

# A retrospective analysis of case series using home-prepared and chicken hydrolysate diets in the diagnosis of adverse food reactions in 181 pruritic dogs

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## Abstract

**The purpose of this retrospective study was to compare home-prepared and chicken hydrolysate diets in the diagnosis of canine adverse food reactions (AFR). Seventy-two dogs were fed home-prepared diets and 109 were fed hydrolysate. Owners chose the type of diet at presentation, and ingredients of home-prepared diets were selected depending on each dog's dietary history. Ectoparasitic infestations and microbial infections were treated during the trials. Cutaneous and gastrointestinal signs and pruritus scores were recorded before starting the diet, 6 weeks into the trials and after provocation with the original diets. AFR was diagnosed if pruritus resolved during the trial and recurred on dietary provocation. The dropout rate was lower for home-prepared diets although not statistically significant (18.1% home prepared; 24.7% hydrolysate,  $P = 0.377$ ). AFR alone was diagnosed in 10 dogs (17%) using home-prepared diets and in 15 (18.3%) fed the hydrolysate. Gastrointestinal problems were more frequent in dogs with AFR than in dogs without AFR ( $P = 0.001$ ). Another 11 dogs (18.6%) in the home-prepared diet group and 20 (24.4%) in the hydrolysate diet group had AFR concurrent with other pruritic diseases, mainly atopy. The similar frequencies of AFR diagnosis in the two groups ( $P = 0.837$  AFR;  $P = 0.416$  concurrent AFR) indicate that the chicken hydrolysate diet may be a valuable alternative to home-prepared diets in the diagnosis of canine AFR. Prospective cross-over studies are warranted to confirm these findings.**

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## Introduction

Adverse food reactions (AFR) are well recognized as differential diagnoses for nonseasonal pruritic skin and ear diseases in dogs. Gastrointestinal signs, respiratory and neurological problems have also been attributed to AFR.<sup>1,2</sup>

These reactions are thought to include immune-mediated (food allergies) and nonimmune-mediated (food intolerances or nonallergic food hypersensitivities) pathomechanisms,<sup>3,4</sup> although this differentiation is rarely made in veterinary clinical practice.

The prevalence of canine AFR reported in the literature varies and remains controversial, possibly due to the difficulties associated with its diagnosis.<sup>5–7</sup> Within a referral population of dogs, earlier studies estimated AFR to be responsible for 10% to 15% of canine allergic dermatoses.<sup>8,9</sup> More recently, AFR is described in 20–35% of dogs with nonseasonal pruritus as the sole cause for skin disease.<sup>6,7,10</sup>

Dietary elimination trials followed by dietary provocation remain the procedure of choice for the diagnosis of suspected AFR while serological, intradermal and gastroscopic challenge tests have not been proven reliable in diagnosing canine AFR.<sup>11–18</sup> However, feeding a prescribed diet exclusively for a minimum of 6 weeks according to current recommendations requires owners' cooperation, discipline and patience, and up to one-third of dogs enrolled in food trials at referral centres may dropout mainly for lack of owners' compliance.<sup>1,6,10,19</sup>

Diets for diagnostic trials can either be home-prepared foods or commercial products. Home-prepared diets are traditionally recommended as the 'gold standard' for the diagnosis of canine AFR as they can be tailored to each dog's dietary history individually, avoiding foods to which the animal has already been exposed.<sup>20,21</sup> However, such diets are labour-intensive for owners and ingredients novel to the dog may not be readily available. They are also not adequate for maintenance after diagnosis or for diagnosis in young, growing dogs.<sup>22,23</sup>

Commercial diets using limited and less commonly fed ingredients have been shown to be inferior to home-cooked diets in most comparative studies in the diagnosis of AFR.<sup>11,19,24,25</sup> Furthermore, individual dogs have been described that tolerate home-prepared ingredients but not their commercially prepared versions, raising concerns over processing additives.<sup>1,19,26</sup> Although allergenic food additives have been identified in human food, they have not been characterized in dog foods.<sup>27</sup>

More recently, hydrolysed veterinary diets have been introduced for the diagnosis of canine AFR. During hydrolysis, protein sources, including chicken, poultry liver, casein and soy, are enzymatically broken down to polypeptides, changing and reducing the allergenic properties of the molecules.<sup>28,29</sup> In one study, the majority (11/14) of dogs with confirmed adverse reactions to soy and corn did not show a flare-up of their skin disease when fed a soy hydrolysate and cornstarch diet.<sup>16</sup> Differences in the degree of hydrolysatation and the protein source can

| Pruritus category | Owner observation                                                                                 |
|-------------------|---------------------------------------------------------------------------------------------------|
| Normal            | Brief scratching, rubbing or licking once or twice daily                                          |
| Minimal           | Scratching, rubbing or licking briefly and occasionally during the day                            |
| Mild              | Frequent scratching, rubbing or licking during the day                                            |
| Moderate          | Longer, more intense scratching, rubbing or licking episodes with signs of distress               |
| Severe            | Scratching, rubbing or licking at every opportunity and even at night associated with self-trauma |

