PROGRAMME

NAVIGATION BY DAY

DAY 1
Tuesday 18th October

DAY 2
Wednesday 19th October

DAY 3
Thursday 20th October

DAY 4
Friday 21st October

NAVIGATION BY SUBJECT

About WINSS
Poster Session
Hot Topics

Plenaries
Career Development Workshops
Networking Opportunities

Forthcoming Opportunities
Biographies
ABOUT WINSS

Preface

Acknowledgements

SUPPORTING PARTNERS

ACVN

ECVCN
Preface
Welcome to the WALTHAM International Nutritional Sciences Symposium 2016 here in the “windy city” of Chicago. The theme for this year’s symposium is ‘Growing Science in Pet Nutrition’, which encompasses the desire of Mars Petcare to support and develop the field of companion animal nutrition in order to drive forward our vision to create A Better World for Pets.

As you may have already noticed, WINSS has gone digital. By using enhanced technology platforms we provide you with the best opportunity to connect with fellow researchers and help grow a strong scientific community in the field of companion animal nutrition. The exclusive WINSS Yammer community will enable you to discuss presentations and ideas with peers, and provide an opportunity to promote your own research. To support those in the early stages of their career there will be two career development workshops. The first will be focussed on how to promote your research via traditional media and social media and the second will discuss the rewards and challenges of a career working in the companion animal nutrition field. New to the WINSS programme this time, will be a flashlight poster session that will showcase some of the most interesting research presented by early career researchers this year at WINSS.

All presenting authors have been offered the opportunity to publish their research online in a special supplement of the Journal of Nutritional...
Science, with our plenary speakers submitting review articles to the British Journal of Nutrition.

For over 50 years, the WALTHAM Centre for Pet Nutrition has been a leading authority in the field of companion animal health and nutrition. WALTHAM is the global scientific research centre for Mars Petcare and is proud to be hosting WINSS 2016 with support from the American College of Veterinary Nutrition and the European College of Veterinary and Comparative Nutrition. We would like to thank both colleges for their continued enthusiasm in supporting WINSS and also academics and clinicians working in the field of companion animal nutrition.
Acknowledgements

WINSS is supported by

WALTHAM extends a heartfelt thank you to those individuals who have spent a great deal of time and effort in making this event possible.

Kevin Andrews, Business Partner Functional Manager, Mars Global Services

Zainul Bax, Project Assistant, Science Engagement and Communications Team, WALTHAM Centre for Pet Nutrition

Tina Blackmore, PhD, Science Engagement and Communications Research Partner, WALTHAM Centre for Pet Nutrition

Richard Butterwick, PhD, Global Nutrition Advisor, WALTHAM Centre for Pet Nutrition

Christophe Carlier, DVM, Scientific, Regulatory and Public Affairs Director, Royal Canin

Meg Christensen, IT Services Senior Technician, Mars Global Information Services

James Clarke, MA, Head of Science Engagement and Communications, WALTHAM Centre for Pet Nutrition

Ian Davis, PhD, Science Engagement and Communications Events Manager, WALTHAM Centre for Pet Nutrition
Denise Elliott, BVSc (Hons), PhD, Dipl ACVIM, Dipl ACVN, Head of Research, WALTHAM Centre for Pet Nutrition

Jo Gale, BVetMed CertLAS MRCVS, Science Engagement and Communications Team Manager, WALTHAM Centre for Pet Nutrition

Pippa Jones, Lead Conference Consultant, Mars Conference Team, HRG UK

Karyl Hurley, DVM, DACVIM, DECVIM-CA, Global Scientific Affairs Director, Mars Petcare

Yann Queau, DVM Dipl. ACVN, Research and Clinical Nutritionist, Royal Canin

Kay Rutherford, Events consultant, The Events Clinic

Abigail Stevenson, PhD, Stakeholder Relations Director, Mars Petcare

Ingrid van Hoek, DVM, PhD, R & D - Discover & Corporate Affairs - Scientific and Regulatory Affairs, Royal Canin

**Scientific Reviewers**

Geraldine Blanchard, DVM, PhD, Dipl. ECVCN, European Veterinary Specialist in Comparative Nutrition, Animal Nutrition Expertise SARL, France

Jennifer Larsen, DVM, PhD, DACVN, Associate Professor of Clinical Nutrition, School of Veterinary Medicine, University of California, Davis

Dottie Laflamme, DVM, PhD, DACVN, Scientific Communications Consultant

Marjorie Chandler, DVM, MS, MANZCVS, DACVN, DACVIM, MRVCS, Clinical Nutritionist, Vets Now Referrals
Myriam Hesta, PhD Vet Sci, Dip ECVVN, European Veterinary Specialist in Comparative Nutrition, Department of Nutrition, Genetics and Ethology, Ghent University

Andrea J Fascetti, VMD, PhD, DACVIM, DACVN, Professor of Nutrition, School of Veterinary Medicine, University of California, Davis

Nick J Cave, DACVN, PhD, MVSc, BVSc, Senior Lecturer in Small Animal Medicine, Institute of Vet, Animal and Biomedical Sciences, Massey University

Penelope Morris, PhD, Nutrition Manager, WALTHAM Centre for Pet Nutrition

Sally Perea, DVM, MS, DACVN, Veterinary Clinical Nutritionist, Royal Canin

John Rawlings, PhD, Head of Welfare and Ethics, WALTHAM Centre for Pet Nutrition

Kelly Swanson, MS, PhD, Professor of Animal and Nutritional Sciences, Division of Nutritional Sciences, University of Illinois at Urbana-Champaign

Megan Shepherd, DVM PhD, DACVN, Clinical Assistant Professor in Clinical Nutrition, Department of Large Animal Clinical Science, Virginia-Maryland College of Veterinary Medicine, Virginia Tech

Korinn E. Saker, DVM, PhD, DACVN, Associate Professor of Clinical Nutrition, College of Veterinary Medicine, North Carolina State University

Phillip Watson, PhD, Nutrition Research Manager, WALTHAM Centre for Pet Nutrition

Lisa P. Weeth, DVM, DACVN, Gulf Coast Veterinary Telemedicine, Houston, TX, USA & Weeth Nutrition Services, Edinburgh UK
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DAY 1
Tuesday 18th October

13:00-16:00  Career Development Workshop  
Robin Banerji
Exchange, 11th floor

16:30-21:30  Registration
Atrium, 8th floor

19:00-21:00  Welcome Reception
Pool, 14th floor
Career development – Using traditional media and social media to promote your research

Using traditional media, social media, blogs and video blogs can be very powerful in promoting your work and building a scientific career, but how can we use all these different media tools effectively? Has the very nature of the media changed with the growing popularity of social media, self-publishing, and citizen journalism? Most importantly, why should we promote scientific research? And how can it be of benefit to you and your career?

In this workshop you will learn how the modern media landscape has changed and how you can benefit from it. The workshop will equip you with practical skills to promote your research and build a professional, public profile.

The session will cover the following:

• How has the media landscape changed?
• The rise and rise of social media, blogging, vlogging
• Where is traditional media today? (newspapers, magazines, radio and TV)
• Writing press releases and approaching the media
• Working with your in-house media and public relations team
• Promoting your professional profile and skillset online

ABOUT THE SPEAKER
Robin Banerji has advised senior cabinet ministers, chairmen, chief executives, British military chiefs and leading UK scientists on some of the most high profile issues to hit the headlines over the last 20 years. He has successfully led numerous communications operations, as Director of Communications for the NHS National Institute for Health Research based at the Department of Health, Head of Communications for the Commission for Social Care Inspection (now CQC), Director of Press and Broadcasting for the Liberal Democrats, Head of Communications for the Commission for Racial Equality, Director of Communications and Marketing for the £2.5bn Business Growth Fund and External Affairs Director for The Nutrition Society.

In addition to high-profile media relations, Robin’s experience includes successfully using social media, blogging, podcasting and vodcasting to connect and communicate with audiences. He is an experienced trainer, and has delivered media training to numerous high profile organisations and individuals. Robin is a member of the Chartered Institute of Public Relations and the Chartered Institute of Marketing.

http://www.rapportalk.co.uk/
Welcome Reception

The welcome reception will be held alongside the junior Olympic swimming pool on the 14th floor from 19:00 to 21:00.

Complimentary drinks and light food will be available. At the time the pool was built in 1929, it was considered an engineering feat.
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<th>Time</th>
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<tr>
<td>07:30</td>
<td>Breakfast</td>
<td>Empire Ballroom, 7th floor</td>
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<td>08:30</td>
<td>Opening Session and Welcome</td>
<td>Grand Ballroom, 7th floor</td>
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<td>09:00</td>
<td>Plenary: Nutrient Density - addressing the challenge of obesity</td>
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<td>Prof. Adam Drewnowski</td>
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<td>10:00</td>
<td>The effect of changing moisture levels of dry extruded and wet canned</td>
<td>Grand Ballroom, 7th floor</td>
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<td>diets on physical activity in cats</td>
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<td>David G Thomas</td>
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<td>10:20</td>
<td>Starch gelatinization influence on nutrient digestibility and</td>
<td>Grand Ballroom, 7th floor</td>
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<td>fermentation products on feces on dogs fed kibble diets</td>
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<td>Bruna Agy Loureiro</td>
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DAY 2
Wednesday 19th October

10:40 Break
Empire Ballroom, 7th floor

11:10 Evaluation of high calcium intake on health and physiological parameters in adult dogs
Phillip Watson
Grand Ballroom, 7th floor

11:30 Selenium intake and immune parameters of adult dogs
Thaila Cristina Putarov
Grand Ballroom, 7th floor

11:50 Can dietary fish oil modulate serum leptin, adiponectin or monocyte chemotactrant (MCP-1) in dogs?
Younes Chorfi
Grand Ballroom, 7th floor

12:10 Lunch
Grand Ballroom, 7th floor
AFTERNOON SESSION

Session Chair: Dr John Rawlings, WALTHAM Centre for Pet Nutrition

13:30
Plenary: The 3Rs – research in an ethical context
Dr Judy MacArthur Clark
Grand Ballroom, 7th floor

14:30
Effects of post-exercise carbohydrate and protein supplement on repeat performance, serum chemistry, insulin, glucagon in competitive weight pulling dogs
Christopher Frye
Grand Ballroom, 7th floor

14:50
Determination of the methionine requirement of large breed adult dogs using the Indicator Amino Acid Oxidation (IAAO) technique
Phillip Watson
Grand Ballroom, 7th floor

15:10
Break
Empire Ballroom, 7th floor

15:40
Resistant starch on the intestinal health of old dogs: fermentation products and histological features of the intestinal mucosa
Ludmilla Geraldo Di Santo
Grand Ballroom, 7th floor
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<tr>
<td>16:00</td>
<td>Effects of dietary selenium and moisture on the physical activity and thyroid axis of cats</td>
<td>Sarah Hooper</td>
<td>Grand Ballroom, 7th floor</td>
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<td>16:20</td>
<td>Raw red meat diets decrease faecal microbial diversity in the dog</td>
<td>Nick J Cave</td>
<td>Grand Ballroom, 7th floor</td>
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<td>16:40</td>
<td>Energy required by Siberian Husky dogs swimming with a flotation jacket</td>
<td>Richard C Hill</td>
<td>Grand Ballroom, 7th floor</td>
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<td>17:00</td>
<td>Close</td>
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WALTHAM™
International Nutritional Sciences Symposium
WINSS

DAY 2
Wednesday 19th October
EVENING SESSION

18:30 Flashlight Poster Session
Grand Ballroom, 7th floor

19:30 General Poster Session
Grand Ballroom Balcony, 8th floor

21:30 Close
Achieving a balanced and nutrient-rich diet is becoming progressively more difficult within the constraints of the global food supply. The observed disparities in health between the global rich and the global poor can be explained, in part, by unequal food prices and by the rising cost of eating healthy. In general, added sugars and fats cost less than do many of the recommended healthier options that provide better nutrition and better nutrient balance. But need healthier diets cost more? New metrics of nutrient density can help consumers identify foods that are nutrient-rich, affordable, and appealing. Metrics of nutrient balance can help identify those combinations of foods that provide optimal nutritional value. Merging dietary intakes data with local or national food prices permits the estimation of diet costs at the individual level, opening the door to novel studies in nutrition economics.

Is it possible to eat better for less? In the US, higher Healthy Eating Index (HEI-2010) scores were linked to higher energy-adjusted diet costs. Conversely, cheap empty calories from solid fats and added sugars were linked to lower diet costs. In general, lower cost diets were consumed by lower income groups. However, some population subgroups, including Mexican Americans and other Hispanics, managed to achieve diets consistent with DASH and other dietary guidelines at a lower-than-expected cost. Being able to achieve complete and balanced diets on limited budgets is one example of nutrition “resilience”.

Energy and nutrient density of foods
Energy density of foods is measured in terms of calories per gram (kcal/g). The extremes are represented by plain water (0 kcal/g) and oil (9 kcal/g). Carbohydrates, including sugar, and protein provide about 4 kcal/g. The main determinant of foods’ energy density is water, which provides bulk and volume but no calories and no nutrients. As a result, the most energy-dense foods are those that are dry. Refined grains, cereals, and fats, oils
and sweets are more energy dense than water-containing beverages (0.4 kcal/g) or fresh produce (<1 kcal/g).

Nutrient density of foods is measured as nutrients per calorie, serving, or per unit weight (100g). Nutrient profiling models rank foods by their nutritional value, separating foods that contain empty calories from those that are nutrient-rich. For example, the 2015 US Dietary Guidelines classified solid fats and added sugars as empty calories, while stressing the need to consume more dietary fiber, potassium, calcium and vitamin D. Since most foods provide multiple nutrients, profiling models have tried to take the overall nutritional value of foods into account. In compensatory models, beneficial nutrients (vitamins and minerals) were able to compensate for the presence of nutrients to limit (sugar, sodium and fat). In non-compensatory models, foods were disqualified because of excessive amounts of nutrients to limit. The communications goal was to convey the nutritional value of the food to the consumer easily and at a glance.

The Nutrient Rich Foods (NRF) family of scores was based on a variable number of nutrients to encourage and on three fixed nutrients to limit: saturated fat, added sugar and sodium. The NRF9.3 variant of the score was based on protein, fiber, calcium, iron, potassium, and magnesium, vitamin A, vitamin C and vitamin E. The final NRF9.3 algorithm was based on the sum of percent daily values (%DVs) for 9 nutrients to encourage minus the sum of %DVs for the 3 nutrients to limit. Higher NRF scores were associated with food patterns of lower energy density and higher nutrient content.

New affordability metrics
The affordability of foods has been expressed in terms of calories or nutrients per penny or per dollar. Calcium value metrics developed for a wide range of milks and dairy products in France, showed that fluid milks, hard cheeses, and low fat yogurts delivered calcium at relatively low monetary cost and without excessive amounts of calories, sodium or fat. Based on USDA national prices for 98 vegetables, potatoes and beans were the lowest cost sources of potassium and fiber. Also providing high nutrient value per penny were carrots, sweet potatoes, red and green
peppers, spinach and broccoli. Nutrient density was based on a custom-created nutrient profiling model that included fiber, vitamins A, C, and K, potassium and magnesium. Nutrient affordability was the cost associated with the provision of 10% daily value of each nutrient per cup equivalent.

**Estimating individual-level diet costs**

Estimating diet costs by attaching retail prices to dietary intakes data opens the door to novel studies on the relation between diet quality and diet cost. Merging dietary intake data from the National Health and Nutrition Examination Survey (NHANES) with the USDA national food prices allowed us to examine the monetary cost of different quality diets. In general, better diets were also more expensive, on a per calorie basis. The association was stronger among women (p-interaction=0.003). As expected, the higher cost diets higher in vegetables, fruits, whole grains, and seafood and were lower in refined grains and solid fats, added sugars, and alcohol. As diet cost increased, the proportion of empty calories in the diet dropped.

Calculating the relative costs of eating healthy has now entered the mainstream of nutrition economics. Helping consumers identify foods that are nutrient-rich, affordable, and culturally acceptable would go a long way to making sure that the DGAs can reach all socioeconomic strata of the US public. Mathematical modeling techniques, such as linear programming, have extended nutrient profiling of foods to create nutritionally acceptable food patterns, subject to a variety of constraints. Here, the goal is to create food patterns that are simultaneously nutrient-rich, affordable, acceptable and appealing. Following the principles of one health, linear programming techniques have been applied to developing optimal diets for both animals and humans.
Prof. Adam Drewnowski
Director of the Center for Public Health Nutrition, University of Washington, USA

Prof. Drewnowski is a world-renowned leader in the study of social and economic disparities in diet quality and health. He is the Director of the Center for Public Health Nutrition and the Center for Obesity Research at the University of Washington in Seattle. Prof. Drewnowski is also the Director of the Nutritional Sciences Program at the School of Public Health and Professor of Epidemiology with a joint appointment at the Fred Hutchinson Cancer Research Center.

Prof. Drewnowski’s current research is focused on access to healthy foods and the relation between poverty, obesity, and diabetes both in the US and globally. He has developed novel metrics to identify foods and food patterns that are nutrient rich, affordable, sustainable and culturally appropriate. Prof. Drewnowski has conducted extensive research on the drivers of food choice, ranging from basic biology and taste genetics to the economics of food choice behaviour. He is the author of the Nutrient Rich Foods index, a nutrient profiling model to assess nutrient density of foods.
The effect of changing moisture levels of dry extruded and wet canned diets on physical activity in cats

Post M¹, Guido Bosch¹, David G Thomas²

¹Wageningen University; ²Massey University

Introduction
Obesity levels in cats are increasing and the main causative factor is higher energy intake versus energy expenditure over time. Therefore, altering energy expenditure by enhancing physical activity of the cat could be a strategy to reduce obesity. Hydrating commercial dry diets with water has been observed to increase activity in cats; however no study has compared this approach with feeding high moisture canned diets.

