

# Dog allergen levels in homes with hypoallergenic compared with nonhypoallergenic dogs

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## ABSTRACT

**Background:** Despite the public interest in hypoallergenic dogs, few scientific, including epidemiological studies have attempted to evaluate claims of hypoallergenicity. This study was designed to determine whether dog breeds reported as hypoallergenic correspond to lower dog allergen in the home versus nonhypoallergenic dogs.

**Methods:** A web search was conducted to identify breeds cited as hypoallergenic. Four separate classification schemes using combinations of purebred and mixed breed dogs were used to compare the levels of *Canis familiaris* 1 in dust samples collected from homes with hypoallergenic versus nonhypoallergenic dogs from an established birth cohort.

**Results:** No classification scheme showed that the level of dog allergen in homes with hypoallergenic dogs differed from other homes.

**Conclusion:** Dog-allergic individuals should have access to scientifically valid information on the level of allergen shedding of different breeds of dogs. (Am J Rhinol Allergy 25, 252–256, 2011; doi: 10.2500/ajra.2011.25.3606)

Public interest in hypoallergenic dog breeds recently flourished with the selection of Bo, the First Dog, a topic of national interest;<sup>1,2</sup> however, this enthusiasm still has not translated to peer-reviewed scientific publications assessing whether specific breeds or dog characteristics are associated with “hypoallergenicity”—defined here as dogs that disperse less dog allergen in their surroundings. Little is known about the discovery of the “hypoallergenic dog,” but labeling dogs under this moniker originates from the late 20th century.<sup>3,4</sup> Few scientific studies on allergen levels by dog breed have been published.<sup>4–6</sup> Published studies present findings from studies where dogs were shaved and dander was extracted from the hair.<sup>4,5</sup> Despite sound methodology for detecting allergens, these studies involved only a handful of dogs from a limited number of dog breeds. Furthermore, analysis from hair samples removed from the dog may represent a suboptimal approach to estimating allergen shedding in contrast to measuring allergen in a fashion that more closely approximates natural allergen accumulation in homes. We recently investigated a variety of dog characteristics and the allergen levels in their corresponding homes.<sup>7</sup> The aim of our current analyses was to identify whether groupings of dog breeds based on claims of hypoallergenicity influence the accumulation of the major dog allergen, *Canis familiaris* 1 (Can f 1), levels in homes.

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## METHODS

The methodology for the Wayne County Health, Environment, Allergy, and Asthma Longitudinal Study (WHEALS) has been described in detail elsewhere.<sup>8</sup> This research was approved by the Henry Ford Health System Institutional Review Board. Briefly, urban and suburban Detroit residents with an estimated date of confinement during our study enrollment window were recruited during a second or third trimester prenatal visit to a Henry Ford Health System obstetrics clinic. Interviews were conducted at recruitment and at the 1-month postpartum home visit.

Dust samples were collected at the 1-month postpartum visit and processed thereafter using a standardized protocol.<sup>8,9</sup> The dust sample was assayed using standard monoclonal antibody assays (Indoor Biotechnologies, Ltd., Charlottesville, VA) with a lowest detectable limit of 0.5 ng of allergen per milliliter of saline. Units for allergen dust measurements were converted to micrograms of allergen per gram of fine dust ( $\mu\text{g/g}$ ) to make them comparable with the literature. Because of financial constraints, only dust from the floor of the baby's bedroom was analyzed for Can f 1.

Dog breed, number of dogs in the home, and whether the dog was allowed in the baby's bedroom were based on maternal report during a personal interview in her home. The dog's altered (neutered) status and time the dog was indoors daily were also captured in this interview. Living in the city of Detroit was defined as living in an “urban” area versus living in a suburban residence. Detailed information on these and other dog characteristics is available.<sup>7</sup> The focus of this discussion involves the hypoallergenic categorization of study dogs. Only homes with one dog were included in the following categorization schemes for assessing hypoallergenicity.

