIA position) statement about allergy prevention in children, specifically exposure to pets, until today were unable to give recommendation about the relationship between exposure to pets and development of allergy. However, they only suggested that when a family had already care for a pet, the pet was unnecessary to be excluded, but it was not recommended to add more pets to prevent allergy.

In this study, we also found that contact to cockroach, house dust mites, passive smoker and history of allergy in study subject were all risk factors for the development of asthma. This result was appropriate with other former studies.<sup>24,35-39</sup>

Based on the result, we may conclude that there was a relationship between contact to cat and risk to develop asthma in children. Children who had contact history to cat had four times higher risk suffering asthma compared to children without any contact history. Based on analysis of dose-response, it was found that the children would have more risk to develop asthma if they had contact with more than one cat, or contact with the cat in their first year of life.

Other risk factors that also statistically significant were: contact to cockroach, use of kapok mattress, passive smoker, and history of allergy in study subject. Therefore we suggest the parents to have their children's environment away from cats especially in their first year of life.

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