



Inclusion of Lemna as a plant-based protein ingredient in dog and cat diets

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Abstract

Our objective was to evaluate the inclusion of a novel plant-based protein (Lemna; MC Select; Parabel®; Vero Beach, FL) in dog diets at 0, 5, and 10% and cat diets at 0, 10 and 15% for palatability, stool quality, and nutrient digestibility. We hypothesized that Lemna would be a viable protein source in both cat and dog diets by showing no detriments to nutrition outcomes. All feeding tests were conducted at an independent research facility (Susquehanna, Pa). A standard 2 bowl palatability test over a 2 day period was done with adult dogs and cats (n=30 each) to determine intake ratios (IR) between test diets (Lemna -containing diets) and control (0% Lemna) diet. Total tract nutrient digestibility was conducted with 18 adult dogs and 21 adult cats (n=6-7 per diet) with 5 days of diet acclimation followed by 5 days of total fecal collection. Stool quality was evaluated on a 1-5 scale where 1 = non-formed/diarrhea and 5 = hard, formed. Palatability data was analyzed via Wilcoxon Signed Rank, and digestibility and stool quality data were analyzed by ANOVA with a Tukey's post-hoc means separation (SAS version 9.4). Intake ratios in cats between 10% Lemna and control were significantly (P<0.05) in favor of control, while no difference was observed between 15% Lemna and control. For dogs, 5% and 10% Lemna had significantly (P<0.05) lower IR demonstrating a preference to control. Both cats and dogs fed Lemna diets had acceptable stool quality (3.42 avg for cat and 3.34 avg for dog). No detriments in nutrient digestibility were observed in dogs fed 5% and 10% Lemna; however, cats fed 10% and 15% Lemna had significantly (P<0.05) lower dry matter, protein, and energy digestibility versus control. In conclusion, this data suggest more development is needed for Lemna inclusion into companion animal diets.

Introduction

- Novel ingredients are always being investigated to promote differentiation in the pet food industry.
- Furthermore, identifying sustainably sourced plant-based protein alternatives provides numerous benefits to formulators by controlling minerals
- Lemna (MC Select; Parabel®; Vero Beach, FL) is a novel plant-based protein source from water lentils that is considered a source of essential amino acids and macro minerals.

Objective: To evaluate the inclusion of a novel plant-based protein (Lemna; MC Select; Parabel®; Vero Beach, FL) in both dog and cat diets.

Design

- Adult dogs and cats at an independent research facility (Susquehanna, PA) were fed dry extruded kibble containing 3 concentrations of Lemna:
 - Dog: 0% (Control), 5%, and 10%
 - Cat: 0% (Control), 10%, and 15%
 - All diets were formulated to be equal in protein, fat, energy, fiber and moisture. Lemna was balanced at the expense of pea fiber, pea protein, and pea starch.
- Palatability:** Diets were offered once daily for 2 days. Bowl placement was reversed daily and both bowls were presented for 4 hours. Food consumption and first choice preference were recorded for each dog and cat (n=30 each).
- Digestibility:** Adult dogs (n=18) and cats (n=21) were each provided test diets for 10 days (5 days of acclimation, and 5 days of total fecal collection). Total tract nutrient digestibility for dry matter, protein, fat, and energy was determined for all diets.
- Stool quality:** Assessed on a 5 point scale (1 = watery diarrhea; 5 = hard, dry, crumbly). Adult dogs and cats (n=10 each) were assessed over a 7 day period.

Results

Nutrient Composition: Dog Test Diets

	Control	5% Lemna	10% Lemna
Nutrient, % as-is			
<i>Crude Protein</i>	20.78	20.29	22.63
<i>Crude Fat</i>	14.18	15.09	14.63
<i>Crude Fiber</i>	4.2	5.0	4.7
<i>Moisture</i>	7.2	5.9	5.3

Table 1: Nutrient composition of control and test diets. All dog diets are a lamb grain-free formula and formulated to exceed AAFCO guidelines for adult maintenance.

