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This paper describes a retrospective analysis of data from dietary trials with dogs fed a commercial chicken hydrolysate and maize starch diet to evaluate its usefulness in the diagnosis of adverse food reactions.

Dietary Trials with a Commercial Chicken Hydrolysate Diet in 63 Pruritic Dogs

The owners of 63 pruritic dogs were instructed to feed them a chicken hydrolysate diet exclusively for 6 weeks as part of diagnostic investigations into nonseasonal pruritus. Ectoparasitism and microbial infections were eliminated during the dietary trial. The dogs' skin lesions, gastrointestinal signs, and frequency of defecation were assessed and scores for pruritus were assigned before they started the diet and before and after they resumed their original diet. An adverse food reaction was diagnosed if the pruritus resolved while they were on the diet but recurred when they resumed their original food regimen. Seventeen of the 63 dogs were withdrawn from the trial, including 4 which found the diet unpalatable; however, its palatability was reported to be good or excellent in 48 of the dogs. An adverse food reaction alone was diagnosed in 9 (19.6%) of the 46 dogs and another 9 had an adverse food reaction and atopy. There were gastrointestinal signs in 6 of the 9 dogs with an adverse food reaction, which resolved on the trial diet but recurred when they resumed their original diet.

There are two types of adverse reactions to food: immune-mediated food allergy and nonimmunological food intolerance.¹ In dogs, the skin is an important target of adverse food reactions but gastrointestinal signs and, less often, respiratory and neurological problems also occur.^{2,3} In general practice, adverse food reactions are reported to be associated with 1% of all canine dermatoses⁴ and, in a referral population of dogs with nonseasonal pruritus, with up to 30.6%.⁵ Such reactions are differential diagnoses for nonseasonal pruritus, recurrent otitis, and for a variety of gastrointestinal problems and they cannot be differentiated from perennial atopy by routine clinical examination. A final diagnosis can only be achieved by observing the resolution of the clinical signs during an elimination dietary trial and their recurrence when the dog resumes the suspect diet, a time-consuming process associated with many potential pitfalls. However, intradermal tests and serology are not reliable alternatives in the diagnosis of canine food allergy.⁶⁻⁸

The choice of a test diet requires careful consideration of the diets previously fed, its palatability, and the owner's circumstances. Test diets can either be home cooked

or commercially prepared, and both may typically contain a single source of protein and a single source of carbohydrate. In some studies, home-cooked diets have been reported to be superior for the diagnosis of adverse food reactions.^{6,9} White observed adverse reactions to commercially prepared foods with the same sources of protein and carbohydrate as a previously tolerated home-cooked diet in 54% of the dogs studied.¹⁰ Possible adverse reactions to processing aids or additives have been suspected, but to the

authors' knowledge they have not been substantiated in dogs. Moreover, most home-prepared diets are not nutritionally complete and unsuitable for the dog's maintenance after a diagnosis has been established,¹¹ and many owners prefer the convenience of a commercial diet. Hydrolysed protein diets have recently been introduced to the veterinary market. Hydrolysed cow's milk protein is used routinely in the management of cow's milk allergy in human

infants.¹² Hydrolysis reduces the antigenicity of the protein and increases its digestibility by breaking the protein chains into peptides with a molecular weight below that which elicits an allergic response. Enzymatic hydrolysis does not change the nutritional value of the protein but bitterness has been associated with hydrolysis.¹³ In two studies, a partially hydrolysed diet¹⁴ and different types of protein hydrolysates¹⁵ were evaluated for the diagnosis of adverse food reactions in dogs.

This paper describes a retrospective analysis of data from dietary trials with dogs fed a commercial chicken hydrolysate and maize starch diet to evaluate its usefulness in the diagnosis of adverse food reactions.

MATERIALS AND METHODS

Sixty-three dogs were fed a dried commercial chicken hydrolysate and maize starch diet Hill's® Prescription Diet® Canine z/d® ULTRA Allergen Free as part of diagnostic investigations into probable allergic skin disease. They had been referred to the Dermatology Service of the Queen Mother Hospital for Animals, Royal Veterinary College, between June 2001 and November 2002, 59 of them with the primary complaint of nonseasonal

pruritus, 3 with ear disease and otic pruritus, and 1 with recurrent interdigital nodules and otitis. The requirements for a dietary trial were discussed with the owners, who were offered a choice of three diets: a home-cooked diet, a commercial restricted protein diet, or a hydrolysed protein diet. Taking into account their dog's previous food history, practicability, cost, and commitment to a 6-week dietary trial,^{2,16} they chose the hydrolysed protein diet.

