Food Sensitivity and Intolerances Associated with Diet Type in Golden Retrievers: A Retrospective Study

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Abbreviations

AFR	Adverse food reaction(s)
GI	Gastrointestinal
GR	Golden Retriever(s)

Abstract

This study examined the source of food sensitivities and intolerances in a retrospective cohort of predominantly adult (98% of 523) Golden Retrievers (GR), generally healthy except for the presence of ongoing pruritus and/or gastrointestinal (GI) problems. Electronic data files of GR from January 2016 through December 2018 were analyzed. The dogs were divided into 4 subgroups according to diet type: commercial grain-containing kibbles (n =273; 52%); commercial or home-prepared raw diets without wheat, corn, or soy (n =133; 25%); commercial grain-free (n =79; 15%); or home-prepared cooked diets without wheat, corn, or soy (n =38;7%). Within the 4 diet subgroups, 24 ingredients were tested and ranked for food reactivities based upon the test results. Of the 24 ingredients tested, turkey and white-colored fish were the most reactive (54–60%), followed by venison and corn, including cornstarch (44–48%). The lowest reactive foods were lamb and those that caused no reaction (11%). It was concluded that among generally healthy, adult GR, the ranking of 24 identified reactive food ingredients was the same across the 4 diet subgroups, indicating that diet type is not the determining factor for food sensitivities or intolerances in GR. Whole blood or plasma taurine concentrations were measured in a subset of dogs (n=22) fed grain-free diets. The results were normal or modestly elevated.

Introduction

The Golden Retriever (GR) is one of the most popular dog breeds and has been the subject of the Lifetime Studies clinical data base at the School of Veterinary Medicine, University of California Davis. (1, 2). This breed is prone to a variety of conditions, the most common being gastrointestinal (GI) disorders like inflammatory bowel disease, “leaky gut syndrome,” bloat, and gastric torsion; pemphigus, ichthyosis, and other skin/coat disorders; autoimmune thyroiditis and hypothyroidism; hip and elbow dysplasia; dilated cardiomyopathy and subaortic stenosis; immune-mediated hematologic diseases; pigmentary uveitis; masticatory myositis; allergies; and cancers, such as hemangiosarcoma, lymphoma, and osteosarcoma (1–3).

Food sensitivity and intolerance can manifest in non-GI signs such as pruritus or changes in cognitive and memory functions (4, 5). There are 2 types of adverse food reactions (AFR): non-immunological AFR such as food sensitivities and intolerances, and immunologically-based AFR, such as food allergies and hypersensitivities (4–7). Non-immunological AFR are diagnosed when there are increased levels of IgA and IgM in body secretions, such as saliva and feces (4). In contrast, true food allergies are hypersensitivity disorders that typically present with signs of urticaria, scratching, or wheels, and cause increases in serum IgD, IgE, and IgG.

Other causes of AFR include dietary indiscretion, food poisoning, metabolic and pharmacological reactions to foods, anaphylaxis, food contamination, and food idiosyncrasy (5, 6). The classic tests to diagnose AFR in humans and animals are the skin patch or prick test, food elimination trials, and the recent addition of serum IgD, IgE, or IgG measurements (4–7). Published studies have shown that food elimination trials are fraught with discrepancies and failure of compliance by animal owners, and skin patch or prick testing is unsightly (6). Even more problematic is the fact that serum testing to identify AFR in people and companion animals is poorly predictive of the actual response the patient will have to that ingredient (4–7). Saliva and fecal tests have been documented to be reliable and predictive diagnostics for AFR (4, 6).

The connection between the type of diets companion animals are fed and their health is a concern among veterinarians and pet owners (8–11). This retrospective cohort study of 523 GR investigated a correlation between sensitivities/intolerances to specific diet ingredients in relation to diet type in generally healthy GR with pruritus and/or GI signs.

In light of recent data about the effect grain-free diets may have on canine heart health and longevity, a secondary goal of this study was to measure the taurine levels in a subgroup of GR fed grain-free diets (7, 10–12).