Nutrient digestibility not impacted in dogs fed increased concentrations of Lemna

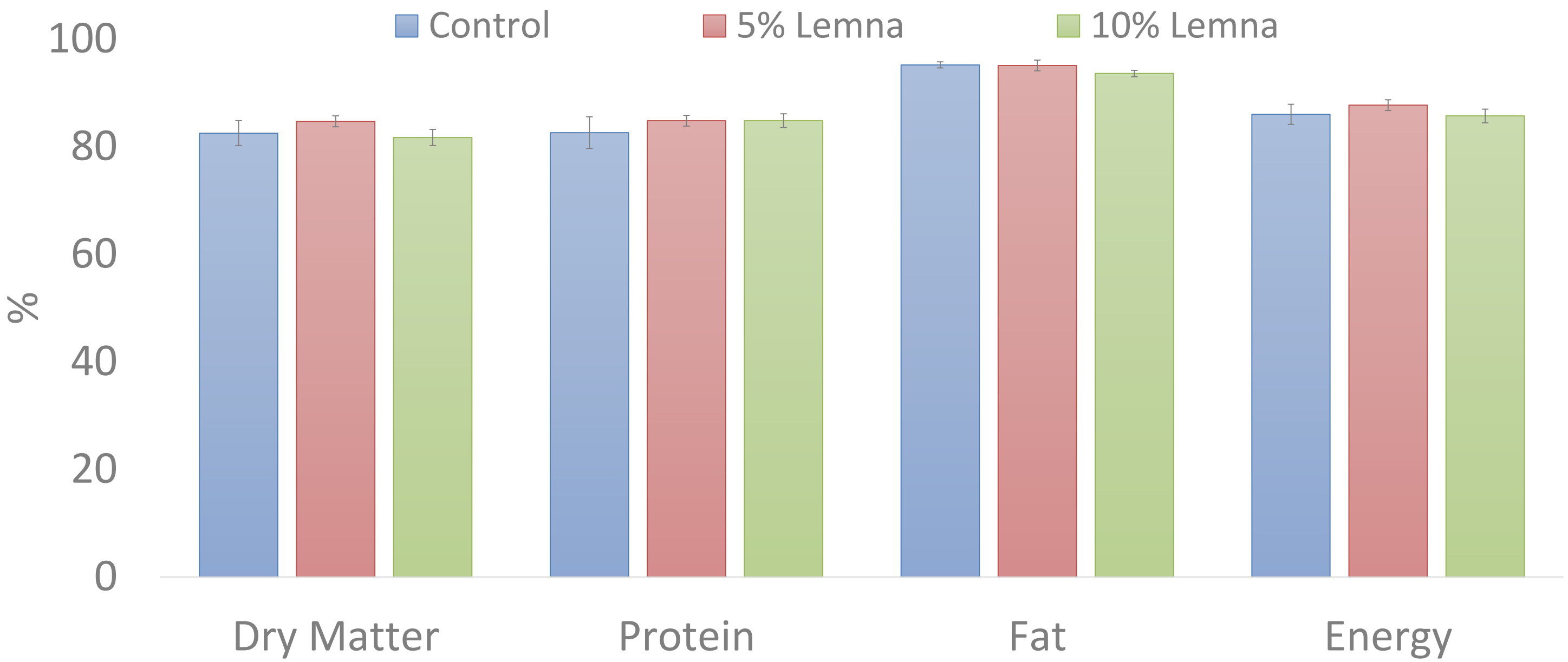


Figure 1: Total tract nutrient digestibility in dogs (n=18) fed diets with 5% and 10% inclusion levels of Lemna. All values are means ± SEM. Data were analyzed by one-way ANOVA in SAS v 9.4.

