Owner impressions of three premium diets fed to healthy adult dogs

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Objective—To determine owner impressions of 3 premium canine diets when factors such as price and retail source were removed; to compare body condition scores (BCSs) assigned by owners versus a veterinarian; and to determine consistency of owner impressions of diets when owners were not informed that they were feeding the same diet during 2 consecutive periods.

Design—Randomized controlled trial.

Animals—44 healthy adult dogs.

Procedure—During the initial 12 months of the study, dogs were each fed 3 premium diets for 4 months in random order. After feeding each diet for 1 and 4 months, owners completed questionnaires regarding palatability of the diet; the dog’s attitude, energy level, fecal consistency, frequency of defecation, hair coat quality, and BCS; and whether they would feed the diet if available commercially. During the last 4 months of the study, owners fed the same diet they had been feeding during the previous 4 months.

Results—Scores for most variables did not differ among diets. However, mean BCS assigned by owners was significantly lower than mean BCS assigned by an investigator, with a moderate correlation between scores. When asked at the end of the third and fourth study periods whether they would consider feeding the diet long-term, 12 of the 44 (27%) owners gave inconsistent responses.

Conclusions and Clinical Relevance—Results indicate that when unaware of retail price and source, owners have similar impressions of 3 premium diets fed to healthy adult dogs, suggesting that factors other than the diets themselves may affect owner impressions. Owners also underestimate their dog’s BCS. (J Am Vet Med Assoc 2005;227:1931–1936)

Americans spent approximately $12.8 billion on pet food during 2003 and were projected to spend $13.4 billion in 2004. With this continued growth in the pet food industry, consumers undoubtedly will have an increasing variety of pet foods to choose from, along with an increasing number of retail outlets from which to purchase these foods, including grocery stores and pet specialty outlets. There is a perception among some dog owners and even some veterinarians that dog foods sold in grocery stores are inferior in quality to those sold in pet specialty outlets. However, little information is available comparing the quality of dog foods sold through various retail channels. In addition, although many owners indicate that they are concerned about providing their dogs with optimal nutrition, little is known about how owners form impressions of the various diets that are available or to what extent owner opinions are based on actual performance of these diets in their dogs versus other factors.

The purposes of the study reported here, therefore, were to determine owner impressions of 3 premium canine diets when extraneous factors, such as price and source (ie, grocery store vs pet specialty store or veterinary clinic), were removed and to assess consistency of owner impressions when owners unknowingly fed the same diet to their dogs during 2 consecutive feeding periods.

Subjectively, the prevalence of obesity and obesity-related problems among dogs in the United States appears to be increasing, even though excess body weight has been shown to be associated with an increased risk for a variety of diseases that can decrease quality of life and lifespan. One factor that may be contributing to this apparent increase in the prevalence of obesity is the inability of dog owners to recognize when their dogs are overweight. A previous study suggested that most dog owners underestimate their dogs’ body condition score (BCS) and do not recognize when their dogs are overweight. Therefore, an additional purpose of the present study was to determine how well individuals affiliated with a veterinary teaching hospital, including veterinary students and staff and faculty members, were able to determine BCSs of their own dogs.

Materials and Methods

Dogs—Forty-eight healthy adult dogs of any breed and either sex owned by veterinary students and staff and faculty members at the University of Georgia College of Veterinary Medicine were enrolled in the study. Dogs were determined to be healthy at the beginning of the study on the basis of results of a physical examination, CBC, serum biochemical profile (including measurement of albumin, total bilirubin, cholesterol, phosphorus, total protein, urea nitrogen, glucose, creatinine, calcium, sodium, potassium, chloride, and carbon dioxide concentrations and alkaline phosphatase, alanine transaminase, and amylase activities), measurement of serum thyroxine (T4) concentration, urinalysis, and fecal flotation test. All blood samples were collected after food had been withheld overnight. Dogs were excluded from the study if they had any abnormalities that could affect the dietary evaluation. All dogs were receiving prophylactic treatment for ectoparasites, and if intestinal parasitism was identified by means of fecal flotation tests, appropriate anthelmintics were administered. The study protocol was approved by the University of Georgia Animal Care and Use Committee.
Dietary—Three nationally known premium dog diets were used in the study; all 3 were classified as dry diets. One of the diets was generally sold through grocery stores at the time of the study, although it was also available through other retail outlets. The other 2 diets were available exclusively through pet specialty stores and veterinary clinics at the time of the study.