Materials and Methods
Eight healthy male domestic shorthair cats were fed four different dietary treatments in a Latin Square Design. Treatments were a canned diet as is (82% moisture) and freeze-dried (4% moisture), a dry diet as is (3% moisture) and with added water (70% moisture). Cats were group housed during the first 14 days of each period during which activity was measured continuously using Actical® accelerometers. During the last 7 days cats were housed in individual cages with monitoring of food and moisture intake and faecal and urine production for the final 4 days.

Results
Food and energy intake was similar for each diet. The average activity over 24 hr and average activity during the light and dark period was not different between treatments (P>0.05). However the ratio between average activity counts during day versus night was significantly higher when cats were fed the dry diet, compared to all other treatments.
(P=0.030). Total water intake and urine volume increased when the wet diet was fed, compared to all other treatments (P<0.001).

**Discussion and Conclusion**

The lack of difference in total activity of the cats on the dietary treatments seems to indicate that neither dietary moisture nor macronutrient content has a major effect in cats. However, the stronger diurnal activity patterns observed in the cats when they were fed the dry diet versus all other treatments are intriguing and require further study.
Starch gelatinization influence on nutrient digestibility and fermentation products on feces on dogs fed kibble diets

Michele Cristina Camargo Oliveira¹, Bruna Agy Loureiro¹*, Érico de Mello Ribeiro², Mayara Correa Peixoto², Thaila Cristina Putarov², Ana Paula Judice Maria³, Aulus Cavalieri Carciofi⁴

¹São Paulo State University (UNESP), Department of Animal Science, College of Agrarian and Veterinarian Sciences; ²UNESP; ³Veterinary Medicine and Surgery Department, College of Agrarian and Veterinarian Sciences (FCAV), São Paulo State University (UNESP); ⁴FCAV Unesp

Introduction

A combination of raw material particle size and extrusion parameters determines thermal and specific mechanical energy (SME) implementation, promoting starch gelatinization (SG), protein texturization, and kibble macrostructure. However, the starch gelatinization amounts required for a proper digestibility is not determined for dogs yet. The effects of processing parameters and SG on nutrient digestibility and fermentation products on feces were evaluated for dogs.

Materials and Methods

A formula with corn as the cereal was grind and extruded to obtain three SG degrees: SG99 (SG=99.9%; mean geometric diameter [MGD]=224 mm; SME=22kW-h/t); SG76 (SG=76%; MGD=283 mm; SME=12kW-h/t); SG63 (SG=63%; MGD=312 mm; SME=11kW-h/t). A fourth treatment constituted by a pelleted diet, not extruded (SG26; with 26% of SG, and raw material MDG of 312 mm). Twenty-four dogs were used, six per treatment. Digestibility was measured by total fecal collection, and fermentation products on fresh fecal samples. Results were evaluated by polynomial contrast and regression (P<0.05).
Results
Apparent total tract digestibility (ATTD) of crude protein and starch increased linearly with high SG ($P<0.01$). Significant correlation between SG and ATTD of crude protein ($r^2=0.54$) was found. Fecal production decreased and fecal score increased (from 3.7 to 3.9) with high SG ($P<0.02$). Significant correlations ($P<0.01$) was found between SG and the fecal pH ($r^2=0.86$), and fecal contents of propionate ($r^2=0.68$), acetate ($r^2=0.30$), butyrate ($r^2=0.46$), total short-chain fatty acids ($r^2=0.49$), and lactate ($r^2=0.53$).

Discussion and Conclusion
Although significant, the increase on digestibility of protein (from 83.7% to 86.6%) and starch (from 99.7% to 99.8%) were not numerically high. Fecal score was also similar for the diets, bringing to the question of how much is required to grind and cook the diets for dogs. Lower particle reduction and energy implementation, with reduced SG promotes the formation of butyrate and other fermentation products correlated with health benefits.

* Early career researcher
Evaluation of a high calcium intake on health and physiological parameters in adult dogs

Jonathan Stockman¹, Phillip Watson¹, Matthew Gilham¹, Jujhar Singh Atwal¹, Richard M Haydock¹, Alison Colyer¹, Helen Renfrew², Britta Dobenecker³, Ellen Kienzle³, Penelope J Morris¹

¹WALTHAM Centre for Pet Nutrition; ²VetCT St John’s Innovation Centre; ³LMU München

Introduction
A recent meta-analysis (Mack et al. 2015) indicated that adult dogs do not adapt calcium absorption to compensate for changes in dietary levels suggesting that feeding a high calcium diet has the potential to lead to calcium accumulation and adverse consequences. This study therefore, aimed firstly to evaluate the impact of feeding a diet containing 7.1g ·1000 kcal⁻¹ calcium on health parameters in adult dogs and secondly to determine whether calcium balance is impacted by dietary calcium level.

Materials and Methods
Eighteen neutered adult Labrador Retrievers, (9 males and 9 females) aged 2.3–7.3 years were randomized to 1 of 2 extruded diets containing either 1.7g ·1000 kcal⁻¹ or 7.1g ·1000 kcal⁻¹ calcium with calcium to phosphorous ratio of 1.6 in both cases. Dogs underwent a clinical examination, 5 day faeces collection to assess digestibility, urine analysis to assess mineral excretion and RSS, blood analysis for haematological and biochemical variables as well as PTH, Vitamin D, serum cross laps, BALP and FGF23 and an iohexol clearance test at baseline, 9, 17, 25, 33 and 41 weeks.
Results
17 dogs completed the study. Dogs in both groups maintained good health throughout the trial without evidence of urinary, renal, or orthopaedic disease. There were no clinically relevant significant differences between the groups for any of the health markers at any timepoint. Calcium balance was not significantly different from zero during the study in either group.

Discussion and Conclusion
No adverse effects of feeding a diet containing 7.1g·1000 kcal\(^{-1}\) to adult Labrador retrievers for 41 weeks were observed. In addition, calcium balance in both the control and test groups were not significantly different from zero suggesting that adult dogs can adequately compensate for increased dietary calcium.
Selenium intake and immune parameters of adult dogs

Thaila Cristina Putarov¹*, José Roberto Sartori², Fernanda Sant‘Anna Kroll¹, Leandro Zaine¹, Silvio Luiz Oliveira², Katiani S Venturini³, Bruna Ponciano Neto⁴, Aulus Cavalieri Carciofi⁵

¹Unesp - Univ Estadual Paulista, Jaboticabal Campus; ²Unesp - Univ Estadual Paulista, Botucatu Campus; ³Universidade do Estado de São Paulo- Unesp/FCAV; ⁴Maringa State University (UEM), Department of Animal Science, Maringa PR Brazil; ⁵FCAV Unesp

Introduction
Selenium is involved in the arachidonic acid metabolism and IL-2 gene modulation, playing important roles in the immune system. Due to this, selenium effects on immune parameters of dogs were evaluated.

Materials and Methods
The experiment included five diets: control (CO; 0.12 ppm of Se); three additions of selenium-yeast (0.33 ppm, 0.66 ppm, 0.99 ppm of Se, respectively, SY33, SY66, SY99); and diet with sodium selenite (SNaSe0.66; 0.66 ppm Se). Dogs were fed the CO diet for 90 days. After, they were randomly assigned to one of the five diets (6 dogs per diet) for 120 days. On days 0, 30, 60, 90 and 120 the leukocyte population, phagocyte activity of neutrophils (NPAc), in vitro proliferation of peripheral blood mononuclear cells (PPBMC), in vitro production of reactive oxygen (ROS) and nitrogen (NOS) intermediate species were performed. Dogs were inoculated with sheep blood red cells on day 60 to quantify serum IgG and IgM. On day 120 fecal IgA and delayed-type hypersensitivity skin test were performed. Results were compared by polynomial and orthogonal contrasts (P<0.05).
Results
Few differences among groups were observed. The PPBMC was higher for $S_{NaSe}66$-fed animals on day 30 ($P<0.05$), on day 90 the only difference was a lower value for SY66. The mean value of NPAc tended to be higher for SY33-fed dogs ($P=0.07$). The CD5$^+$CD8$^+$ tended to be lower for SY33 and SY66-fed dogs ($P=0.06$), resulting in higher CD5$^+$CD4$^+$/CD5$^+$CD8$^+$ ratio ($P<0.05$). The mean values of CD21$^+$ cells were lower for CO and SY99 diets ($P<0.05$). The ROS produced by monocytes after lipopolysaccharide stimulation were higher for the SY99 ($P<0.05$), but $S_{NaSe}66$ presented intermediate values. Other parameters were not affected by diet.

Discussion and Conclusion
The results suggest that 0.33 of selenium (NRC, 2006) is adequate for proper immune function. Some limitations to be considered are the body reserves of the nutrient and that dogs were not challenged.

* Early career researcher
Can dietary fish oil modulate serum leptin, adiponectin or monocyte chemottractant (MCP-1) in dogs?

Younes Chorfi\textsuperscript{1*}, April E. Blong\textsuperscript{2}, Corri B. Levine\textsuperscript{2}, Daniel J. Fletcher\textsuperscript{2}, Joseph J Wakshlag\textsuperscript{2}

\textsuperscript{1}University of Montreal Faculty of Veterinary Medicine; \textsuperscript{2}Cornell University College of Veterinary Medicine; \textsuperscript{3}Cornell University

Introduction
In dogs, long chain omega-3 fatty acids (DHA and EPA) from marine sources have been used in the management of several inflammatory processes. Dietary target ranges for EPA and DHA can vary but typically falling between 50 and 220 mg/kg body weight depending on the disease process. This study aimed to determine the effect of two high inclusion rates of dietary fish oil on serum leptin, adiponectin and monocyte chemottractant (MCP-1) in adult dogs.

Materials and Methods
Eight dogs were enrolled and fed the same commercial diet to maintain body condition. Two amounts of fish oil (1 g/kg or 1.5 g/kg) were fed to achieve 250 mg/kg/day (Low) and 375 mg/kg/day (High) total EPA and DHA, for a minimum of 80 days. There was a minimum 50 day wash out period between treatments. Plasma concentrations of leptin, adiponectin and MCP-1 were measured using commercially available ELISA kits. Plasma fatty acids profile using gas chromatography (GC-FID) was performed. Data were analyzed using a linear mixed model with time and treatments as intra-subject factors.
Results
Supplementation of low and high doses had no significant effects on plasma concentrations of leptin adiponectin and MCP-1. Plasma DHA (2.27±1.22 vs 5.90±1.42 and 1.74±0.78 vs 6.44±2.61 mg/mL) and EPA (1.34±0.95 vs 12.13±2.94 and 0.78±0.39 vs 15.01±6.58 mg/mL) were significantly increased respectively after Low (P≤0.003) and High (P≤0.001) supplementation. Plasma concentrations of EPA and DHA post-dietary treatments were not different between the high and low supplementation group.

Discussion and Conclusion
Fish oil supplementation significantly increased circulating concentrations of DHA and EPA. Dietary inclusion rates of fish oil (1 g/kg or 1.5 g/kg) in this study had no effect on leptin, adiponectin or MCP-1. Further investigation is warranted to determine whether this effect may be extended to dogs with clinical conditions such as obesity or inflammatory disease.

* Early career researcher
The 3Rs of Replacement, Reduction and Refinement were first described by William Russell and Rex Burch in their book “The Principles of Human Experimental Technique” in 1959. Their work was sponsored by the Universities Federation for Animal Welfare (UFAW) as a systematic study of laboratory techniques and their ethical aspects. It was published in the UK but attracted little attention beyond academic interest for over 20 years.

However in the 1980s there was an awakening of appreciation that these principles offered a rational framework for advancing our ethical use of animals in a science-led manner which could contribute significantly to animal welfare. They unify concerns for better science with causing less harm to animals and underpin the supposition that good welfare enables good science. In 1993, the First World Congress on Alternatives and Animal Use in the Life Sciences was held in Baltimore, USA followed by a second conference in 1996 in Utrecht. Now a regular event, the tenth conference (affectionately known as WC10) will take place in Seattle in 2017.

A common misconception of the 3Rs is that they refer only to Replacement – what may commonly be called “alternatives” to animals. However their meaning is more far-reaching and this presentation will consider those wider implications of promoting all the 3Rs in science, including in nutritional research, and provide examples.

Replacement is often considered in relation to in vitro or in silico approaches where isolated tissues or organs are being studied or systems are being modelled in computer simulations. However Replacement may equally apply to use of lower organisms (e.g. invertebrates, insects and bacteria) where the ability to sense harm (pain or distress) is considered to be less than in vertebrate species. In studying vertebrate biology in
health and disease, it may not be either essential or desirable to carry out all studies in the target species. Further, there are often significant advantages to using simpler, tissue-based systems for early studies before moving to intact animals.

The scientific community is coming under increasing attack for the lack of reproducibility of published studies, often due either to poor experimental design or inadequate reporting. The tradition of peer-review is being widely criticised, including by well-respected experts in statistics and experimental design. Where animals are involved, the ethical consequences are magnified. This may be a much-needed wake-up call for improved science which thoroughly applies the principle of Reduction. This means that, in a well-designed experiment, the optimal number of animals is used to obtain the scientific result sought – neither too many nor too few.

Refinement applies not only to methods which alleviate or minimise potential pain, suffering, distress or lasting harm, but also to ways of enhancing the welfare of animals used. Improved housing and environmental enrichment with appropriate socialisation can have a significant impact on well-being. Training animals to undergo procedures can significantly reduce their stress by enabling them to voluntarily co-operate. Positive reinforcement techniques are well-developed for many species and can rapidly result in benefits both for the animals and their handlers.

An oft-quoted barrier to implementing the 3Rs is the imbalance of risk through applying the “precautionary principle”. In regulatory safety assessment, it is commonly perceived as a lower risk to adhere to the traditional methodologies (usually animal-based) rather than to make an active decision to accept an alternative approach, even though the latter may be based on better science. Hence validated alternative methods often simply become additional requirements rather than real Replacements. Likewise, conservative peer-reviewing often rejects research proposals or submitted papers which are based on non-traditional methods (possibly for self-serving reasons) or requires the traditional (animal-based) data to be generated in parallel. Both these
approaches act as disincentives for the 3Rs and are being addressed in ways which will be discussed.

The last quarter century has seen an almost exponential increase in interest in the 3Rs and proliferation of valid and validated examples of ways in which these principles can be implemented. Regulatory systems protecting research animals throughout the world are embracing the concept of ethical review of all research proposals based upon applying these principles. It can be expected that this trend will continue – and both the quality of science and the welfare of animals will benefit as a consequence.
Dr Judy MacArthur Clark, CBE
Head of the Animals in Science Regulation Unit, Home Office of UK Government

As the Head of the Animals in Science Regulation Unit in the UK Home Office, and previously Chief Inspector, Dr Judy MacArthur Clark has been responsible for regulating the use of animals in research throughout the UK over the last eight years. She is also the government’s key adviser on promoting the 3Rs internationally.

Her career spans over 35 years in animal welfare and biomedical research in a variety of academic, government, commercial, NGO and consultant roles. Prior to joining the Home Office in 2007, she was Vice-President of Worldwide Comparative Medicine with Pfizer Global R&D based in Groton, Connecticut, USA and with a team of scientists and professionals spread across multiple sites in North America, Europe and Japan.

She works closely with colleagues in a range of different countries, including in emerging scientific regions, to co-ordinate symposia and research initiatives focusing on research animal welfare and ethical use. She is passionate about the science-led promotion of the 3Rs. She has authored over 150 scientific publications, book chapters and major presentations. Internationally, she is a much sought-after speaker having a strong background in scientific and policy publication and a well established reputation for presenting complex concepts to lay audiences and the media as well as to scientific audiences.

VIEW PLENARY
Effects of post-exercise carbohydrate and protein supplement on repeat performance, serum chemistry, insulin, glucagon in competitive weight pulling dogs

Christopher Frye¹, Gina Dinallo¹, Gretchen VanDeventer¹, Jennifer Franklin¹, Sabine Mann¹, Ella Pittman¹, Joseph J Wakshlag¹

¹Cornell University

Introduction
Repetitive exercise can improve with post-exercise carbohydrate supplementation. An initial model of muscle strength was developed through examination of repeated bouts of weight pulling, as well as serum chemistry, lactate and selected hormones over two bouts of repetitive identical pulling activities in competitive weight pulling dogs.

Materials and Methods
Two groups of dogs were enrolled (8 control; 9 supplemented); with one group given a commercial carbohydrate and protein supplement after an initial bout of exercise. Dogs repeated the same exercise regimen 3 hours after the initial exercise bout. Blood was drawn at baseline and after the initial pull, 15 minutes, and 30 minutes post exercise. Blood was drawn again before and immediately after the second pull series. Maximum weight pulled was recorded for each bout of exercise. Routine serum chemistry was assessed before and immediately after both weight pull series. Lactate was assessed at baseline and immediately after the first exercise bout. Insulin, and glucagon were measured for all blood draws. Fisher’s exact test (weight pulled), Student’s T-test (lactate) or repeated measures of analysis of variation with Tukey’s post-hoc analysis (serum biochemistry, insulin and glucagon) were performed to assess differences.
Results
Maximum weight pulled was no different for the second pull series regardless of supplementation. Lactate was no different from baseline to post-exercise. No serum biochemistry differences were observed with supplementation, while exercise induced mild decreases in bicarbonate and increases in anion gap (p<0.05). The supplement induced a significant rise in insulin at 30 minutes and 3 hours, and a rise in glucagon at 3 hours after supplementation (p<0.05).