Materials and Methods

Database and Tests

Our veterinary diagnostic laboratory (a) has been collecting breed-specific clinicopathologic data for over 2 decades. In the 2-year period from January 2016 through December 2018, laboratory tests were performed on 22,192 GR. From this group, a cohort of 523 predominantly adult GR had canine saliva-based food sensitivity and intolerance testing (b) for 24 different food ingredients including highly purified protein extracts of beef, chicken, duck, lamb, goat, pork, turkey, venison, rabbit, white-colored fish and their oils, salmon and salmon oil, hen eggs, cow milk, soy, wheat, barley, corn and cornstarch, lentils and peas, millet, oatmeal, peanuts and peanut oil, potatoes, quinoa, rice, and sweet potatoes (4, 6). This test methodology was validated for sensitivity (93–99%), specificity (69–72%), and accuracy by likelihood ratios (3.08–5.30% for positive ratios; 0.63–0.65% for negative ratios) (4).

The saliva samples had been collected by the owner or their veterinarian according to specified instructions that included an overnight fast, and then sent to the author's laboratory for food sensitivity testing (4).

Upon owner request, whole blood or plasma taurine concentration was measured by another laboratory (c) in a subset of GR that were fed grain-free (commercial or home-prepared) diets (n =22).

Retrospective Analysis

Analysis was done on the results of saliva samples from 523 predominantly adult GR (513/523; 98%) fed a variety of diets comprised of commercial grain-containing kibbles (n = 273; 52%); commercial or home-prepared raw diets without wheat, corn or soy (n = 133; 25%); commercial grain-free diets (n =79; 15%); and home-prepared cooked diets without wheat, corn, or soy (n = 38; 7%). The recruitment and enrollment of the dogs for the present study was accomplished by providing the owners or their veterinarians with a simple questionnaire (see Appendix); in some cases, the questionnaire was administered by telephone interview with the owner and the author's laboratory staff. Each owner provided informed consent to participate.

The diets had been fed to 5% of the dogs for 6–12 months and for 2 or more years for the remaining 95%. The sex, age, and weight parameters of each group are shown in **Table 1**.

The dogs were generally healthy when examined by their veterinarians except for ongoing pruritus and/or GI issues. The diet fed was the only source of taurine; none of the dogs received taurine supplements.

Results

Table 1 shows the demographics of the GR studied. The total group of 523 dogs was composed of more males (288; 55%) than females (235; 45%); more males were neutered than intact (54%); most females were spayed (74%). The relative breakdown accord- ing to sex and body weight was similar for each of the 4 diet subgroups.

The median age was similar for all 4 subgroups, and the mean and standard deviation of age was not statistically different between the groups. Within the 4 subgroups, the ages ranged from less than a year of age for 11 dogs (2%) to 10 years or older for 33 of the dogs (6%).

The ranking of the reactive food ingredients was based on the number of dogs that tested positive for AFR. Of the 24 foods tested, the ranking was essentially the same across the 4 diet subgroups (**Table 2**). The high- est reactive foods were turkey and white-colored fish (54–60%); medium reactive foods were venison and corn, including cornstarch (44–48%); and the lowest reactive foods were lamb or those that caused no food reaction (11%) (**Table 2**) (10–13).

All the whole blood or plasma taurine concentrations from the 22 GR fed grain-free diets were normal except for 5 that were elevated. The whole blood taurine levels of 12 dogs ranged from 242–484 nmol/L (normal reference range 200–350 nmol/L; mean 311 ± 22 (SEM); median 294 nmol/L); the plasma taurine levels of 10 dogs ranged from 60–212 nmol/L (normal reference range 60–120 nmol/L; mean 117 ± 12 (SEM); median 111nmol/L) (10). The taurine level results in relation to sex are shown in **Figure 1**. The body weight ranges are listed in the legend for **Figure 1**.

Discussion

The author has an ongoing compilation of cumulative clinical and laboratory data on the health and longevity of purebred dog breeds. The cohort of GR for this study came from the author's data and from others who have been compiling data regarding health issues in this breed (1, 2). The veterinary medical community, companion animal breeders, pet caregivers, and the pet food industry have raised concern about the potential impact different types of diets may have on canine health (4, 5, 8–11). For example, the apparent digestibility of protein and energy were found to be higher in raw food diets than in cooked, processed diets, while the fecal weight and volatile fatty acids levels of dogs fed these raw diets were lower (18). Different ingredients can affect the quality and nutritious value of pet foods; this is especially relevant to vegan and vegetarian pet diets, which are gaining popularity (9).