For hypoallergenic classification of each dog, four separate schemes were constructed to facilitate comparison of allergen levels. Dogs were assigned to these four hypoallergenic categorization groupings based on popular report by breed.<sup>10–25</sup> Table 1 lists the sources identifying the breed as hypoallergenic. All dog breeds that were ever cited during the web search (detailed later) as being hypoallergenic are included in Table 1. Breeds not listed in Table 1 (>100 breeds) were not identified by any cited web resource as hypoallergenic.

The first scheme, “Scheme A,” consisted only of purebred dogs, where hypoallergenic dogs, *i.e.*, breeds cited by at least 25% of web resources (identified through Internet searches using the following key words: “hypoallergenic dogs” or “hypoallergenic dog breeds”) as hypoallergenic, were compared with other purebreds. “Scheme

Table 1 Breeds cited as “hypoallergenic” and their references

| Breed                       | Reference(s)                              | Schemes A–C* | Scheme D* |
|-----------------------------|---|--------------|-----------|
| Affenpinscher               | 24  |              |           |
| Airedale Terrier            | 11, 13–15, 20, 21, 23, and 24             | X            |           |
| American Hairless Terrier   | 13–16, 18, 20, 24, and 25                 | X            |           |
| Australian Terrier          | 21 and 24                                 |              |           |
| Barbet                      | 11  |              |           |
| Basenji                     | 10–18, 20, 24, and 25                     | X            |           |
| Bedlington Terrier          | 10, 11, 13–17, 19, 20, and 23–25          | X            | X         |
| Bergamasco                  | 11, 13, 15, and 23                        | X            |           |
| Bichon Frise                | 10–17 and 19–25                           | X            | X         |
| Bolognese                   | 11, 13, 15, 24, and 25                    | X            |           |
| Border Terrier              | 10, 11, 13, 15, 18, and 20                | X            |           |
| Bouvier des Flandres        | 11, 15, and 21                            |              |           |
| Brussels Griffon            | 24  |              |           |
| Cairn Terrier               | 11, 13–15, 17, 18, 20, 21, and 24         | X            |           |
| Cesky Terrier               | 24  |              |           |
| Chihuahua                   | 12, 16, 21, and 22                        | X            |           |
| Chinese Crested             | 10–21 and 23–25                           | X            | X         |
| Coton de Tuléar             | 10, 11, 13, 15–17, and 23–25              | X            |           |
| Dandie Dinmont Terrier      | 11, 23, and 24                            |              |           |
| Fox Terrier                 | 17 and 24                                 |              |           |
| Giant Schnauzer             | 13–15, 19, 21, 24, and 25                 | X            | X         |
| Glen of Ismaal Terrier      | 24  |              |           |
| Greyhound                   | 11  |              |           |
| Havanese                    | 10–15, 17, 18, 20, and 23–25              | X            |           |
| Irish Terrier               | 22 and 24                                 |              |           |
| Irish Water Spaniel         | 10, 11, 13–17, 19, 21, and 23–25          | X            | X         |
| Italian Greyhound           | 11, 12, 16, 21, 24, and 25                | X            |           |
| Kerry Blue Terrier          | 10–20 and 23–25                           | X            | X         |
| Khala (hairless)            | 13 and 15                                 |              |           |
| Komondor                    | 16 and 25                                 |              |           |
| Lagotto Romagnolo           | 11, 13, 15, and 23                        | X            |           |
| Lakeland Terrier            | 24  |              |           |
| Lhasa Apso                  | 11 and 14                                 |              |           |
| Löwchen                     | 13, 15, 24, and 25                        | X            |           |
| Maltese                     | 10–21 and 23–25                           | X            | X         |
| Miniature Schnauzer         | 11–15, 18–21, and 23–25                   | X            | X         |
| Norfolk Terrier             | 21 and 24                                 |              |           |
| Norwich Terrier             | 21 and 24                                 |              |           |
| Peruvian Inca Orchid        | 11, 13, 15, 16, and 23–25                 | X            |           |
| Polish Lowland Sheepdog     | 15 and 23                                 |              |           |
| Poodle (miniature)          | 11, 14, 15, 19, and 21–25                 | X            | X         |
| Poodle (standard)           | 10 and 12–25                              | X            | X         |
| Poodle (toy)                | 13–15 and 18–25                           | X            | X         |
| Portuguese Water Dog        | 10–25                                     | X            | X         |
| Puli                        | 10, 11, 13, 15, 16, 20, 21, 23, and 25    | X            |           |
| Samoyed                     | 11  |              |           |
| Scottish Terrier            | 11 and 24                                 |              |           |
| Sealyham Terrier            | 24  |              |           |
| Shih Tzu                    | 10, 11, 13–15, 17, 18, 20, 23, and 24     | X            |           |
| Silky Terrier               | 11 and 24                                 |              |           |
| Soft Coated Wheaten Terrier | 10, 12–21, 24, and 25                     | X            | X         |
| Spanish Water Dog           | 13, 15, 18, 20, and 24                    | X            |           |
| Standard Schnauzer          | 10, 13–21, 24, and 25                     | X            | X         |
| Tibetan Terrier             | 13, 15, 18, 20, 21, 24, and 25            | X            |           |
| Welsh Terrier               | 21, 24                                    |              |           |
| West Highland White Terrier | 11, 13, 15, 18, 20, and 24                | X            |           |
| Wire Fox Terrier            | 11, 13–15, 18, and 20                     | X            |           |
| Wirehaired Pointing Griffon | 24  |              |           |
| Xoloitzcuintli              | 10, 12, 13, 15, 16, 19, 21, 24, and 25    | X            | X         |
| Yorkshire Terrier           | 10, 11, 13–15, 17, 18, 20, 21, 23, and 24 | X            |           |