Discussion and Conclusion
Unlike other short-duration high-intensity exercises no significant hemodynamic or electrolyte changes occurred. No improvement in repeated weight pulling was observed in the supplement group. Supplements showed a hormonal response typical of post-exercise carbohydrate repletion in sled dogs.
Determination of the methionine requirement of large breed adult dogs using the Indicator Amino Acid Oxidation (IAAO) technique

David Allaway\textsuperscript{1}, Kerry Gray\textsuperscript{1}, Phillip Watson\textsuperscript{1}, Alison Colyer\textsuperscript{1}, Ken Smith\textsuperscript{2}, Penelope J Morris\textsuperscript{1}

\textsuperscript{1}WALTHAM Centre for Pet Nutrition; \textsuperscript{2}University of Nottingham

Introduction
Methionine, an essential amino acid, is often the first limiting amino acid in diets formulated using natural ingredients. The current NRC recommended allowance for methionine is predominantly based on data obtained from puppy/immature dogs. The current study aimed to determine the methionine requirement in large breed adult dogs, using a novel adaptation of the IAAO technique.

Materials and Methods
Nine semi-purified diets differing only in methionine content (0-2.4g.1000 kcal\textsuperscript{-1}) and with other nutrients, including total sulphur amino acids in excess of NRC 2006 requirements, were fed in a 9-way crossover study to Labrador Retrievers (n=21) for 3 days with at least a 5 day wash-out between trials. On the third day the test diet was offered in 8 meals and meals 4-8 were supplemented with \textsuperscript{13}C-Phe. To determine phenylalanine oxidation, 11 breath samples per dog per diet were collected and assayed for \textsuperscript{13}CO\textsubscript{2} enrichment. To determine phenylalanine flux, 6 blood samples were collected (per dog per diet) and assayed for \textsuperscript{13}C-Phe enrichment.

Results
A mixed effect break point regression model estimated the mean breakpoint for methionine to be 0.635g.1000 kcal\textsuperscript{-1}, with an upper 95% confidence interval of 0.77g.1000 kcal\textsuperscript{-1}. 
Discussion and Conclusions
These data suggest that the methionine requirement of large breed adult dogs may be less than described in current nutrition guidelines. Caveats include the large variability between individual dogs, which may overestimate the actual requirement. Further, longer-term studies are required to confirm that this lower level can be fed to adult dogs without any adverse health consequences.
Resistant starch on the intestinal health of old dogs: fermentation products and histological features of the intestinal mucosa

Mayara Correa Peixoto¹, Ludmilla Geraldo Di Santo*¹, Erico de Mello Ribeiro¹, Ana Paula Judice Maria¹, Bruna Agy Loureiro², Thaila Cristina Putarov², Gener Tadeu Pereira³, Lilian Marques Rose Sá⁴, Aulus Cavalieri Carciofi⁵

¹Veterinary Medicine and Surgery Department, College of Agrarian and Veterinarian Sciences (FCAV), São Paulo State University (UNESP); ²São Paulo State University (UNESP), Department of Animal Science, College of Agrarian and Veterinarian Sciences; ³UNESP – São Paulo State University, Jaboticabal, SP, Brazil; *FMVZ USP; ⁵FCAV Unesp

Introduction
Resistant starch (RS) may promote intestinal health by the formation of fermentation products and gut microbial modulation. This study evaluated the effects of a low-processed high RS extruded food on digestibility, fermentation products and gut mucosa histology of old dogs.

Materials and Methods
The same formulation based on corn, as the cereal, was extruded to obtain elevated starch cooking degree (99%) with low RS content (0.21%), or lower starch cooking (63%) with high RS content (1.5%). Eight old dogs (11.5±0.4 years old) were used in a cross over design, and fed the diets for 61 days. Digestibility was measured by total fecal collection, fermentation products and IgA on fresh faecal samples. Dogs were submitted to endoscopy and colonoscopy for gastrointestinal mucosa biopsy. Data were analysed by parametric or non-parametric statistics (P<0.05).
Results
Protein, fat, and energy digestibility were higher for the low-RS diet ($P<0.05$). Dogs receiving the high-RS diet had lower faecal pH and ammonia, and higher values for propionate, butyrate, total volatile fatty acids and lactate ($P<0.05$). No differences on faecal production and score were verified. No differences between diets were found on faecal IgA or the histological parameters of the gut mucosa, only a tendency for deeper crypts in the descending colon was observed for dogs fed the high-RS diet ($P=0.083$).

Discussion and Conclusion
The less processed food presented reduced starch cooking and higher RS content. Its consumption increased fermentation products concentration on faeces, specially butyrate, and improved colon histology, with deeper crypts. Although presenting reduced nutrient digestibility, no adverse effect on faecal formation was verified.

* Early career researcher
**Effects of dietary selenium and moisture on the physical activity and thyroid axis of cats**

**Sarah Hooper**¹, Robert Backus², Sybill Amelon³

¹Department of Veterinary Pathobiology, College of Veterinary Medicine, University of Missouri, Columbia, USA; ²University of Missouri; ³USDA Forest Service Northern Research Station;

**Introduction**

Hyperthyroidism is the most commonly diagnosed endocrine disorder of cats in the United States. Because selenium alters the conversion of thyroxine (T4) to triiodothyronine (T3), objectives of this study were to determine if increased dietary selenium or water alter the function of the hypothalamic-pituitary-thyroid axis and lead to an increase in activity level.

**Materials and Methods**

Employing a 28 day latin square design with a 14 day washout, 6 neutered adult male domestic shorthair cats were fed 1) commercially available adult dry feline diet containing 0.8 ppm selenium (control), 2) control diet with added sodium selenite to achieve a dietary selenium concentration of 1.125 ppm (selenium treatment), and 3) the control diet with additional water to achieve a moisture content of 75% wt/wt (water treatment). Water consumption was determined using deuterium oxide washout. Thyroid hormones were measured on Day 0, 14, 28 of each block with a thyrotropin releasing hormone (TRH) stimulation test conducted on day 28 to determine treatment effects on serum concentrations of thyroid hormones. Actical activity monitors were placed on each cat’s collar to allow quantification of the activity of each cat.
Results
There was a significant increase in daily water consumption with dietary water treatment (192 mL ± 7.85 SEM) compared to the control (120 mL ± 20.4) and selenium (116 mL ± 14.6) treatments. Both water and selenium treatments were associated with greater (p<0.05) activity over that of the control treatment by 20.5% and 11% respectively. Serum TT3 AUC concentrations (0 to 4 hr) of TRH stimulation tests were greater (p<0.05) by 16% with water compared to control treatments.

Discussion and Conclusion
The results of this study indicate that dietary water content may alter the function of the thyroid axis and that this effect is associated with an increase in physical activity.

* Early career researcher
Raw red meat diets decrease faecal microbial diversity in the dog

Nick J Cave¹, Wayne Young², David G Thomas¹, Emma Bermingham²

¹Massey University; ²AgResearch

Introduction
Several intestinal diseases of dogs are associated with reduced microbial diversity, including dysbiosis in acute diarrhoea, and inflammatory bowel disease. Although causality has not been demonstrated, it is hypothesised that strategies promoting diversity in healthy dogs might reduce disease risk. This study aimed to determine the short-term effect of two different diets on the faecal microbial composition in the dog.

Materials and Methods
Adult dogs (n=16) acclimated to a mixed wet/dry commercial diet for several months, were randomised to either a dry (1.8% crude fibre) or a raw red-meat diet formulated to be complete and balanced (0% crude fibre) for 9 weeks. Microbiota composition was assessed in fresh faeces at weeks 0, 3, 6 and 9 by amplifying the V4-V6 region of the bacterial 16S rRNA gene. Faith’s Phylogenetic Diversity estimates (PD) were performed using the core_diversity_analyses.py script in Qiime 1.8. Faecal concentrations of short-chain fatty acid (SCFA) were assayed.

Results
Faecal microbial diversity was not significantly different between groups at week 0 (mean PD ± SEM = 199 ± 5). Microbial diversity was maintained over the 9 weeks in dogs fed the dry diet diets. However, the microbial diversity was decreased by 3 weeks (177 ± 6) in the dogs fed the red meat diet, and continued to decrease throughout the 9 weeks (146 ± 12), whilst the diversity in the dry diet fed dogs did not significantly change. Both phyla associated with SCFA production and the faecal concentrations were decreased in the red-meat fed dogs. Gross
faecal quality of both groups was normal for the study duration.

Discussion and Conclusion
A dietary change from conventional commercial diets to a raw meat-based diet rapidly and persistently reduced microbial diversity in healthy dogs. The implications of this reduced diversity for health remains to be determined.
Introduction
The purpose of this study was to measure energy expenditure (EE) of swimming dogs.

Materials and Methods
EE was measured using indirect calorimetry in four healthy intact Siberian husky pet dogs, weighing 19-27 kg, 3-10 years old, habituated over several months to stand fully in water or swim in an “endless” pool under a floating tent with or without a flotation vest. Measurements were repeated until values were consistently within 5% of each other at each of seven flow rates. Dogs were exercised for 10 minutes per speed for a total of 30 minutes per session two to three times weekly.

Results
The male dog was unable to remain afloat without a vest unless his tail was supported. Mean EE standing in water was equivalent to a daily EE of 104 kcal/kg^{0.75} and increased 50% with a vest and 100% without a vest when the dogs maintained buoyancy with no flow. With increasing water flow up to 3 kph, mean EE increased almost linearly until it was four-fold more than standing EE in dogs with or without a vest. Blood lactate concentrations were unchanged at the highest speed, which was close to the dogs’ maximum sustainable speed.

Discussion and Conclusion
An inactive 23 kg pet dog maintaining weight while consuming 800 kcal/d will require about 6% more energy if it swims for 30 min daily at 2 kph. Swimming at 2 kph expends as much energy as trotting at 11 kph.
in elbow-deep water on an underwater treadmill¹ and represents a useful method of increasing EE in dogs.

¹Energy expenditure of dogs exercising on an underwater treadmill compared to that on a dry treadmill, Shmalberg, JW, Scott, KC, Williams, JM, Hill, RC Proceedings of AAVN symposium 2013
Flashlight & General Poster Session

New to WINSS 2016 is the addition of a flashlight poster session. This session will showcase five posters from early career researchers, selected by a review panel. Presenters will have five minutes to speak about their work and answer questions. This session will start at 18:30 on Wednesday 19th October (day 2) and take place in the Grand Ballroom. It will be followed by the general poster session on the Grand Ballroom balcony at 19:00.

Light refreshments will be available during the general poster session. Those presenting posters are expected to be available by their poster/s during this session to speak with attending delegates.
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<td>07:30</td>
<td>Breakfast</td>
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<td>Welcome</td>
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<td>Plenary: Promoting healthy growth in children</td>
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<td>Plenary: Promoting healthy growth in pets</td>
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<td>Dr Alex German</td>
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<td>Promoting healthy growth in children and pets:</td>
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<td>Nitrogen and sulphur amino acids requirements for kittens</td>
<td>Joyce Sato</td>
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<td>Development of nonlinear mixed models of growth curves from cats to identify risk factors for obesity</td>
<td>Nick J Cave</td>
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<td>Modelling the canine intestinal epithelium: characterisation and assay development</td>
<td>Janet Alexander</td>
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<td>Development of an original method to quantify auto-coprophagia in dogs</td>
<td>Vincent Biourge</td>
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<td>Serum 25-hydroxyvitamin D3 and 24R,25-dihydroxyvitamin D3 concentrations in adult dogs are more substantially increased by oral supplementation of 25-hydroxyvitamin D3 than by vitamin D3</td>
<td>Lauren Young</td>
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Session chair: Dr Richard Butterwick, WALTHAM Centre for Pet Nutrition

13:10 Hot Topics Introduction
Grand Ballroom, 7th floor

13:25 Hot Topic: Regulatory requirements for novel ingredients in pet food in the US
Charlotte Conway
Grand Ballroom, 7th floor

14:10 ECVCN Hot Topic: Instinctual and ancestral diets, aligning nutritional needs with physiologic and metabolic capabilities
Adronie Verbrugghe
Grand Ballroom, 7th floor

14:55 ACVN Hot Topic: Need, benefits, and risks of supplementing Vitamin D in dogs and cats
Robert C Backus & Joe Wakshlag
Grand Ballroom, 7th floor

15:40 Break
Empire Ballroom, 7th floor
DAY 3
Thursday 20th October

AFTERNOON SESSION 2

Session chair: Dr Denise Elliott, WALTHAM Centre for Pet Nutrition

16:00
Career Development Workshop – Challenges and rewards of developing a career in companion animal nutrition
Exchange, 11th floor

18:00
Close

EVENING

19:00
Drinks Reception
Toledo room, 5th floor

19:30
Gala Event
Renaissance Ballroom, 5th floor

23:00
Close
Plenary: Promoting healthy growth in children
Prof. Gary Butler

Childhood growth is routinely assessed by comparison with growth standards. The science of growth, or auxology, is a relatively new one. The first description of the growth of one individual child is ascribed to the 18th century French naturalist Gueneau de Montbeillard. The first published use of measurements of children at all ages was in Boston USA in the late 19th century. This began an interest in the measurement of children routinely. After the First World War, the British government was dismayed at the health of potential recruits. One of the first tasks of the newly formed Medical Research Council was to investigate the link between the environment, nutrition and a child’s health using height and weight as indices of wellbeing. The effect was very clear, and the need for good child nutrition and care became a public health matter.

Assessing growth has always been an important matter but appropriate reference standards were not always available. Constructing growth charts became an art, with different approaches. Many children of different ages measured all at once produced charts for ready reference of height and weight, but didn’t give information about how a single child grew. Small numbers of children measured serially provided much information on the pattern of growth-longitudinal charts- but took a long time to construct hence limiting their validity.

Other challenges include the depiction of the adolescent growth spurt, a phenomenon unique to humans. Several attempts have been made to portray the wide variations in height and weight growth on a single chart, but obtaining useable standards for clinical practice is challenging.

Another complexity in the provision of growth charts for population use is the change in the shape of children over time. The current generation is taller than previous, but this is not a constant increase from one generation to the next. There is some evidence of a slowdown. Much commented upon is the obesity epidemic/the significant change in the
shape of children as a result of an excess of high-energy food and reduced physical activity levels. The debate ensues as to whether growth charts should be updated to reflect the weight of contemporary children or whether holding references at the same position to highlight any trends and provide a reference for public health interventions to reverse the obesity trend. The debate continues. In 2001, the UK government, worried about the long term effect on health, set out to measure the height and weight of children entering primary school aged 4 yr and leaving aged 10 yr. Unwittingly this national data has provided a valuable source of public health information.

The World Health Organisation conducted the most extensive study on infant and early child growth ever done. By tracking the height, weight and head circumference of health singleton infants of normal birthweight, breastfed by their mother exclusively for the first six months of life, we now understand the correct and optimal pattern of human growth and this venture allowed the construction of the first true international growth standards i.e. depictions of how children should actually grow. The adoption as the primary growth reference for health in the preschool child population is almost worldwide.

The importance of overnutrition, not only in the healthy normal sized infant producing obesity, but also in the underweight, undernourished infant is now better understood. The intense striving to facilitate rapid catch-up growth is now understood to be detrimental to long term metabolic health, producing a state of metabolic imbalance similar to that caused by nutritional excess in the normal sized individual. This has provoked a rethink in infant feeding policies.

Rapid increases in weight from one generation to the next and increasing stature has accelerated reaching adulthood, thus reducing time as a child as a result of the age achieving puberty advancing. The effect is not only on immediate metabolic health due to the increases weight-height balance but also the potential timebomb of having reached adult life at an earlier age thus commencing degenerative changes at a younger age, hence the earlier appearance of adult diseases. This is on top of the social
challenges of children growing into adults physically and sexually, yet remaining childlike in their emotional development.

Measuring growth in childhood is a way of getting a handle, not only on the wellbeing of an individual child, but also on the health of the population too. It is a new science, only having been developed over the past 100 years, but thanks to the folklore tradition of observing children grow, it provides us with perhaps the most valuable tool in nutrition and wellbeing.
Prof. Gary Butler
Professor and Consultant in Paediatric & Adolescent Endocrinology, University College Hospital & Institute of Child Health, UK

Professor Gary Butler is Consultant in Paediatric and Adolescent Endocrinology at University College Hospital in London and holds a personal Chair in Paediatrics at the UCL Institute of Child Health. He is a Fellow of the Royal College of Paediatrics and Child health, and of the Royal College of Physicians. He trained in paediatric endocrinology in Edinburgh at the Medical Research Council Human Genetics Unit and the MRC Reproductive Biology Unit in addition to the Royal Hospital for Sick Children. His principal research interests were the growth and development in puberty of boys with extra X and Y chromosomes (doctoral thesis), the neuroendocrine control of puberty and the auxology of normal growth. He has established an adolescent endocrine service in London focused on disorders of puberty with a number of specialist clinics.

His current research programmes focus on gonadotropin deficiency, Klinefelter syndrome, adolescent gynaecomastia, and is the endocrine lead for the UK adolescent gender identity development service as well as on the development of the immune system during puberty. He is the UK PI for the European growth hormone safety study.