Table 1. Golden Retriever Demographics (January 2016–December 2018)

	Number of Dogs				
Parameter	**Total #**	**Kibble Diet***	**Raw Diet ** **	**Grain-Free Diet**	**Home-Prepared Cooked Diet†**
Sex					
Male	132	56	43	23	10
Male, Neutered	156	92	30	27	7
Female	64	36	17	6	5
Female, Spayed	171	89	43	23	16
Totals	523	273	133	79	38
Age (years ± SD)	0.50–13.70	0.50–13.70	0.58–13.00	0.50–12.58	0.75–10.00
Range	3.96	3.52	4.22	3.05	5.05
Mean	± 3.08	± 2.51	± 3.20	± 2.60	± 3.08
Median	4.17	3.58	5.00	3.25	6.25
Weight (pounds ± SD)	39–129	40–118	39–105	42–129	39–102
Range	70.3	70.8	68.8	69.2	69.0
Mean	± 14.4	± 20.0	± 13.38	± 13.55	± 14.66

*Commercial grain-containing foods; **Commercial or home-prepared raw foods; †Without wheat, corn, or soy

The primary purpose of this retrospective study was to determine if otherwise healthy GR with persistent pruritus and/or GI conditions had intolerances or sensitivities to ingredients in food that differed based on the type of food they ate (commercial grain-containing kibbles, commercial or home-prepared raw diets without wheat, corn, or soy, commercial grain-free, or home-prepared cooked diets without wheat, corn, or soy).

A questionnaire was developed in order to recruit appropriate GR candidates for the saliva tests required for this study (see **Appendix** on page 58).

The results show that there are no differences in diet sensitivities and intolerances among adult GR of both sexes, matched in age and weight, that were fed the 4 different diet types (**Tables 1** and **2**).

Although the participants' responses to the questionnaire stated that they were not giving flavored commercial heartworm, flea, and tick preventives, it remains unknown if meat, fowl, and fish flavorings were contributing factors to the test results (4, 6, 10).

There was no statistically significant difference in age or weight of the GR in the 4 different diet subgroups, whether they were intact, neutered, or spayed (**Table 1**).

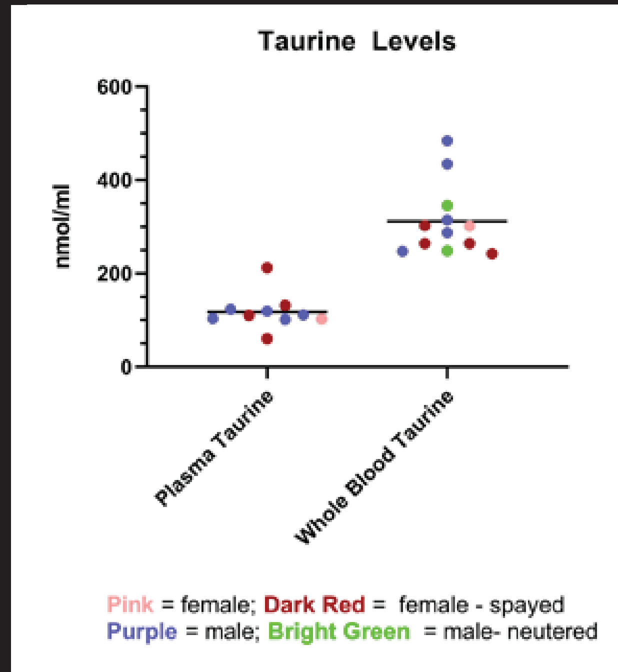
Factors which lend credence to the present results are the large sample size within the 4 diet sub-groups, variety of diet types analyzed, length of time the diets were fed (at least 2 years for the majority), and the record that no other treats or supplements were given except commercial canine vitamin-mineral preparations.

Table 2. Golden Retriever Nutrition Data (January 2016–December 2018)

Parameter	Number of dogs	Comments
Total number with Nutriscan testing	523	All healthy or had pruritus and /or GI issues
Commercial grain-containing diet	273 (53 % of total)	Variety of meats, fowl, and fish with grains including wheat, corn, or soy
Raw diet, commercial or home-prepared without grains	133 (25% of total)	Variety of meats, fowl, and fish plus some carbs and vegetables; no wheat, corn, or soy
Grain-free commercial diet	79 (15% of total)	Same as raw group*
Home-prepared diet without grains	38 (7% of total)	Same as raw group
Reactive foods on Nutriscan testing (24 key foods)	523 (total results) and the combination of Raw, Grain-free, and Homemade diet groups (250) yielded the same breakdown of reactive foods	Highest (54–60%) = turkey & white-colored fish; Medium (44–48%) = venison & corn; Lowest (11%) = lamb & no food reactions
Total number in data base (all diagnostics)	22,192	Includes any type of diagnostic test run at Hemopet/Hemolife during the 2-year period

*26 dogs on grain-free commercial diets were tested for whole blood or plasma taurine levels upon client request. All were mid-normal, except that 3 were slightly elevated (not supplemented with taurine beyond their diet level).