Palatability Results: Dog and Cat

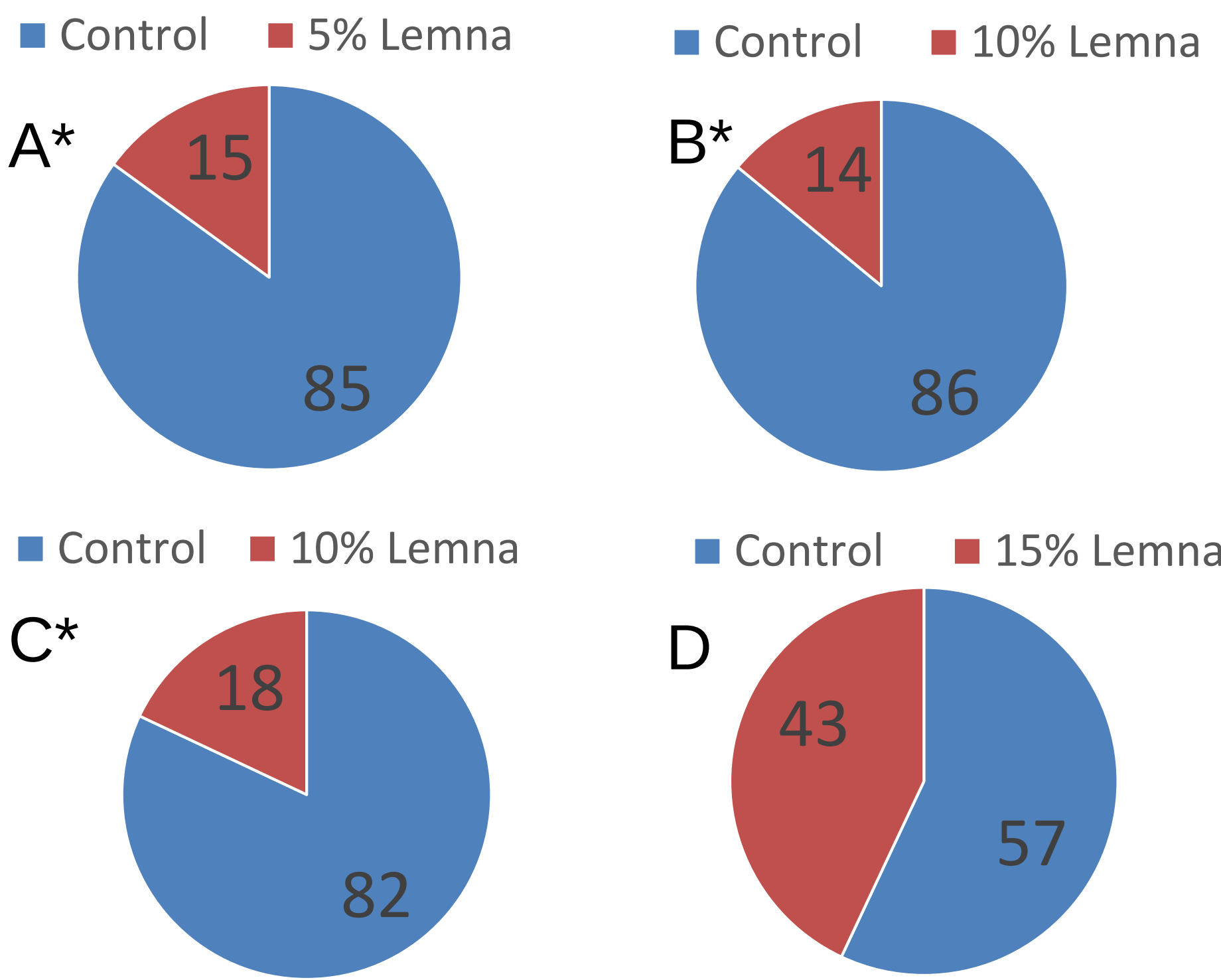


Figure 3: Average intake ratios for dogs (n=30) fed Control vs. 5% Lemna (A) and Control vs. 10% Lemna (B); and cats (n=30) fed Control vs. 10% Lemna (C) and Control vs. 15% Lemna (D). *Denotes a significant difference (P<0.05) between comparisons via Wilcoxon Signed-Rank (SAS 9.4).

Nutrient Composition: Cat Test Diets

	Control*	10% Lemna	15% Lemna
Nutrient, % as-is			
<i>Crude Protein</i>	31.53	31.98	34.73
<i>Crude Fat</i>	14.18	18.24	19.49
<i>Crude Fiber</i>	4.2	4.2	4.2
<i>Moisture</i>	6.1	5.9	3.4

Table 2: Nutrient composition of control and test diets. All cat diets are a whitefish grain-free formula and formulated to exceed AAFCO guidelines for adult maintenance. *A misapplication of canola oil resulted in different fat levels.

Cats fed 10 and 15% Lemna exhibited lower dry matter, protein, and energy digestibility