He was a member of the Royal College of Paediatrics and Child Health team developing new Child Growth Standards incorporating new growth data from the World Health Organization. These new charts were launched in 2009 and are now received by all new mothers in the UK as part of the personal child health record, or ‘red book’. He also led the design of the 2013 school age growth charts incorporating concurrent puberty assessments now used in all hospitals.
The growth phase is fundamental to the lifelong health and wellbeing in all humans. A growth pattern that deviates from optimal can be the result of malnutrition or an underlying developmental disorder. Further, overly rapid growth or catch-up growth are known to predispose to childhood obesity, which is a risk factor for lifelong obesity. As with humans, growth patterns in dogs and cats that deviate from ideal can either indicate the presence of a disease affecting growth, or a pattern of growth that may itself lead to disease. For example, developmental diseases can cause under-nutrition leading to poor growth, whilst over-nutrition and overly rapid growth can cause developmental musculoskeletal disorders (e.g. diseases of the osteochondrosis group). Rapid growth has also been linked to the development of obesity later in life in both cats and dogs. This association is of particular concern as obesity is now the most prevalent medical disease in pets, adversely affecting the quality of life of millions worldwide. Outcomes of weight management are often disappointing with many animals either failing to reach target weight, or subsequently regain the weight. Given the poor success of weight management, the veterinary profession should arguably consider focusing on prevention of obesity and, for this, ensuring a healthy growth pattern could be key.

Growth standards, such as those created and promoted by the World Health Organisation (WHO), are now a vital component of the human paediatric tool kit, allowing trained health professionals to gauge the growth pattern of individual children by comparison to a healthy reference population. By monitoring proactively, children whose growth deviates from expected can be identified earlier enabling appropriate investigations and therapy to be implemented. Having similar growth standards for companion animals could bring similar benefits in terms of early identification of individuals at risk and, therefore, early intervention.
Of course, the canine species presents a unique challenge when attempting to develop growth standards due to the diversity of breeds. There are a vast array of different shapes and sizes, ranging from the Chihuahua that often weighs only 1 kg to the St Bernard that may weigh more than 100 kg. Growth patterns can differ markedly amongst breeds with very small dogs reaching maturity at between 8 and 12 months of age and larger breeds requiring up to 24 months to reach adult body weight. Therefore, unlike the WHO growth standards, it is doubtful that a single growth standard would be applicable to all dogs.

In a recent project, evidence-based growth standards have been developed for dogs, using retrospective analysis of bodyweight and age data from over 6 million young dogs attending a large corporate network of primary care veterinary hospitals across North America. Separate charts were constructed for male and female dogs in 5 different size categories, with an adult weight of up to 40 kg. Modelling studies demonstrated broad consistency between the pattern of growth in individual breeds and those from the equivalent size category (e.g. size category III, 30-40 kg for the Labrador retriever). The effect of neutering at different stages of growth was also assessed. Whilst neutering before 37 weeks was generally associated with a slight upwards shift in growth trajectory, and neutering after 37 weeks was associated with a slight downwards shift in growth trajectory, these deviations were small and were dwarfed by inter-individual variability. Thus, healthy growth after neutering did not differ significantly from the healthy growth in dogs remaining entire.

In a further study, the newly-developed growth charts were validated using datasets from healthy dogs, from those with abnormal body condition (underweight and overweight), and from dogs diagnosed with diseases that may affect the growth pattern. Growth patterns from most healthy dogs followed the centiles reasonably closely, generally crossing a maximum of 1 centile line in either direction, and at least 95% of these dogs crossed <2 centiles. In contrast, many more of the dogs from the datasets of unhealthy dogs crossed >2 centiles. Using population analysis, the mean body weight of overweight and obese dogs started at or slightly above the zero line, and then displayed an upwards trajectory during
growth, suggesting a faster rate of weight gain, on average, than predicted by the growth charts. Conversely, in underweight dogs, the median body weight started at or below the zero line, and then sloped downwards, indicating a slower growth rate than that of the growth curves. For many diseases that would be expected to affect growth (e.g. portosystemic shunt, megaoesophagus, and persistent right aortic arch), the mean population bodyweight was below average at 12 weeks, indicating that most dogs were small for their age, and then displayed a downward trend in trajectory at 12 weeks.

The potential for these growth standards is huge. Such a tool could facilitate proactive intervention by veterinary professionals, with the aim of promoting optimal husbandry and nutrition practices, identifying and correcting abnormal growth patterns and, ultimately, preventing the development of disease. Currently, besides visits for vaccination and neutering, formal visits to the veterinarian during early life are inconsistent and irregular, with growth matters only discussed if concerns arise. With the advent of validated growth charts, veterinarians can now monitor growing puppies proactively, thereby facilitating conversations with owners regarding optimal veterinary care and nutrition. Diseases that arise during the growth period may be identified quicker given the greater interaction between owner and veterinary professional. Puppy growth charts could help veterinary professionals raise awareness about ‘healthy’ body weight, and ensure that more dogs are in optimal body condition on entering early adulthood. This should in turn help to promote the maintenance of a healthy weight for life, through continued regular weight monitoring to ensure that the early adult bodyweight is then maintained throughout life.
Dr Alex German  
Reader in Small Animal Medicine, School of Veterinary Science, University of Liverpool, UK

Dr German qualified as a veterinary surgeon from the University of Bristol in 1994. After two years in mixed practice he returned to Bristol to undertake a PhD, and then a residency in small animal internal medicine. He moved to the University of Liverpool in October 2002, where he currently holds the position of Royal Canin Reader in Small Animal Medicine. He became a Diplomat of the European College of Veterinary Internal Medicine in September 2004, and a Royal College of Veterinary Surgeons Recognised Specialist in Internal Medicine in 2006.

To date, his main clinical and research interests have included gastroenterology, and comparative obesity biology. The main aims of his current research are to improve quality of life and prevent chronic disease during all life stages of companion animals, with ongoing projects that include determining what constitutes optimal growth, maintaining a healthy adult bodyweight, and improving the clinical care of senior pets.

VIEW PLENARY
Nitrogen and sulphur amino acids requirements for kittens

Joyce Sato*1, Mônica Estela Zambom Merenda1, Aline Terumi Uemoto1, Mateus Santos Pereira1, Layne Carolina Pereira1, Edney Pereira Silva2, Aulus Cavalieri Carciofi2, Ricardo Souza Vasconcellos1,

1State University of Maringá (UEM), Department of Animal Sciences; 2FCAV Unesp

Introduction
Methionine is usually the first limiting amino acid in practical diets for cats. Since the protein requirement depends on the balance among amino acids in the diet, the aim of this study was to determine simultaneously the sulphur amino acid and nitrogen requirement for kittens between 150 to 240 days-old.

Materials and Methods
Thirty-six kittens (150 days-old) were divided in six treatments (n=6 per treatment). The nitrogen balance (NB) and hair collection was conducted at 150, 195 and 240 days-old. The trials lasted 5 days of adaptation followed 6 days of total collection. The fur’s collection had shaving at 150 days and measured at 195 and 240 days-old. Six isoenergetics diets (4.000 kcal/kg) were formulated, with increasing protein concentration (22; 29; 35; 42 and 50% CP) but constant ratio of amino acids, by using of dilution technique (Fisher and Morris, 1970). The diets were relatively deficient in Methionine + Cystine (M+C) in order to determine the requirements of these amino acids. The amount of food was calculated individually to meet the recommend nutrient requirements for growing cats (NRC, 2006). Protein and M+C requirements were determined according to Göttingen approach, by using of an exponential model and mathematical relationships between nitrogen intake (NI), nitrogen excreted (NEX), nitrogen deposition (ND) obtained in the nitrogen balance trials (Liebert et al., 2000).
Results
The nitrogen requirements for maintenance (NMR) of the kittens were 565, 558 and 457 mg/BWkg\(^{0.67}\)/day, respectively at 150, 195 and 240 days-old. Considering 60% of NRmaxT, according to optimal weight gain and growth fur, the M+C requirements were 1.15, 1.20 and 1.08% for each period, respectively, at 150, 195 and 240 days-old.

Discussion and Conclusions
The M+C requirements were higher than the NRC (2006) recommended allowances, probably due to the difference in the age of the cats among the studies, methods or the difference between extruded versus purified/semi-purified diets. According to this study, the kitten’s M+C requirements are 1.15, 1.20 and 1.08% and the nitrogen to replace the endogenous lost are 565, 558 and 457 mg/BWkg\(^{0.67}\)/day at 150, 195 and 240 days-old.

* Early career researcher
Development of nonlinear mixed models of growth curves from cats to identify risk factors for obesity

Nick J Cave¹, Janis P Bridges¹, David G Thomas¹

¹Massey University

Introduction
We hypothesised that there would be growth model parameters and early life variables that would predict an overweight (OW) phenotype in colony cats.

Materials and Methods
Cats were housed in an in-bred seasonal colony of c.150 cats, where the staple diet is an AAFCO maintenance tested commercial canned diet fed 

ad libitum. Data included date of birth, sex, litter size, parentage, birth weight and weekly bodyweight (BW) from birth to > 9 years. Cats were categorised as normal (NW) or overweight (OW) based on peak weight in their 8th year. A nonlinear mixed-effects model was fitted to bodyweight data. Parameter estimates applied as starting values for the model were obtained by fitting a standard 3-parameter growth curve model (Gompertz function). The maximum body weight attained between the 7th and 8th year was chosen as an indicator of overweight/obesity during adulthood. To identify the variables associated with being OW, a general linear regression model comprising both numeric and categorical variables and their interactions was fitted to the data.

Results
OW status was defined in 27% of cats, and was associated with male sex, larger litter size, weight at peak growth rate (PGRwt), and birth during spring/early summer (adj $R^2 = 0.65$). The model remained significant after omission of litter size and substitution of PGRwt with weight at 15 weeks.
Seasonal fluctuations in BW were greater in OW than NW cats ($P<0.003$).

**Discussion and Conclusions**

These results support the hypothesis that the trajectory to obesity is established early in life, but do not support parentage or gestational conditions as strong risk factors. Seasonal BW changes suggest that differences in food intake regulation exist in OW cats versus NW cats. Application of growth models to individual cats may allow early intervention of at risk individuals to prevent obesity.
Modelling the canine intestinal epithelium: characterisation and assay development

Michelle Farquhar¹, Emma McCluskey¹, Kevin R Hughes¹, Ruth Staunton¹, Jennifer C Coltherd¹, Janet Alexander¹

¹WALTHAM Centre for Pet Nutrition

Introduction
Research indicates that certain food ingredients and bacteria can modulate intestinal epithelial permeability and induce inflammation. As this effect is difficult to study in vivo, we developed an in vitro intestinal model using immortalised dog intestinal epithelial cells (DIECs) to better understand effects of simulated luminal contents on epithelial health and function.

Materials, Methods and Results
Characterisation of DIECs revealed that, at 32°C, they resemble proliferating immature enterocytes whereas culturing at 39°C caused cessation of growth and differentiation into a phenotype more closely reflecting mature enterocytes in vivo. Differentiated DIECs increase in size and granularity, shown via flow cytometry, and express appropriate intestinal epithelial markers, tight junction proteins and transporters. Compared to cells at 32°C, differentiated cells exhibit enhanced barrier function, demonstrated by increased transepithelial electrical resistance (TEER; mean±SEM, 869.0±44.1 vs 570.7±29.5 Ω/cm², n=3), decreased permeability to Lucifer yellow (% passage; 0.478±0.037 vs 0.751±0.056, n=3) and increased activity of the brush border enzyme alkaline phosphatase (ALP activity; 0.476±0.022 vs 0.064±0.015 U/ml, n=2). Combining quantification of TEER with Lucifer Yellow (measures of paracellular permeability) and assessment of cell viability allowed a model to be developed to enable us to robustly quantify modulation of intestinal epithelium health and function. In addition, visualising the nuclear translocation of NFκB has been used as a measure of cellular
inflammation; positive controls Lipopolysaccharide (LPS) and phorbol 12-myristate 13-acetate (PMA) increased translocation in the assay to 13.97±1.14% and 63.63±2.75% (mean±SEM) respectively when compared to untreated cells.

Discussion and Conclusion
Using these cells we have developed methods to assess how simulated luminal contents affect the intestinal barrier, quantifying changes in TEER and permeability, and effects on cell viability and inflammation. This model enables assessment of diets for effects on gastro-intestinal epithelium prior to feeding trials, supporting Mars’ commitment to the 3Rs in scientific research.
Development of an original method to quantify auto-coprophagia in dogs

Mickael Weber¹, Louise Kleim¹, Vincent Biourge¹, Alexandre Feugier¹

¹Royal Canin, Aimargues, France

Introduction
Coprophagia is a common behaviour in dogs. Few studies are available in the literature due to the difficulty to quantify this behaviour. Observations, questionnaires and videos are the most common methods used but are subjective, non-quantitative and time-consuming. The aim of this study was to develop an original, simple and accurate method to quantify auto-coprophagia in dogs.

Materials and Methods
Twenty one adult dogs were used: seven non coprophagic dogs, seven moderately coprophagic dogs and seven very coprophagic dogs. All those dogs were fed the same dry diet and receive food quantity to meet their energy requirements. Dogs were housed in individual pens with outdoor access, and had 2 hrs exercise each day. Coprophagia was evaluated over 6 days by measuring the faecal excretion of sixty 1.5 mm radiopaque markers (BIPS®) given on day 1. Faeces of each animal were collected every consecutive day (morning and afternoon). The number of markers in each stool was identified by X-ray. This protocol was repeated twice. A mixed model was performed (SAS, Version 9.3). Results were expressed as mean±SE.

Results
Excretion kinetics of markers were significantly different between non coprophagic and coprophagic dogs in both repetition (p<0.01). In non coprophagic dogs, all markers were excreted in the first 3d. In coprophagic dogs, only 41.5±9.8% and 42.1±7.1% of markers were recovered after 3d., and 50.9±11.3% and 71.1±5.7% after 6d., for repetition 1 and 2 respectively.
Coprophagia severity significantly affected excretion times of markers in both protocols: 4.0±0.8 and 5.5±0.3 days were required on average to excrete 75% of markers in moderately and highly coprophagic dogs respectively (p<0.05).

**Discussion and Conclusion**

Time of excretion of faecal markers appears interesting to quantify auto-coprophagia in dogs. This method shows a good repeatability and allows a good discrimination between moderately and highly coprophagic dogs. It could easily be used to test different nutritional strategies on coprophagia behaviour.
Serum 25-hydroxyvitamin D3 and 24R,25-dihydroxyvitamin D3 concentrations in adult dogs are more substantially increased by oral supplementation of 25-hydroxyvitamin D3 than by vitamin D3

Lauren Young¹, Robert L Backus¹

¹University of Missouri, College of Veterinary Medicine, Columbia, MO

Introduction
We previously found a weak and variable response in serum 25-hydroxyvitamin D [25(OH)D] concentrations when dogs were supplemented with oral vitamin D3 (D3). In this study, we determined the relative potency of oral 25(OH)D3 compared to D3 for increasing vitamin D status in dogs with low serum 25(OH)D concentrations.

Materials and Methods
Four male and three female, 4 year-old, intact, lean (5-10 kg), genetically-related, University-owned, Chinese-crested/Beagle dogs were studied in a randomized, single cross-over trial. After feeding a low vitamin D diet (<4 IU/100g) for 30 days, 4 dogs received daily D3 supplementation at 2.3 µg/kg BW⁰.⁷⁵, while the other 3 dogs received a molar equivalency as 25(OH)D3. The supplements, dissolved in ethanol (~1 µL/kg BW), were applied to a commercial treat for consumption. Serum 25(OH)D and 24R,25 dihydroxyvitamin D [24R,25(OH)₂D] were analyzed weekly using a validated HPLC method. A washout of one month separated the two supplementation phases.

Results
Both supplementations increased (p<0.01) serum 25(OH)D3 concentrations. However, oral 25(OH)D3 resulted in greater (p<0.01)
concentrations than D3 by week one, with a difference of 172% ($p<0.01$) by week 2. The supplementation period was limited to 14 days because serum 25(OH)D3 concentrations were not appearing to plateau. Serum 25(OH)D3 concentrations declined twice as rapid ($p<0.01$) following discontinuation of 25(OH)D3 compared with D3 supplementation. Following 25(OH)D3, but not D3 supplementation, serum 24R,25(OH)2D3 concentrations increased ($p<0.02$) to peaks of 50-119 ng/mL, one to three weeks after supplementation withdrawal.

**Discussion and Conclusion**
Vitamin D status, as indicated by serum 25(OH)D and 24R,25(OH)2D concentrations, is more rapidly and efficiently increased in adult dogs by oral supplementation of 25(OH)D3 than D3. Given equilibrium in serum 25(OH)D3 concentration was not observed at the 25(OH)D3 dosage used, further work is needed to identify a safe and effective 25(OH)D3 dosage for improving vitamin D status in dogs.

* Early career researcher
Hot Topic Discussions

Introduction to hot topics
The hot topics session will debate and discuss three current topics in pet nutrition. This session will be interactive, introduced and led by an expert in the particular area.

