

Role of the environment in the development of canine atopic dermatitis in Labrador and golden retrievers

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Conflict of Interest

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Abstract

Canine and human atopic dermatitis are multifaceted diseases whose clinical development may be influenced by several factors, such as genetic background, environment, secondary infections, food and psychological effects. The role of the environment has been extensively examined in humans but remains unclear in dogs. The aim of this study was to examine environmental factors in two genetically close breeds, Labrador and golden retrievers. Using standard criteria, atopic dogs in Switzerland and Germany were selected and compared with healthy individuals. Information on environmental factors was collected using a 46-question survey encompassing date and place of birth, way of life at the breeder's and owner's home, food and treatments. Univariate and multivariate logistic regression were used to assess the association between potential risk factors and disease status. The following parameters were associated with an increased risk of disease development: living in a shed during puppyhood, adoption at the age of 8–12 weeks and washing the dog regularly. In contrast, the following factors were associated with a lower risk: living in a rural environment, living in a household with other animals and walking in a forest. These associations do not prove causality but support the primary hypothesis that certain environmental factors may influence the develop-

ment of canine atopic dermatitis. Further studies are warranted to confirm these results and conclusions.

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Introduction

Canine atopic dermatitis (CAD) is a genetically predisposed inflammatory and pruritic allergic skin disease with characteristic clinical features most commonly associated with IgE antibodies produced in response to environmental allergens.¹ Canine atopic dermatitis, which affects ~10–15% of the canine population, has become more frequent during the past decades.^{2,3} Such a sudden and dramatic increase suggests that environmental factors, in addition to genetic factors, play a role in the development of the disease.⁴

Recent studies have demonstrated that CAD bears numerous similarities to its human counterpart, including prevalence, development, clinical and histological signs, immunological mechanisms and response to treatment.⁵ Human atopic dermatitis (HAD) is regarded as a multifaceted disease resulting from complex interactions between host (genetic susceptibility leading to skin barrier or immunological dysfunction) and environmental factors (exposure to airborne or food allergens, contact with infectious agents, stress and ultraviolet light).⁶

Environmental factors influencing development of HAD have been extensively studied, and some of them may be relevant for dogs. As pets have accompanied human beings in their lifestyle changes, it is tempting to hypothesize that shared environmental factors may also have influenced the development of CAD. The so-called 'hygiene hypothesis' suggests that early-life exposure to microbes can influence the development of the immune system, possibly promoting T-helper 1 (Th1) responses and downregulating T-helper 2 (Th2) responses.⁴ Therefore, one can speculate that the increased use of antibiotics, vaccines and anthelmintic drugs in dogs may have contributed to the increasing prevalence of CAD. It has been shown that both living in an urban area and a Western lifestyle tend to increase the risk of developing allergic diseases in humans.⁷ Exposure to diesel exhaust particles, for example, has also been associated with increased incidence of HAD.⁶ Contact with farm animals, in contrast, seems to have a protective effect on the development of HAD, possibly through early exposure to bacterial endotoxins, which are potent inducers of type Th1

cytokines.⁸ Furthermore, contact with dogs appears to have a protective effect in children.⁶ The age of the individuals at the time of exposure to different allergens has also been shown to play an important role.⁸ Finally, diets rich in essential fatty acids have been associated with a decreased risk of developing the signs of the disease.⁹

In comparison, data in the veterinary literature are very limited. A study carried out in Sweden suggested that living in a town and being born in autumn is associated with an increased risk of CAD.¹⁰ Another study carried out by the same team revealed that home-made food diets during pregnancy seem to have a protective effect on the development of atopic dermatitis in puppies.¹¹ The goal of the present study was to analyse the environmental risk factors for CAD in Swiss and German Labrador and golden retrievers.

Materials and methods

The present work was done in the context of a larger study with the aim of evaluating genetic factors that influence the development of CAD in Labrador and golden retrievers. This LUPA project is a European initiative aiming at collecting DNA samples from large cohorts of dogs suffering from diseases relevant to human health.¹² Canine atopic dermatitis (CAD) is one of the diseases chosen because of its similarities with HAD.