\*An “X” denotes breeds included in specified analyses as “hypoallergenic.” Breeds were labeled as “hypoallergenic” if  $\geq 25\%$  of references cited the breed as “hypoallergenic.” Scheme A compared hypoallergenic purebred dogs to other purebreds. Scheme B compared purebred and mixed breed dogs with at least one hypoallergenic parent to purebred nonhypoallergenic dogs. Scheme C compared purebred and mixed breed dogs with at least one known hypoallergenic parent to purebred and mixed breed dogs with no known hypoallergenic component. Scheme D compared only those purebred dogs identified as hypoallergenic by the American Kennel Club to all other dogs.

Table 2 Percent of one-dog homes where the dog was allowed indoors with nondetectable dog allergen levels by hypoallergenic status, WHEALS cohort, Detroit, MI

| Hypoallergenic Status by Scheme | Detectable <i>n</i> (row %) | Nondetectable <i>n</i> (row %) | Fisher's Exact <i>p</i> Value |
|---------------------------------|-----------------------------|--------------------------------|-------------------------------|
| Scheme A*                       |                             |                                | 0.35                          |
| Hypoallergenic                  | 25 (100%)                   | 0 (0%)                         |                               |
| Not hypoallergenic              | 114 (93.4%)                 | 8 (6.6%)                       |                               |
| Scheme B#                       |                             |                                | 0.35                          |
| Hypoallergenic                  | 28 (100%)                   | 0 (0%)                         |                               |
| Not hypoallergenic              | 114 (93.4%)                 | 8 (6.6%)                       |                               |
| Scheme C§                       |                             |                                | 0.37                          |
| Hypoallergenic                  | 28 (100%)                   | 0 (0%)                         |                               |
| Not hypoallergenic              | 135 (93.1%)                 | 10 (6.9%)                      |                               |
| Scheme D¶                       |                             |                                | 0.99                          |
| Hypoallergenic                  | 9 (100%)                    | 0 (0%)                         |                               |
| Not hypoallergenic              | 154 (93.9%)                 | 10 (6.1%)                      |                               |

\*Hypoallergenic purebred dogs vs other purebreds.

#Purebred and mixed breed dogs with at least one hypoallergenic parent vs purebred nonhypoallergenic dogs.

§Purebred and mixed breed dogs with at least one known hypoallergenic parent versus purebred and mixed breed dogs with no known hypoallergenic component.

¶Purebred dogs identified as hypoallergenic by the American Kennel Club vs all other dogs.

WHEALS = Wayne County Health, Environment, Allergy, and Asthma Longitudinal Study.