**Table 1.** Categories offered to dog owners for assessment of pruritus

influence the clinical response as shown in experimentally sensitized dogs.<sup>30</sup> Two clinical investigations into possible AFR in pruritic dogs, one using a commercially available chicken hydrolysate diet,<sup>10</sup> the other a soy-based hydrolysate,<sup>7</sup> reported similar frequencies of AFR as diagnosed in a study with home-prepared diets.<sup>6</sup>

This paper describes two case series on dietary trials with pruritic dogs fed either home-prepared diets or a commercial chicken hydrolysate and maize starch diet. Data on clinical signs and diagnostic criteria of the dietary trials were collected retrospectively. The proportions of dogs diagnosed with AFR using the two different diets were compared retrospectively in order to assess the appropriateness of the two test diets in the diagnosis of canine AFR.

## Materials and methods

All study dogs had been referred to the Dermatology Service of the Queen Mother Hospital for Animals, Royal Veterinary College, between June 2001 and September 2004. Inclusion and exclusion criteria, case management and data recording were as described in a previous retrospective study from which 63 dogs were also included in this comparison.<sup>10</sup> All dogs had been followed through their dietary trial period by one of four clinicians, all using the same protocol for investigating suspected allergic skin disease. Data that had not been recorded in the case files were obtained from owners by telephone follow-up calls.

Briefly, the dogs presented with nonseasonal generalized, widespread or localized pruritus with or without secondary microbial skin infections and otitis. Ectoparasitic infestations were excluded prior to enrolment and parasitocidal therapy was continued throughout the trial. To investigate probable allergic skin disease in these dogs, the requirement for and implications of dietary trials were explained to owners in detail. They were asked to choose either a home-prepared diet or a commercial diet marketed for the diagnosis of AFR to be fed exclusively for a minimum of 6 weeks. Following the owner's decision on the type of diet, ingredients, one meat and one carbohydrate source novel to the pet were jointly chosen by the owner and clinician for home-prepared foods, taking into account the dog's previous food history. For commercial diets, the clinician chose a hydrolysed diet, taking into account the pet's food history, availability and cost. In some dogs, the trials were extended to 8 weeks if clinician and owner anticipated further improvement of pruritus after the 6-week assessment. Following the dietary trial, the dogs resumed their original diet including all supplements and treats within 24 h and clinical signs were re-evaluated 2 to 14 days later, depending on their recurrence.

Data were evaluated for dogs fed home-prepared diets (group 1), irrespective of diet ingredients, and for those fed a commercial chicken hydrolysate and maize starch diet (group 2) (Hill's Prescription Diet Canine z/d ULTRA Allergen-Free; Hill's Pet Nutrition Inc., Topeka, KS, USA). The home-prepared diets consisted of white fish and potatoes in 52 cases, rabbit and potatoes in 13, turkey and potatoes in three, lamb and potatoes in two and white fish and rice in two cases. Dogs were included in the study if they were presented at least once after starting the diet. Dogs that had not adhered to the diet or did not complete the food trial were recorded as dropouts.

Cutaneous changes (erythema, scaling, excoriations and erosions, interdigital nodules, otitis, urticaria, pyotraumatic dermatitis), microbial infections (pyoderma, *Malassezia* dermatitis, microbial otitis), their distribution, gastrointestinal problems, body weight and defecation frequency were recorded by the clinician, while pruritus was scored (minimal, mild, moderate and severe, Table 1) by the owners before and after the dietary trial and again after dietary rechallenge. At the end of the trial, owners were asked to assign a score of excellent, good, moderate or poor to the diet's palatability as observed during feeding their dog.

Microbial infections of the skin and ear were treated until resolution during the dietary trials and antimicrobial therapy was continued, where appropriate, during the rechallenge period to avoid confusion over recurrence of infection-associated pruritus. Oral prednisolone and topical glucocorticoids were allowed for all dogs requiring anti-inflammatory treatment to alleviate their pruritus. Oral glucocorticoids were withdrawn at least 2 weeks and topical glucocorticoids at least 2 days before the end of the food trials.

AFR as the sole cause of pruritic dermatitis was diagnosed if the dog's pruritus had resolved or decreased to minimal levels during the trial, but recurred when resuming the original diet. If pruritus had reduced to mild or moderate levels and increased by at least one category on provocation, concurrent AFR was diagnosed and concurrent pruritic diseases were suspected and investigated. AFR was considered unlikely, if pruritus had not increased within 2 weeks of dietary challenge.<sup>1</sup> Atopic dermatitis was diagnosed clinically according to Willemse's criteria.<sup>31</sup> Predominant clinical signs and microbial infections at presentation were compared between dogs later diagnosed with AFR, concurrent AFR and without AFR.

## Statistical analysis

The two groups were compared using the Pearson chi-square test, taking into account the continuity correction estimate. Data analysed included the number of dogs diagnosed with AFR, microbial infection, clinical signs (otitis, pyoderma, *Malassezia* dermatitis and gastrointestinal signs) and mean defecation frequencies before and after the trial. Changes in bodyweight during the trial, age at the time of the trial and age at onset of clinical signs were compared using the two-sided paired *t*-test. A *P*-value of less than 0.05 was used to indicate statistical significance.