Labradors, golden retrievers and Labrador × golden retriever crossbreeds were recruited in Switzerland and Germany between January 2008 and October 2009. For each dog (older than 6 months), a thorough history was recorded and a clinical examination performed by a veterinary dermatologist in order to determine whether it was allergic or not. All dogs with a history of skin or ear diseases not compatible with CAD were excluded. Only dogs with no present or past signs of skin/ear diseases were enrolled in the control group. For dogs with suspected CAD, Willemse¹³ and Prélard *et al.*¹⁴ criteria were used, and other pruritic diseases, such as ectoparasites and primary bacterial and yeasts infections, were ruled out. Most dogs underwent a 6-week elimination diet and a subsequent dietary challenge. None of these dogs responded completely to this procedure, and they were therefore not considered food allergic. Following the recent position of the International Task Force on Atopic Dermatitis¹⁵ stating that food allergens might in some individuals trigger flares of CAD, dogs presenting with clinical signs of CAD that responded partially to an elimination diet were kept in the CAD group. Dogs with a clinical diagnosis of CAD that did not complete an elimination diet were also kept in the CAD group.

Dog owners were asked to fill in a questionnaire (see Appendix) of 46 questions clustered in five risk factor groups encompassing the following aspects of their dog's lifestyle: date of birth, breeding conditions, surroundings, housing conditions and feeding. When the answer 'others' was ticked by the owners, the answer was not taken into account for further statistical analysis.

When questions corresponded to more than one risk factor, they were either interpreted as yes/no or grouped together. For example, possible answers to the question 'Are there other animals in the surrounding area?' were 'no', 'dogs/cats', 'birds', 'ruminants', 'horses', 'rodents (including rabbits)' or 'others'. For the statistical analysis, the data were analysed as 'Are there dogs and cats in the surrounding area?' – yes/no; 'Are there birds in the surrounding area?' – yes/no; and so on. Possible answers for the question 'In which residential area does the owner live with the dog?' were 'rural', 'urban', 'both (rural and urban)' or 'suburban'. For the statistical analysis we grouped 'rural' and 'both' together as 'rural and urban' and 'suburban' together as 'urban'.

After initial descriptive statistics and data cleaning, a basic two-factor logistic regression model was run to assess the association between all risk factors (individually) and disease status (dogs with CAD versus healthy control dogs). Breed was always included as a

potential confounder. Association between the month of birth (12 categories) and disease status was analysed with a cross-tabulation and two-sided Fisher's exact test. Significance was set at $P < 0.05$. However, trends with $P < 0.12$ were taken into account if they were causally related to other factors with $P < 0.05$.

Risk factors were considered as candidates for the final multivariate analysis if at least one of the risk factors in the group had $P < 0.12$ (see Table 2). In order to avoid problems with collinearity in the final model, the association between candidate risk factors was assessed within the following topic groups: (i) breeding conditions; (ii) surroundings; (iii) housing conditions; and (iv) feeding, using a cross-tabulation and chi-squared test. Factors within those groups that were significantly associated were either combined or one was excluded from further analysis (see Table 2).

All remaining candidates were submitted to an automatic forward selection process for the multivariate logistic regression analysis until ten variables (including intercept) were selected in decreasing order of significance. Subsequently, nonsignificant variables ($P > 0.05$) were manually inserted/added in a stepwise elimination process. Finally, breed was forced into the model to correct for any potential confounding effect and the parameter estimates of those factors remaining in the final model expressed as odds ratios and 95% confidence intervals. All descriptive and conclusive statistical data analyses were performed with NCSS 2007 (NCSS, Kaysville, UT, USA).

Results

Data from 378 dogs, including 224 Labrador (59.3%) and 154 golden retrievers (40.7%) were analysed. Of these, 144 dogs (38.1%) suffered from CAD and 234 (61.9%) were classified as control dogs. For the univariate analysis, we first ensured that breed (Labrador versus golden retriever) did not influence the outcome. In all variable-screening steps, the breed was nonsignificant, with odds ratios ranging from 0.658 to 0.933, indicating that there was no significant association between breed (Labrador versus golden retriever) and the environmental risk factors.