For purposes of the present study, all 3 diets were repackaged in plain white bags labeled simply with a number as diet 1 through diet 6. Ingredients, select nutrient composition, and retail cost for each diet are listed (Table 1). All diets provide complete and balanced nutrition as substantiated by the Association of American Feed Control Officials animal feeding trials.3

Study protocol—During the initial 12 months of the study, dogs were fed each of the 3 diets for 4 months (study periods 1, 2, and 3); the order in which each of the dogs was fed the 3 diets was randomly assigned. During the last 4 months of the study (study period 4), dogs were fed the same diet they had been fed during the previous 4 months (ie, study period 3), except the diet was designated by a different number on the bag. Owners were told that the diet fed during period 4 should look identical to the diet fed during period 3; however, they were not told that diets fed during these 2 periods were identical.

Throughout the study, the amount of food offered was equivalent to the caloric intake of dogs being consumed prior to starting the study, except that caloric intake was adjusted as necessary to maintain a stable body weight. Dogs were transitioned to each new diet over a period of 7 days by gradually increasing the amount of new diet that was fed and decreasing the amount of old diet that was fed. If owners were feeding treats prior to the study, they were instructed to continue feeding the same treats throughout the study so that the only change made to the dog’s diet was the particular food being fed.

Patient evaluation—Dogs were evaluated by a single individual (SLS) prior to enrollment in the study and every 4 months throughout the study. These evaluations consisted of a physical examination, assignment of a BCS, CBC, urinalysis, and fecal flotation test. In addition, during each of these evaluations, each owner was asked to assign a BCS for his or her dog. Possible BCSs ranged from 1 to 9, with 1 identified as thin, 5 identified as ideal, 7 identified as overweight, and 9 identified as obese. At the end of the study (ie, after period 4), a serum biochemical profile was performed and serum T4 concentration was measured.

Owner evaluation—Owners completed a questionnaire soliciting information on signalment, home environment, and dietary history prior to enrollment of their dogs in the study. In addition, at the end of the first and fourth months of each of the 4 study periods, owners completed a questionnaire regarding how well the dog ate the study diet; the dog’s overall attitude, energy level, fecal consistency, frequency of defection, hair coat quality, and body condition; whether the dog developed any adverse clinical signs while being fed the diet; and whether the owner would consider feeding the diet on a long-term basis (Appendix).

Statistical analysis—Repeated-measures ANOVA followed by the Fisher least significant difference test was used to compare owner responses to the questionnaire among diets. Backward stepwise regression analysis was used to determine whether owner responses were affected by diet fed during the preceding study period. Owner- and veterinarian-assigned BCSs were compared by use of a paired t test, and a Pearson correlation coefficient was calculated. All statistical analyses were performed with commercially available software. For all analyses, a value of P < 0.05 was considered significant.

Results

Dogs enrolled in the study consisted of 28 females (2 sexually intact and 26 spayed) and 20 males (5 sexually intact and 15 castrated). Mean ± SD age at the time of enrollment was 53.5 ± 38.2 months (range, 12 to 150 months). Thirty of the dogs were of mixed breeding, and 18 were purebred. Seventeen dogs were personal pets of veterinary students, 18 were personal pets of staff members, and 13 were personal pets of faculty members or residents.