## Results

One hundred and eighty-one pruritic dogs were enrolled. Breed, age at presentation and age at onset of pruritus of the dogs are presented in Tables 2 and 3. The majority of dogs (129 dogs, 71.3%) showed generalized or widespread cutaneous changes; in others they were more localized to the face and pinnae (14 dogs), the paws (17 dogs), the ventrum (13 dogs) or the perianal skin (8 dogs). Inflammatory skin disease without secondary microbial infection was seen in 65 dogs (35.9%), including two dogs with urticaria, two with pyotraumatic dermatitis and three dogs with erythema and generalized scaling; secondary microbial infections and common clinical signs are summarized in Table 4. Three dogs presented with otitis as the only clinical sign, while otitis was concurrent in 120 of pruritic dogs (66.3%). Otitis was purely inflammatory in 58 dogs (48.3%); macroscopic and otoscopic examination

**Table 2.** Breed distribution at presentation in each case series (group 1 fed home-prepared diets; group 2 fed chicken hydrolysate) and among dogs diagnosed with adverse food reactions (AFR) using either diet

| Breed                               | Dogs in group 1<br><i>n</i> = 72 | Dogs in group 2<br><i>n</i> = 109 | Dogs with AFR/concurrent AFR<br><i>n</i> = 56                                          |
|-------------------------------------|----------------------------------|-----------------------------------|----------------------------------------------------------------------------------------|
| Boxer                               | 2                                | 3                                 | 3                                                                                      |
| Bullterrier                         | 7                                | 3                                 | 2                                                                                      |
| Crossbred                           | 3                                | 8                                 | 2                                                                                      |
| German shepherd dog                 | 5                                | 12                                | 7                                                                                      |
| Jack Russel terrier                 | 3                                | 5                                 | 2                                                                                      |
| Labrador retriever                  | 17                               | 23                                | 9                                                                                      |
| Setter                              | 2                                | 4                                 | 2                                                                                      |
| Spaniel                             | 6                                | 7                                 | 6                                                                                      |
| West Highland white terrier         | 4                                | 11                                | 6                                                                                      |
| Other large breeds (dogs > 20 kg)   | 15 (10 different breeds)         | 23 (13 different breeds)          | 10 (3 bulldogs, 2 deerhounds, 2 poodles, 1 mastiff, 1 Dogue de Bordeaux, 1 Weimaraner) |
| Other smaller breeds (dogs < 15 kg) | 8 (6 different breeds)           | 10 (7 different breeds)           | 7 (3 schnauzer, 1 griffon, 1 Yorkshire terrier, 1 Tibetan terrier, 1 Wheaten terrier)  |

**Table 3.** Ages and sexes of dogs enrolled in each case series (group 1 fed home-prepared diets; group 2 fed the chicken hydrolysate diet)

| Age and sex              | Group 1: average age<br>in months (min–max)<br><i>n</i> = 72 | Group 2: average age<br>in months (min–max)<br><i>n</i> = 109 | <i>P</i> -value* |
|--------------------------|--------------------------------------------------------------|---------------------------------------------------------------|------------------|
| Age at presentation      | 46 (9–144)                                                   | 50 (7–168)                                                    | 0.178            |
| Age at onset of pruritus | 22 (2–120)                                                   | 27 (2–148)                                                    | < 0.05           |
| Sex                      | 13 FE, 16 FN,<br>18 ME, 25 MN                                | 6 FE, 25 FN,<br>34 ME, 44 MN                                  | Not calculated   |

FE, entire female; FN, neutered female; ME, entire male; MN, neutered male.

\**P*-values < 0.05 were considered significant.**Table 4.** Predominant secondary infections and clinical signs at presentation in the two case series (group 1 fed home-prepared diets; group 2 fed the chicken hydrolysate)

| Type of infection and clinical sign | Group 1,<br><i>n</i> = 72 (%) | Group 2,<br><i>n</i> = 109 (%) | <i>P</i> -value* |
|-------------------------------------|-------------------------------|--------------------------------|------------------|
| Pyoderma                            | 27 (37.5)                     | 49 (44.9)                      | 1.000            |
| <i>Malassezia</i> dermatitis        | 13 (18.1)                     | 24 (22)                        | 1.000            |
| Otitis                              | 38 (52.8)                     | 85 (78)                        | 0.003            |
| Gastrointestinal signs              | 26 (36.1)                     | 54 (49.5)                      | 0.104            |

\**P*-values < 0.05 were considered significant.

revealed erythema of the medial aspects of the pinnae extending variably into the ear canals but without otic exudate. A microbial component, based on clinical signs and cytology, was recorded in 62 dogs (51.7%). Bacteriological examination of swabs identified *Pseudomonas* species in 15 of those (12.5% of dogs with otitis).