Results of the univariate analysis are shown in Tables 1 and 2. This analysis suggested that 31 factors might play a protective role or be risk factors for the development of CAD. These factors were submitted to the selection process described in the Materials and Methods, which selected ten risk factors for multivariate analysis. Statistically significant results of the multivariate logistic regression are summarized in Table 3, with six factors having a P -value < 0.05 .

Table 1. Association between month of birth and disease status

Month of birth	Season	No. dogs	No. positive (%)	P -value
1	Winter	28	13 (46.4)	0.426
2	Winter	26	12 (46.2)	0.533
3	Spring	37	13 (35.1)	0.724
4	Spring	40	18 (45)	0.494
5	Spring	33	12 (36.4)	0.853
6	Summer	42	13 (31)	0.315
7	Summer	44	17 (38.6)	1.000
8	Summer	22	4 (18.2)	0.043*
9	Autumn	32	12 (37.5)	1.000
10	Autumn	30	18 (60)	0.019*
11	Autumn	21	8 (38.1)	1.000
12	Winter	27	9 (33.3)	0.683

* P -values < 0.05 (two-sided Fisher's exact test) indicate statistically significant differences between that month and all others combined.

Table 2. Significant associations between examined factors and canine atopic dermatitis in 378 golden and Labrador retrievers in Switzerland (2007)

Potential risk factor	Comparison categories	P-value	Odds ratio	LCL	UCL	Candidates for MV model	Information about the selection of the candidates
(1) Date of birth							
(i) Season (baseline: autumn)	Summer	0.058	0.556	0.304	1.019	No	Excluded; resumed in factor 1b
	Spring	0.320	0.737	0.403	1.346		
	Winter	0.618	0.853	0.456	1.594		
(ii) Warm months (baseline: spring/summer)	Autumn/winter	0.091	1.440	0.944	2.196	Yes	Included; summary of factor 1a
(2) Breeding conditions							
(i) Where kept during puppyhood (baseline: house)	Shed	0.003	22.565	2.849	178.714	No	Excluded; resumed in factor 2b
	Kennel	0.701	0.900	0.526	1.541		
	Kennel and house	0.134	0.542	0.244	1.208		
	Others	0.903	1.086	0.291	4.043		
(ii) Where kept during puppyhood (baseline: all others)	Shed	0.002	24.882	3.202	193.380	Yes	Included; summary of factor 2a
(iii) Age at adoption (baseline: <8 weeks)	8–12 weeks	<0.001	5.651	2.287	13.964	Yes	Included; no correlation to other factors
	>12 weeks	0.056	2.682	0.976	7.372		
(iv) Vaccinating status before adoption (baseline: yes)	No	0.003	0.274	0.118	0.640	No	Excluded; resumed in 2f
(v) Deworming status before adoption (baseline: yes)	No	0.010	0.397	0.196	0.804	No	Excluded; resumed in 2f
(vi) Combination vaccination and deworming (baseline: yes)	No	0.023	0.461	0.237	0.897	Yes	Included; summary of 2d and 2e
(3) Surroundings							
(i) Environment (baseline: rural)	Urban	<0.001	3.582	2.205	5.818	Yes	Included; correlated to factors 3b, 3d, 3f and 3g
(ii) Contact with ruminants (baseline: yes)	No	0.017	1.847	1.114	3.062	No	Excluded; correlated to factor 3a
(iii) Contact with horses (baseline: yes)	No	0.105	1.918	0.873	4.214	Yes	Included; no correlation to other factors
(iv) Home with garden (baseline: yes)	No	0.002	2.418	1.392	4.201	No	Excluded; correlated to factor 3a
(v) Walking in the forest (baseline: yes)	No	0.006	2.465	1.288	4.717	Yes	Included; no correlation to other factors
(vi) Walking through the fields (baseline: yes)	No	0.061	1.705	0.975	2.982	No	Excluded; correlated to factor 3a
(vii) Walking in a town park (baseline: yes)	No	0.073	0.551	0.287	1.058	No	Excluded; correlated to factor 3a
(4) Housing conditions							
(i) Wood-fired heating system (baseline: yes)	No	0.007	2.123	1.228	3.672	Yes	Included; no correlation to other factors
(ii) Parquet floor (baseline: others)	Yes	0.045	1.555	1.010	2.393	Yes	Included; no correlation to other factors
(iii) Plants (baseline: no or some)	Many	0.042	0.429	0.189	0.969	Yes	Included; no correlation to other factors
(iv) Dog basket (baseline: yes)	No	<0.001	0.418	0.255	0.686	Yes	Included; no correlation to other factors
(v) Dog pad (baseline: yes)	No	<0.001	2.362	1.400	3.984	Yes	Included; no correlation to other factors
(vi) Living with other dogs (baseline: yes)	No	<0.001	2.266	1.400	3.667	No	Excluded; resumed in factor 4h
(vii) Living with cats (baseline: yes)	No	0.016	1.697	1.102	2.611	No	Excluded; resumed in factor 4h
(viii) Living with dogs or cats (baseline: yes)	No	<0.001	2.338	1.509	3.622	Yes	Included; summary of factors 4f and 4g
(ix) Mould problems at home (baseline: yes)	No	0.031	2.448	1.084	5.524	Yes	Included; no correlation to other factors
(x) Washing the dog (baseline: yes)	No	0.004	0.525	0.339	0.813	No	Excluded; correlated to factor 4k
(xi) Washing the dog (baseline: no or less than once a month)	Once per week or more	0.071	1.875	0.948	3.705	Yes	Included; correlated to factor 4j
	Less than once per week	0.004	6.865	1.871	25.193		

