

## Companion Animals: Companion Animal and Comparative Animal Nutrition

**W236 Compositional analysis of various whole grains and whole grain dog treats.** A. N. Beloshapka\*<sup>1</sup>, P. R. Buff<sup>3</sup>, and K. S. Swanson<sup>1,2</sup>, <sup>1</sup>Department of Animal Sciences, University of Illinois, Urbana, <sup>2</sup>Division of Nutritional Sciences, University of Illinois, Urbana, <sup>3</sup>The Nutro Company, Franklin, TN.

Whole grains, including the resistant starch (RS) components, may be beneficial to canine health through the use of a baked treat matrix; however, the use of whole grains in pet food has not been thoroughly evaluated. Our first objective was to measure the chemical and starch composition of various whole grains, processed grains and grain components which may be incorporated into baked treats for dogs. Thirty-one grain samples, including whole yellow corn, conventional quinoa, organic spelt hull pellets, conventional whole millet, conventional hulled millet, sorghum, brown rice, rice, rice flour, rice bran, whole wheat, potato flake, whole pearled barley, barley flake, cut barley, pearled barley flakes, steamed rolled barley, ground pearled barley, malted barley, groats, steel cut groats, ground steamed groats, steamed rolled oat groats, instant oats, quick oats, regular rolled oats, oat fiber, oat bran #1, oat bran #2, oat flour, and oatmeal (ground) were analyzed. The grains contained the following: crude protein (1.71–17.04% DMB), fat (1.28–8.49% DMB), total dietary fiber (2.16–85.16% DMB), and RS (0.0–9.38% DMB). Because cooking alters RS content of whole grains, our second objective was to evaluate the chemical composition, starch composition and gelatinization score of commercial baked whole grain dog treats and baked whole grain dog treats processed to alter the RS content. Ten treat samples were analyzed, including 4 commercially available canine treats (Nutro Natural Choice Lite All Natural Biscuits, Nutro Natural Choice Skin and Coat All Natural Biscuits, Nutro Ultra Healthy Skin and Coat Blend All Natural Biscuits, Nutro Ultra Healthy Digestion Blend All Natural Biscuits) and 6 test dog treats processed to alter the resistant starch content. The treats contained the following: crude protein (9.80–19.72% DMB), fat (6.27–15.55% DMB), and RS (1.29–5.60% DMB). Based on our compositional analysis, whole grains vary greatly in nutritive value, but some may provide a generous amount of functional nutrients (i.e., total dietary fiber and RS) to dogs, but more research is needed to test the effects of whole grain containing dog treats in vivo.

**Key Words:** canine, treats, grain

**W237 Increasing dietary water content increases voluntary physical activity in healthy adult cats.** P. Deng\*<sup>1</sup>, M. Pallotto<sup>1</sup>, and K. Swanson<sup>1,2</sup>, <sup>1</sup>Department of Animal Sciences, University of Illinois, Urbana, <sup>2</sup>Division of Nutritional Sciences, University of Illinois, Urbana.

Low physical activity has been identified as a major risk factor for the development of feline obesity and diabetes. Increased dietary water content has been suggested as a method to reduce dietary energy density to maintain body weight (BW) in cats. The objective was to evaluate the effect of increasing dietary water content on voluntary physical activity in healthy adult cats fed to maintain BW. Ten healthy adult neutered male cats (4.39 ± 0.43 kg BW; 4.5–5 BCS on 9-point scale) were used in a crossover design consisting of 52 d (two 26-d periods). Both periods included a 14-d adaptation phase, a 7-d phase for voluntary physical activity measurement via Actical activity collars, and a 5-d phase for fecal and urine collection. Cats were randomly assigned to 2 rooms (5

cats per room) under a 16 h light:8 h dark cycle and remained in the same room throughout the study. Cats were group-housed in the rooms for 22 h/d and were individually housed 2 h/d in cages at feeding times (0900–1000 h and 1500–1600 h). Cats were fed the Royal Canin Adult Fit 32 diet without or with added water (added to kibbles to reach 70% water content 1 h before feeding) at amounts to maintain BW and BCS. Drinking water was available ad libitum. Activity levels were expressed as 'activity counts' per epoch (15 s). Daily average activity level of cats fed the 70% hydrated diet tended to be higher ( $P = 0.06$ ) than cats fed the dry diet, especially during the dark period ( $P = 0.007$ ). Two-h food anticipatory activity before the afternoon meal for cats fed the 70% hydrated diet was lower ( $P = 0.05$ ) than cats fed the dry diet, but not at the morning meal. Despite no differences in fecal score or total fecal weight, cats fed the 70% hydrated diet had greater ( $P = 0.002$ ) total urinary volume and lower ( $P = 0.003$ ) urinary specific gravity, and tended to have greater ( $P = 0.06$ ) fecal moisture compared with cats fed the dry diet. In conclusion, increasing water content without changing energy intake or dietary macronutrient composition appears to promote physical activity and influence urinary specific gravity, which may aid in weight loss or maintenance in cats.