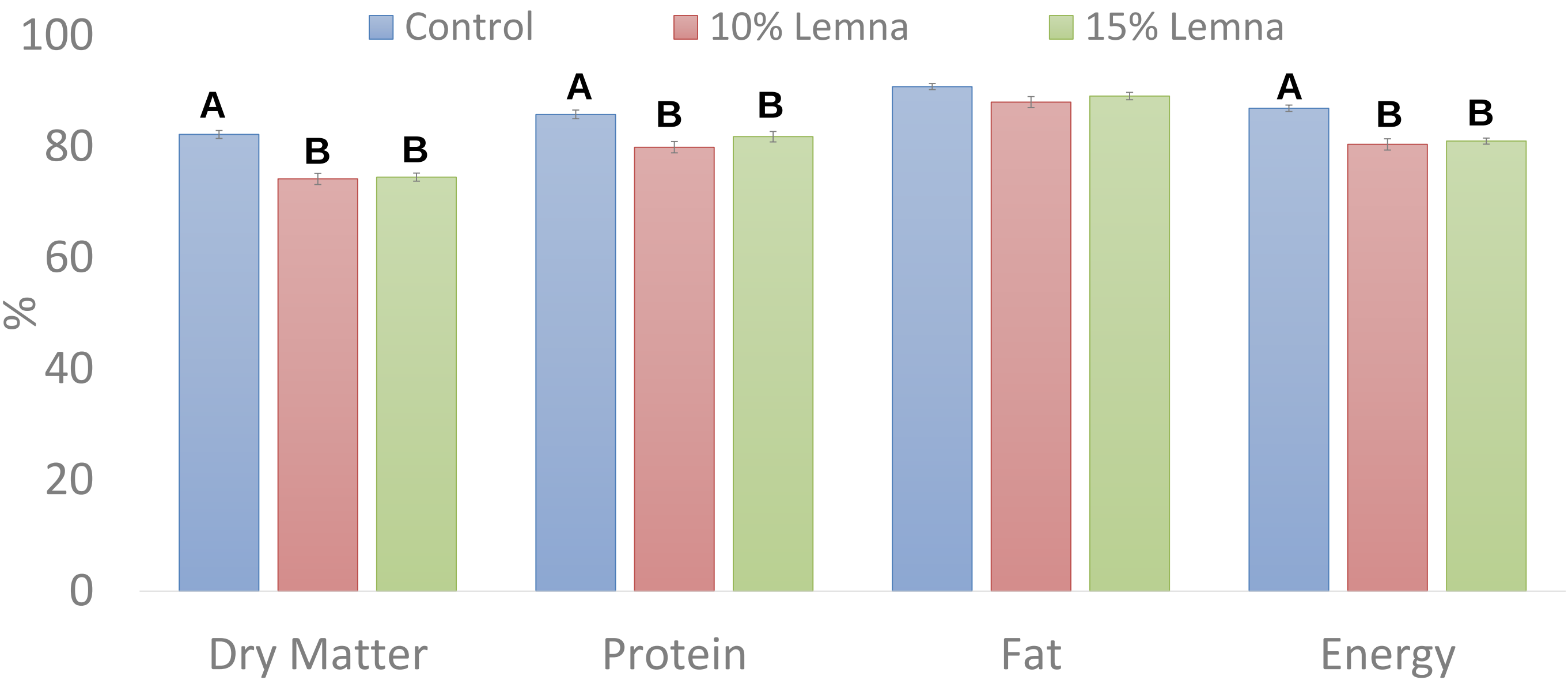


Figure 2: Total tract nutrient digestibility in cats (n=21) fed diets with 10% and 15% inclusion levels of Lemna. All values are means ± SEM. ^{AB}Different letters denote a significant (P < 0.05) difference between dietary treatments. Data were analyzed by one-way ANOVA in SAS v 9.4.

Stool quality was acceptable in dogs and cats fed Lemna

	Average stool quality scores			P-Value
Dog diets	Control: 3.28 ^{ab}	5% Lemna: 3.41 ^{a*}	10% Lemna: 3.27 ^{b*}	0.0270
Cat diets	Control: 3.33	10% Lemna: 3.42 [*]	15% Lemna: 3.42 [*]	0.1178

Table 3: Average stool scores in cats and dogs (n=10 cat and dog each) fed Lemna-containing diets. Stool quality was evaluated on a 1-5 scale where 1 = non-formed/diarrhea and 5 = hard, formed. ^{ab}Different letters denote a significant (P < 0.05) difference between dietary treatments. *Denotes green colored stool. Data were analyzed by one-way ANOVA in SAS v 9.4.

Conclusions

- Nutrient digestibility was not impacted in dogs fed diets containing 5% and 10% Lemna; however, cats fed 10% and 15% Lemna exhibited decreases in dry matter, protein, and energy digestibilities.
- Stool consistency was ideal in all diets tested for dogs and cats. However, the color of the stool was green due to green color of Lemna.
- Diets containing Lemna exhibited lower palatability compared to control diets in both dogs and cats.
- These data suggest further development is needed in order to include Lemna as a protein source in companion animal diets.
- No conflicts of interest to disclose.

Brand Mascot: Blue Bishop

