

Companion Animals

370 Effect of breed and size of dog on body composition. C. J. Cupp, DVM, MS* and G. Czarnecki-Maulden, PhD, Nestle Purina Research, St. Louis, MO.

The objective of this study was to evaluate body composition in small breeds of dogs as compared with larger breeds. Body composition by Dual Energy X-ray Absorptiometry (DEXA) was performed in 34 adult small and toy breed dogs. Results were compared with data obtained from 41 Beagles and 6 Labrador retrievers. Body weight, bone density, total calcium, fat grams, lean grams and bone mineral content were significantly lower in small dogs than in larger breed dogs, which were directly related to their body size. However, small dogs showed a higher percentage of bone and lean tissue, and lower percentage of fat tissue relative to larger breed dogs. Age, gender and reproductive status may influence the differences seen in these parameters and warrants further study.

Key Words: Dog, Body Composition

371 Influence of age on flatulence in dogs. C. Apanavicius*¹ and G. Czarnecki-Maulden², ¹University of Illinois, Urbana, ²Nestle Purina Research, St. Joseph, MO.

Digestive function is thought to decline in elderly animals. One indicator of digestive function is flatus production. The objective of this trial was to determine the effect of aging on flatulence in the dog. Twenty young adult (15 years old, mean age 2.6 years) and twenty elderly adult (8-14 years old, mean age 12.2 years) beagle dogs were used in the trial. All dogs were fed a nutritionally complete extruded dog food. Three hours after meal consumption, a hydrogen sulfide (H₂S) monitor was placed in a vest worn by the dog. Hydrogen sulfide is the main component of flatulence in dogs. Hydrogen sulfide concentration (ppm) was measured by the monitor at 4-second intervals. There was no statistically significant ($P>0.05$) difference in number of flatulence events, peak H₂S, or average H₂S per event in young adult vs. elderly dogs. Therefore, flatulence, as measured by H₂S expulsion, was not affected by aging in beagle dogs. Further research is needed to determine whether other indicators of digestive function are influenced by aging in the dog.

Key Words: Dog, Digestion, Aging

372 Management of canine food intake to reduce obesity. D. Mattsson* and L. Deffenbaugh, Kemin Nutrisurance, Inc., Des Moines, IA.

Obesity in pets is a significant veterinary health issue that manifests in over 40% of dogs and cats that are seen by veterinarians. Most obesity is due to over feeding at mealtime and to owners providing unnecessary snacks to their pets. Unfortunately, veterinarians estimate that they have been successful in treating obesity in only about 10% of cases. One reason for the lack of success might be the difficulty that pet owners have with compliance to a strict feeding program. Pet owners that wish to help their pet lose weight might find a dietary supplement that impacts food intake very helpful in achieving their goal. Cholecystokinin (CCK) is a gastrointestinal peptide hormone that is released from the digestive tract into the circulatory system after consuming food and acts to control short-term food intake. Release of CCK from the digestive tract is stimulated by protein and inhibited by endogenous proteases such as trypsin. Normally, following a meal, the human circulating CCK level can reach 8 pmol/L then decline to a pre-meal level after about 40 minutes. In the absence of proteases, an endogenous releasing factor interacts with cells that produce CCK resulting in stimulation of CCK release. Canine digestive physiology is very similar to humans, particularly with respect to CCK release and serum levels after food consumption. The canine basal CCK level is about 2 pmol/L which rises to a peak of 5-11 pmol/L within 30-45 minutes of the start of food consumption. The serum CCK level then declines to the basal level about 120 minutes after the start of feeding. While exogenous CCK delays gastric emptying, it is not clear whether the increased serum level of CCK following feeding is sufficient to induce satiety. A canine dietary supplement that might temporarily impact short-term food intake may provide pet owners with a means to help their pet consume less food.