**Key Words:** physical activity, dietary water content, cat

**W238 Chemical composition of dietary items consumed by two lemur species (*Varecia variegata* and *Propithecus diadema*) in the Analamazaotra Special Reserve, Madagascar.** B. C. Donadeo\*<sup>1</sup>, V. R. A. Randrianindrina<sup>2</sup>, K. R. Kerr<sup>1</sup>, S. L. Burke<sup>3</sup>, E. E. Louis Jr.<sup>3</sup>, C. L. Morris<sup>3,4</sup>, and K. S. Swanson<sup>1</sup>, <sup>1</sup>University of Illinois at Urbana-Champaign, Urbana, <sup>2</sup>Université d'Antananarivo, Antananarivo, Madagascar, <sup>3</sup>Omaha's Henry Doorly Zoo & Aquarium, Omaha, NE, <sup>4</sup>Iowa State University, Ames.

The objective of this study was to determine the nutrient concentrations of selected fruits and leaves consumed by free-ranging black-and-white ruffed lemurs (*Varecia variegata*) and diademeds sifakas (*Propithecus diadema*) that had been re-located to the Analamazaotra Special Reserve in eastern Madagascar. Twelve known groups of *P. diadema* (1 to 4 lemurs) and 2 known groups of *V. variegata* (3 to 4 lemurs) were observed from October 2008 to March 2009 to determine the predominant food items consumed in the wild. Plant samples were collected the day after lemurs were observed feeding from them. After collection, samples were dried at 57°C and secured in heat sealed bags for transport to Omaha's Henry Doorly Zoo (OHDZ). The Nutrition Department at OHDZ then ground the samples and dried them at 105°C to obtain absolute dry matter (DM) values, after which a subsample of each was analyzed for organic matter (OM), gross energy (GE), and crude protein (CP) concentrations. Samples were then stored at 4°C until shipment to the University of Illinois (UI). At UI, 13 species ( $n = 36$ ) were selected to allow analysis of both fruits ( $n = 15$ ) and leaves ( $n = 21$ ) from each species. Fat concentrations were determined via acid hydrolysis. Dietary fiber fractions of the samples were determined using the total dietary fiber (TDF), neutral detergent fiber (NDF), and acid detergent fiber (ADF) assays. Samples were also examined for free sugars and hydrolyzed monosaccharides via HPLC. Fat values for the fruit samples (range = 3.1% to 23.1%; median = 7.9%) were higher ( $P < 0.05$ ) than those from the leaf samples (range = 1.5% to 11.1%; median = 3.7%). The protein:ADF ratio of fruits ranged from 0.10 to

0.97, while leaves ranged from 0.11 to 0.66. Median ADF concentration was 42.9% (range = 9.8% to 65.9%), which far exceeds the minimum 10% recommendation from the NRC's Nutrient Requirements of Non-Human Primates (2003). The data from this study will aid in improving understanding of the nutrient composition of dietary items available to wild lemurs and allow comparison to captive diets.

**W239 Inclusion of fresh pork pancreas in raw pork-meat based diets for African wildcats (*Felis silvestris tristrami*) does not affect macronutrient digestibility.** C. L. Morris<sup>\*1,2</sup>, S. L. Burke<sup>2</sup>, and C. L. Bexten<sup>2</sup>, <sup>1</sup>Iowa State University, Ames, <sup>2</sup>Omaha's Henry Doorly Zoo and Aquarium, Omaha, NE.