Seventy-two dogs had been fed home-prepared diets; 109 dogs had been fed the hydrolysed diet. There was no statistically significant difference in the dropout rates between the two groups (*P* = 0.377). In total, 13 dogs (18.1%) were excluded from the final evaluation in the home-prepared diet group and 27 dogs (24.7%) from the hydrolysed diet group. Most dogs were withdrawn because they had not been fed the diet exclusively (four in group 1; 13 in group 2) or because they did not eat the food (four in group 1, all fed white fish and potatoes; five in group 2). Three dogs in group 1 and one dog in group 2 required glucocorticoids beyond the withdrawal period. One dog in each group developed diarrhoea; two dogs in group 2 developed unrelated diseases that required discontinuation of the trials. Two owners of large breed dogs in group 2

**Table 5.** Palatability scores for home-prepared diets and the chicken hydrolysate as assessed by owners at the end of the trials

| Palatability score | Dogs fed<br>home-prepared diets<br><i>n</i> = 59 (%) | Dogs fed the<br>chicken hydrolysate<br><i>n</i> = 82 (%) |
|--------------------|------------------------------------------------------|----------------------------------------------------------|
| Excellent          | 29 (49.2)                                            | 32 (39)                                                  |
| Good               | 24 (40.7)                                            | 36 (43.9)                                                |
| Moderate           | 5 (8.5)                                              | 11 (13.4)                                                |
| Poor               | 1 (1.7)                                              | 3 (3.7)                                                  |

changed the diet, owing to expenses. One dog from group 1 and three dogs from group 2, which had shown resolution of clinical signs during the dietary trial, were also removed from the evaluation because their owners subsequently refused dietary rechallenge. All three dogs from group 2 were still fed the hydrolysate at least 3 months later; the dog in group 1 was fed on a commercial-limited ingredient diet without relapse.

Of the 141 dogs, seven showed resolution of pruritus within 4 weeks and were then rechallenged with their original diet. One dog showed increasing pruritus after 5 weeks of dietary elimination; AFR was considered unlikely in this patient and its normal diet was reintroduced; it was scored as non-AFR.

Palatability was regarded as good or excellent by the majority of dog owners (Table 5). Reductions in bodyweight during the trials were significant in both groups (*P* = 0.007 in group 1, *P* = 0.035 in group 2). Dogs in group 1 lost a mean (SD) of 2.3% (1.68) of their bodyweight and dogs in group 2 lost a mean (SD) of 1.4% (1.52) of their bodyweight.

AFR alone and AFR concurrent with other diseases were diagnosed in both groups with similar frequencies

**Table 6.** Final diagnoses for 141 pruritic dogs that completed a dietary trial with either home-prepared (group 1) diet or a commercial hydrolysed chicken and maize starch diet (group 2) and comparison of the two diets in the diagnosis of adverse food reactions (AFR)

| Diagnoses              | Group 1,<br><i>n</i> = 59 (%) | Group 2,<br><i>n</i> = 82 (%) | <i>P</i> -values* |
|------------------------|-------------------------------|-------------------------------|-------------------|
| AFR                    | 10 (17)                       | 15 (18.3)                     | 0.837             |
| AFR + concurrent atopy | 11 (18.6)                     | 16 (19.5)                     |                   |
| AFR + concurrent other | 0                             | 4† (4.9)                      |                   |
| Atopy                  | 32 (54.2)                     | 39 (47.6)                     | NA                |
| Atopy + FAD            | 3 (5.1)                       | 1 (1.2)                       | NA                |
| FAD                    | 2 (3.4)                       | 2 (2.4)                       | NA                |
| Non-allergic diseases  | 1 (1.7)                       | 5 (6.1)                       | NA                |

FAD, flea allergy dermatitis; NA, not applicable.

\**P*-values < 0.05 were considered significant.

†, two dogs did not meet the criteria for atopy but diagnostic procedures were not continued further; two dogs had concurrent neurological abnormalities.

(AFR: *P* = 0.837; concurrent AFR: *P* = 0.416). The other diagnoses are listed in Table 6 but were not compared statistically. Of the six dogs with nonallergic pruritus, three were diagnosed with reactive histiocytosis, one dog had epitheliotropic lymphoma and may have suffered from atopic dermatitis prior to referral, one had skin lesions of erythema multiforme, and one dog had recurrent pyoderma and was ultimately diagnosed as hypothyroid.

Of the 25 dogs with AFR alone, 23 showed recurrence of pruritus within 3 days after dietary provocation, one dog started scratching 4 days after reintroduction of the original diet; one dog relapsed after 7 days on two occasions. In 29 of the 31 dogs with AFR and concurrent diseases, relapse was observed after 2 to 5 days; in two dogs, timing of the relapse was not reported by the owners.