Table 1—Comparison of characteristics of 3 premium diets for healthy adult dogs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Purina diet*</th>
<th>Hill’s diet†</th>
<th>Eukanuba diet‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein content</td>
<td>31.85</td>
<td>24.70</td>
<td>28.49</td>
</tr>
<tr>
<td>Absolute (g/100 kcal)</td>
<td>6.88</td>
<td>3.80</td>
<td>6.05</td>
</tr>
<tr>
<td>Fat content</td>
<td>19.25</td>
<td>15.80</td>
<td>18.37</td>
</tr>
<tr>
<td>Relative (% dry matter)</td>
<td>4.17</td>
<td>5.90</td>
<td>3.90</td>
</tr>
<tr>
<td>Fiber content</td>
<td>1.68</td>
<td>2.1</td>
<td>2.0</td>
</tr>
<tr>
<td>Relative (% dry matter)</td>
<td>0.462</td>
<td>0.5</td>
<td>0.36</td>
</tr>
<tr>
<td>Energy density (kcal/cup)</td>
<td>449</td>
<td>380</td>
<td>405</td>
</tr>
<tr>
<td>Retail cost ($/20 lb bag)</td>
<td>16.99</td>
<td>23.99</td>
<td>22.99</td>
</tr>
</tbody>
</table>

*Purina ONE chicken and rice formula lifelong health brand dog food (ingredients: chicken, brewer’s rice, corn gluten meal, whole-grain corn, poultry by-product meal [natural source of glucosamine], whole-grain wheat, beef tallow preserved with mixed tocopherols [source of vitamin E], natural flavor, dicalcium phosphate, chicken cartilage [natural source of glucosamine], salt, vitamins, and minerals]. Hill’s Science Diet adult original diet (ingredients: chicken, corn meal, ground grain sorghum, ground wheat, chicken by-product meal, brewer’s rice, soybean meal, animal fat [preserved with mixed tocopherols and citric acid], chicken liver flavor, vegetable oil, dried egg product, flaxseed, preserved with mixed tocopherols and citric acid, minerals, rosemary extract, and beta-carotene vitamins). Eukanuba adult maintenance formula (ingredients: chicken, chicken-by-product meal, corn meal, ground whole-grain sorghum, ground whole-grain barley, fish meal [source of fish oil], chicken fat [preserved with mixed tocopherols, a source of vitamin E and citric acid], brewer’s rice, natural chicken flavor, dried beet pulp [sugar removed], dried egg product, brewers dried yeast, potassium chloride, salt, sodium hexametaphosphate, vitamins, and minerals]).

**Discounted retail price at local outlets as of Sep 11, 2004.
Prior to the study, 32 of the 48 dogs were being fed a diet produced by Hill’s Pet Nutrition, 9 were being fed a diet produced by the Nestle Purina Company, 5 were being fed a diet produced by the Iams Company, 5 were being fed a diet produced by the Waltham Company, and 3 were being fed diets produced by other companies (some dogs were being fed >1 diet prior to the study). The most common reasons given by owners for why they choose to feed that particular diet were low cost of the diet (n = 34), quality of the diet (15), convenience and availability (6), and palatability (3).

Forty-four of the 48 dogs that were initially enrolled completed the entire 16-month study. The 4 dogs that did not complete the study were withdrawn because the dog refused to eat any of the diets, the dog was euthanized owing to aggression, the dog gained a substantial amount of weight, or the owner moved from the area.

Owner impressions—Results showed that the order in which the 3 diets were fed did not have a significant effect on owner responses to the questionnaire. Scores for overall attitude and energy level were high in all dogs and did not differ among diets at any time during the study. Likewise, scores for hair coat quality and body condition did not differ among diets throughout the study.

All diets were readily consumed, with significant differences in overall palatability scores among diets (Table 2). At the end of the first and fourth months of study period 1, mean palatability score for the Purina diet was higher than scores for the other 2 diets, and at the end of the first month of study period 4, palatability score for the Eukanuba diet was higher than the score for the Purina diet.

Scores for overall fecal consistency and frequency of defecation did not differ significantly among the diets. However, when dogs were fed the Eukanuba diet, mean score for fecal consistency, compared with consistency during the preceding study period, was significantly higher (ie, more formed) than scores for the other 2 diets, and mean score for frequency of defecation, compared with frequency during the preceding study period, was significantly lower (ie, defecated more frequently) than score for the Purina diet (Table 2).