Table 2. (Continued)

Potential risk factor	Comparison categories	P-value	Odds ratio	LCL	UCL	Candidates for MV model	Information about the selection of the candidates
(5) Feeding							
(i) Food (baseline: other/multiple feeds)	Dry food	0.120	0.692	0.435	1.100	No	Excluded; resumed in factor 5b
	Wet food	0.970	0.984	0.427	2.267		
	Home cooked	0.351	1.708	0.555	5.252		
(ii) Food (baseline: dry food)	All others	0.055	0.662	0.434	1.009	Yes	Included; summary of factor 5a
(iii) Oil supplementation (baseline: yes)	No	0.015	0.374	0.169	0.826	Yes	Included; no correlation to other factors

Odds ratios and confidence limits were derived in a logistic regression model, the breed always being included as a potential confounder. Candidates for the multivariate (MV) model were selected. In order to avoid problems with collinearity in the final model, the association between candidate factors was assessed within the following topic groups: (i) breeding conditions; (ii) environment; (iii) housing; and (iv) feeding, using a cross-tabulation and chi-squared test. Factors within those groups that were significantly associated were either combined or one was excluded from further analysis.

LCL, lower confidence level; UCL, upper confidence level.

Bold values are statistically significant values.

Table 3. Statistically significant risk factors after multivariate analysis

Risk factor	Comparison categories	P-value	Odds ratio	LCL	UCL
Breeding conditions					
Where during puppyhood (baseline: others)	Shed	0.006	19.60	2.37	162.03
Age at adoption (baseline: <8 weeks)	8–12 weeks	0.003	4.89	1.69	14.12
	>12 weeks	0.105	2.86	0.80	10.17
Surroundings					
Environment (baseline: rural)	Urban	0.002	2.67	1.45	4.92
Walking in the forest (baseline: yes)	No	0.033	2.52	1.08	5.90
Housing conditions					
Living with other dogs or cats (baseline: yes)	No	0.020	1.95	1.11	3.43
Washing the dog (baseline: no or less than once a month)	Once per week or more	0.011	21.47	2.05	225.31
	Less than once per week	0.462	1.35	0.61	2.97

All remaining candidates were offered to an automatic forward selection process of the multivariable logistic regression analysis until ten variables (including intercept) were selected in decreasing order of significance. Subsequently, nonsignificant variables ($P < 0.05$) were manually eliminated in a stepwise elimination process. In a final step, breed was forced into the model to correct for any potential confounding effect, and the parameter estimates of those factors remaining in the final model expressed as odds ratios and 95% confidence intervals. Possible interactions were not tested due to the limited number of observations in the final model.

LCL, lower confidence level; UCL, upper confidence level.

Bold values are statistically significant values.