Microbial infection and otitis were seen with similar frequencies in dogs with AFR or concurrent AFR as in dogs without AFR, whereas gastrointestinal signs were more frequent in dogs with AFR or concurrent AFR (Table 7). In 24 of the 36 dogs with gastrointestinal problems and AFR involvement, these gastrointestinal signs resolved on the diet and recurred on dietary provocation (10 of 12 in group 1; 14 of 24 in group 2). The mean defecation frequency was reduced from 2.7 to 2.4 times per day during the trial (*P* = 0.001 for both groups together), but more markedly in group 2 (mean reduction of 0.79 times per day; *P* < 0.001). Defecation frequencies were reduced during the trial and increased on provocation in 13 of the 25 with AFR. Six of eight dogs in which pruritus and erythema were recorded as predominant in the perianal region were diagnosed with AFR or concurrent AFR. Pruritus, erythema and papules on the caudal dorsum of another dog resolved during the dietary trial and recurred within 24 h of dietary provocation. Owners of three dogs described behavioural changes as the first and most remarkable difference within 48 h of dietary provocation; two dogs became lethargic and one dog overexcited.

## Discussion

Food for diagnosis of AFR should eliminate potential allergens or offending molecules from the dogs' diet and demonstrate good palatability, ease of use, availability and

**Table 7.** Comparison of secondary infection and clinical signs at first presentation in dogs subsequently diagnosed with adverse reactions to food (AFR) or other diseases

| Type of infection and clinical signs | Dogs with AFR<br><i>n</i> = 25 (%) | Dogs with concurrent AFR<br><i>n</i> = 31 (%) | Dogs without AFR<br><i>n</i> = 85 (%) |
|--------------------------------------|------------------------------------|-----------------------------------------------|---------------------------------------|
| Pyoderma                             | 8 (32)                             | 17 (54.8)                                     | 34 (40)                               |
| <i>Malassezia</i> dermatitis         | 6 (24)                             | 6 (19.4)                                      | 24 (28.2)                             |
| Otitis                               | 20 (80)                            | 17 (54.8)                                     | 57 (67.1)                             |
| Gastrointestinal signs               | 16 (64)*                           | 20 (64.5)*                                    | 21 (24.7)                             |

\**P*-values were < 0.05 for comparison with non-AFR and considered significant.

reasonable cost. The large proportion of dogs diagnosed with AFR and concurrent AFR (38%) using the chicken hydrolysate gives an indication of the value of the hydrolysate in the diagnosis of canine AFR. In addition, the similarities of AFR frequencies in the two case series, each involving a large number of dogs, suggest that the studied commercial hydrolysate diet may be as useful as the home-prepared 'gold standard' diets in the diagnosis of canine AFR. However, comparison of the two case series can only give an indication of the value of the diets, and the results from this study do not assess the diagnostic accuracy of the hydrolysate diet. The two groups of dogs varied in age at onset of pruritus and had different breed composition and sex distribution so interpretation of the data is limited. A prospective, blinded cross-over study using both diets in the same dogs is difficult to achieve in a clinical setting. Owner compliance is difficult to obtain for a single diet so substantially higher dropout rates may result from two successive trials.

While the prevalence of canine AFR is unknown, this retrospective analysis supports recent reports of AFR being involved in over one-third of dogs referred with non-seasonal pruritus, either alone or concurrent with other allergies.<sup>6,7,10</sup> In addition, a number of AFR cases may not have been identified in the dogs studied because of the limited trial duration, and some AFRs may have been missed as a consequence of relatively short withdrawal periods for glucocorticoids.<sup>1</sup> The advantage of polypeptides in the hydrolysate diet being too small for immunoglobulin E (IgE) cross-linking on mast cells only applies to IgE-mediated AFR processes, and feeding this type of diet does not identify food intolerances. Most importantly though, dropout rates indicate that about 20% of dogs with a potential diagnosis of AFR are not properly evaluated, mainly due to a lack of owners' compliance. While reliable diagnostic alternatives are awaited, this emphasizes the need for detailed client education and the optimal choice of diet.

The palatability scores indicate that both diet types were well accepted by dogs. Palatability may be less problematic than owner compliance in feeding any chosen diet exclusively. However, palatability is subjective so no statistical comparison was made. On the other hand, dropout rates may be a more accurate measure of acceptability as they resulted from a combination of observations such as scavenging episodes, length of trial and refused provocation. Dropout rates were similar for the home-cooked

and commercial diets, so, practicality, may be a minor factor once owners are committed to the trial procedure.

Clinical signs in dogs with AFR were consistent with those described in the literature. In 10 of the 25 dogs with AFR, clinical signs were also indistinguishable from those described for canine atopic dermatitis, the disease diagnosed in the majority of study dogs with nonseasonal pruritus.<sup>32–34</sup> Only concurrent gastrointestinal problems and marked perianal pruritus were more frequent in dogs with AFR than in dogs with atopy. This confirms the results of the previous study that evaluated 63 of the dogs described here.<sup>10</sup> Approximately 65% of dogs with AFR had concurrent gastrointestinal signs.<sup>10,35</sup> Two-thirds of these resolved during the dietary trials but, with pruritus, recurred on provocation. These clinical signs may therefore raise suspicion for AFR in a dog presenting with nonseasonal pruritus. Dogs with AFR had less frequent defecation than dogs without AFR. This contradicts the findings of our smaller, previous investigation on 63 of these dogs.<sup>10</sup> In our series, frequency of defecation was not a reliable indicator of possible AFR.