Small exotic felids are frequently fed raw meat-based diets in managed environments, including zoological institutions. In addition, feeding raw meat-based diets to domestic companion animals (dogs, cats) is becoming more common. Many companion animal owners feeding raw meat diets indicate improvements in macronutrient digestibility when raw pancreas is included in the diet, particularly for senior animals or for clinical conditions including pancreatic insufficiency; however, data to substantiate these claims are lacking. The objective of this study was to determine the influence of fresh pork pancreas inclusion, in a raw pork-based diet for African wildcats, on apparent total tract macronutrient digestibility. Four animals were used (2 males, 2 females) in a randomized crossover design that consisted of 4 raw meat diets including the standard beef-based zoological formula [Beef; 33.4% dry matter (DM), 56.9% crude protein (CP), 29.4% crude fat (CF) and 6.3 kcal/g gross energy (GE)]; pork with 0% added pancreas (P0; 31.1% DM, 54.1% CP, 32.6% CF, 6.3 kcal/g GE); pork with 3% (wt/wt as fed) (P3; 31.9% DM, 53.8% CP, 31.1% CF, 6.4 kcal/g GE); pork diet with 5% (wt/wt as fed) (P5; 31.7% DM, 54.2% CP, 31.3% CF, 6.3 kcal/g GE). Apparent DM (87.0 to 89.5%), OM (90.8–92.7%), CF (97.5–98.6%) and GE (92.5–94.2%) digestibility values were high for all diets and were not affected by treatment. Crude protein apparent digestibility was higher ( $P < 0.05$ ) in cats fed P3 (96.4%) compared with cats fed Beef (93.8%). Apparent CP digestibility for P5 and P0 were 94.8 and 95.0%, respectively and did not differ. Beef CP digestibility (93.8%) was lower ( $P = 0.02$ ) than all 3 pork diets (95.4%) when contrasts were analyzed statistically; therefore, the difference between Beef and P3 was likely a result of the different protein source, not the inclusion of pancreas. Inclusion up to 5% fresh pancreas did not increase macronutrient digestibility in healthy animals. Additional research may be warranted to determine if inclusion of pancreas can improve digestibility in senior or GI-compromised animals.

**Key Words:** cat, raw diet

**W240 Neither enzymes nor synbiotic supplementation influenced nutrient digestibility or fecal characteristics of dogs.** B. S. Obeidat\*, K. K. Guatam, and M. A. Ballou, Texas Tech University, Lubbock.

The objectives of this study were to determine the influence of enzymes or synbiotic supplementation on nutrient digestibility and fecal characteristics of adult mixed breed dogs (BW = 23.6 ± 2.45; n = 4) using a 3 × 3 Latin square design. Treatments were a control (CON), enzyme mixture (ENZ), or synbiotic (SYN). Each dog in the CON treatment was supplemented with 4 g/d of maltodextrin; whereas in the ENZ treatment, each dog was supplemented with 2 g/d of maltodextrin and 2 g/d enzyme mixture (fungal amylase, hemicellulase, xylanase, lipase, fungal protease, and acid stable protease). Dogs in the SYN

were supplemented with 1.47 g/d of maltodextrin, 2 g/d of FOS, 0.5 g/d of MOS, and 109 cfu/d each of *Bacillus subtilis* and *Enterococcus faecium*. Each treatment was top dressed to ensure complete consumption of the 4 g. In each period, one of the treatment groups had 2 dogs while the other 2 groups had 1 dog (a total of 4 dogs per treatment). Dogs were housed in individual pens. Each period composed of 10-d as adaptation and 4-d period for data collection. During the collection period, total fecal was collected from each dog and frozen at -80°C for later analysis. Fresh fecal sample was taken during the last day of the collection period and analyzed for dry matter (DM), unbound water, pH, ammonia, and volatile fatty acids (VFA). A commercial dog food (Adult Large Breed; Hill's Pet Nutrition; Topeka, KS) was offered at 1.25% of metabolic BW. Body weight was measured at the beginning and end of each period. Enzyme or synbiotic supplementation did not ( $P > 0.05$ ) change the BW. Nutrient digestibilities were not influenced ( $P > 0.05$ ) by the enzymes or synbiotic supplementation. There were no differences ( $P > 0.05$ ) observed for the fecal DM, unbound water, ammonia, or VFA concentrations between treatment groups. In summary, results demonstrate that enzymes or synbiotic supplementation did not affect performance of adult mixed breed dogs.

**Key Words:** canine, enzyme, synbiotic

**W241 Prediction of metabolizable energy value of extruded dog food: Comparing values generated by equations proposed in the literature and values obtained in vivo.** F. S. Ebina, R. C. S. Ogoshi, M. G. Zangeronimo, P. B. Rodrigues, F. M. O. B. Saad, and C. E. P. Saad\*, Federal University of Lavras, Lavras, Minas Gerais, Brazil.