Reported incidences of adverse clinical signs that might have been related to diet were low and did not differ among diets (Table 3). At the end of study period 2, mean platelet count for dogs consuming the Hill’s diet (309,000 ± 59,000/µL) was significantly higher than mean count for dogs consuming the Purina diet (209,000 ± 82,000/µL) or the Eukanuba diet (192,000 ± 59,000/µL). No other significant differences in regard to hematologic or serum biochemical parameters were found among diets.

Percentages of owners indicating that they would consider feeding the diet on a long-term basis were not significantly different among diets overall or during any of the study periods. Although palatability scores did not differ substantially among diets during the study, poor palatability was the most commonly cited reason why owners would not be willing to feed a diet long-term (Table 4).

<p>| Table 2—Owner impressions of the performance of 3 premium diets fed to healthy adult dogs. |
|-----------------------------------------------|---------------|---------------|---------------|-----------------------------|</p>
<table>
<thead>
<tr>
<th>Variable (question No.)</th>
<th>Study period</th>
<th>Purina diet*</th>
<th>Hill’s diet†</th>
<th>Eukanuba diet‡</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet-by-period interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palatability score (1a)</td>
<td>1 (month 1)</td>
<td>5.00 ± 0.79</td>
<td>3.68 ± 1.17</td>
<td>4.00 ± 1.24</td>
<td>0.020</td>
</tr>
<tr>
<td>1 (month 4)</td>
<td>5.08 ± 0.86</td>
<td>4.21 ± 1.05</td>
<td>4.07 ± 1.07</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>4 (month 4)</td>
<td>3.85 ± 0.99</td>
<td>4.57 ± 0.94</td>
<td>4.75 ± 0.94</td>
<td>0.045</td>
<td></td>
</tr>
<tr>
<td>Fecal consistency score (4a)</td>
<td>1 (month 1)</td>
<td>90.63 ± 12.07</td>
<td>73.21 ± 28.53</td>
<td>89.27 ± 12.64</td>
<td>0.049</td>
</tr>
<tr>
<td>3 (month 4)</td>
<td>2.67 ± 0.78</td>
<td>2.77 ± 0.83</td>
<td>3.57 ± 0.94</td>
<td>0.018</td>
<td></td>
</tr>
<tr>
<td>3 (month 4)</td>
<td>3.00 ± 0.85</td>
<td>3.15 ± 0.56</td>
<td>4.00 ± 1.30</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Frequency of defecation score (5a)</td>
<td>2 (month 1)</td>
<td>1.50 ± 0.00</td>
<td>2.83 ± 0.29</td>
<td>1.86 ± 0.64</td>
<td>0.002</td>
</tr>
<tr>
<td>2 (month 4)</td>
<td>1.50 ± 0.00</td>
<td>2.00 ± 0.67</td>
<td>1.50 ± 0.00</td>
<td>0.033</td>
<td></td>
</tr>
<tr>
<td>Diet comparison for the entire study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative fecal consistency score (4b)</td>
<td>NA</td>
<td>3.05 ± 0.85</td>
<td>3.01 ± 0.74</td>
<td>3.27 ± 0.80</td>
<td>0.029</td>
</tr>
<tr>
<td>Relative frequency of defecation score (5b)</td>
<td>NA</td>
<td>3.11 ± 0.69</td>
<td>3.03 ± 0.45</td>
<td>2.90 ± 0.42</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Data are given as mean ± SD. Dogs (n = 44) were fed each of the 3 diets for a 4-month period (study periods 1, 2, and 3) in random order; during study period 4, dogs were fed the same diet as they were fed during study period 3. Owners, who were blinded to the identity of the diets, completed a questionnaire on diet performance at the end of the first and fourth months of each study period. Relative indicates in relation to the preceding study period. Only those variables for which significant differences were found are shown. *In each row, values with different letter superscripts were significantly (P < 0.05) different. NA = Not applicable; scores refer to entire study. See Table 1 for remainder of key. See Appendix for scoring criteria and questions.
Owner consistency in responses—Owner responses at the end of period 3 as to whether they would consider feeding the diet long-term were compared with responses at the end of period 4 (during period 4, owners unknowingly fed the same diet that they had fed during period 3). Eight of the 44 (18%) owners gave a response at the end of period 4 that was the opposite of their response at the end of period 3. Specifically, 5 owners who said they would not consider feeding the diet long-term after period 3 stated they would consider feeding the diet long-term after period 4, and 3 owners who said they would consider feeding the diet long-term after period 3 stated they would not consider feeding the diet long-term after period 4. Four (9%) other owners gave inconsistent responses: 2 who indicated they would not consider feeding the diet long-term after period 4, and 2 who were undecided after period 4 stated they would consider feeding the diet long-term after period 4.