Key Words: Canine, Obesity, CCK

373 Meeting the challenge of stabilizing weight management petfood diets. L. B. Deffenbaugh*, Kemin Nutrisurance, Inc.

Weight management diets designed to counter the epidemic of obesity in companion animals abound. For many years, petfood diets for weight reduction have been reduced calorie, reduced fat and / or increased fiber. When fat content is reduced in a petfood diet, special attention must be given to ensure that the limited fat in the formulation meets fatty acid profile requirements. Not surprisingly, the low carbohydrate (high fat and protein) trend in human dietary regimes is also making an appearance in petfoods. In this case, higher fat diets also beg for manipulation of the fatty acid profile to avoid unhealthy excesses of saturated fats. Thus, weight management diets are carefully formulated for not only the amount of fat but also the types of fat. Regardless of the formulation approach for weight reduction diets, whether low or high fat, the ratio of healthy, unsaturated fats will be increased at the expense of unhealthy, saturated fats. Unsaturated fats, especially vegetable and marine oils, are notoriously difficult to protect against autoxidation, and oxidized lipids will cause more harm than the best of intentions for meeting an ideal fatty acid profile. Low fat diets also pose the seeming paradox of being more difficult to stabilize than medium or high fat diets. The chief consideration with increased use of unsaturated fats is selection of the appropriate antioxidant. Recent research has shown that rosemary extract is uniquely suited for highly unsaturated diets, and especially diets relatively low in total fat. For example, the shelf-life stability of a diet with only 8% total fat in which most of the fat was from highly unsaturated menhaden oil was more than doubled by treating the oil with rosemary extract compared to equivalent actives from mixed tocopherols, the most commonly used natural antioxidant. Further, rosemary extract has positive consumer appeal equivalent to the perceptions of fresh, healthy, natural and holistic diets. Proper selection of antioxidants and other strategies to ensure oxidative stability of weight management diets throughout the entire shelf-life will be detailed.

Key Words: Rosemary Extract, Unsaturated Oils, Shelf-Life

374 Diet and age affect canine small intestinal and colonic gut morphology. K. N. Kuzmuk*, K. S. Swanson, L. B. Schook, and G. C. Fahey, Jr., University of Illinois, Urbana.

The objective of this experiment was to determine the effects of diet and age on gut morphology in healthy dogs. Small intestinal villus width, height, and area, and small intestinal and colonic crypt depth were measured. Twelve senior (age = 12 yr old; 6 M, 6 F) and 12 young adult (age = 1 yr old; 6 M, 6 F) beagles were randomly assigned to one of two dietary treatments: an animal product-based diet (APB) and a plant product-based diet (PPB). The APB diet was primarily composed of highly digestible, animal-derived ingredients and was formulated to contain 30% crude protein and 20% fat. The PPB diet was primarily composed of plant-derived ingredients and was formulated to contain 22% crude protein and 8% fat. In addition to dietary protein and fat differences, total dietary fiber was greater in the PPB diet (15.2%) compared to the APB diet (4.8%). Diets were fed for one year. Intestinal sections were collected from the duodenum, jejunum, ileum, and colon and placed in formalin for preservation. Tissues were embedded in paraffin and cut into 3 mm sections, and placed on glass slides. Digital images of tissues were taken using a Nikon Optiphot-2 microscope (Nikon, Melville, NY). Height and width measurements, a minimum of 15 per section, were taken using Image Pro Plus[®] software. Jejunal and ileal villus height, and duodenal villus width were greater ($P<0.05$) for dogs consuming the PPB diet. Age also affected gut morphology as young dogs had greater ($P<0.05$) jejunal villus height while senior dogs had greater ($P<0.001$) colonic crypt depth. Thus, both diet and age affect small intestinal and colonic morphology of the dog. This research was supported by Pyxis Genomics, Inc.

Key Words: Dog, Gut Morphology, Aging

375 Evaluation of glycylsarcosine and cefadroxil as substrates for non-invasive determination of canine small intestine PepT1 capacity and demonstration that maximal cefadroxil absorption occurs when consumed 4 h after meal ingestion. B. M. Zanghi*¹, G. L. Sipe¹, G. M. Davenport², and J. C. Matthews¹, ¹Department of Animal Science, University of Kentucky, Lexington, ²The IAMS Company, Lewisburg.