Table 3 Can f 1 levels\* by canine characteristic, # WHEALS cohort, Detroit, MI

|                    | One-Dog Homes (home with detectable levels only) |      |            |                |                                   |      |           |                |
|--------------------|--|------|------------|----------------|-----------------------------------|------|-----------|----------------|
|                    | Dog Allowed in Baby's Bedroom                    |      |            |                | Dog Not Allowed in Baby's Bedroom |      |           |                |
|                    | <i>n</i>   | GM   | 95% CI     | <i>p</i> Value | <i>n</i>                          | GM   | 95% CI    | <i>p</i> Value |
| Scheme A§          |  |      |            | 0.88¶          |                                   |      |           | 0.35¶          |
| Hypoallergenic     | 12   | 2.43 | 0.43–13.8  |                | 13                                | 1.27 | 0.29–5.51 |                |
| Not hypoallergenic | 56   | 3.07 | 1.69–5.60  |                | 58                                | 0.64 | 0.37–1.11 |                |
| Scheme B           |  |      |            | 0.38¶          |                                   |      |           | 0.57¶          |
| Hypoallergenic     | 14   | 1.46 | 0.28–7.48  |                | 14                                | 1.00 | 0.23–4.23 |                |
| Not hypoallergenic | 56   | 3.07 | 1.69–5.60  |                | 58                                | 0.64 | 0.37–1.11 |                |
| Scheme C**         |  |      |            | 0.39¶          |                                   |      |           | 0.69¶          |
| Hypoallergenic     | 14   | 1.46 | 0.28–7.48  |                | 14                                | 1.00 | 0.23–4.23 |                |
| Not hypoallergenic | 69   | 2.88 | 1.63–5.07  |                | 66                                | 0.73 | 0.43–1.25 |                |
| Scheme D##         |  |      |            | 0.90¶          |                                   |      |           | 0.15¶          |
| Hypoallergenic     | 5  | 2.58 | 0.05–130.2 |                | 4                                 | 3.02 | 0.33–27.6 |                |
| Not hypoallergenic | 78   | 2.56 | 1.49–4.42  |                | 76                                | 0.72 | 0.43–1.20 |                |

\*All Can f 1 units are in micrograms per gram.

#Not all characteristics are known for each dog; therefore, there are missing data.

§Hypoallergenic purebred dogs vs other purebreds.

¶Wilcoxon rank sum test.

||Purebred and mixed breed dogs with at least one hypoallergenic parent versus purebred non-hypoallergenic dogs.

\*\*Purebred and mixed breed dogs with at least one known hypoallergenic parent vs purebred and mixed breed dogs with no known hypoallergenic component.

##Purebred dogs identified as hypoallergenic by the American Kennel Club vs all other dogs.

Can f 1 = Canis familiaris 1; CI = confidence interval; GM = geometric mean.

B" compared purebred and mixed breed dogs with at least one hypoallergenic parent to purebred nonhypoallergenic dogs. "Scheme C" compared purebred and mixed breed dogs with at least one known hypoallergenic parent to purebred and mixed breed dogs with no known hypoallergenic component, and "Scheme D" compared only those purebred dogs identified as hypoallergenic by the American Kennel Club, a well-recognized national organization in the United States devoted to dogs, to all other dogs. For example, the "Labradoodle," a popular half labrador retriever, half poodle combination cited by numerous websites<sup>10–15</sup> to be hypoallergenic, would be excluded from Scheme A because it is not a purebred dog, would be categorized as hypoallergenic in Schemes B and C, but would be classified as nonhypoallergenic in Scheme D. It was beyond the scope of the original

birth cohort study to personally confirm the reported breed of the dogs.

Because Can f 1 was not normally distributed, geometric means and 95% confidence intervals (95% CI) were used to summarize the data. Wilcoxon rank sum statistics were calculated for all two-group comparisons. Can f 1 was log-transformed before inclusion in the regression models because of skewness of the data.