HOT TOPICS

13:25
Hot Topic: Regulatory requirements for novel ingredients in pet food in the US
Charlotte Conway
Grand Ballroom, 7th floor

14:10
ECVCN Hot Topic: Instinctual and ancestral diets, aligning nutritional needs with physiologic and metabolic capabilities
Adronie Verbrugghe
Grand Ballroom, 7th floor

14:55
ACVN Hot Topic: Need, benefits, and risks of supplementing Vitamin D in dogs and cats
Robert C Backus & Joe Wakshlag
Grand Ballroom, 7th floor
DAY 3: 13:25 - 14:10

Hot Topic: Regulatory requirements for novel ingredients in pet food in the US
Charlotte Conway
Charlotte Conway is a scientific reviewer in the US Food and Drug Administration’s Division of Animal Feeds with primary responsibilities including pet food labeling policy and novel ingredient review. She is also a member of the Association of American Feed Control Officials (AAFCO) Pet Food and Ingredient Definitions Committees, heading and participating in working groups to update AAFCO publications. She joined the FDA in 2010 after completing her Master’s at the University of Kentucky studying canine nutrition. Her passion for canine health and nutrition is driven by a lifetime of involvement in AKC dog activities.

www.fda.gov/safefeed
ECVCN Hot Topic: Instinctual and ancestral diets, aligning nutritional needs with physiologic and metabolic capabilities
Dr Adronie Verbrugghe
Dr. Adronie Verbrugghe graduated as a companion animal veterinarian (DVM) from Ghent University, Belgium in 2005. She completed her PhD dealing with nutritional modulation of carbohydrate metabolism in cats also at Ghent University in 2009 and continued with a 2-year post-doctoral fellowship focusing on anti-inflammatory properties of beta-glucans in cats at the same university. She became board certified for the European College of Veterinary and Comparative Nutrition in 2010. In 2011, Dr. Verbrugghe immigrated to Canada to join the Ontario Veterinary College, University of Guelph, as assistant professor and Royal Canin Veterinary Diets Endowed Chair in Canine and Feline Clinical Nutrition. Dr. Verbrugghe’s academic responsibilities include development and teaching of small animal clinical nutrition curriculum and running the small animal clinical nutrition service at OVC. Her research interests include companion animal nutrition, the link between nutrition, gut microbiota, health and disease, alteration of metabolic pathways through nutrition and nutritional modulation of inflammation and immunity. Currently pet obesity and canine cancer are the major subjects of her research. Dr. Verbrugghe has received research funding through the Canadian and Ontario government such as the Natural Science and Engineering Research Council of Canada, the Canadian Foundation of Innovation and the Ontario Ministry of Research and Innovation as well as from pet food industry and local charitable organizations. To date Dr. Verbrugghe has authored and co-authored 20 peer-reviewed publications, has trained 15 graduate students and postdocs, served as mentor for multiple undergraduate research projects, is a reviewer for various scientific journal and sits on several institutional committees.

https://ovc.uoguelph.ca/clinical-studies/faculty/Adronie-Verbrugghe
ACVN Hot Topic: Need, benefits, and risks of supplementing Vitamin D in dogs and cats
Robert C Backus & Joe Wakshlag
Robert C. Backus
MS, DVM, PhD, DACVN

Associate Professor and Director of the Nestlé Purina Endowed Program in Small Animal Nutrition. Board-Certified Specialist in Veterinary Nutrition.

Robert C. Backus graduated of the University of California-Davis, School of Veterinary Medicine in 1987 and received MS and PhD degrees in Physiology in 1987 and 1991. While at Davis, he began study of small animal nutrition as a WALTHAM Fellow investigating causes of taurine deficiency in cats. In 2004, Dr. Backus received Board certification with the American College of Veterinary Nutrition and became a faculty member of the College of Veterinary Medicine at the University of Missouri-Columbia. Currently, he directs research and clinical nutrition programmes at the Veterinary Health Center of the College. His current research activities focus on vitamin D nutrition and metabolism and disease and nutritional causality of thyroid hyperplastic disease.

http://vhc.missouri.edu/small-animal-hospital/nutrition/
Dr. Joseph Wakshlag graduated from Cornell College of Veterinary Medicine in 1998, where he continued his residency training in both pathology and nutrition, as well as receiving his PhD in Pharmacology in 2005. He is a member of the American College of Veterinary Nutrition and the American College of Veterinary Sports Medicine and Rehabilitation. He is currently the Associate Professor at Cornell University and Associate Chair of Research and Graduate Education in the Department of Clinical Sciences. His research endeavors are varied with focus in the areas of obesity, working dog physiology and metabolism, the role of vitamin D in health and disease and cancer cell biology.

http://www.vet.cornell.edu/faculty/Wakshlag/
DAY 3: 16:00 - 18:00

Career Development Workshop: Challenges and rewards of developing a career in companion animal nutrition

A career in companion animal nutrition can develop in many different ways. This session features speakers with varied backgrounds and career paths in this field; from academia, clinical nutrition and the pet nutrition industry from a variety of geographical locations. You’ll hear about their challenges and rewarding experiences as they developed their career, and will have the opportunity to ask questions in a panel Q&A session.

Invited speakers

Yann Queau
Wouter Hendriks
Jennifer Larsen
Myriam Hesta
Maryanne Murphy
After graduation from the National Veterinary School of Toulouse (France) in 2007, Yann Quéau completed an internship in Renal Medicine and Hemodialysis, followed by a residency in Small Animal Clinical Nutrition at the University of California, Davis. He became a Diplomate of the American College of Veterinary Nutrition (ACVN) in 2011.

In 2011, he joined the Royal Canin Research & Development (R&D) Center to conduct the urinary and renal research projects, both internally and in collaboration with universities. As a Clinical & Research Nutritionist, he is also in charge of providing support and guidance in nutrition for global R&D projects, including product development and clinical trials. Yann is responsible for ensuring nutritional consistency across the Royal Canin diet portfolio in close collaboration with other nutritionists at Royal Canin and Mars Petcare. Sharing knowledge via lectures to veterinarians and students, research presentations at international congresses and in articles is another important part of his mission. Finally, through his activities within the ACVN, as a past Board member and a current member of working committees, he is committed to promoting the specialty of veterinary nutrition and supporting its role in the health and wellbeing of dogs and cats.

http://eng.royalcanin-world.com
Wouter H. Hendriks, Ph.D., holds the chair of Animal Nutrition at the Department of Animal Science of Wageningen University and the chair of Nutrition at the Faculty of Veterinary Medicine, University of Utrecht in the Netherlands. In his current capacity, he manages and directs active research programmes examining aspects of general mammalian and avian nutrition and physiology. He specializes in the nutrition of companion animals, such as cats and dogs, in the area of protein nutrition, digestive physiology and nutrient requirements. He is currently an editorial board member of 3 international journals related to animal nutrition and feeds. He received his degree in Animal Nutrition from Wageningen University and his Ph.D. in Monogastric Nutritional Physiology from Massey University in New Zealand.

www.wageningenur.nl/en/Expertise-Services/Chair-groups/Animal-Sciences/Animal-Nutrition-Group.htm

www.uu.nl/staff/WHHendriks
Dr. Jennifer Larsen holds Bachelor’s and Master’s degrees in Animal Science and a Doctorate degree in Veterinary Medicine from the University of California, Davis. She completed one year in local private practice before accomplishing a clinical nutrition residency at UCD. In 2007, Dr. Larsen attained Diplomate status from the American College of Veterinary Nutrition, and completed a PhD in Nutritional Biology in 2008. She is an Associate Professor of Clinical Nutrition at the Veterinary Medical Teaching Hospital at the University of California, Davis and does clinical nutritional consulting through the VMTH Nutrition Support Service.

In 1996, Myriam Hesta graduated at the Faculty of Veterinary Medicine, Ghent University. In 1997, she started working at the Animal Nutrition Laboratory at the same faculty. She started the nutrition consultations at the small animal clinic at the faculty and in 2001 she successfully passed her ECVCN (European College of Veterinary and Comparative Nutrition) diplomate exam. Her main research topic was prebiotic supplementation in dogs and cats and in 2003 this resulted in a PhD degree.

She is also very active as an executive board member of the European college (ECVCN) and is the current president. She is a lecturer in companion animal nutrition at the Ghent University and her focus is on obesity, gastrointestinal health and nutritional effects on immunity in dogs, cats and horses. In December 2011, she started an equine nutrition consultation service for horse owners and veterinarians to complement an existing service for dogs and cats. She is the main supervisor of 3 ECVCN residents and promoter of several PhD students.

Myriam Hesta is internationally recognised for her expertise in companion animal nutrition.

Dr. Murphy received her dual Bachelor degree in animal sciences and biological sciences from Rutgers University in 2004 and her DVM from Iowa State University in 2008. She completed a rotating general medicine and surgery internship at Fifth Avenue Veterinary Specialists in New York City and a clinical nutrition residency at the University of Tennessee. She became a Diplomate of the American College of Veterinary Nutrition in 2013 and earned her PhD in Comparative and Experimental Medicine from the University of Tennessee in 2014. The focus of Dr. Murphy's dissertation research was energy metabolism and satiety in lean and obese dogs. She joined the staff of Red Bank Veterinary Hospital in Tinton Falls, New Jersey as a clinical nutritionist in 2014. Her clinical duties involve assessing the nutritional status of all hospitalized patients and making dietary changes as warranted, including making recommendations for assisted enteral or parenteral nutrition. Dr. Murphy also sees in-person consultations for any cat or dog needing appropriate diet recommendations, whether using commercially or home prepared options. Dr. Murphy's major professional interests are obesity prevention and management and veterinary nutrition education.

http://www.rbvh.net/medical-services/clinical-nutrition.html
Gala Event

The gala event will open with a drinks reception in the Toledo room (5th floor) from 19:00 followed by a three course gala meal in the Renaissance Ballroom (5th floor) from 19:30 - 22:30.

The Renaissance ballroom was modelled to depict the indulgence and extravagance of the French Renaissance during the era of Louis XVI. The meal will be followed by classic Chicago jazz played by the Bugsy Tunes Quartet.

As a guide, the dress code is smart, but this is not essential.
DAY 4  
Friday 21st October

MORNING SESSION

Session Chair: Prof Lisa Freeman, Tufts University

07:30  Breakfast  
Empire Ballroom, 7th floor

08:30  Welcome  
Grand Ballroom, 7th floor

08:45  Plenary: The impact of age, disease and nutrition on human muscle mass and function (sarcopenia)  
Prof. Olav Rooyackers  
Grand Ballroom, 7th floor

09:45  Factors affecting weight loss in client-owned dogs: an international weight loss study  
John Flanagan  
Grand Ballroom, 7th floor

10:05  Vitamin D status and acute phase protein concentrations in canine cancer patients  
Nicole Weidner  
Grand Ballroom, 7th floor
DAY 4
Friday 21st October

10:25  Break  Empire Ballroom, 7th floor

10:55  Effect of high and moderate protein diets in the body composition and metabolic parameters of neutered dogs  Iris Mayumi Kawauchi  Grand Ballroom, 7th floor

11:15  Overweight dogs are more likely to display undesirable behaviours: Results of large online survey of dog owners from the United Kingdom  Alexander German  Grand Ballroom, 7th floor

11:35  Dietary macronutrient profile (MNP) and feline bodyweight regulation  Janet Alexander  Grand Ballroom, 7th floor

11:55  Early Career Researcher Award Presentation  Grand Ballroom, 7th floor

12:30  Close and Lunch
The loss of muscle mass is a well know feature of inactivity, disease and aging. During aging the process of muscle loss is slow and takes several decennia. During disease (e.g. diabetes, kidney disease, COPD or cancer cachexia), this is faster and reaches the fastest loss in patients that are critically ill and treated in the intensive care unit (ICU). In this latter group the loss can be as high as 10% per week. Not only muscle mass is lost but also muscle function is compromised in these situation. This loss of function is not only due to the loss of muscle mass but is often also the result of a loss in muscle quality.

Muscle consists mostly of proteins and the loss of muscle mass and function is therefore most often a loss of muscle protein. Changes in muscle protein are due to changes in muscle protein turnover. A loss is than the due to protein breakdown exceeding protein synthesis. Loss of muscle function during aging and disease has different mechanisms with the loss during aging most likely a reduced response in protein synthesis due to feeding (anabolic resistance) and in the critically ill patients it is mainly the result of a dramatically increased protein breakdown. To design or test therapies to prevent, reduce or counteract the muscle loss one needs to know the underlying mechanisms for the loss: should one aim at stimulating protein synthesis or inhibiting protein breakdown.

There are three obvious ways of increasing muscle mass and function and these are: feeding, activity and hormones. In normal life these three factors work together to have muscle growth and adaptations when needed. Also therapies for maintaining or restoring muscle mass in
diseased states often use these three factors. However, the question is whether these will work in isolation or need to be used in a coordinated fashion. Nutrition and even protein feeding alone seldom increases muscle mass without activation of the muscle, most often in the form of physical activity. Hormonal treated has been used but has often side effects which we do not fully understand.

The presentation will cover the loss of muscle mass and function in the different physiological situations and the mechanisms for the loss. Several situations and diseases will be covered but the dramatic loss in the critically ill patients will be shown in more depth as an example. Possible interventions to preserve or restore muscle mass and function will be discussed with a focus on the combination of protein nutrition and physical activity. Also the use of special proteins (e.g. whey protein) and nutrients (e.g. leucine) will be discussed.
Prof. Olav Rooyackers
Professor of Experimental Anaesthesiology and Intensive Care
Clintec, Karolinska Institutet and University Hospital, Huddinge, Sweden

Prof Rooyackers received his PhD from the University of Maastricht in 1995, after which he held post doctoral positions at the Mayo Clinic and Foundation in Rochester, USA and at the University of Edinburgh, Scotland. He has been with his current research group at Clintec, Karolinska Institutet and University Hospital, Huddinge, Sweden for 16 years.

The research group is dedicated to the nutritional and metabolic problems of critically ill patients treated in the Intensive Care Unit. One of the focus points is the dramatic loss of muscle mass that these patient experience and that negatively affects their survival and recovery. We are investigating the causes for the loss and the possibilities to influence this by nutrition.
Factors affecting weight loss in client-owned dogs: an international weight loss study

John Flanagan¹, Thomas Bissot¹, Marie-Anne Hours¹, Bernabe Moreno¹, Alexandre Feugier¹, Alex German²

¹Royal Canin, Aimargues, France; ²University of Liverpool

Introduction
Obesity is now a global concern in dogs and prevalence is increasing. Therefore, effective weight loss solutions are required that work in different geographical regions. Our main aim was to conduct an international, multi-centre, weight loss study to determine the efficacy of a dietary weight loss intervention in obese pet dogs. A key objective was to examine factors affecting efficacy of weight loss in different regions of the world.

Materials and Methods
A 3-month (median 12-weeks, range 10-14 weeks) weight loss programme was conducted at 340 veterinary practices in 27 countries, and enrolled a total of 926 dogs. All were fed commercially available dry or wet weight loss diets, with the energy allocation fed varying between 60 and 80 kcal/kg body weight⁰.₇⁵/day based on sex and neuter status. The Royal Canin Ethics Committee approved the study, and owners gave informed consent. The effect of time on bodyweight was analysed with a linear mixed model. A general linear model was used to determine factors (e.g. dog size, initial body condition score (BCS), geographical location) affecting outcome in a subpopulation of 437 dogs that had complied best with the study visit schedule.

Results
At baseline, mean age was 6.5±2.3 years and median BCS was 8 (range 7-9). Ninety-seven percent of dogs lost weight during the programme, losing 11.4±5.8% at a rate of 0.89±0.46%/week. Neuter status (entire vs neutered: 12.8±0.5% vs 10.7±0.3%, P<0.001), continent (Europe vs America: 12.4±0.4% vs 11.0±0.5%, P<0.01) and sex (female vs
male: 12.4±0.4% vs 11.1±0.4%, P=0.01) significantly (p<0.05) and independently affected rate of weight loss.

Discussion and Conclusions
This is the largest international multi-centre weight loss study ever conducted in obese dogs. Most dogs lost weight, but there were notable differences between dogs of different sex and neuter status and between dogs in different geographical locations.
Vitamin D status and acute phase protein concentrations in canine cancer patients

Nicole Weidner*1, JP Woods2, Anthony Mutsaers1,2, Julie Bayle3, Adronie Verbrugghe2

1Department of Biomedical Sciences, Ontario Veterinary College, University of Guelph; 2Department of Clinical Studies, Ontario Veterinary College, University of Guelph; 3Royal Canin Research Center, Aimargues, France

Introduction
The prevalence of canine cancer continues to increase, thus research investigating potential prognostic factors is warranted. In humans, low blood 25-hydroxyvitamin D (25(OH)D) levels are linked with increased acute phase protein (APP) concentrations in several diseases. These findings have been observed separately in canine cancer patients, but links between the two have not yet been studied. Our objective was to determine and assess the relationship between blood 25(OH)D and APP levels in healthy dogs and dogs with newly diagnosed cancer.

Materials and Methods
Client-owned dogs with lymphoma (n=34), osteosarcoma (n=21), and mast cell tumors (MCT) (n=26), and healthy control dogs (n=25), were enrolled. Blood samples were collected prior to treatment and analyzed for plasma 25(OH)D using radioimmunoassays, and plasma C-reactive protein (CRP), haptoglobin (Hp), alpha-1-acid glycoprotein (AAG) and serum amyloid A (SAA) using ELISAs. Variance analyses followed by adjusted post-hoc analysis were parametrically performed or not as appropriate. Pearson correlation coefficients were also calculated.

Results
Lymphoma patients showed significantly higher circulating CRP, Hp, SAA, AAG concentrations and lower plasma 25(OH)D concentrations than healthy dogs (p<0.001, p<0.001, p=0.010, p=0.004, p=0.035, respectively).
Dogs with osteosarcoma had elevated blood CRP, Hp, and SAA concentrations ($p<0.001$, $p=0.005$, $p=0.010$) and MCT dogs had increased Hp concentrations ($p=0.020$) compared to healthy dogs. There was a moderate, inverse relationship between plasma 25(OH)D and AAG concentrations ($r=-0.48$, $p=0.004$) in lymphoma patients, and 25(OH)D and CRP in MCT patients ($r=0.41$, $p=0.040$), and a moderate, positive relationship between 25(OH)D and SAA in MCT patients ($r=0.43$, $p=0.027$).

**Discussions & Conclusions**

25(OH)D and APP concentrations are consistent with previous findings, although this is the first report for some of these APPs pairings and cancers in dogs. Certain APP concentrations in dogs with cancer were above reference range; therefore, future research investigating the influence of cancer treatment on these variables is warranted.