Comparison of owner-versus veterinarian-assigned BCSs—Mean ± SD owner-assigned BCS was 5.5 ± 0.97 (range, 2 to 7), and mean veterinarian-assigned BCS was 6.0 ± 1.1 (range, 3 to 9). These values were significantly (P < 0.001) different, indicating that owners underestimated their dog’s BCS. The coefficient of determination (r²) was 0.452.

During the study, a total of 227 paired owner-assigned BCSs and veterinarian-assigned BCSs were collected. Eighty-nine of 227 pairs of BCSs showed that the owner-assigned BCS was lower than the veterinary-assigned BCS. Of these 89 responses, 43 of 89 (48.3%) were from staff, 24 of 89 (27.0%) were from veterinary students, and 22 of 89 (24.7%) were from faculty and residents.

Discussion

Results of the present study suggest that owners, when blinded to retail price and source, had similar impressions of 3 premium diets fed to healthy adult dogs. These results do not imply that all dog foods sold in grocery stores are of equal quality to each other, nor do they imply that all dog foods sold through pet specialty outlets are of equal quality to each other. Variations exist in the quality of pet foods sold through various retail outlets. Therefore, good- and poor-quality pet foods can be purchased at both retail outlets, and owners must evaluate the quality of a diet regardless of where it is purchased.

Most dogs in the present study were fed a diet pro-

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### Table 3—Frequency of clinical signs reported by owners of healthy adult dogs fed 3 premium diets.