Date of birth

In the multivariate analysis, only the comparison between warm seasons (spring/summer, months March to August) and cold months (autumn/winter, September to February) was taken into account. However, this factor was not associated with a significantly higher or lower risk for the development of the disease in the multivariate analysis.

Breeding conditions

In the risk factors group 'breeding conditions', seven factors were significantly associated with the disease in the univariate analysis. Three were selected for the multivariate analysis, and two had a significant association with CAD.

Puppies kept in a shed outside the breeder's house during puppyhood developed CAD more often (odds ratio 19.6) than dogs kept indoors during the first months of life ($P = 0.006$). Furthermore, dogs adopted between the ages of 8 and 12 weeks developed CAD more often (odds ratio 4.89; $P = 0.011$) than dogs adopted at an age of <8 weeks.

Surrounding area

In this group of risk factors, seven factors were preselected by the univariate analysis. As some of them correlated strongly with each other, only three factors were selected for multivariate analysis. Firstly, we compared the proportions of atopic dogs living in an urban or rural environment in both groups. This analysis revealed that dogs living in urban environments developed CAD more often (odds ratio 2.67) than dogs living in the countryside ($P = 0.002$). It also became apparent that walking the dog regularly in a forest was associated with a significantly lower probability ($P = 0.006$) of developing CAD (odds ratio 0.41).

Housing conditions

Among the 13 risk factors preselected with the univariate analysis, eight were selected for the multivariate analysis and two had a significant association with CAD. While the presence of other animals (dogs and cats) in the same household had a protective effect, dogs living alone ($P = 0.020$) were affected more often (odds ratio 1.95). Shampooing may also influence the disease. In fact, dogs

that were washed once per week ($P = 0.011$) by the owner were more likely to have CAD (odds ratio 21.47) than dogs that were never washed or were washed less than once per week.

Other factors

In the multivariate analysis, feeding-related factors did not reveal an influence on the development of CAD. Possible interactions were not tested owing to the limited number of observations in the final model.

Discussion

To the best of our knowledge, the present study is the third one aiming to explore the role of environmental factors in the development of CAD. The first study was based on insured dogs in Sweden and compared the environment of atopic and nonatopic animals.¹⁰ That study had the advantage of enrolling a large number of animals. However, the disadvantage was that the diagnoses were poorly controlled. The second study was case controlled and included only three breeds.¹¹ A further advantage of the second study was that both the owners and the breeders were asked to fill in the questionnaire. However, the major drawback was the limited number of dogs ($n = 119$). In comparison, our study concentrated on two genetically close breeds in a limited geographical area and enrolled numerous animals using only the owners' questionnaires. These differences should be taken into account when comparing the results.

Epidemiological studies consist of computing odds ratios and determining whether differences are statistically significant or not. It should be kept in mind that while differences may be directly associated with the factors studied, some can be linked to interacting or confounding factors. For example, we demonstrated that living in a city is associated with an increased likelihood of CAD. This could be due to exposure to diesel exhaust particles (as in human beings), the lack of contact with microbes or other factors. In this study, confounding or interacting factors could include boredom (because dogs living in the city usually spend less time outside) or the fact that owners living in a city take their pets to veterinarians more frequently, which results in an increased diagnosis of CAD. In the following discussion, we consider these as potential interacting factors. In addition, some of the factors were not precisely defined and could have been variable. For instance, the responses 'numerous plants' and 'some plants' were not quantified, and the distance of 'lakes, rivers, streams, forest and other animals in the surrounding area' from the owner's residence was not specified.

Walking the dog regularly in a forest and living in a rural area had a protective effect against the development of CAD in this study. It is tempting to interpret this association in the light of some human studies suggesting that urban lifestyles predispose to HAD.¹⁶ However, as mentioned earlier, some factors that are specific to the canine urban lifestyles may also influence the outcome.