* Early career researcher
Effect of high and moderate protein diets in the body composition and metabolic parameters of neutered dogs

I.M. Kawauchi¹, Juliana Toloi Jeremias¹, Paula Takeara¹, Danilo Ferreira de Souza¹, Júlio Cesar de Carvalho Balieiro², Marcio Antonio Brunetto², Cristiana Fonseca Ferreira Pontieri¹

¹Grandfood Indústria e Comércio LTDA, Dourado, São Paulo, Brazil; ²School of Veterinary Medicine, University of São Paulo, São Paulo/Pirassununga, São Paulo, Brazil

Introduction
The influence of protein content in food for neutered dogs is not known. Possible modifications in energy requirement, changes in metabolic, hormonal and body composition parameters of dogs after neutering consuming high or moderate protein diets were studied.

Materials and Methods
Fourteen adult dogs (10.7kg body weight, 2.9-30.5) fed a moderate (59.7g protein/1000kcal) or high protein diet (94.0g protein/1000kcal) before and after neutering. Dogs were fed for 26 weeks to maintain the previous neutering weight. A mixed model was fitted to verify the diets and time effects in energy intake for body weight maintenance, serum concentrations of fructosamine, cholesterol, triglycerides, total lipids, insulin, glucagon, leptin, insulin-like growth factor-1 (IGF-1) and fat and lean body mass by deuterium method. In order to better analyze the results for all variables the effects of diet in each time were evaluated. The results are expressed in median and range.

Results
The diets effects analysis within each time indicated that the high protein diet did not change the parameters evaluated ($P>0.05$). Significant changes ($P<0.05$) were observed in dogs which consumed a moderate
protein diet presenting a linear decrease both in energy requirement from 61.6 (50.3-83.9) to 54.6kcal/kg BW\(^{0.75}\) (46.4-64.3) and in IGF-1 concentration from 36.0 (18.0-71.2) to 13.9ng/mL (10.4-34.2), and an increase in fat mass from 1.3 (0.13-4.15) to 2.0kg (0.84-4.58) and serum concentration of triglycerides from 41.0 (34.0-109.0) to 73.0mg/dL (38.0-96.0). Glucagon, fructosamine and total lipids showed a quadratic response.

**Discussion and Conclusion**
Moderate protein diet influenced the metabolic, hormonal and body composition responses in neutered dogs. Dogs fed a moderate protein diet presented less energy requirement for weight maintenance after neutering. Even when adjustments in the amount of food were made and the body weight was maintained, the moderate protein diet caused an increase in fat mass deposition. A high protein diet is recommended for dogs after neutering.
Overweight dogs are most likely to display undesirable behaviours: Results of a large online survey of dog owners from the United Kingdom

Alexander James German¹, Emily Blackwell², Mark Evans³, Carri Westgarth¹

¹University of Liverpool; ²University of Bristol; ³Independent Veterinary Consultant

Introduction
Much of the global canine population is now overweight, and this can adversely affect health, lifespan, and quality of life. Undesirable behaviours are also common in pet dogs, and these can adversely affect welfare, as well as being stressful to owners. However, links between obesity and behavioural disorders have never previously been explored.

Materials and Methods
An online survey was conducted between June and August in 2014, coinciding with the broadcast of a National UK television programme, exploring dog health, welfare and behaviour. Information gathered included signalment, overweight status, and the prevalence of a range of undesirable behaviours. The University of Liverpool Ethics Committee approved the project, and owners consented to data use. Fisher’s exact test and multiple logistic regression analysis were used to determine associations between overweight status and owner-reported behaviours.

Results
A total of 17,028 responses were received. After ‘cleaning’ (to remove obvious errors and missing data) and ‘editing’ (so that only dogs >2y were included), the final dataset comprised 11,500 dogs, 1815 (15.8%) of which were reportedly overweight. Owners of overweight dogs were more likely to see them as “a baby” (odds ratios [OR] 1.39, P<0.001) and allow them to sleep on their bed (OR 1.42, P<0.001). Overweight dogs were also more likely to eat faeces (OR 1.19, P=0.007), guard food
(OR 1.61, \( P < 0.001 \)), and steal food (OR 1.74, \( P < 0.001 \)). Other undesirable behaviours more commonly reported in overweight dogs included barking, growling or snapping at familiar people, strangers and other dogs (all \( P < 0.001 \)), and being fearful of outdoors (OR 1.42, \( P < 0.001 \)). Finally, owners were more likely to report that unsociable behaviours adversely affected their dog’s health (OR 1.29, \( P < 0.001 \)).

Discussion and Conclusion
Overweight status is associated with an increased odds of displaying many undesirable behaviours. Further studies are required to explore the reasons for these associations.
Dietary macronutrient profile (MNP) and feline bodyweight regulation

Janet E Alexander¹, David Allaway¹, Adrian Hewson-Hughes¹, Carlos Hernangomez de Alvaro¹, Ruth Staunton¹, Penelope J Morris¹

¹WALTHAM Centre for Pet Nutrition

Introduction

Obesity is a significant issue in companion animal nutrition. Despite feeding guidelines, pets are offered diets in excess of energy requirements (ER)¹. Intake self-regulation is therefore important in maintaining a healthy bodyweight (BW). Cats adjust dietary consumption to achieve a target macronutrient intake and dietary MNP influences total energy intake². To identify diet compositions supporting healthy BW maintenance, effect of dietary MNP was investigated in adult cats offered food in excess of ER.

Materials and Methods

From the same raw materials, 6 complete (AAFCO 2015) diets were made containing moderate (~7%) or high protein (~10%) and varying levels of carbohydrate and fat. For 4 weeks, 120 cats were offered 100% ER of a diet at MNP target for adult cats². Baseline intake, BW, body composition (BC), activity and palatability were assessed. Subsequently, cats were randomised into 6 groups and received one of the 6 diets at 200% ER for 4 weeks. Measurements were repeated.

Results

Cats offered high protein diets for 4 weeks had greater energy intake (+76.5 95%CI (60.2, 92.9) kcal) (p<0.01) and BW (+0.45 95%CI (0.39, 0.51) kg) than those offered moderate protein diets (p<0.01). BW reduced by 0.36 95%CI (0.39, 0.33) kg from baseline in those offered moderate protein diets (p<0.01). The diet at MNP target² was preferred to moderate protein diets i.e. intake significantly higher (p<0.01). No
statistically significant differences in BC were detected between diet groups ($p>0.01$). Reduced activity levels were observed when high protein diets were offered in excess of requirements but variability was such that significance was not met.

**Discussion and Conclusion**
High protein diets do not assist healthy BW maintenance when offered to cats in excess of ER. This study emphasises the importance of portion control for healthy weight maintenance in cats.

1German et. al. 2011, 2Hewson-Hughes et. al. 2011
WALTHAM Early Career Researcher Awards

WALTHAM continues to support early career researchers (ECRs). Two awards will be available at WINSS, one for the best oral and another for the best poster presentations given by ECRs. The awards will each be for £3,000 to fund the opportunity to visit the WALTHAM Centre for Pet Nutrition and attendance at the ESVCN Congress in 2017, which is to be held in Cirencester, UK on 20-23 September 2017.

To be eligible for an award, the presenting author must be studying for a postgraduate qualification, or have been awarded a postgraduate qualification within the past 5 years (awarded after October 2011).

The best oral and poster presentation will be chosen by a review panel, with the best poster presentation being selected from one of the invited flashlight poster presentations.

Recipients of the awards will be announced at the Early Career Researcher award presentation at the close of WINSS (11:55 Day 4: Friday 21 October).
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P1. Yorkshire Terrier observed energy requirements for growth

Janet E Alexander¹, Alison Colyer¹, Penelope J Morris¹

¹WALTHAM Centre for Pet Nutrition

Introduction
The 2006 National Research Council equation calculating puppy energy requirements (NRC) does not account for reported breed differences in growth pattern¹,². Energy requirements of toy breed puppies are unknown and it is unclear whether feeding guidelines should differ between breeds. We observed energy requirements of Yorkshire Terrier (YT) puppies over their first year of life and compared them with those predicted by the NRC and to those observed in large (Labrador Retriever; Lab) and small (Miniature Schnauzer; MS) breed puppies studied previously at WALTHAM³.

Materials and Methods
Twenty-two puppies (from 8 litters) were offered complete and balanced diets to maintain ideal body condition score (BCS). Energy intakes, bodyweight and BCS were recorded from 10 - 52 weeks. Every 12 weeks, health was monitored (veterinary examination, routine haematology, serum biochemistry) and bone turnover markers C-terminal telopeptide of Type I collagen (CTx) and bone-specific alkaline phosphatase (BAP) were measured.

Results
Puppies remained clinically healthy with normal skeletal development. After analysis by linear mixed models it was observed that the NRC equation overestimate YT energy requirements between 10 and 20 weeks of age by 18.6, 95% confidence interval (34.4, 2.8) to 77.5 (93.3, 61.7) kcal/kg⁰.⁷⁵. Energy intake was lower (p<0.05) in YT than Labs until 29 weeks by 8.5 (31.7, 14.6) to 90.0 (114.1, 65.8) kcal/kg⁰.⁷⁵ and lower than MS between 16 and 25 weeks by 28.4 kcal/kg⁰.⁷⁵ (51.5, 5.2) to 51.7 (74.8, 28.6) (p<0.05). Up to one year of age, higher levels of CTx were observed in Labs than YT (p<0.05).
Discussion and Conclusion
Data indicate differences in toy, small and large breed energy requirements for growth. The NRC equation for puppy energy requirements over-estimated the requirements of this YT population, suggesting the need for breed specific feeding guides for growth to avoid overfeeding.

1Hawthorne et. al. 2004. 2Dobenecker et. al. 2013. 3Brenten et. al. 2014
P2. The effect of reducing dietary energy density, via the addition of water to dry diet, on bodyweight and physical activity in Miniature Schnauzer dogs

Janet E Alexander¹, Alison Colyer¹, Penelope J Morris¹

¹WALTHAM Centre for Pet Nutrition

Introduction
Approximately 40% of pet dogs are estimated to be overweight and this is associated with health conditions significantly reducing life span and quality. When dietary energy content is diluted, cats do not increase their intake to fully compensate. Furthermore, adding water to a dry diet has been reported to increase the activity levels of cats, possibly aiding weight control¹. The aim of this study was to assess the effect of dietary energy dilution on bodyweight and activity in dogs offered energy in excess of requirements.

Materials and Methods
Forty-six adult Miniature Schnauzers were randomised into 2 treatment groups. For a 28 day baseline period all dogs were fed to individual maintenance energy requirements (MER) on a standard dry diet hydrated with water to a total moisture content (TMC) of 72.0%. Diet intake, bodyweight, body condition score (BCS) and activity (via Actical™ accelerometer) were measured. Over the following 28 days, dogs were offered 200% of their individual MER daily of the dry diet with or without hydration (7.6% or 72.0% TMC) and measurements were repeated.

Results
When fed in excess of MER, dogs offered the hydrated diet gained bodyweight significantly faster (~20g/day) than those offered the dry diet (p=0.001), but activity levels did not change from baseline (p=0.392). In contrast, the activity levels of the dogs offered the dry diet reduced significantly (~15%, p<0.001).
Discussion and Conclusion
Dogs offered the hydrated diet completely compensated for the dilution of the dietary energy content indicating that this is not a useful strategy for maintaining bodyweight when excess food (energy in excess of MER) is offered. However, dogs fed the hydrated diet maintained their activity levels even when their weight increased, suggesting that dietary moisture content has a positive effect on activity levels in the dog.

1Alexander et. al. 2014
P3. Development of assays to measure immune function in feline whole blood and reduce blood volume requirements

Michelle J Farquhar¹, Janet E Alexander¹, Richard M Haydock¹, Adrian Hewson-Hughes¹, Emma McCluskey¹

¹WALTHAM Centre for Pet Nutrition

Introduction
The immune system protects against infection through innate and adaptive mechanisms, with both responsive to nutritional intervention. Assessment of an appropriate range of immune function parameters presents several challenges in cats, including a need to reduce blood volume requirements. Previous studies have used peripheral blood mononuclear cells isolated from 10 ml of whole blood. The aim of this work was to develop and refine a series of methodologies to measure the immune response in whole blood.

Materials and Methods
Engulfment of pH sensitive pHrodo red *Escherichia coli* Bioparticles was used to measure phagocytosis. Lymphocyte populations and lymphocyte responses to mitogen stimulation were examined by flow cytometry. Inter- and intra- animal variability was assessed in 2 ml of whole blood from 10 adult neutered cats sampled twice, two months apart.

Results
Fluorescence indicative of phagocytosis was observed in 29.01% with 95% confidence interval (18.11, 39.92%) of the granulocyte population. Immunophenotyping revealed the leukocyte population to be composed of 16.63% (13.86, 19.39%) lymphocytes, of which 23.67% (19.79, 27.55%) were CD21+ B-lymphocytes, 34.94% (29.55, 40.33%) CD5+/CD4+ T-helper and 21.45% (18.15, 24.75%) CD5+/CD8+ T-cytotoxic lymphocytes. The average CD4:CD8 ratio was 1.92 (1.36, 2.49%). Concanavalin A (ConA) and phorbol myristate acetate (PMA) / Ionomycin (Ion) stimulated a dose-dependent increase in CD5+ lymphocytes.
Across methods intra-cat variability was observed however inter-cat variability was acceptable (<30%).

**Discussion and Conclusion**
Methodologies have been successfully established to investigate both innate and adaptive immune response while reducing the volume of whole blood required from 10 to 2 ml. Data are in agreement with published values, with an acceptable degree of variability. This work supports MARS’ commitment to the principles of the 3Rs (Replacement, Reduction and Refinement).
P4. Effects of dietary moisture and sodium on urinary parameters in adult cat

Concetta Amato*1, Agnès André1, Jürgen Zentek2, Géraldine Blanchard3, Patrick Nguyen1

1Oniris, National College of Veterinary Medicine, Food Science and Engineering, Nutrition and Endocrinology Unit, Nantes, France; 2Institute of Animal Nutrition, Freie Universität Berlin, Berlin, Germany; 3Animal Nutrition Expertise, Antony, France

Introduction
Water intake and urine dilution have been used to prevent or reduce the occurrence (and recurrence) of uroliths in cats. This study aimed to investigate the effect of dietary moisture and sodium content on urinary parameters in healthy cats.

Materials and Methods
Eight cats (5-year old, BW = 4.7±1.0, BCS = 5.0±0.8) were included in a Latin-square designed protocol. Seven diets were evaluated: two home-made (H1-H2), one wet (W), three dry (D1-D3), and D1 given with zucchini (D1Z). With respect to the aim of the study, the commercial diets (W and D) were chosen to differ by their moisture, sodium, and protein content. After 7-day adaptation, urine was collected, and total water intake (TWI: diet moisture + fresh water) was assessed, for 12 days. Urinary parameters, and relative supersaturation (RSS) for calcium oxalate (CaOx) and struvite were determined. Data were submitted to repeated measures ANOVA analysis (significance: \( p < 0.05 \)).

Results
Diet W was associated with the highest TWI, urinary volume, and the lowest urine gravity. The home-made diets, the wet diet, and the addition of zucchini to dry the diet D1 resulted in lower CaOx RSS, as well as high-sodium intake (D3). No difference was observed for struvite RSS. Urinary pH was different among wet and dry diets.
Discussion and Conclusion
Total water intake was rather influenced by the diet moisture content than by its sodium or protein level. The diets with higher water content had similar effects as a high-sodium dry diet regarding the urine saturation, and then prevention of CaOx formation.

* Early career researcher

**Nutritional characteristics of the diets & Main results**

(*p.100g DM) H1 H2 W D1Z D1 D2 D3

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<th></th>
<th>H1</th>
<th>H2</th>
<th>W</th>
<th>D1Z</th>
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<td>66±9^B</td>
<td>107±17^A</td>
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P5. In-barrel moisture on extrusion parameters, kibble macrostructure and reactive lysine in cat foods

Mayara Aline Baller¹, Pacheco PDG¹, Thaila Cristina Putarov¹, Francine Mendes Peres¹, Mariana Monti², Bruna Agy Loureiro¹, Aulus Cavalieri Carciofi¹

¹UNESP- Univ Estadual Paulista, Jaboticabal, SP, Brazil; ²Veterinary Medicine and Surgery Department, UNESP – São Paulo State University, Jaboticabal, SP, Brazil / Grandfood Indústria e Comércio LTDA, Dourado, São Paulo, Brazil

Introduction
Water addition is required for proper extrusion, it favors dough flow, starch hydration and swelling, viscosity, and cell structure formation. However, the implications of different in-barrel moisture is little studied for cat foods. Six water additions on extruder barrel were studied on processing traits, kibble formation, and protein damage on a cat food recipe.

Materials and Methods
A diet for cat maintenance was formulated. Six amounts of processing moisture were tested by modulation of water addition in a single-screw extruder barrel. After stabilization (45 min), extrusion parameters was recorded at each 10 min, with four samplings per treatment. Raw material and extruded diets were analyzed for linked lysine. Results were submitted to variance analysis and compared by polynomial contrasts ($P<0.05$).

Results
The in-barrel moisture increased from 21.6% to 32.6% with higher water addition. The greater fluidization of the dough reduced specific mechanical energy (SME) implementation, temperature and pressure of extrusion ($P<0.001$), but it increased specific thermal energy ($P<0.01$).
It resulted in quadratic reduction on kibble apparent density ($P<0.001$), whose values was lowest for moistures between 25% to 29%, and increased after that. Kibble expansion ratio showed an opposite results, with higher expansion on moistures between 25% and 29%. Starch gelatinization reduced quadratically with the increase of moisture ($P<0.01$). The ratio of total:linked lysine increased for the diet with lowest processing moisture, but not for the high in-barrel moisture food ($P=0.09$).