Apart from the classical signs of facial, pedal and ventral pruritus in the allergic dogs, four dogs in this group of 25 dogs with AFR showed unusual clinical signs. Behavioural changes were reported in three of them during the elimination diet and after dietary provocation. While those are well recognized in children with food hypersensitivities,<sup>36</sup> they have only been described in individual dogs so far.<sup>26</sup> In another dog, which showed a diet and provocation responsive papulo-pruritic dermatitis on the caudal dorsum, clinical signs resembled flea allergy dermatitis rather than atopy. These cases emphasize the value of investigations into AFR in every dog with nonseasonal pruritus. Once owner cooperation is obtained, AFR may have a better prognosis than atopy or flea allergy dermatitis in dogs as it can be effectively managed by allergen avoidance.

In conclusion, both home-prepared diets and the chicken hydrolysate diet had similar value in the diagnosis of canine AFR although firm conclusions cannot be supported from this retrospective comparison. While a prospective, blinded cross-over trial might provide optimal comparison of the two diet types, the results of this study challenge the traditional view that home-prepared diets present the 'gold standard' for diagnosis of AFR in pruritic dogs.

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## References

- Rosser EJ. Diagnosis of food allergy in dogs. *Journal of the American Veterinary Medical Association* 1993; 203: 259–62.
- Guilford WG. Adverse reactions to food. In: Guilford WG, Center SA, Strombeck DR, Williams DA, Meyer DJ, eds. *Strombeck's Small Animal Gastroenterology*, 3rd edn. Philadelphia, PA: W.B. Saunders, 1996: 436–50.
- Anderson JA. The establishment of common language concerning adverse reactions to food and food additives. *Journal of Allergy and Clinical Immunology* 1986; 78: 140–4.
- Johansson SGO, Bieber T, Dahl R et al. Revised nomenclature for allergy for global use: report of the Nomenclature Review Committee of the World Allergy Organization, October 2003. *Journal of Allergy and Clinical Immunology* 2004; 113: 832–6.
- Walton GS. Skin responses in the dog and cat to ingested allergens. Observations on 100 confirmed cases. *Veterinary Record* 1967; 81: 709–13.
- Chesney CJ. Food sensitivity in the dog: a quantitative study. *Journal of Small Animal Practice* 2002; 43: 203–7.
- Biourge VC, Fontaine J, Vroom MW. Diagnosis of adverse reactions to food in dogs: efficacy of a soy-isolate hydrolysate-based diet. *Journal of Nutrition* 2004; 134: 2062S–2064S.
- Ackerman L. Food hypersensitivity: a rare, but manageable disorder. *Veterinary Medicine* 1988; 83: 1142–8.
- Carlotti DN, Remy I, Prost C. Food allergy in dogs and cats. A review and report of 43 cases. *Veterinary Dermatology* 1990; 1: 55–62.
- Loeffler A, Lloyd DH, Bond R et al. Dietary trials with a commercial chicken hydrolysate diet in 63 pruritic dogs. *Veterinary Record* 2004; 154: 519–22.
- Jeffers JG, Shanley KJ, Meyer EK. Diagnostic testing of dogs for food hypersensitivity. *Journal of the American Veterinary Medical Association* 1991; 198: 245–50.
- Kunkle G, Horner S. Validity of skin testing for diagnosis of food allergy in dogs. *Journal of the American Veterinary Medical Association* 1992; 200: 677–80.
- Elwood CM, Rutgers HC, Batt RM. Gastroscopic food sensitivity testing in 17 dogs. *Journal of Small Animal Practice* 1994; 35: 199–203.
- Mueller R, Tsohalis J. Evaluation of serum allergen-specific IgE for the diagnosis of food adverse reactions in the dog. *Veterinary Dermatology* 1998; 9: 167–71.
- Foster AP, Knowles TG, Hotston Moore A et al. Serum IgE and IgG responses to food antigens in normal and atopic dogs, and dogs with gastrointestinal disease. *Veterinary Immunology and Immunopathology* 2003; 92: 113–24.
- Jackson HA, Jackson MW, Coblenz L et al. Evaluation of the clinical and allergen specific serum immunoglobulin E responses to oral challenge with cornstarch, corn, soy and a soy hydrolysate diet in dogs with spontaneous food allergy. *Veterinary Dermatology* 2003; 14: 181–7.
- Halliwell REW, Gordon C, Horvath C et al. IgE and IgG antibodies to food antigens in sera from normal dogs, atopic dogs and dogs with adverse food reactions. *Veterinary Dermatology* 2004; 15 (Suppl. 1): 2.
- Ishida R, Masuda K, Kurata K et al. Lymphocyte blastogenic responses to inciting food allergens in dogs with food hypersensitivity. *Journal of International Veterinary Medicine* 2004; 18: 25–30.
- Tapp T, Griffin C, Rosenkrantz W et al. Comparison of a commercial limited-antigen diet versus home-prepared diets in the diagnosis of canine adverse food reaction. *Veterinary Therapeutics* 2002; 3: 244–51.
- Reedy LM, Miller WH, Willemse T (eds). *Food hypersensitivity*. In: *Allergic, Skin Diseases of Dogs and Cats*, 2nd edn. London: W.B. Saunders, 1997: 173–88.
- Scott DW, Miller WH, Griffin CE. Skin immune system and allergic skin diseases. In: Scott DW, Miller WH, Griffin CE, eds. *Muller and Kirk's Small Animal Dermatology*, 6th edn. Philadelphia, PA: W.B. Saunders, 2001: 543–666.
- Roudebush P, Cowell CS. Results of a hypoallergenic diet survey of veterinarians in North America with a nutritional evaluation of homemade diet prescriptions. *Veterinary Dermatology* 1992; 3: 23–8.
- Streiff EL, Zwischenberger B, Butterwick RF et al. A comparison of the nutritional adequacy of home-prepared and commercial diets for dogs. *Journal of Nutrition* 2002; 132: 1698S–1700S.
- Roudebush P, Schick RO. Evaluation of a commercial canned lamb and rice diet for the management of adverse reactions to food in dogs. *Veterinary Dermatology* 1994; 5: 63–7.
- Leistra MHG, Markwell PJ, Willemse T. Evaluation of selected-