When the dogs were first examined, ectoparasite infestations were ruled out by clinical examination, coat brushings, hair plucks, skin scrapings, and, where appropriate, by serological testing for scabies or acaricidal trial therapy. Strict flea control was instituted in all the dogs. Cutaneous signs and ear infections were assessed and recorded as erythema, scaling, excoriations/erosions, interdigital nodules, otitis (erythematous or complicated by microbial infection), and urticarial or pyotraumatic dermatitis. Pyoderma and/or *Malassezia* dermatitis and their distribution were recorded if the type and distribution of the lesions and the results of cytology were compatible. Microbial skin and ear infections were assessed and treated until they resolved with topical and/or systemic antibiotics or antifungal therapy, as appropriate during the dietary trial phase. Each owner was asked to assess their dog's pruritus as minimal (very briefly and occasionally during the day), mild (frequently during the day), moderate (more than half of the day), or severe (at every opportunity and even at night) and to record any concurrent gastrointestinal signs and the dog's frequency of defecation. These observations were recorded at the dogs' first examination, at the end of the dietary trial, and after each dog resumed its original diet. Antimicrobial therapy was continued after the dietary trial, when appropriate, to eliminate pruritus associated with recurrent infection. Oral prednisolone was prescribed for some of the dogs during the first 3 weeks of the dietary trial to alleviate pruritus, but systemic glucocorticoids were withheld for at least 2 weeks before and topical glucocorticoids for at least 2 days before they resumed their original diet, which included all supplements and treats. Their clinical signs were reevaluated 2 to 14 days later, depending on their recurrence. An adverse reaction to food was diagnosed if the dog's pruritus had resolved or decreased to minimal levels during the trial, but recurred when they resumed their original diet. If the level of pruritus had not increased during the 2 weeks after this challenge it was concluded that the test diet had not influ-

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enced the skin disease.² Dogs in which clinical signs recurred were fed the trial diet again until they resolved, and long-term dietary options were discussed with the owners. If information about the frequency of defecation or any gastrointestinal signs had not been recorded it was obtained by follow-up telephone conversations with the owners.

STATISTICAL ANALYSIS

The dogs' body weights before and after the trial were compared by using a two-sided paired test. Fisher's exact test was used to compare the presence of various clinical signs between the dogs with and without an adverse food reaction. Any changes in the frequency of defecation were compared between the dogs with and without an adverse food reaction or concurrent gastrointestinal signs by using a linear mixed model in which the dog's identity was included as a random effect, and the diagnostic grouping and time (before versus during the trial), and their interaction term were included as fixed effects.¹⁷ $P < 0.05$ was used to indicate statistical significance.

RESULTS

The cutaneous changes observed at presentation were widespread and generalized in 47 (74.6%) of the dogs, affecting the face, ventrum, and the paws, but were more localized to either the face, paws, or ventrum alone in 14 of them (22.2%). In 3 dogs the lesions affected predominantly the perineal skin; 1 of these dogs also had mild pedal pruritus. Interdigital nodules and urticaria affected 2 of the dogs and scaling and acute moist dermatitis affected 3. Erythema was the only dermatological sign in 7 of the dogs (11%). Forty-six of the dogs (73%) had otitis which was complicated in 12 cases by a microbial infection. Concurrent gastrointestinal signs such as soft feces, intermittent diarrhea, flatulence, and signs consistent with colitis were reported in 29 of the dogs (46%) (**Table 1**).

Eight of the 63 dogs were withdrawn from the dietary trial within the first 2 weeks; 4 of them refused to eat the test diet, 2 owners of large-breed dogs weighing more than 40 kg changed the diet owing to the expense, 1 dog developed diarrhea, and 1 dog was euthanized for unrelated causes. Another 8 dogs were excluded from the final evaluation because the test diet had not been fed exclusively, and 1 dog whose owner refused to return it to its previous diet after its severe clinical signs had resolved on the test diet

was also excluded from the analysis. The remaining 46 dogs (73%) were followed through the prescribed trial period. Six dogs were reevaluated and returned to their original diet after 5½ weeks because the pruritus had resolved in 5 of them but was still severe in 1. The dietary trial was extended by 2 weeks for 8 dogs whose pruritus had improved but was still above acceptable levels (mild or moderate) and whose owners agreed to continue the diet.