Glycylsarcosine (GlySar) and cefadroxil (Cef) are reputedly poorly-metabolized substrates of PepT1, the low affinity, H⁺-coupled, peptide cotransporter expressed in the apical membranes of enterocytes. To non-invasively study PepT1 functional capacity in dogs, 50 μ Ci of GlySar (12.5 nmols) or Cef (50 nmols) was orally bolused in a gel capsule to adult, intact female, mongrel dogs to characterize the amount, form, and time required for ³H appearance in blood, urine, and feces. A pilot study (n = 3) demonstrated that GlySar was well absorbed (97.6 versus 2.4% of total ³H was recovered within 24 h after bolusing in plasma versus feces, respectively), but GlySar accounted for only 11.5 \pm 7.8% of serum ³H and 161 \pm 9 d was required for clearance of ³H from plasma (17.3 d half-life). In contrast, Cef was poorly metabolized, and cleared from plasma, urine, and feces within 27 d. Therefore, a 4 x 4 Latin Square experimental design with 35 d periods was performed using dogs (n = 4; BW = 21.3 \pm 2.5 kg) to evaluate the influence of time of Cef bolusing after meal ingestion (0-, 2-, 4-, 6-h) on appearance, metabolism, and clearance of bolused Cef as an indicator of relative PepT1 absorption capacity. Plasma content of Cef (pmol) from 1.5 through 12 h was 530 to 43% greater (P < 0.10) for the 4-h treatment than for the 0-h. Quantitatively, the 4-h after meal ingestion treatment also was 111 to 22% and 60 to 9.4% greater than the 2- or 6-h treatments, respectively. For all bolus treatments, 89 to 95% of serum ³H was in the form of Cef within 1.5 h after dosing. No treatment effect was observed for plasma or urine ³H clearance, and the mean plasma ³H half-life was 6.3 d. These data demonstrate that Cef is a useful marker to evaluate in vivo PepT1 functional capacity and is maximally absorbed when consumed 4-h after ingestion.

Key Words: Dog, Biological Transport, Antibiotic

376 Digestibility of dry dog kibble containing spray dried animal plasma. C. J. Hammer, J. D. Quigley, J. C. Campbell, J. D. Crenshaw*, and L. E. Russell, APC, Inc., Ankeny, IA.

Addition of spray dried animal plasma (SDAP) to diets of farm animals improves feed efficiency; however, there are few data with companion animals. Objective of this study was to determine effects of SDAP on intake and digestibility in dogs. Nine adult Beagle dogs (initial BW = 11.7 kg) were used in a replicated 3 x 3 Latin Square design with 10-d periods. The final five days of each period were used for measurement of intake and fecal collection. A dry dog kibble was prepared and SDAP was added at 1% of the mixture either by blending with other ingredients prior to extrusion, or by blending with fat and applying on the outside of the kibble. Intake and apparent digestibility of nutrients were determined. Addition of SDAP did not markedly affect chemical composition of diets. Intake of dog food was unaffected by treatment; however, intake of DM tended to be reduced (P = 0.09) by 9 g/d when SDAP was added to the diet. Digestibility of DM was improved (P = 0.02) when SDAP was included in the diet. Crude protein digestibility was improved (P < 0.01) by 4.6 and 3.8% when SDAP was added to the kibble pre- or post-extrusion, respectively. Digestion of ash also was improved (P < 0.01) by 11.0 and 10.9% when SDAP was added to the kibble pre- or post-extrusion, respectively. Digestibility of energy tended to be increased (P = 0.07) when SDAP was included in the diet. Digestibility of total dietary fiber was decreased (P < 0.01) by 3.5% when SDAP was applied pre-extrusion and decreased by 9.4% when SDAP was included post extrusion. Although digestibility of total dietary fiber was decreased, fecal weight was reduced an average of 23 g/d and fecal DM excretion was reduced an average 18.5% when SDAP was added to the kibble. In conclusion, spray-dried animal plasma was an acceptable ingredient in this dry dog food preparation and improved digestion and reduced fecal output.

Key Words: Canine, Plasma, Digestibility

377 Chemical composition, bioavailability, palatability, and digestibility of alternative protein sources for dogs. J. M. Dust*¹, C. M. Grieshop¹, C. M. Parsons¹, N. R. Merchen¹, J. D. Quigley, III², and G. C. Fahey, Jr¹, ¹University of Illinois, Urbana, ²American Protein Corp. Inc., Ankeny, IA.