<table>
<thead>
<tr>
<th>Clinical sign</th>
<th>Purina diet*</th>
<th>Hill's diet†</th>
<th>Eukanuba diet‡</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratching</td>
<td>3.63 ± 2.39</td>
<td>2.25 ± 1.75</td>
<td>4.13 ± 1.55</td>
<td>0.157</td>
</tr>
<tr>
<td>Excessive shedding</td>
<td>0.75 ± 1.04</td>
<td>0.75 ± 1.04</td>
<td>1.50 ± 1.51</td>
<td>0.379</td>
</tr>
<tr>
<td>Weight gain</td>
<td>1.75 ± 1.58</td>
<td>1.88 ± 0.64</td>
<td>2.13 ± 1.81</td>
<td>0.869</td>
</tr>
<tr>
<td>Weight loss</td>
<td>0.88 ± 0.99</td>
<td>1.83 ± 1.06</td>
<td>1.38 ± 1.30</td>
<td>0.414</td>
</tr>
<tr>
<td>Loss of muscle mass</td>
<td>0.25 ± 0.46</td>
<td>0.00</td>
<td>0.63 ± 0.74</td>
<td>0.067</td>
</tr>
<tr>
<td>Muscle weakness</td>
<td>0.25 ± 0.46</td>
<td>0.00</td>
<td>0.38 ± 0.74</td>
<td>0.339</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0.88 ± 0.64</td>
<td>1.13 ± 0.84</td>
<td>0.88 ± 0.35</td>
<td>0.972</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>1.13 ± 1.13</td>
<td>0.75 ± 1.17</td>
<td>0.75 ± 0.71</td>
<td>0.702</td>
</tr>
<tr>
<td>Constipation</td>
<td>1.00 ± 1.07</td>
<td>1.00 ± 1.41</td>
<td>0.50 ± 0.76</td>
<td>0.592</td>
</tr>
<tr>
<td>Increased water intake</td>
<td>1.00 ± 1.41</td>
<td>1.13 ± 1.36</td>
<td>2.00 ± 0.93</td>
<td>0.242</td>
</tr>
<tr>
<td>Decreased water intake</td>
<td>0.00</td>
<td>0.13 ± 0.36</td>
<td>0.25 ± 0.46</td>
<td>0.350</td>
</tr>
<tr>
<td>Increased urination</td>
<td>0.75 ± 1.04</td>
<td>0.75 ± 1.39</td>
<td>1.38 ± 0.74</td>
<td>0.430</td>
</tr>
<tr>
<td>Decreased urination</td>
<td>0.00</td>
<td>0.00</td>
<td>0.25 ± 0.46</td>
<td>0.122</td>
</tr>
<tr>
<td>Bad breath</td>
<td>1.50 ± 1.41</td>
<td>1.50 ± 1.20</td>
<td>2.63 ± 1.41</td>
<td>0.179</td>
</tr>
<tr>
<td>Reduced appetite</td>
<td>0.88 ± 0.84</td>
<td>1.88 ± 1.25</td>
<td>1.25 ± 1.39</td>
<td>0.254</td>
</tr>
<tr>
<td>Refused food</td>
<td>1.13 ± 1.25</td>
<td>1.75 ± 0.89</td>
<td>0.63 ± 0.74</td>
<td>0.095</td>
</tr>
<tr>
<td>Intolerance of cold or heat</td>
<td>0.38 ± 0.74</td>
<td>0.13 ± 0.35</td>
<td>0.25 ± 0.46</td>
<td>0.663</td>
</tr>
<tr>
<td>Lethargy</td>
<td>0.38 ± 0.74</td>
<td>0.63 ± 0.74</td>
<td>0.75 ± 0.89</td>
<td>0.636</td>
</tr>
<tr>
<td>Excessive drooling</td>
<td>0.00</td>
<td>0.13 ± 0.35</td>
<td>0.13 ± 0.35</td>
<td>0.614</td>
</tr>
</tbody>
</table>

Data represent mean ± SD. See Table 1 for key.

### Table 4—Reasons given by owners for not wanting to feed each of 3 premium diets to their dogs long-term.

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Percentage of negative responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Purina diet*</td>
</tr>
<tr>
<td>Desire larger kibble size</td>
<td>12.2</td>
</tr>
<tr>
<td>Poor palatability</td>
<td>45.9</td>
</tr>
<tr>
<td>Desire diet with lower energy density</td>
<td>20.3</td>
</tr>
<tr>
<td>Poor performance of diet (eg, soft feces, poor hair coat, or constipation)</td>
<td>21.6</td>
</tr>
<tr>
<td>Unpleasant odor of diet</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Dogs (n = 44) were fed each of the 3 diets for a 4-month period (study periods 1, 2, and 3) in random order; during study period 4, dogs were fed the same diet as they were fed during study period 3. At the end of each study period, owners were asked whether they would consider feeding the diet long-term. After the first exposure to each diet (study periods 1, 2, and 3), 13 of the 44 owners indicated they would not consider feeding the Purina diet long-term, 11 indicated they would not consider feeding the Hill’s diet long-term, and 14 indicated they would not consider feeding the Eukanuba diet long-term. During study period 4, 5 of 44 owners indicated they would not consider feeding the Purina diet long-term, 5 of 44 indicated they would not consider feeding the Hill’s diet long-term, and 4 of 44 indicated they would not consider feeding the Eukanuba diet long-term. Percentages of owners who would not consider feeding the diet long-term did not vary significantly among diets. Data represent percentage of all negative responses for each diet. See Table 1 for key.
duced by Hills Pet Nutrition prior to enrollment in the study. This was not surprising given that Hills' products are available to veterinary students, veterinary school staff, and faculty members at a substantial discount, and low cost was the most commonly cited reason for why owners choose to feed the particular diet they were feeding.