The breeding conditions were also shown to play an important role in the development of CAD. Puppies living

outdoors in a shed had a significantly higher incidence of developing CAD than puppies living in a house during the first month of their life. This is surprising, because indoor dogs are more exposed to house dust mite allergens, which are supposed to play a major role in CAD. This finding could be explained by an increased exposure to infectious agents, leading, for example, to diarrhoea and skin infections. These may contribute to an increase in allergen exposure and alteration of the epidermal barrier. Our findings seem to contradict the preliminary findings on the protective effect of endoparasites in dogs with CAD.¹⁷ However, these dogs had already been suffering from CAD. Therefore, a possible protective preventive effect on developing CAD in dogs cannot be evaluated. Moreover, the importance of regular anthelmintic treatment in preventing zoonosis must be considered.

Dogs that were adopted by the new owner at between 8 and 12 weeks of age had a higher risk of developing CAD than dogs adopted at an age of <8 weeks. Between 8 and 12 weeks is the normal age for a puppy to change hands. This period may correspond to a pivotal phase of the development of the immune system, and the exposure or absence of exposure to certain allergens during this period may be crucial for the development of CAD.

Dogs living together with other dogs or with cats were less likely to have CAD than dogs living alone. Similar findings have been reported in humans, which may support the hygiene hypothesis.⁶ One confounding factor could be that the owners of atopic dogs may be less prone to adopt other animals.

Washing the dog once per week or more was strongly correlated with the development of CAD. This correlation derives most certainly from the fact that washing the dog is an element of the normal treatment of allergic dogs. It is, however, also possible that frequent bathing removes sebum, affecting the epidermal lipid layer, thus compromising skin barrier function.

This study provides an overview of the possible risk factors associated with CAD. Some results, such as living in a rural area, are consistent with results found in humans or from earlier veterinary studies. However, this study was carried out in one specific geographical area and only included dogs from two breeds. This may have influenced the results of the study. Similar studies in other countries and/or with other dog populations are warranted to confirm or refute the results. Ideally, cohort studies investigating the influence of specific controlled factors on the development of the diseases should be carried out in the future.

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Appendix Applied questions

No.	Question	Possible answers
1	Date of birth	Day, month and year
2	In which season was the dog born?	In spring (3–5 months), summer (6–8 months), autumn (9–11 months) or winter (12–2 months)
3	In which residential area does the owner live with the dog?	Rural, urban, both (rural and urban) or suburban
4	Is the home of the owner beyond 1000 m above sea level?	Yes or no
5	Are there any lakes, rivers or streams in the surrounding area?	Yes or no
6	Is there a forest in the surrounding area?	Yes or no
7	Are there other animals in the surrounding area?	Dogs/cats, birds, ruminants, horses, rodents (including rabbits) or others
8	Does the owner have a garden?	Yes or no
9	Where does the owner prefer to walk the dog?	In the forest, in the fields, in the city park or other areas
10	Where does the dog live?	House/flat, kennel or elsewhere
11	Where does the dog stay during the day?	Indoors, outdoors or both
12	How is the house/flat heated?	Wood-fired heat, oil-fired heat, filament heat, gas-fired heat or any other heat
13	Was the domicile built after 1970?	Yes or no
14	Which kind of floor is predominant in the house/flat?	Carpet, wooden floor or flagged floor
15	How many plants are there in the house/flat?	A lot of plants, some plants or no plants
16	How often does the owner vacuum?	We grouped the answers as: 1–3 times per week, more than 3 times per week or less than once per week
17	Does the owner use a special vacuum cleaner for allergic people?	Yes or no
18	Does the owner smoke in the residence?	Yes or no
19	In which room does the dog usually stay?	In the owner's bedroom, living room, hallway, office or elsewhere
20	Where does the dog usually lie or rest?	In a dog basket, on a dog pad, in a bed or on the sofa or elsewhere
21	Are there any other animals/pets in the same household?	Yes or no; if yes, list other pet dogs, cats, rodents (including rabbits) or birds
22	Are there or were there any mould problems in the residence?	Yes or no
23	Does the owner regularly use a humidifier?	Yes or no
24	Does the owner regularly use an air freshener?	Yes or no
25	Does the dog regularly swim in water?	Yes or no
26	Does the owner bathe the dog at home?	With shampoo, only with water or no bathing
27	How often does the owner bathe the dog?	We grouped the answers as: every week, once a month or less than once a month
28	Which kind of food does the dog normally eat?	We grouped the answers as: dry food, wet food, home cooked or a combination
29	Does the dog regularly eat leftover food?	Yes or no
30	Does the dog regularly eat treats?	Yes or no
31	Does the dog regularly eat garbage (also faeces, carcasses)?	Yes or no
32	Does the dog receive any food supplement?	We grouped the answers as: vitamins, trace elements, oil and others
33	What kind of material is the dog's food bowl made of?	Plastic, metal or other (glass or ceramic)
34	Is the dog regularly vaccinated?	Yes or no
35	Is the dog regularly dewormed? How often?	We grouped the answers as: twice a year or more, or less than twice a year
36	Where does the dog stay while the owner goes on holiday?	At home, at another place, in a shelter or the dog accompanies the owner on holiday
37	Has the dog ever vacated Switzerland (Germany)?	We grouped the answers as: Mediterranean, Europe excluding Mediterranean, tropics
38	Where does the dog spend its time during the day?	At home, at another place or at your place of work
39	Was the dog imported?	Yes or no
40	Where was the breeder located?	Rural, urban or both (rural and urban)
41	What type of place did the breeding bitch live in?	House/flat, kennel, shed or other
42	How old was the dog when it was adopted by the current owner?	We grouped the answers as: between 8 and 12 weeks, younger than 8 weeks or older than 12 weeks
43	Had the dog been vaccinated and/or dewormed when it was adopted by the owner?	Vaccinated, dewormed, both or neither
44	When it was a puppy, what type of dog food did the puppy eat while it stayed with the breeder?	We grouped the answers as: dry food, wet food, home cooked or multiple
45	When it was a puppy, what did the dog eat when it was living with the owner?	We grouped the answers as: dry food, wet food, home cooked or multiple
46	Has the dog ever had fleas or mites?	Yes or no