Twenty-seven of the 63 owners (42.9%) reported that the palatability of the test diet was excellent; 21 (33.3%) that it was good; 5 (7.9%) that it was moderate; and 10 (15.9%) that it was poor (these 10 dogs were excluded from the final evaluation). Twenty-four of the owners mentioned cost as a concern. On average the dogs lost a mean (sd) of 1.3% (0.59%) of their body weight during the dietary trial.

The level of pruritus was reduced in 30 (65.2%) of the 46 dogs during the dietary trial but recurred in 22 of them (47.8%) when they were challenged; in 9 of these 22 dogs their pruritus had resolved or decreased to a minimum, and they were therefore diagnosed with an adverse food reaction. Their pruritus resolved after 2 to 4 weeks but recurred in all 9 within 1 to 5 days of their resuming their original diet. They all improved again when the test diet was reintroduced but 2 of them required additional topical antimicrobial therapy once a week for maintenance. Their clinical signs improved more rapidly after the reintroduction of the test diet than during the initial trial. In the other 13 dogs, the level of pruritus had remained unacceptable throughout their period on the test diet and concurrent pruritic diseases were suspected. Concurrent atopy was diagnosed in 9 of them on the basis of Willemse's criteria¹⁸ and 5 of them showed positive intradermal test reactivity. An adverse food reaction was diagnosed as the sole cause of pruritic dermatitis in 9 of the 46 dogs (19.6%), with nonseasonal pruritus followed through the trial.

Concurrent gastrointestinal signs were reported in 21 of the 46 dogs (45.6%) and they all improved on the diet; in 19 of them, the gastrointestinal signs resolved completely, and in the other 2 cases the diarrhea improved to soft but formed feces. Six dogs with normal

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feces developed gastrointestinal signs after the introduction of the test diet; 2 became constipated and in 4 the feces became soft. One of the dogs which had constipation also had flatulence. Five of the owners reported that the feces had become less voluminous and firmer.

When they were first examined, the average frequency of defecation was significantly higher (3.1 times per day) in the dogs that had an adverse food reaction than in the dogs without one (2.1 times per day) ($P=0.002$). The frequency was reduced significantly to 1.6 times per day in all the dogs, but more markedly in the dogs with an adverse food reaction, and while they were on the test diet there was no significant difference between the frequency of defecation of the two groups.

Eight of the 9 dogs with an adverse food reaction ranged in age at the onset from 6 to 30 months (mean 16 months), but the other dog first showed signs at 10 years of age. No statistical comparison of the ages, breeds, and sex of the dogs with an adverse food reaction was possible because of the small number of dogs, but 2 of the 9 were West Highland white terriers and 2 were German shepherd dogs. Pruritus was the predominant clinical sign in all 9 dogs. The perineum was worst affected in 3 of the 9 dogs with an adverse food reaction, but not in the other 37 dogs in the trial. Gastrointestinal signs affected 6 of the 9 dogs with an adverse food reaction, a significantly higher proportion ($P=0.04$) than in the 24 dogs that showed no signs of an adverse food reaction, of which only 6 were affected (**Table 1**). The gastrointestinal signs resolved in all 6 dogs during the dietary trial, but recurred together with pruritus in 5 of them after they resumed their original diet.

In 24 of the dogs the trial provided no evidence that an adverse food reaction was involved in their pruritic skin disease. Atopy was confirmed in 17 of them (37% of all the 46 dogs); flea allergic dermatitis was diagnosed in 2 (4.4% of the 46 dogs); and nonallergic diseases were diagnosed in 5 (10.9% of the 46 dogs). In total, 37 of the 46 dogs (80.4%) were diagnosed with an allergic skin disease and in 9 of them an adverse food reaction was the only apparent cause of their pruritus.