Eleven proteinaceous ingredients (chicken protein sources, blood protein sources, enzyme hydrolyzed fish protein concentrate (EHFPC), soybean meal (SBM), and spray dried pork liver (SDPL)) were analyzed for chemical composition and biological availability. Chicken protein sources ranged in concentrations of CP, acid hydrolyzed fat, and total amino acids (TAA) by 20, 31, and 24%, respectively, and GE by 1.7 kcal/g. Blood proteins ranged in concentrations of CP and TAA by 11 and 8%, respectively. Protein solubility differences within chicken and blood protein source categories averaged 57 and 69%, respectively. Protein solubility of EHFPC, SBM, and SDPL was 53, 67, and 26%, respectively. Calculated lysine digestibility (using immobilized digestive enzyme assay) ranged approximately 16 and 24% for blood and chicken protein sources, respectively. Lysine digestibility values for SBM and SDPL were 89 and 77%, respectively. A chick protein efficiency ratio (PER) assay indicated that chicken protein sources, EHFPC, SBM, and SDPL were highly available (PER value > 2.8) and blood protein sources were poorly available (PER values < 1.5). An experiment to determine palatability and digestibility of a diet supplemented with 0 or 3% processed red blood cells (PRBC) fed to canines was conducted. Palatability data indicated an intake ratio of 0.34 for the 3% PRBC diet. Total tract nutrient digestibilities of DM, OM, and acid hydrolyzed fat were not different (P > 0.05). Digestibility of CP was higher (P < 0.05) for dogs consuming the 0% PRBC diet than the 3% PRBC diet. These data suggest that chemical composition and bioavailability of alternative protein sources differ greatly among ingredients within the same category. The feeding study data suggest that a PRBC-containing diet is not highly palatable and elicits somewhat of a decrease in protein digestion.

Key Words: Bioavailability, Digestibility, Dog

378 Evaluation of preference and acceptability of 2-hydroxy-4 methylthio butanoic acid (HMTBA) and D-methionine (DLM) by canine and feline animals. M. Vazquez-Anon*¹ and L. R. Prewitt², ¹Novus International, Inc., St. Louis, MO, ²Prewitt Global Consulting Services, Balwin, MO.

This study was designed to evaluate the preferences and acceptability of an 88% solution of HMTBA (Alimet Feed Supplement, Novus International, Inc.) and DLM (dry 99%) in pet food diets. Three levels of HMTBA (0.05, 0.10, 0.15% in canine and 0.2, 0.25, 0.30 % in feline diets) and two levels of DLM supplementation (0.10, 0.15% in canine and 0.25, 0.30 % in feline diets) were added to a basal diet deficient in methionine (M). The first and second level in canine and the third level of supplementation in feline diets represent commercial levels of supplementation. In a three day preference tests, canine and feline animals preferred (P 0.05) diets containing either of the M sources over the control. Canine gram-intake ratios for M compared to control were 2.07:1, 5.58:1, and 5.13:1 for 0.05, 0.1, and 0.15% HMTBA and 5.32:1 and 4.95:1 for 0.1 and 0.15% DLM concentrations. Feline gram-intake ratios for M compared to the basal diet were 1.67:1, 1.91:1, and 1.85:1 for 0.20, 0.25, and 0.30 % HMTBA and 1.87:1 and 1.63:1 for 0.2 and 0.25% DLM. No differences were found between the M sources at 0.10% and 0.25 % for canine and felines, respectively. Canines preferred DLM 2.5:1 times (P 0.05) over HMTBA when over-supplemented at 0.15 % and felines preferred 1.24:1 times (P 0.05) HMTBA over DLM when fed at 0.3 %. Consumption over a 7-day period with no choice demonstrated no significant differences between basal, 0.1 % HMTBA and 0.1 % DLM in canines. In felines, higher consumption (P 0.05) was observed for 0.25 % DLM (69a g) followed by 0.25% HMTBA (62b g), and control (60b g). Addition of HMTBA or DLM to a canine or feline M deficient diet improves palatability and had no detrimental effect on food consumption.