Résumé La dermatite atopique canine et humaine (AD) sont des maladies multifactorielles dont l'évolution clinique peut être influencée par plusieurs facteurs comme les prédispositions génétiques, l'environnement, les infections secondaires, les effets de l'alimentation ou psychologiques. Le rôle de l'environnement a été intensivement étudié chez l'homme mais reste peu clair chez le chien. L'objectif de cette étude est d'examiner les facteurs environnementaux de deux races génétiquement proches : Labrador et Golden Retrievers. Des chiens atopiques ont été sélectionnés selon des critères standards en Suisse et en Allemagne puis comparés à des individus sains. Les facteurs environnementaux ont été collectés grâce à une enquête comportant 46 questions portant sur : la date et le lieu de naissance, le mode de vie chez l'éleveur puis chez le propriétaire, l'alimentation et les traitements. La régression logistique univariable et multivariable a été utilisée pour évaluer l'association entre les facteurs de risque potentiels et le statut de la maladie. Les paramètres suivants étaient associés avec une augmentation du risque de développer la maladie : vivre dans un hangar pendant les premiers mois de vie, être adopté entre l'âge de 8 et 12 semaines et laver l'animal régulièrement. En revanche, les facteurs suivants étaient associés à un plus faible risque : vivre en milieu rural, vivre dans un habitat avec d'autres animaux et se promener en forêt. Ces associations ne prouvent pas de causalité mais supportent l'hypothèse primaire que certains facteurs environnementaux peuvent influencer le développement de la dermatite atopique canine. D'autres études sont nécessaires pour confirmer ces résultats et conclusions.

Resumen La dermatitis atópica canina y humana (AD) son enfermedades multifactoriales cuyo desarrollo clínico puede verse influido por diversos factores como la base genética, ambiente, infecciones secundarias, alimentación y efectos psicológicos. El papel del ambiente ha sido estudiado ampliamente en humanos, pero permanece poco aclarado en perros. El propósito de este estudio fue examinar los factores ambientales en dos razas genéticamente relacionadas: Labrador y Golden Retriever. Utilizando criterios estándar se seleccionaron perros atópicos en Suiza y Alemania y se compararon con individuos sanos. La información de los factores ambientales se recopiló utilizando un cuestionario de 46 preguntas incluyendo: día y lugar de nacimiento, modo de vida en casa del criador y del propietario, alimentación y tratamientos. Se utilizó un análisis de regresión logística de una variante entre factores potenciales de riesgo y el estado de enfermedad. Los siguientes parámetros se asociaron con un mayor riesgo de desarrollo de enfermedad: haber vivido en una perrera durante la vida de cachorro, adopción a una edad entre 8 y 12 semanas y lavar al perro regularmente. En contra, los siguientes factores se asociaron con menor riesgo: vida en un ambiente rural, vivir en una casa con otros animales y caminar en el bosque. Estas asociaciones no son prueba de causa, pero apoyan la hipótesis inicial de que ciertos factores ambientales pueden influir el desarrollo de dermatitis atópica canina. Se necesitan otros estudios para confirmar estos resultados y conclusiones.