- protein-source diets for management of dogs with adverse reactions to foods. *Journal of the American Veterinary Medical Association* 2001; 219: 1411–4.
26. Rutgers HC, Batt RM, Hall EJ et al. Intestinal permeability testing in dogs with diet-responsive intestinal disease. *Journal of Small Animal Practice* 1995; 36: 295–301.
  27. Hannuksela M, Haahtela T. Hypersensitivity reactions to food additives. *Allergy* 1987; 42: 561–75.
  28. Cave NJ, Guilford WG. A method for 'in vitro' evaluation of protein hydrolysates for potential inclusion in veterinary diets. *Research in Veterinary Science* 2004; 77: 231–8.
  29. Boumans H (ed.). *Physicochemical and functional properties of protein hydrolysates in nutritional products*. Proceedings of the Hill's European Symposium on Adverse Food Reactions. Madrid: Chapter 5, Watford: Hill's Europe Publication 2001: 30–3.
  30. Olson ME, Hardin JA, Buret AG et al. Hypersensitivity reactions to dietary antigens in atopic dogs. In: Reinhart GA, Carey DP, eds. *Proceedings of the Iams Nutrition Symposium. Recent Advances in Canine and Feline Nutrition, Volume III*. Wilmington, OH: Orange Frazer Press, 2000: 69–77.
  31. Willemse T. Atopic skin disease: a review and a reconsideration of diagnostic criteria. *Journal of Small Animal Practice* 1986; 27: 771–8.
  32. White SD. Food hypersensitivity in 30 dogs. *Journal of the American Medical Association* 1986; 188: 695–8.
  33. Harvey RG. Food allergy and dietary intolerance in dogs: a report of 25 cases. *Journal of Small Animal Practice* 1993; 34: 175–9.
  34. Reedy LM, Miller WH, Willemse T (eds). *Urticaria, angioedema, and atopy*. In: *Allergic Skin Diseases of Dogs and Cats*. 2nd edn. London: W.B. Saunders, 1997: 25–49.
  35. Paterson S. Food hypersensitivity in 20 dogs with skin and gastrointestinal signs. *Journal of Small Animal Practice* 1995; 36: 529–34.
  36. Sampson HA. Update on food allergy. *Journal of Allergy and Clinical Immunology* 2004; 113: 805–19.

**Résumé** Le but de cette étude rétrospective était de comparer un régime d'éviction ménager et un régime industriel à base de poulet hydrolysé pour le diagnostic de réaction alimentaire (AFR). Soixante douze chiens ont reçu le régime ménager et 109 le régime hydrolysé. Les propriétaires choisissaient le type de régime lors de l'inclusion et les ingrédients du régime ménager étaient choisis en fonction de ls habitudes alimentaires de chaque chien. Les ectoparasitoses et les infections microbiennes étaient traitées pendant l'essai. Les signes cutanés et digestifs et les scores de prurit étaient déterminés avant de commencer l'essai, et 6 semaines plus tard ainsi qu'après provocation avec le régime initial. Une AFR était diagnostiquée si le prurit disparaissait pendant l'essai et réapparaissait après provocation. Le taux de perdus de vue était plus faible dans le groupe alimentation ménagère, sans différence significative (18.1% régime ménager, 24.7% hydrolysats,  $P = 0.377$ ). Une AFR seule a été diagnostiquée dans 10 cas (17%) en utilisant le régime ménager et dans 15 cas (18.3%) nourris avec les hydrolysats. Des signes digestifs étaient plus fréquents chez les chiens à AFR que chez les chiens sans AFR ( $P = 0.001$ ). 11 chiens (18.6%) du groupe régime ménager et 20 (24.4%) du groupe hydrolysats avaient une AFR en plus d'une autre maladie prurigineuse, principalement une atopie. Les fréquences de diagnostic étant similaires entre les deux groupes ( $P = 0.837$  AFR;  $P = 0.416$  AFR et autre dermatose) indiquent que le régime à base d'hydrolysats de poulet peut représenter une alternative intéressante aux régimes ménagers dans le diagnostic de l'AFR chez le chien. Des études prospectives en cross-over sont indispensables pour confirmer ces résultats.