In contrast, palatability was rarely cited by owners prior to the study as a reason why they chose the particular diet they were feeding to their dogs. However, poor palatability was the most common reason given when owners indicated that they would not consider feeding one of the study diets long-term. This suggests that prior to the study, owners did not consciously think of palatability as an important factor in their decision-making process, possibly because they had already identified a diet that their dogs found to be palatable. Yet during the study, when owners were asked to pay more attention, this factor played a dominant role in the decision as to whether to feed a particular diet long-term. Thus, palatability appears to be an important factor in determining owners' initial willingness to feed a diet.

During the course of the study, there were no significant differences among diets in regard to most variables evaluated. However, significant differences were found for scores for fecal consistency and frequency of defecation in relation to the previous diet. Specifically, owners perceived that dogs had more formed feces when fed the Eukanuba diet than they had when consuming a previous diet but that dogs defecated more frequently when fed the Eukanuba diet than when fed a previous diet. This perceived difference in fecal quality while feeding the Eukanuba diet may be attributable to incorporation of a moderately fermentable fiber source in the diet. All 3 diets were chicken-based; however, only the Eukanuba diet contained dried beet pulp, which is a moderately fermentable fiber source. Bacterial fermentation of dried beet pulp produces short-chain fatty acids, which are an important energy source for the epithelial cells lining the large intestine. In a previous study, dogs fed diets containing moderately fermentable fiber were found to have increased colon weights, increased mucosal surface area, and mucosal hypertrophy, compared with dogs fed diets that did not contain moderately fermentable fiber sources.

Owners perceived that dogs in the present study defecated more frequently, compared with the previous study period, when fed the Eukanuba diet than when fed the Purina diet or, alternatively, that they defecated less frequently when fed the Purina diet than when fed the Eukanuba diet. This may have been related to the higher energy density of the Purina diet, which resulted in the need to consume a smaller quantity of this diet to meet daily kilocalorie needs.

On the other hand, scores for absolute fecal consistency and frequency of defecation did not differ significantly among diets, suggesting that owner impressions when evaluating a diet by itself may differ from their impressions when comparing that diet with a previous diet. Nevertheless, owner recall likely has a great influence on decisions regarding dog food purchases.

The reason for the significant difference in platelet counts at the end of study period 2 among dogs fed the various diets is not obvious. However, some dogs consistently had higher or lower platelet counts than did other dogs throughout the study, while there was also individual variation in platelet counts for some dogs. In addition, the possibility that sampling technique affected the platelet count cannot be discounted. Finally, although there was a statistically significant difference, this difference was likely not clinically important.

Our finding that owners tended to underestimate their dog's BCS was similar to findings of a previous study, even though the populations of pet owners in the 2 studies differed. In the previous study, dog owners were not affiliated with a college of veterinary medicine and therefore were likely not familiar with the concept of body condition scoring. In contrast, the population of dog owners in the current study consisted of students and employees of a college of veterinary medicine. All veterinary students participating in the study were taught the concepts of body condition scoring during a first-year veterinary nutrition course, and most of the residents and faculty members were familiar with BCSs, but about 23% of these individuals underestimated BCS for their dogs. Most of the staff members who participated in the present study were unfamiliar with BCSs, and approximately 50% underestimated BCS for their dogs. Increasing the number of dog owners capable of determining ideal body condition through training in body condition scoring may help prevent some dogs from becoming overweight and may help owners identify dogs that should participate in a weight-loss program.

Study period 4 was incorporated in the present study to determine how consistent owners were in evaluating dog foods. Owners were not informed that they were feeding identical diets during the third and fourth study periods, and when queried as to whether they would consider feeding the diet long-term, 12 of 44 (27%) provided inconsistent responses. It is possible that some of this inconsistency reflected true differences in performance of the diet during the 2 study periods, which is possibly related to seasonal or other environmental changes. However, the subjective nature of the variables evaluated in the present study and the dependency on recall by the owners for some of their responses likely contributed to a greater extent, and the high percentage of owners that gave inconsistent responses suggests that factors other than the diets themselves play a role in how owners perceive the performance of dog foods.