Zusammenfassung Die atopische Dermatitis (AD) des Hundes und des Menschen ist eine facettenreiche Erkrankung, deren klinische Entwicklung von verschiedenen Faktoren wie zum Beispiel dem genetischen Hintergrund, der Umgebung, Sekundärinfektionen, Futter und psychischen Faktoren beeinflusst sein kann. Beim Menschen wurde der Einfluss der Umgebung bereits ausführlich untersucht, bleibt aber bei Hunden noch unklar. Das Ziel dieser Studie war es, die Umweltfaktoren bei zwei nahestehenden Rassen, dem Labrador und dem Golden Retriever, zu untersuchen. Mittels Standardkriterien wurden atopische Hunde in der Schweiz und in Deutschland ausgewählt und mit gesunden Individuen verglichen. Die Information über die Umgebung wurde mit Hilfe eines Fragebogens gesammelt, der 46 Fragen, wie: Datum und Ort der Geburt, Lebensweise beim Züchter und beim Besitzer, Futter und Behandlungen beinhaltete. Univariate logistische Regression und multivariable logistische Regression wurden verwendet, um den Zusammenhang zwischen möglichen Risikofaktoren und Status der Krankheit zu erheben. Die folgenden Parameter wurden mit einem erhöhten Risiko die Krankheit zu entwickeln in Zusammenhang gebracht: als Welpen in einer Hütte zu leben, im Alter von 8 bis 12 Wochen adoptiert zu werden und regelmäßiges Waschen. Im Gegensatz dazu wurden die folgenden Faktoren mit einem diesbezüglich geringeren Risiko gesehen: in einer ländlichen Umgebung zu wohnen, in einem Haushalt mit anderen Tieren zu leben und im Wald spazieren zu gehen. Diese Zusammenhänge beweisen die Ursachen nicht, unterstützen aber die primäre Hypothese, dass gewisse Umweltfaktoren die Entwicklung von caniner AD beeinflussen können. Es sind weitere Studien nötig, um diese Ergebnisse und Schlussfolgerungen zu beweisen.

要約 犬とヒトのアトピー性皮膚炎 (AD) は多面性疾患で、それらの臨床的な発症は遺伝的な背景、環境、二次感染、食事、心理的な要因などによって影響をうけることがある。環境の役割はヒトでは大規模に検討されているが、犬ではまだ明らかではない。この研究の目的は環境因子を遺伝学的に近い2つの犬種：ラブラドルレトリバーとゴールデンレトリバーで調査することである。標準的な診断基準を用いて、スイスとドイツ国内でアトピーの犬を選択し、健康犬と比較した。環境因子の情報は生年月日、出生地、ブリーダーに飼われていた時の生活様式、飼主に飼われている時の生活様式、食事や治療など46の質問形式で収集した。可能性のあるリスク要因と病態との相関を評価するために、単変量または多変量ロジスティック回帰法を使用した。以下のパラメーターは疾患の発症リスクの高いことと関係していた：仔犬期の納屋での生活、生後8-12週齢での譲渡、定期的な犬のシャンプー。対照的に以下の因子は低いリスクとして関係していた：田舎の環境での生活、家庭での他の動物との生活、森の中での散歩。これらの関係は因果関係を説明することはできないが、特定の環境因子がイヌのADの発症に影響するかもしれないという第一義的な仮説を支持する。さらなる調査がこれらの結果と結論を確認するために必要である。