DISCUSSION

The diagnosis of a cutaneous adverse food reaction alone in 9 (19.6%) of the 46 dogs that completed the dietary trial

is in broad agreement with earlier work: Chesney⁵ reported the condition in 30.6% of 62 referred cases fed exclusively on a home-cooked diet; Kunkle and Horner⁷ reported 14.3%; Denis and Paradis¹⁹ 17.9%; and Vroom²⁰ 24.4%. The hydrolysis process reduces the antigenicity of proteins and, as a result, previous exposure to the protein and the choice of protein become less critical. Recent studies suggested that dogs allergic to a parent protein will tolerate the hydrolysed version of the same protein.^{21,22} The selection of owners on the basis of their preference for this type of diet may have reduced the number of dogs that had to be withdrawn from the analysis. The convenience, the good or excellent palatability of the diet to 76.2% of the dogs, and its beneficial effect on gastrointestinal function are also likely to have increased its acceptability. The 27% of the dogs which were excluded from the analysis was a lower proportion than previously reported with home-cooked diets,^{5,9} but it is still likely that some dogs with an adverse food reaction will not be recognized because they fail to complete a dietary trial.

The clinical findings of pruritus affecting predominantly the face, ventrum, and paws, often with concurrent otitis and secondary microbial skin infections, were in line with those described in the literature.^{4,23,24} In addition, the results indicate that the condition should be considered as an important differential diagnosis in dogs with pruritus predominantly affecting the perineal skin. Anal pruritus has been reported in dogs with colitis and in human patients with food allergy³ and pruritus in the perianal/perineal region, as one of the affected sites, was observed in 11 of 51 dogs with adverse food reactions by Rosser.²

Table 1: Predominant Clinical Signs Observed in 63 Dogs Before the Dietary Trial

Clinical sign	All dogs (%)	Dogs with AFR (%)	Concurrent AFR (%)	Non-AFR (%)
Pruritus	63 (100)	9 (100)	13 (100)	24 (100)
Otitis	46 (73)	7 (77.8)	7 (53.8)	19 (79.2)
Pyoderma	33 (52.4)	5 (55.6)	8 (61.5)	13 (54.2)
<i>Malassezia</i> dermatitis	25 (39.7)	5 (55.6)	4 (30.8)	10 (41.7)
Gastrointestinal signs	29 (46)	6 (66.7)	9 (69.2)	6 (25)*

* $P=0.04$ in comparison with dogs with an AFR
AFR, Adverse food reaction

Gastrointestinal signs were observed in 60% of the dogs with the condition, a similar proportion to the 65% reported by Paterson,²⁵ who also questioned every owner specifically. Gastrointestinal problems may not be reported by owners during a dermatology consultation and are often accepted as unrelated problems, which may explain the lower percentages of 2%, 9.1%, and 14.6% reported by Walton,⁴ Carlotti and others,²³ and Rosser,² respectively, and the apparent absence of gastrointestinal signs in other studies. Although the gastrointestinal signs were significantly more common in

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the dogs with the condition than in those without it, the lack of them cannot rule out the condition as a possible differential diagnosis. Furthermore, 25% of the dogs that did not have an adverse food reaction did have gastrointestinal signs, the significance of which remains unclear. Although the majority of them had atopy, gastrointestinal signs have not been reported as a common complaint in dogs with atopy.²⁶ The gastrointestinal signs improved in all the dogs on the test diet, but whether the improvement was due to the resolution of the disease and/or to a nonspecific effect associated with the high digestibility of the diet is uncertain. Both effects were

probably involved because the gastrointestinal problems resolved in the dogs with and without an adverse food reaction; the beneficial effect of an elimination diet is thought to be due partly to its greater digestibility, because small peptides are less antigenic than undigested protein.²⁷ In the 1 dog in which the gastrointestinal signs did not recur, they may have been unrelated to its adverse food reaction, or its gut mucosa may have been repaired during the dietary trial, resulting in a delay or absence of clinical problems.²⁸

Although no normal values for the frequency of defecation in dogs could be found in the literature and the accuracy of the owner's assessment may be questionable,

the frequency of defecation was initially significantly higher in the dogs with an adverse food reaction, and the significant reduction in its frequency when they were on the test diet suggests that it was highly digestible.

These results indicate that the commercial dried chicken hydrolysate diet fed in this study is useful in the diagnosis of adverse food reactions in dogs with nonseasonal pruritus when it is fed exclusively for at least 5½ weeks. It also appears that among dogs with pruritus, predominantly perineal pruritus, together with gastrointestinal signs such as an increased frequency of defecation, should raise the suspicion that the diet may be involved and that a dietary trial may be needed.

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