Key Words: Canine, Feline, Methionine

379 Beneficial effects of mannan oligosaccharide on diet component digestibility and fermentation characteristics in the dog. L. C. Kappel¹, Y. Zhang¹, Y. Marcum¹, W. H. Taylor¹, W. G. Henk¹, P. Jowett¹, C. Hedlund¹, K. E. Newman², H-P. Healy³, and A. Kocher*³, ¹*School of Veterinary Medicine, Louisiana State University, Baton Rouge*, ²*Venture Laboratories, Lexington, KY*, ³*Alltech Inc., Nicholasville, KY*.

Adult Beagles (36) and mixed-strain hounds (4), in 8 groups of 5 dogs each, were used to evaluate organic matter digestibility of 4 diets having no fibrous ingredient (CON), beet pulp (BP), soybean hulls (SH), or cellulose (CEL), with or without 0.11% mannan oligosaccharide (MOS; Bio-Mos[®], Alltech, Inc., Nicholasville, KY). Analyzed total (and soluble) fiber percents, respectively, were: 8.1 (2.4), 15.3 (3.7), 16.7 (1.5), and 15.6 (1.7). The study conducted 6 times involved a 21-d adaptation period and a 5-d total fecal collection period. Insoluble fiber digestibility was greatest for SH diet whereas CON, BP, and CEL diets were similar. Insoluble fiber of SH was about 25% more fermentable than that of BP though nonsignificant. Soluble fiber digestibility was variable and not significantly different among fiber sources. The MOS increased soluble fiber digestibility across all fiber sources ($P < 0.05$; 72.9 vs 61.5%, on average), indicating a strong beneficial effect on microbial metabolism due to increased proliferation of the fermentation microbe population. In vitro fermentation of starch, BP, SH, or CEL was evaluated using inocula from feces of 12 dogs (3 from each of the CON and BP diets with and without MOS). Organic matter digestibility of BP and SH was improved with BP + MOS diet but not CON + MOS diet fecal inoculum, indicating that some adaptation period was required for MOS to lead to changes in microbial metabolism. However, fecal inoculum from dogs fed BP + MOS diet decreased acetate, propionate, and total volatile fatty acids using BP or SH substrates and fecal inoculum from dogs fed CON + MOS diet increased acetate and total volatile fatty acids using starch. Histology revealed the number of colonic mucous secreting goblet cells was greater for BP and SH than CON and CEL diets in response to amount of fermentation not fiber per se. Addition of MOS to dry dog food improved fiber digestibility and altered intestinal fermentation patterns.

Key Words: Canine, Fiber, Manno-Oligosaccharide

380 Effect of Bioplex organic trace minerals on copper, manganese, and zinc status of the canine. L. C. Kappel¹, J. F. Williams¹, G. R. Pettifer¹, H-P. Healy*², and A. Kocher², ¹*School of Veterinary Medicine, Louisiana State University, Baton Rouge*, ²*Alltech, Inc., Nicholasville, KY*.

A 24-wk study was conducted with 20 adult, mixed-strain hounds from five litters, housed two dogs per pen, to compare Cu, Mn, and Zn in serum, liver, and hair when feeding a control (CON) diet with an inorganic trace mineral premix or a diet supplemented with an organic trace mineral premix (OTM; Bioplex[®], Alltech, Inc., Nicholasville, KY) at equal mineral inclusion levels. One dog was removed from the OTM group for non-nutritional causes. Dogs used in this experiment were mature with low mineral requirements and adequate mineral status prior to the study. By analysis, the commercial dry basal diet (Animal Nutrition, Ogden, UT) had 10 ppm Cu, 29 ppm Mn, and 56 ppm Zn. Typical industry levels of 8 ppm Cu, 10 ppm Mn, and 140 ppm Zn were added in sulfate form to the CON diet or in proteinate form to the OTM diet. These mineral concentrations were probably above the dogs' mineral requirements. Jugular blood samples (8 mL) were taken at 0, 2, 8, 12, 16, and 24 wk two hours before feeding for serum mineral analysis (stored frozen). Liver samples (15-25 mg) were obtained by liver biopsy at 0, 12, and 24 weeks on test (stored frozen). Two 10 x 10 cm areas on the left side were closely clipped initially, and from one location hair was clipped at the skin at 4, 8, and 12 wk and from the other site hair was sampled at 12 and 24 wk. Over 24 wk, serum and liver mineral concentrations did not differ between diets and were in normal ranges for dogs. Although hair Zn levels did not differ significantly by dietary treatments, the OTM supplemented diet increased hair Cu ($P < 0.05$; 1-4 wk, 17.9 vs 12.9, and 9-12 wk, 11.1 vs 7.2 mcg/g) and Mn (main effect $P < 0.10$; 12.6 vs 9.7 mcg/g) in 4-wk interval hair samples, indicating better Cu- and Mn-proteinate uptake, utilization, different distribution in the body or a combination of the three than Cu and Mn sulfates in the CON diet. Trace mineral availabilities may be more easily demonstrated with growing dogs or those previously deficient, or when using supraoptimal trace mineral inclusion rates.