### References

Appendix

Questionnaire used to assess owner impressions of dog foods fed to healthy adult dogs.

Question 1a: how well does your dog eat the current study diet? (circle 1 answer)
1: Not at all
2: Picks at food, does not finish all of it
3: Eats slowly but finishes food
4: Eats normally and finishes food by next meal
5: Eager to eat and finishes food within minutes
6: Ravenous, never acts satisfied

Question 1b: how does this compare with how well your dog was eating the diet fed the previous month or previous 4 months? (circle 1 answer)
1: Likes it less
2: No difference
3: Likes it better than previous diet
4: Don't remember

Question 2a: how would you rate your dog's attitude while consuming the current study diet? (circle 1 answer)
1: Very listless and lethargic
2: Raises head alertly and wags tail to greet but does not get up
3: Stands to greet
4: Runs to greet
5: Runs to greet, wants to play

Question 2b: how does this compare with your dog's attitude while consuming the diet fed the previous month or previous 4 months? (circle 1 answer)
1: Less playful
2: No difference
3: More playful
4: Don't remember

Question 3a: how would you describe your dog’s body weight and condition? (circle 1 answer)
1: Muscle wasting
2: Thin
3: Ideal, excellent
4: Overweight
5: Obese

Question 3b: how does this compare with your dog's body weight and condition while consuming the diet fed the previous month or previous 4 months? (circle 1 answer)
1: Worse
2: No difference
3: Better
4: Don't remember

Question 4a: which score* best describes the consistency of your dog's feces? (circle all that apply)
0: Very loose, no form, diarrhea, possibly bloody
25: Mixture of formed and unformed, mostly loose
50: Formed feces but very soft
75: Formed, drier but not hard
100: Well formed
Occasionally constipated
Frequently constipated

Question 4b: how does consistency of your dog's feces compare with consistency while consuming the diet fed the previous month or previous 4 months? (circle 1 answer)
1: Less formed
2: No difference
3: More formed
4: Don't remember

Question 5a: on average, how often does your dog defecate per day? (circle 1 answer)
< 1 time/d
1 to 2 times/d
3 times/d
> 3 times/d
Don't know

Question 5b: how does this compare with the number of times your dog defecated while consuming the diet fed the previous month or previous 4 months? (circle 1 answer)
1: Defecates more frequently now
2: No difference
3: Defecates less frequently now
4: Don't remember

Question 6a: how would you describe your dog’s hair coat? (circle 1 answer)
1: Dull
2: Poorly reflective
3: Slightly reflective
4: Shines
5: Greasy

Question 6b: how does this compare with your dog's hair coat while consuming the diet fed the previous month or previous 4 months? (circle 1 answer)
1: Worse
2: No difference
3: Better
4: Don't remember

Question 7a: how would you describe your dog's body weight and condition? (circle 1 answer)
1: Muscle wasting
2: Thin
3: Ideal, excellent
4: Overweight
5: Obese

Question 7b: how does this compare with your dog's body weight and condition while consuming the diet fed the previous month or previous 4 months? (circle 1 answer)
1: Worse
2: No difference
3: Better
4: Don't remember

Question 8: has your dog shown any of the following clinical signs in the past month or 4 months?
Scratching or chewing on skin or feet, excessive shedding, weight gain, weight loss, loss of muscle mass, muscle weakness, vomiting, diarrhea, constipation, increased water intake, decreased water intake, increased urination, decreased urination, bad breath, reduced appetite or food intake, refused food, intolerance of cold or heat, lethargy, or excessive drooling

Question 9: assuming cost was not an issue, if the current study diet was available on the market, and based on how it performed in your dog during the previous month or previous 4 months, would you consider feeding this diet to your dog on a long-term basis? Why or why not?

Question 10: do you have any other comments about your dog that would be important for us to know?

Dogs were fed each of 3 diets for 4-month periods; questionnaires were completed after the first and fourth month of each study period.