## RESULTS

There were 190 one-dog families with dog allergen data at the 1-month data point whose dog had identifiable breed information. In 17 of the 190 homes, the dog was not allowed indoors at all and these homes were excluded from further analyses. Table 2 shows

the percent of homes with detectable Can f 1 levels by hypoallergenic status within the four classification schemes. Of the 173 homes, 163 (94.2%) had detectable levels of Can f 1. There were no statistically significant differences in percent of homes with detectable Can f 1 by hypoallergenic status using any of the four classification schemes.

Dog allergen levels specific to the four hypoallergenic classification schemes are shown in Table 3, stratified by whether the dog was allowed in the room where the sample was collected. For homes with detectable dog allergen levels, these dog allergen levels did not differ between homes with hypoallergenic dogs versus homes with nonhypoallergenic dogs for any of the four classification schemes, regardless of whether the dog was allowed in the baby's bedroom (all,  $p > 0.05$ ). Because each home had the same amount of surface area vacuumed for Can f 1 quantification, we were also able to assess for differences in hypoallergenic status by micrograms of Can f 1 per square foot. For homes with detectable allergen levels, there was no difference in weight of Can f 1 per square foot by any of the hypoallergenic schemes ( $p > 0.20$ , data not shown). After adjusting for whether the dog was allowed in the baby's bedroom, weight of the dog, length of dog ownership, time the dog was indoors daily, the floor surface assessed for dog allergen, and location of residence, no hypoallergenic scheme was significantly associated with dog allergen level ( $p > 0.20$ , data not shown).

## DISCUSSION

Hypoallergenic classification schemes yielded no statistically significant differences between reportedly hypoallergenic and nonhypoallergenic dogs when considered as either the percentage of homes with detectable dog allergen levels or as the level of dog allergen in homes where it was measurable. When dogs were restricted from the room sampled for Can f 1, homes with hypoallergenic dogs had consistently higher levels of Can f 1, although these differences were not statistically significant. In homes where the dog was allowed in the bedroom, Can f 1 levels were slightly lower for homes with hypoallergenic dogs in three of the four schemes, but these differences also did not achieve statistical significance. Can f 1 levels did not appear to be highly influenced by dog characteristics such as weight or ownership variables such as time spent indoors.

Despite these noteworthy findings, there are a few limitations worth mentioning. The amount of time the dog spent in the baby's bedroom (the floor surface assessed for Can f 1) was not collected and this variable may have confounded the association if type of breed was associated with time in the bedroom. Capturing time the dog spent in the baby's bedroom would have clarified whether hypoallergenic status is related to Can f 1 or merely a dose-response effect related to amount of time the dog was allowed in the bedroom. Having larger sample sizes may also have provided the ability to more precisely assess whether hypoallergenic dogs disperse less Can f 1 in their surroundings than nonhypoallergenic dogs.

Collecting samples directly from the dog as opposed to from the floor of the baby's bedroom may have made our results more similar to the few in the literature; however, the goal was not to replicate these laboratory studies, but rather to learn if certain breeds of dogs were associated with lower levels of dog allergen in the home. Similarly, having study staff assess each dog to personally discern dog breed as opposed to relying on maternal report may have affected our findings; however, our research team was not trained in dog breed ascertainment and because the study focused on many biological and environmental determinants of allergic disease, there is no reason to believe that study respondents would intentionally report their dog to be a breed other than its actual breed. Hence, any over- or underreporting of hypoallergenicity should be nondifferential and not bias our results. Assessing Can f 1 by individual dog breeds may have

clarified which specific dog breeds were associated with decreased levels of dog allergen but sample size did not allow for analyses by single breeds.

Despite these few limitations, our study had many strengths. Our study used data from a general-risk, population-based birth cohort study with a large sample size. Furthermore, our study families used numerous dog-keeping practices with a robust selection of dog breeds. Unlike the laboratory-based studies,<sup>4,5</sup> we did not find any collection of breeds to be associated with Can f 1 levels; however, with larger breed-specific sample sizes, our results may have been more comparable with theirs.

There was no evidence for differential shedding of allergen by dogs grouped as hypoallergenic. Clinicians should advise patients that they cannot rely on breeds deemed to be "hypoallergenic" to in fact disperse less allergen in their environment. Additional scientific investigation into dog-specific factors and whether hypoallergenic breeds truly exist is warranted.

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