**Discussion and Conclusion**
High moisture increase dough fluidity and reduce shear, explaining the reduction on SME, temperature and pressure, and the decrease on starch gelatinization. Water vaporization is a key phenomenon on cellular formation and kibble expansion, low moisture reduced the water flash off and expansion, but water excess reduced pressure and temperature, also decreasing water vaporization. High processing moisture protects protein from damage during extrusion.

* Early career researcher
P6. Understanding the relationship between macronutrient digestibility and faecal microbiota in the dog

Emma Bermingham¹, David G Thomas², Nick J Cave², Paul Maclean¹, Wayne Young¹

¹AgResearch Ltd; ²Massey University

Introduction
Recent research in companion animal nutrition has focussed on understanding the role of diet on the composition on microbial populations in the intestine (the faecal microbiota). To date, the implications of diet-induced changes in faecal microbiota observed in carnivores (e.g. cats and dogs) have been extrapolated from results in omnivores (e.g. rodents and humans). Species-specific studies integrating microbial composition with physiological responses are necessary to understand nutritional implications of diet-induced changes in faecal microbiota in our pets (Deng & Swanson, 2015: Bri J Nutr 113: S6). The aim of this study was to compare diet-associated changes in faecal microbial composition with macronutrient digestibility.

Materials and Methods
Dogs were maintained on complete and balanced diets (kibbled or red meat, n=8 per diet) for 9 weeks. The apparent digestibility of protein and fat, and microbiota composition (V4-V6 region of the bacterial 16S rRNA gene), were determined. The mixOmics package (http://www.mixomics.org) for R was used for integrated analyses.

Results
There were clear associations of microbial taxa with macronutrient digestibility. In dogs fed kibbled diets, protein and fat digestibilities were positively correlated with Faecalibacterium and Bacteriodes spp. In dogs fed red meat diets, protein and fat digestibilities were positively correlated with Collinsella and Blautia spp.
While some associations were common to both diets (e.g. Fusobacterium negatively correlated with protein and fat digestibility), there were some diet-specific differences for particular taxa. For example, Shigella was positively correlated with protein digestibility in kibbled diets but negatively correlated with protein digestibility in red meat diets.

**Discussion and Conclusion**
Diet composition and the availability of substrates in the intestine will ultimately drive the composition of faecal microbiota, which has implications for health. Our future research will aim to understand these interactions to gain better insights into the effects of diet on the health of our pets.
P7. In vitro assessment of the effect of a strain of *Saccharomyces boulardii*, fructo-oligosaccharides, and lactitol on composition and metabolism of canine faecal microbiota

Carlo Pinna¹, Carla G Vecchiato¹, Monica Grandi¹, Massimo Dall'Olio¹, Paola Parazza¹, Giuliano Zaghini¹, Giacomo Biagi¹

¹Department of Veterinary Medical Sciences, University of Bologna

Introduction
*Saccharomyces boulardii* (SB) is currently used in the prevention and treatment of acute and chronic gastrointestinal disorders in human medicine. To date, little is known about the use of SB in dogs. Goal of the present study was to evaluate in vitro the effect of SB, fructo-oligosaccharides (FOS), lactitol (LAC), and their combination on canine faecal microbiota.

Materials and Methods
There were 6 treatments: 1) control diet with no additives; 2) FOS 1.5g/L; 3) LAC 1.5g/L; 4) Diet 1 + SB 0.25g/L; 5) Diet 2 + SB 0.25g/L; 6) Diet 3 + SB 0.25g/L. Vessels (5 per treatment) contained the residue of an in vitro digested extruded dog diet (10g/L) and a bacterial inoculum obtained from faeces from four healthy adult dogs. Vessels were incubated in an anaerobic cabinet for 24 h at 39°C. From each vessel, a sample of fermentation fluid was collected after 6 and 24 h for microbial (by qPCR) and chemical analyses. Data were analyzed by 2-way ANOVA, with yeast and prebiotics as the main effects; the Newman-Keuls test was used as the post-test.

Results
At 24 h, both prebiotics resulted in higher propionic (+53 and +89% for FOS and LAC) acid and lower pH (-0.51 and -0.59 for FOS and LAC), ammonia (-16% for both), isobutyrate (-13 and -25% for FOS and LAC),
and isovalerate (-15 and -20%, for FOS and LAC) than control (P<0.001). At 24 h, SB increased isobutyrate (+12%; P=0.018). At 6 h, putrescine was reduced (P<0.001) by FOS (-23%) and LAC (-25%), while SB tended to increase cadaverine (+66%; P<0.065). At 24 h, FOS and LAC increased bifidobacteria (P<0.001) and reduced enterococci and *Clostridium perfringens* group (P<0.005) abundances.

**Discussion and Conclusion**
Utilization of FOS and LAC resulted in lower proteolytic metabolites, higher propionic acid and improved composition of faecal microbiota. Conversely, SB failed to exert any significant effect on canine faecal microbiota.
Introduction
The pathophysiology of coprophagia is unclear. It could be hypothesized that a modification of the aromatic profile of stools could affect this behaviour. The aim of the study was therefore to assess the influence of two saponin extract sources on coprophagia and faecal parameters in dogs.

Materials and Methods
Three experimental dry diets were tested. They differed by the inclusion of saponin extracts: Yucca Schidigera (YSC, 125 ppm), Quillaia (60 ppm) or no saponin extracts (control diet).

Fourteen auto-coprophagic adult dogs were fed these 3 diets for 1 month in a cross-over design. Coprophagia was evaluated for 10 days by measuring the excretion of radiopaque markers (BIPS®) in stools. Faecal odour was evaluated by quantifying hydrogen sulphide (H₂S), methyl mercaptan (CH₃SH) and ammonia concentrations in stools for 7 days. Faecal consistency was assessed daily for 10 days using a 9-point numerical scale. A mixed model was performed (SAS, Version 9.3). Results are expressed as mean±SE.

Results
After 10d., the proportion of markers recovered in stools reached 70.6±5.0% and 93.1±5.2% in dogs fed control diet and YSC diet respectively (p=0.15). Compared with control diet, YSC diet induced significant reduction in faecal concentrations of H₂S (15.0±2.4 vs. 6.0±0.7 ppm; p<0.01), CH₃SH (3.8±0.9 vs. 2.3±0.4 ppm; p<0.05) and
ammonia (56.4±7.2 vs. 30.3±2.5 ppm; \(p<0.05\)). Significant improvement of stool consistency was also observed when fed YSC \( (p<0.001) \). Quillaia and control diets showed marker excretion curves extremely similar over the 10 days. No difference was observed in faecal odour and consistency between both diets.

**Discussion and Conclusion**

In contrast to Quillaia, YSC seem to be an interesting saponin source to improve faecal quality and reduce stool odour in dogs. Even if improvements in coprophagia observed are not significant, a real trend was observed when YSC was used. Further studies are however needed to confirm the potential of YSC on this behaviour.
P9. Effect of positioning on dual energy X-ray absorptiometry results

Charlotte Bjoernvad¹, Mie Elisabeth Nielsen¹, Susanna Else Margareta Hansen¹, Dorte Hald Nielsen¹

¹University of Copenhagen

Introduction
Dual Energy X-ray Absorptiometry (DEXA) has been used to assess body composition in dogs and cats in several studies. However, results from these studies are difficult to compare, both because different machines and software has been used, but maybe also due to differences in the investigators preference for positioning of the animal during scanning. The aim of this study was to evaluate whether positioning of cats or dogs in either dorsal or ventral recumbency during DEXA scanning give different results.

Materials and Methods
Dogs and cats that were brought to the University Hospital for Companion Animals for euthanasia during the period September 15th – November 6th 2015 were consecutively recruited if owners signed a written consent. Following euthanasia and before rigor mortis, the animals were DEXA scanned (Lunar Prodigy, GE Healthcare, Germany) using a small animal program in the ENCORE™ 2011 software (GE Healthcare, version 13.60). DEXA measurements of total body mass (TBM), Bone mineral content (BMC), Bone Mineral Density (BMD), Lean body mass (LBM) and Body Fat (BF) were performed five times in ventral and two times in dorsal recumbency on each animal. Differences between positioning were analyzed using students t-test or Wilcoxon test depending on normality of the data.

Results
Thirteen dogs and seven cats of different breeds, size, genders and age were included in the study. The CV for DEXA measured parameters in ventral or dorsal recumbency were for dogs; TBM≤0.1%, BMC≤1.63%,
BMD≤1.29%, LBM≤0.9%, BF≤1.52% and for cats; TBM≤0.08%, BMC≤0.61%, BMD≤0.49%, LBM≤0.45%, BF≤0.88%. There were no differences between measurements in ventral and dorsal recumbency, except for BMD were measurements were higher in dorsal recumbency (P<0.0004).

Discussion and Conclusion
Ventral and dorsal recumbency provides comparable results, except for BMD measurements. Differences in BF% in relation to body condition scoring between studies seem not to be due to positioning.
P10. Characterisation of the French ferret population, lifestyle and feeding habits

Geraldine Blanchard¹, Adeline Linsart², Jean-Jacques Benet³, Bernard-Marie Paragon³

¹Animal Nutrition Expertise sarl; ²CHV St martin Bellevue, France, ³National Veterinary School of Alfort, France

Introduction
Ferrets have become a common companion animal. But there is not data on this population in France. The goal was to characterize the French ferret population.

Materials and Methods
A validated questionnaire was available online between June and October 2012. The recruitment was advertised through newspapers and online specialized forums. Owners answered on a voluntary basis. The demographic characteristics of the sample were studied together with their lifestyle, medical care and feeding habits. Data analysis was run via an epidemiology software Epi-info 3, and a statistics one BiostaTG.

Results
Complete data were available for 1205 ferrets, located in 85 of the 95 French départements. Out of this studied population, 52.8% were male, 60.6% neutered, 19.7% aged under 1 yr-old 47% 1 to 3 yr-old. Body weight was reported to vary seasonally for 60% of ferrets, with the highest in winter and lowest in summer. Average body weight of neutered ferrets seems lower than entire ferrets of comparable age. Most ferrets live exclusively or mainly indoor (86.1%), 47% of ferrets chew their cage and this behavior increases significantly with the restriction of the living surface. Most ferrets are fed ad libitum, most receive one or several complete food, mostly but not only dry, designed for ferrets, cats and kitten, even dogs and puppies. Most ferrets receive treats of all sort. Our survey suggested a link was likely between eating balanced commercial diet (dry food in particular) and diarrhea, early teeth wear and fractured
teeth; between neutering and adrenal disease; and between alopecia and artificial lighting.

**Conclusion**
Even if some biases can be pointed out, and results must be confirmed, it is to our knowledge the first description of the French population of the Ferret as a companion animal.
P11. Influence of renal enriched diet in inflammatory profile and antioxidant capacity in dogs with chronic kidney disease

Brana Sanctos Bonder*, Dóris Pereira Halfen¹, Douglas Segalla Caragelasco¹, Cristiana Fonseca Ferreira Pontieri², Juliana Toloi Jeremias², Márcia Mery Kogika¹, Marcio Antonio Brunetto¹

¹Università de São Paulo; ²Grandfood Indústria e Comércio, Dourado, São Paulo, Brazil

Introduction
Alterations in antioxidant capacity (ATC) and cytokines can be found in dogs with chronic kidney disease (CKD). The aim of this study was to investigate the ATC and serum concentrations of inflammatory cytokines (IC) in dogs with CKD under renal diet.

Materials and Methods
Ten dogs in CKD staging IRIS 3 (n = 8) or 4 (n = 2) received for 6 months extruded food: 8.36g protein/1000 kJ; 10.56g fat/1000 kJ; 0.38g EPA+DHA/1000 kJ; 0.52g/1000 kJ calcium; 0.017g of phosphorus/1000 kJ and 35 mg vitamin E/1000 kJ. Measurements of interleukin-6 (IL-6), interleukin-10 (IL-10) and tumor necrosis factor-α (TNF-α) and ATC were performed at the beginning (T0) and after 6 months (T6). It was considered significant values of $P \leq 0.05$.

Results
There were no significant differences observed in IC (IL-6: 52.67 pg/mL, Me= 3.71 pg/mL, min/max= 1.6/335 pg/mL and 97.26 pg/mL, Me= 17.01 pg/mL, min/max= 1.89/321 pg/mL, respectively; $P=0.1486$; IL-10: 6.93 pg/mL, Me= 3.75 pg/mL, min/max= 0.96/33.24 and 9.04 pg/mL, Me= 2.91 pg/mL, min/max= 0.71/32.40 pg/mL, respectively; $P=0.6276$; TNF-: 9.34 pg/mL, Me=0.84, min/max= 0.27/58.02 pg/mL and 15.87 pg/mL, Me=0.65 pg/mL, min/max= 0.22/63.86 pg/mL respectively; $P=0.2891$) and ATC (50.64 µmol, Me= 36.43 µmol, min/max= 5/140 µmol and
62.72 µmol, Me= 32.85 µmol, min/max= 9.28/191.43 µmol respectively; 
P= 0.6758), although increase in cytokines were observed.

Discussion and Conclusion
There is little information about IC and ATC in dogs. Studies with 
CKD human patients related increase IC to higher risk of death and 
inappetence and few studies in dogs with CKD show decreased ATC 
and this is related of loss of nephron. So changes in these parameters 
contribute to the progression of CKD. However, in this study all 
parameters remained stable over 6 months, indicating control the 
progression of CKD. Thus, the implemented enriched diet with EPA, DHA 
and vitamin E was effective in preventing development of renal injury.

* Early career researcher
P12. Evaluation of an in vitro fibre fermentation method using feline faecal inocula: inter-individual variation

Guido Bosch¹, Heesen L¹, Karine De Melo Santos¹, John W Cone¹, Wilbert F Pellikaan¹, Wouter WH Hendriks¹

¹Wageningen University

Introduction
Fermentability of dietary fibres can be characterised after in vitro incubation with faecal microbiota from individual cats. This study evaluated the inter-individual variation of such a method.

Materials and Methods
Two incubation runs (one run/week) were performed with faeces from nine healthy adult female European shorthair cats (cats 1-5 run 1, cats 6-9 run 2) fed the same diet. From each cat, fresh faecal inoculum was incubated with citrus pectin (CP), fructo-oligosaccharides (FOS), guar gum (GG), sugar beet pulp (SBP) or wheat middlings (WM). Each incubation was done in triplicate. Gas production was measured continuously and short-chain fatty acids (SCFA) were determined at the end of incubation (48 h). Values of replicates were averaged and for each substrate the coefficient of variation (CV) was calculated.

Results
The SCFA analysis for incubation with faecal inocula from one cat failed. Variation in gas production among inocula was low for CP, FOS and GG, whereas SBP and WM showed higher CV values (Table). This pattern was also observed for total SCFA produced and branched-chain proportion, though the latter parameter showed overall higher CV values. The proportion of butyrate varied considerably among inocula with highest CV for FOS.
Discussion and Conclusion
The variation in measured parameters indicate that the microbiota from individual cats differ in their potential to degrade fibres, in particularly the more complex fibres (SBP, WM). Impact of fibres on digestive health may, therefore, differ among cats and number of faecal donors should be adjusted according to parameter variability for accurate fibres characterisation.

Table. Inter-individual variation in an in vitro fermentation method using feline faecal inocula

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Statistic</th>
<th>Substrate</th>
<th>CP</th>
<th>FOS</th>
<th>GG</th>
<th>SBP</th>
<th>WM</th>
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<tr>
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<tr>
<td></td>
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<td>Max</td>
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<td>11.1</td>
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</table>

1Gas in ml/g organic matter (OM); tSCFA = total short-chain fatty acids (acetate + propionate + butyrate + iso-butyrate +valerate + iso-valerate) in mmol/g OM; BP = butyrate proportion in % of tSCFA; BCP = branched-chain proportion (iso-butyrate + iso-valerate) in % of tSCFA
2Statistic for gas production based on n=9 cats and for SCFA on n=8 cats.
3CP = citrus pectin; FOS = fructo-oligosaccharides; GG = guar gum; SBP = sugar beet pulp; WM = wheat middlings

Guido Bosch¹, Heesen L¹, Karine De Melo Santos¹, Wilbert F Pellikaan¹, John W Cone¹, Wouter WH Hendriks¹,

¹Wageningen University

Introduction
In vitro methods are used to characterise the fermentability of dietary fibres for cat foods. This study evaluated the repeatability (within-run precision) and reproducibility (between-run precision) of such a method.

Materials and Methods
Four incubation runs (one run/wk) were performed with faeces from five healthy adult female European shorthair cats fed the same diet each week. For each cat, fresh faecal inoculum was incubated with citrus pectin (CP), fructo-oligosaccharides (FOS), guar gum (GG), sugar beet pulp (SBP) or wheat middlings (WM). Each incubation was done in triplicate. Gas production was measured continuously and short-chain fatty acids (SCFA) at the end of incubation (48 hr). For each substrate, repeatability (expressed as coefficient of variation in %, CVr) was based on the replicates of each cat for each run and reproducibility (CVR) based on the averages of the four runs.

Results
One cat did not produce faeces for run 2. The median and maximal CVr of gas production were lower for CP, FOS, GG and SBP than for WM (Table). This was also observed for total SCFA, except that SBP showed intermediate CVr values. For these two parameters, CVR was lower for CP, FOS, and GG than for SBP and WM. The median CVr and CVR values were considerably higher for proportions of butyrate and branch-chain SCFA.

Discussion and Conclusion
The high CVr values indicate different microbial growth and activity
between replicates, which limits an accurate characterisation of dietary fibres. The method yields reproducible results, except for the branch-chain proportion of SCFA.