The most exact metabolizable energy (ME) estimation method of extruded dog foods is through in vivo digestibility trials. However, due to the difficulty in performing this methodology in commercial routine, faster, low cost, and accurate alternative is warranted. Various equations are already proposed in literature and are widely used. However, due to the differences in ingredients, formulations and analytical methods, it is important to evaluate if this equations are apt in predicting ME in Brazilian rations. The objective of this study was to evaluate the adjustment of equations existent in literature for the prediction of ME in extruded dog foods produced in Brazil and, to do this, digestibility trials were performed of 40 dry extruded food on adults Beagle dogs. Each food was offered in controlled amounts (130 kcal/kg BW<sup>0.75</sup>) to 6 Beagle dogs, individually housed in metabolic cages during 10 d, with 5 d being of adaptation period and 5 d of total feces and urine collection. The ME in vivo values were compared with the values predicted by the equations that used the data of the chemical composition of the ingredients to calculate the energies. Segmentations were done on diets with ether extract (EE) above or below 12% and crude fiber (CF) above or below 2.5% to test the adjustments. The adjustments were evaluated by means of the standard error of estimate, of the coefficients of determination and by the acceptance of the hypotheses tests (a = 0; b = 1) of the linear adjustment (y = a + bx) when observed values of energy were compared with the predicted. The model ME = Digestible Energy - 1.07\*Crude Protein (%) (NRC, 2006) was the best in the diet segments of EE above 12% (r<sup>2</sup> = 0.70), in the diets of CF above 2.5% (r<sup>2</sup> = 0.90) and CF equal or below 2.5% (r<sup>2</sup> = 0.79). For the diets of EE equal or below 12%, the best model was: ME = 0.84DE - 0.6 (r<sup>2</sup> = 0.32) (Kendall et al., 1985). None of the tested equations adapted satisfactorily to the prediction of the energy values of the 40 dog foods. Acknowledgment: CAPES and FAPEMIG.

**Key Words:** pet food, energy estimation, canine

**W242 Prediction of digestible and metabolizable energy value in Brazilian extruded dog foods.** F. S. Ebina<sup>1</sup>, J. S. Dos Reis<sup>1</sup>, J. Franca<sup>2</sup>, C. E. P. Saad<sup>1</sup>, and F. M. O. B. Saad\*<sup>1</sup>, <sup>1</sup>*Federal University of Lavras, Lavras, Minas Gerais, Brazil*, <sup>2</sup>*Federal University of Uberlandia, Uberlandia, Minas Gerais, Brazil*.

In Brazil, the cereal cultivars which generate the byproducts used in dog rations are different than those used in the USA and Europe and this possibly generates differences in the food's nutritional composition. It is also known that pluviometric index (i.e., amount of rain) and the duration of the rainy season may affect the nutritional value. There are also processing differences for animal meal, such as drying time, bone and blood inclusion, among others. Thus, the adequacy of the models currently used for energy prediction in diets fabricated with ingredients cultivated and processed in Brazilian soil is questioned. This study aimed at obtaining digestible energy (DE) and metabolizable energy (ME) prediction equations that attend the Brazilian market of extruded dog foods. Forty dry extruded dog diets were evaluated through in vivo digestibility trials. Each food was offered in controlled amounts (130 kcal/kg BW<sup>0.75</sup>) to 6 Beagle dogs, individually housed in metabolic

cages during 10 d, with 5 d being of adaptation period and 5 d of total feces and urine collection. Analysis of crude protein (CP), crude fiber (CF), ether extract (EE) and gross energy (GE) of the ingredients and DE obtained in vivo as independent variables, were used for the formation of the equations. The best DE and ME estimation models were selected. The evaluation of the energy prediction equation adjustments was done through simple linear regression between the in vivo energy values and the predicted values, the nullity hypothesis test and the evaluation of the coefficient of determination. The best models were:  $DE = -1628.58 + 1.20 GE$  ( $r^2 = 0.84$ ) and  $ME = -1127.26 + 1.02 GE$  ( $r^2 = 0.71$ ). Segmentations were done according to the levels of EE and CF; the selected equations were the following: EE above 12%,  $ME = -352.81 - 19.32 CP + 43.11 EE - 39.51 CF + 0.88 GE$  ( $r^2 = 0.90$ ); CF above 2.5%,  $ME = 100.06 - 92.5 CF + 0.97 DE$  ( $r^2 = 0.94$ ). Finally, to present reliability, it is necessary to validate the equations obtained in this trial using in vivo digestibility data obtained from extruded foods different than those used in this experiment. Acknowledgment: CAPES and FAPEMIG.

**Key Words:** equation, energy estimation, canine