Key Words: Bioplexes, Canine, Trace Minerals

Extension Education - Dairy Science

381 Impact of conducting a dairy herdsman short-course in California. G. E. Higginbotham*¹, J. H. Kirk², C. C. Collar⁵, A. R. Castillo⁶, S. L. Berry³, B. A. Reed⁷, and J. D. Robison⁴, ¹*University of California Cooperative Extension, Fresno/Madera Counties*, ²*Veterinary Medicine Extension, University of California, Davis*, ³*Department of Animal Science, University of California, Davis*, ⁴*California State University, Fresno*, ⁵*University of California Cooperative Extension, Kings County*, ⁶*University of California Cooperative Extension, Merced County*, ⁷*University of California Cooperative Extension, Glenn County*.

Since 2001, University of California Cooperative Extension (UCCE) has conducted four 18-hour training programs at three different locations for dairy farm employees in the central valley of California. The program consists of classroom and hands-on teaching sessions. Session topics include raising replacement heifers, reproductive management, milking management, nutrition, hoof care, labor management and herd health. Material is presented in English with simultaneous translation for Spanish attendees. Over 120 dairymen, dairy workers and dairy industry representatives have attended the courses. To assess impact of materials taught, a survey was mailed to attendees (N=95) who attended one of the first three herdsman shortcourses and who were thought to have been currently employed on a dairy. Time since attendees attended the shortcourse ranged from 8 - 24 months. The survey was provided in both English and Spanish. Thirty-two former attendees returned the survey (34%). Of those responding, English was the first language for 63%. Of the twelve who indicated Spanish was their first language, only ten used the Spanish questionnaire version. All of the respondents indicated that the course met their expectations (33% strongly agreed; 66% agreed). All but one indicated that they would recommend the course to other herdsman. Nearly 66% of the respondents indicated that Spanish translation of presentations helped in their understanding of the materials. The previous dairy experience of those responding was 0-5 years, 45%; 6-10 years, 22%; and over 10 years, 32%. Overall, 41% of the attendees

indicated that they had begun to apply information they had learned in the classes. Hands-on laboratory exercises were found to be useful to most of the past attendees (calf necropsy, 94%; reproductive tracts, 91%; use of CMT, 91%; cow health, 97%; and foot trimming, 88%). Results from this survey demonstrate the need for a dairy herdsman shortcourse in order for dairy employees to improve their practical dairy skills.

Key Words: Herdsman, Training, Dairy

382 Assessing the Occupational Profiles of Senior- and Middle-level Dairy Managers. R. Stup*, L. Holden, and J. Hyde, *Pennsylvania State University, University Park*.

To effectively prepare dairy managers, educators must have a clear understanding of the competencies that lead to success. A competency is a knowledge or skill that an individual can apply to the successful completion of a task. The first objective of this project was to develop comprehensive sets of job competencies for middle managers and senior managers. These can subsequently be used for developing and updating dairy education curricula. The second objective was to assess the level of proficiency in each of the competencies among the current workforce to prioritize training needs.

Highly successful senior- and middle-level dairy managers were identified by Cooperative Extension educators and dairy industry personnel. These successful managers participated in focus groups with the objective of identifying, describing, and categorizing the competencies that lead to success. Four focus groups were conducted, two senior manager groups with a total of 17 people and two middle manager groups with a total of 12 people. Focus groups were professionally facilitated. The focus groups used a computer aided process known as a Customized Occupational Profile (COP) to identify general competency areas and the specific tasks that must be accomplished within those areas. The data resulting from the focus group processes were combined into comprehensive sets of job competencies for each respective manager position.