**Resumen** El objetivo de este estudio retrospectivo fué comparar una dieta casera y una dieta con hidrolizado de pollo en el diagnóstico de reacción alimentaria adversa (AFR). Setenta y dos perros fueron alimentados con una dieta casera y 109 lo fueron con el hidrolizado. Los dueños escogieron el tipo de dieta al inicio y los ingredientes para las dietas caseras fueron seleccionados dependiendo de la historia dietética de cada perro. Las infestaciones ectoparasitarias así como las infecciones bacterianas fueron tratadas durante las pruebas. Los signos cutáneos y gastrointestinales y los valores asignados para el prurito fueron anotados antes de empezar la dieta, a las seis semanas del tratamiento y tras la re-exposición a la dieta original. Una reacción adversa alimentaria fué diagnosticada si el prurito mejoró durante el estudio y reapareció con la provocación alimentaria. El índice de pacientes que no terminaron la prueba fué menor para las dietas caseras, aunque la diferencia no fué significativa estadísticamente (18.1% para las dietas caseras; 24.7% para el hidrolizado,  $P = 0.377$ ). Una reacción adversa por sí sola se diagnosticó en 10 perros (17%) utilizando una dieta casera y en 15 perros (18.3%) alimentados con el hidrolizado. Problemas gastrointestinales fueron más frecuentes en perros con una reacción alimentaria adversa que en perros sin ella ( $P = 0.001$ ). Otros 11 perros (18.6%) en el grupo de la dieta casera y 20 perros (24.4%) en el grupo alimentado con el hidrolizado, manifestaron una reacción alimentaria adversa conjuntamente con otras enfermedades pruríticas, principalmente atopia. La frecuencia similar en el diagnóstico de una reacción alimentaria adversa en ambos casos ( $P = 0.837$  para reacción alimentaria adversa por sí sola;  $P = 0.416$  para la reacción alimentaria adversa conjuntamente con otras enfermedades pruríticas) indican que el hidrolizado de pollo podría ser una alternativa válida a las dietas caseras en el diagnóstico de AFR. Estudios prospectivos cruzados serán necesarios para confirmar estos hallazgos.

**Zusammenfassung** Der Zweck dieser retrospektiven Studie war es eine selbstgekochte mit einer hydrolysierten Hühnchendiät zur Diagnose von Unverträglichkeitsreaktionen auf Futter (AFR) zu vergleichen. Zweiundsiebzig Hunden wurden selbstgekochte Diäten und 109 Hunden das Hydrolysat gefüttert. Die Besitzer wählten die Art des Futters zum Zeitpunkt der Untersuchung aus und die Inhaltsstoffe der selbstgekochten Diäten wurden abhängig von der diätetischen Anamnese eines jeden Hundes ausgewählt.

Ektoparasitenbefall und mikrobielle Infektionen wurden während der Studie behandelt. Hautveränderungen und gastrointestinale Symptome, sowie Juckreiz wurden vor dem Beginn der Diät, sechs Wochen nach Beginn der Eliminationsdiäten und nach der Provokation mit den ursprünglichen Diäten beurteilt und festgehalten. AFR wurden diagnostiziert, wenn der Juckreiz während der Ausschlußdiät verschwand und bei diätetischer Provokation wieder auftrat. Die Ausfallsrate war zwar niedriger bei den selbstgekochten Diäten, aber nicht statistisch signifikant (18.1% selbstgeköcht; 24.7% Hydrolysat,  $P = 0.377$ ). Alleinige AFR wurden bei 10 Hunden (17%) mittels selbstgeköchter Diät und bei 15 Hunden (18.3%) mittels hydrolysi-erter Diät diagnostiziert. Gastrointestinale Probleme waren häufiger bei Hunden mit AFR als bei Hunden ohne AFR ( $P = 0.001$ ). Weitere 11 Hunde (18.6%) in der Gruppe mit selbstgeköchter Diät und 20 (24.4%) in der Gruppe mit hydrolysierte Diät hatten AFR gleichzeitig mit anderen juckenden Hauterkrankungen, vor allem Atopie. Die ähnliche Häufigkeit bei der Diagnose von AFR in den beiden Gruppen ( $P = 0.837$  AFR;  $P = 0.416$  gleichzeitige AFR) weist darauf hin, dass die hydrolysierte Hühnchendiät eine wertvolle Alternative zur selbstgeköchten Diät bei der Diagnose von caniner AFR darstellen könnte. Prospektive Cross-over Studien sind notwendig, um diese Ergebnisse zu bestätigen.