Figure 1. Plasma and Whole Blood Taurine Levels of 22 Golden Retrievers Fed Grain-Free Diets



Dog weights ranged from 61–83 lbs (27.7–37.6 kg) for plasma taurine data, and 59–83 lbs (26.8–37.6 kg) for whole blood taurine data. SD and SEM were 38.4 and 12.1, respectively, for plasma taurine and 76.4 and 22.1, respectively for whole blood taurine. Line among data points indicates mean for each group respectively.

Another potential confounding factor is the presence of ingredients that are not declared on the label (19, 20). The species used as the meat source in pet foods can be identified with a real time polymerase chain reaction assay (19). This tool is used to monitor commercial pet foods for accidentally or deliberately adulterated ingredients and is important in today's industrial market based upon the discrepancies that have been found between ingredients and labeling in commercial pet foods (20). The presence of undeclared ingredients has been discovered in standard and premium pet diets, as well as diets with "novel" or "limited" ingredients, and micronized hydrolysates. The authors tested "novel/limited" ingredient diets used for food elimination trials and found the median for mislabeling was 45% (range of 33–83%) including 1 hydrolyzed protein diet (20).

In response to prior reports that raised concern about the connection between taurine levels in dogs and heart disease, this study also looked at taurine levels in a subset of 22 dogs that were on grain-free diets. Although taurine is added to pet foods, it is not an essential, food-sourced amino acid for dogs, and there is no minimum canine standard listed for taurine by the Association of American Feed Control Officials (AAFCO) (d). Concentrations of taurine, and its precursor amino acid, cysteine, can vary in processed pet foods depending on the temperature of processing and the addition of other ingredients, like beet pulp, which is added as a filler (10, 14–17). Taurine concentrations in dogs that are above 150 nmol/L in whole blood or above 40 nmol/L in plasma are considered to pose "no risk for taurine deficiency," even though these levels are below the stated normal reference ranges for dogs (200–350 nmol/L for whole blood taurine levels; 60–120 nmol/L for plasma taurine levels) (c).

Although there was no association found between age, sex, body weight, or body size on plasma and whole blood taurine concentrations, the type of diet fed has been reported to affect taurine concentrations (10, 14). Dogs who eat diets containing whole grain rice, rice bran, or barley have lower mean whole blood taurine concentrations, and the lowest whole blood taurine concentrations are seen in dogs that eat lamb, or lamb meal and rice diets (10, 11). Furthermore, dogs that eat diets containing animal meats or turkey, and whole grain rice, rice bran, or barley, have lower plasma methionine and cysteine concentrations (14).

In the current study, of the 22 GR fed grain-free diets, 17 had whole blood or plasma taurine concentrations within the established normal limits, and 5 had elevated levels (**Figure 1** and **Table 2**). The laboratory that ran the taurine assays offers testing on plasma and/or whole blood samples. Currently, the preference is for specifically prepared whole blood samples as the taurine levels are not confounded by secondary taurine leakage from granulocytes and platelets that occurs subsequent to clotting or hemolysis (14).

The GR in the present study did not receive taurine supplements in addition to what was already in their diets. It is worth noting that the bioavailability of taurine can be affected by the meat source, the types and amount of fiber in the diet, and the way ingredients are processed (8, 14–16).

Conclusions

The ranking of identified reactive food ingredients was the same across 4 diet types fed to adult GR. This demonstrates that diet type is not a determining factor in whether or not these dogs have specific food sensitivities and intolerances.

Endnotes

a. Hemopet/Hemolife, Garden Grove , CA 92843.

b. NutriScan®, Division of Hemolife Diagnostics, Garden Grove, CA 92843; www.nutriscan.org

c. Amino Acid Laboratory, University of California, Davis, Davis, CA 95616. Analyses are done with a Beckman 6300 amino acid analyzer. https://www.vetmed.ucdavis.edu/labs/amino-acid-laboratory

d. Association of American Feed Control Officials. https://www.aafco.org/

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