**Table. Repeatability and reproducibility of an in vitro fermentation method using feline faecal inocula.**

<table>
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<th>Parameter</th>
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<th>FOS</th>
<th>GG</th>
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</table>

1Gas in ml/g organic matter (OM); tSCFA = total short-chain fatty acids (acetate + propionate + butyrate + iso-butyrate +valerate + iso-valerate) in mmol/g OM; BP = butyrate proportion in % of tSCFA; BCP = branched-chain proportion (iso-butyrate + iso-valerate) in % of tSCFA

2CV_r coefficient of variation for repeatability and CV_r coefficient of variation for reproducibility. CV_r based on replicates for n=5 cats for run 1, 3 and 4 and n=4 cats for run 2 and CV_r based on four runs.

3CP = citrus pectin; FOS = fructo-oligosachharides; GG = guar gum; SBP = sugar beet pulp; WM = wheat middlings
Evaluation of phosphorus metabolism in dogs with chronic kidney disease under renal diet: Serum parathormone and fibroblast growth factor 23 (FGF-23)

Brunetto M1, Douglas Segalla Caragelasco1, Márcia Mery Kogika1, Dóris Pereira Halfen1, Cristiana Fonseca Ferreira Pontieri2, Juliana Toloj Jeremias2, Maria Claudia Araripe Sucupira1

1University of Sao Paulo; 2Grandfood Indústria e Comércio, Dourado, São Paulo, Brazil

Introduction
The aim of this study was to investigate serum phosphorus (SrP), parathormone (PTH) and fibroblast growth factor 23 (FGF-23) in dogs with chronic kidney disease (CKD) under renal diet during a follow-up period.

Materials and Methods
Ten CKD dogs in IRIS staging 3 (n=8) or 4 (n=2) were followed for up to 6 months, and fed with a commercial renal diet (28.46g of carbohydrate/1000 kJ; 8.36g protein/1000 kJ; 10.56g fat/1000 kJ; 0.52g calcium/1000 kJ; calcium and 0.017g of phosphorus/1000 kJ). Phosphorus binder was administered when SrP was above 6.0 mg/dL. Serum phosphorus concentrations were evaluated every 35 days. Serum PTH and FGF-23 were measured in the beginning (T1) and after 6 months (T6).

Results
Serum PTH (15.3±6.3 and 35.3±13.0 pmol/L, respectively; P= 0.1100 paired t test; Reference= 0.5-5.8 pmol/L) and FGF-23 (5518.9±1413.2 and 9649.4±4212.9 pg/mL, respectively; P=0.3857; Reference= 237.5-279.9 pg/mL) were not significantly different comparing the beginning (T1) and after 6 months (T6).
Also, no statistical difference of SrP was noticed during the follow-up period (T1= 5.1±0.5; T2= 5.7±0.8; T3= 5.4±0.4; T4= 6.4±0.8; T5= 5.7±0.3; T6= 5.4±0.3 md/dL; \( P = 0.6946 \), ANOVA).

**Discussion and Conclusion**

In CKD, phosphorus intake control is pivotal to avoid the development of renal secondary hyperparathyroidism. Increased SrP concentrations stimulate FGF-23 synthesis as it is a phosphaturic/hypophosphatemic hormone, and also the PTH synthesis. In this study, PTH and FGF-23 levels were increased since beginning (T1), however they were not significantly different after 6 months, suggesting that those early markers of phosphorus dysregulation have not indicated aggravation on alteration in phosphorus metabolism during those 6 months of follow-up. Thus, probably the controlled intake of phosphorus (diet) may have supported and helped for the balance of phosphorus metabolism in those dogs with advanced CKD stages.
P15. Metabolisable energy of a starch-based dog chew

Danielle Nuttall¹, Phil McGenity¹, Richard F Butterwick²

¹Mars Petcare; ²WALTHAM Centre for Pet Nutrition

Introduction
The NRC 2006 predictive equation for estimating Metabolisable Energy (ME) in pet food was derived from in vivo digestibility studies on wet and dry manufactured pet foods. Starch-based dog chews are commonplace as complementary pet food products across developed pet food markets - the process to manufacture these is markedly different from that of wet and dry pet foods. The nutrient profile of these chews (high in starch) is quite different from typical wet and dry pet foods. This study sought to test whether the predictive equations developed for wet and dry manufactured pet foods is valid for a starch-based dog chew.

Materials and Methods
A twin-screw cooker extruded chew was manufactured with sufficient vitamin and mineral supplementation to render the final product complete regarding micronutrients. The test product, Pedigree® Dentastix®, was fed solus to a panel of 7 adult dogs (various breeds) for a period of 8 days. Dogs were housed in pairs in kennels, with indoor and outdoor runs, and 40 minutes’ daily socialisation. Dietary intake was recorded daily and faecal matter was collected over 5 days. Diet and pooled faecal samples were analysed for proximate nutrients, and digestibility coefficients were calculated as the difference in intake and faecal excretion between days 4 and 8. Digestible Energy (DE) was converted to Metabolisable Energy (ME) by correcting for energy losses in urine, AAFCO (2015). Predicted ME was calculated according to the method recommended by the NRC 2006.
Results
The results showed that the in-vivo measurement of metabolisable energy (304 kcal/100g) was almost exactly the same as the calculated value from the NRC predictive equations (303 kcal/100g).

Conclusion
The NRC 2006 predictive equation for ME provides a good estimate of measured ME in a high starch based chew manufactured using a twin-screw extruder.
Introduction
The benefits of fish oil supplements in human is already extensively studied. In companion animals, there is also evidence of beneficial effects of fish oil supplements. In particular, the n-3 PUFA EPA and DHA are thought to contribute to these beneficial effects. It is, however, still unclear what effect the used formulation of supplements has on the bioavailability of these n-3 PUFAs.

Materials and Methods
In this study, three different n-3 PUFA formulations (ConCordix®, liquid fish oil and Hill’s® J/D) are compared for FFA plasma concentration, AUC<sub>0-24h</sub> and C<sub>max</sub>. Dogs (N=13) received three weeks, diets in random order, a single-dose supplement on T0. Hereafter, samples of ETDA blood were taken and analyzed for the plasma concentration of FFA EPA and DHA. Statistical analysis was performed using IBM® SPSS Statistics for Windows, Version 23.0.

Results
Comparison of the individual plasma concentration measurements (T1-T9) and C<sub>max</sub> resulted in no significant difference for both EPA and DHA between the three diets. Looking at the AUC<sub>0-24h</sub>, it became clear that Concordix® had significant lower AUC<sub>0-24h</sub> for both EPA and DHA compared to LFO and Hill's® J/D.
Discussion and Conclusion
N-3 PUFA bioavailability studies in companion animals are minimally executed. Studies on the effect of the used formulation of n-3 PUFA supplements in companion animals are almost non-existent. In humans it is common and a proven method to compare the FFA concentration in blood plasma. In companion animals, especially dogs, there are studies that have confirmed this method. The results of this study suggest that, when comparing different formulation of n-3 PUFA, the incorporation of EPA and DHA into the membrane of erythrocytes may be a better and more reliable method.
P17. Nutritional management of osteo-articular status in search and rescue dogs

Giuseppe Vassalotti¹, Nadia Musco¹, Pietro Lombardi¹, Serena Calabrò¹, Raffaella Tudisco¹, Vincenzo Mastellone¹, Raffaella Grazioli¹, Sergio Bianchi², Monica Isabella Cutrignelli³

¹Department of Veterinary Medicine and Animal Production, University of Napoli Federico II, Napoli, Italy; ²Mangimi Russo Spa, Nola Italy; ³University of Napoli Federico II

Introduction
Osteo-articular diseases affect both young and old dogs, especially if obese (German, 2006; Corbee, 2014). Dogs used for search and rescue (SAR) may experience continuous micro-traumas and insults that predispose them to skeletal disorders. The aim of the present study was to evaluate the effect of a specific supplementation on skeletal welfare in healthy SAR dogs.

Materials and Methods
Sixteen healthy dogs used for SAR, were divided into two groups, and fed for three months one of two experimental diets with the same protein and energy density, but different content (group 1 vs. 2) of n-3 PUFA (2.5 vs. 3.4% a.f.), chondroitin sulphate (200 vs. 900 mg/kg) and glucosamine (700 vs. 1200 mg/kg) supplementation. Values for haematology/serum chemistry were measured before and after 30 and 60 d. Joint status was scored (0-3, Pollmeier et al., 2010) by physical and lameness evaluations.

Results
In group 2, LDH and CPK significantly decreased after 30d and CPK decreased again at 60d. The same enzymes increased after 60d in group 1. RBCs, Hb and PCV were significantly higher in group 2 vs. 1 at 30 and 60d. In both groups joint status was always below 1, no dog was positive to joint swelling. Indeed, a decrease was recorded at 60d for pain on
manipulation, lameness and range of motion in group 2, whereas no difference was detected in group 1.

Discussion and Conclusion
The supplementation of diet 2 showed positive interesting benefits in terms of both manipulations and haematology/serum chemistry: higher values of RBCs, Hb and PCV, suggesting a better supply of glucose and O\textsubscript{2}; LDH and CPK decrease showed an improvement of muscle function. These results are suggestive of an increases stability of cell membrane (Rosenbaum et al., 2010) and improved articular synovia (Hensen et al. 2008) probably due to the antioxidant properties of n-3 PUFA.
Introduction
Running wheels designed for domestic cats are commercially available, but their effectiveness in increasing voluntary physical activity is unknown. Thus, the objective of this study was to evaluate whether access to a running wheel increases voluntary physical activity in adult female and male domestic cats.

Materials and Methods
Eight neutered domestic shorthair male cats (mean age: 8.6 ± 0.05 yr) and 11 intact domestic shorthair female cats (mean age: 3.3 ± 0.14 yr) were group housed for 22 hours daily and individually housed during the feeding period (0800-1000). The rooms were environmentally controlled with a 16 hour light: 8 hour dark cycle. Voluntary physical activity was measured using accelerometers. Food anticipatory activity (FAA) was calculated as the activity in the 2 hr period prior to feeding time. Experimental design consisted of 1 wk of baseline physical activity measurement, followed by 3 wk of wheel habituation, and 1 wk of physical activity measurement post-wheel habituation. The data were analyzed using MIXED procedure of SAS.

Results
Female cat voluntary physical activity levels increased post-habituation during the dark period (p<0.05), resulting in an altered light:dark activity ratio (p<0.05), whereas male cat voluntary physical activity levels remained unchanged post-habituation. The FAA did not differ pre- and post-habituation, but it corresponded to greater proportion of daily physical activity for males (18.5%) vs. females (12%).
Discussion and Conclusion

In general, female cats were more active than male cats. Running wheels appear to be an effective method to increase voluntary physical activity of younger female cats, but not older male cats. Therefore, a running wheel might be a potential strategy in the management and prevention of feline obesity. Further studies should evaluate the effect of age, gender, and neutering on voluntary physical activity of domestic cats as these factors could not be disassociated in this study.

* Early career researcher
P19. Dietary influence on serum biochemical parameters of Blue-Fronted Amazon Parrots (Amazona aestiva)

Ludmilla Geraldo Di Santo¹*, Lucas Boscov Braos¹, Aline Eiko Kawanami¹, Juliana Paula de Oliveira¹, Nathan da Rocha Neves Cruz¹, Fernanda Sanches Mendonça², Mayara Correa Peixoto¹, Aulus Cavalieri Carciofi¹

¹ FCAV - Universidade Estadual Paulista (unesp); ² UNESP - Univ Estadual Paulista, Jaboticabal, SP, Brazil

Introduction
Captive parrots have high incidence of obesity, atherosclerosis and other metabolic diseases. The transition of a high fat diet based on sunflower seed and fruits (most common diet in Brazil) to a prepared formulation with three starch gelatinization degrees were evaluated.

Materials and Methods
Thirty adult blue-fronted amazon parrots (Amazona aestiva) were individually fed an ad libitum amount of sunflower seed and fruit for 120 days as a basal diet. After, birds were randomly allotted for 180 days to one of three prepared diets. A same formulation based on corn and soybean meal (18% of protein, 3.5% of crude fiber, 8% of fat) were processed to obtain three starch gelatinization (SG) amounts: SG26 - coarse ground and pelleted, with 26.6% of SG; SG82 – coarse ground and extruded with low energy application, with SG of 82.1%; SG99 – fine ground and extruded with high thermal and mechanical energy application, SG of 98.8%. Blood samples were collected and analyzed for glucose, triglycerides, cholesterol, total protein and albumin. Data was submitted to repeated measures analysis of variance and compared with the Tukey test ($P<0.05$).
Results
After birds were fed with sunflowers and fruits they had higher triglycerides (157mg/dL), cholesterol (267mg/dL), and glucose (238mg/dL) than after the consumption of the prepared foods ($P<0.01$). No differences among food processing or SG degree were verified for biochemical parameters (mean values: triglycerides, 111mg/dL; cholesterol, 184mg/dL; glucose, 213mg/dL).

Discussion and Conclusion
Sunflower is a seed with high fat content (>50% on DM-basis), which could explain the higher values of metabolites on the blood. Raw material particle size and SG degree did not change the studied metabolites, but the reduction on fat intake in comparison with a diet based on sunflower improves the serum lipid parameters and glucose, and may help control of metabolic diseases occurrence in parrots.

* Early career researcher
P20. Feeding trends and average caloric intake of agility dogs

Gina Dinallo1*, Jennifer Franklin1, Gretchen VanDeventer1, Sabine Mann1, Laura Eirmann2, Joseph J Wakshlag1

1Cornell University; 2Nestle Purina, Oradell Animal Hospital

Introduction
Over the last 15 years canine agility has become a leading canine sport. Feeding and supplement trends have not been examined, nor do we have information regarding overall daily caloric intake of these dogs, or the caloric proportions coming from dog feeds and treats.

Materials and Methods
A survey was designed and validated through small sample cognitive validation methods. The survey was administered at 20 agility shows across the Northeast and Midwest in 2015 to obtain information regarding competition level, training, feeding practices, known weight, body condition scoring, supplements used, and injuries. Average kilocalorie intake per day from reported consumption was assessed for all dogs with ideal body weight (BCS 4 or 5 of 9) based on manufacturer’s or USDA database information. To assess the respective kilocalorie intake per metabolic body weight across competition levels (beginner, intermediate, master) a one way analysis of variance was used to determine significance.

Results
There were 494 respondents. Results showed that approximately 99% of respondents used treats and 66% utilized health supplements. Sixty-one percent of respondents fed primarily commercial dry food (over 70% of calories). Approximately 25% of owners fed raw, cooked or freeze dried foods. Home prepared/raw diets were 11%, commercial raw/cooked diets were 11%, while the remaining 3% fed freeze dried products. The remaining 14% fed a mix of dry food/home-prepared/raw. Average body condition score was 4.6 + 1.0. Mean kilocalorie consumption of 243 dogs
(BCS 4 or 5) was $106(BW \text{ kg})^{0.75}$ with no significant differences observed between dogs at different levels of competition. Mean percentage of kilocalories from treats was $15.1\% \pm 12.7\%$.

**Discussion and Conclusion**
Reported kilocalorie intake for most agility dogs is not different from the average household pet based on current NRC guidelines. Imbalance of diet due to supplements, treats, or table foods can occur; therefore education regarding feeding practices is important for agility dog clients.

* Early career researcher
P21. The source of phosphorus influences serum PTH, apparent digestibility and blood levels of calcium and phosphorus in dogs fed high phosphorus diets with balanced Ca/P ratio

Britta Dobenecker¹, Stephanie Siedler¹

¹ Ludwig Maximilians University

Introduction
Phosphorus (P) excess might affect renal health of various species (humans, dogs and cats: Calvo & Uribarri 2013, Dobenecker et al. 2013, Pastoor, 1995, Ritz et al. 2012, Schneider et al. 1980). The availability of P from different dietary sources determines the P load for the individual. The aim of this study was to determine apparent digestibility (aD) of P and selected blood parameters in healthy dogs after feeding diets supplemented with P from different sources.

Materials and Methods
In 8 adult Beagles the aD of P and Calcium (Ca) was determined after feeding a complete and balanced diet (0.5% P/DM) for 18 d (13 d adaptation, 5 d balance). This was repeated aiming at the fivefold RDA for P (~2.2% P/DM) by adding different P sources plus CaCO₃ for a Ca/P ratio of ~1.3/1 (diet poultry meal: Ca/P 1.7/1; diet Na₅P₃O₁₀: 3 times RDA) with wash-out periods of 10 d each. Serum P, Ca and PTH was measured at d18 (2 hr postprandially). The study was approved by the Government of Upper Bavaria. Statistics: ANOVA (Bonferroni) or Kruskal Wallis (Tukey) according to value distribution.

Results
Poultry meal showed the lowest aD of P without influencing serum P and PTH. By contrast, the aD of monocalcium- and monosodiumphosphates (Ca(H₂PO₄)₂; NaH₂PO₄) was higher and caused postprandial increase of serum P and PTH. Even though P intake in diet Na₅P₃O₁₀ was lower, serum P and PTH also increased significantly.
Discussion and Conclusion
Next to the total concentration of P and the Ca/P of a diet, serum Ca, P and PTH levels depend on P source and digestibility. Because of the potentially harmful effects of elevated serum P and PTH levels on skeleton, cardio-vascular system and kidneys, we suggest additional monitoring of the aD of P and postprandial blood levels to distinguish between possibly harmful and safe.
P22. Effect of feeding medicinal and aromatic plants on growth performance and digestibility in New Zealand White (NZW) rabbits

Mounir Mahmoud Ibrahim El-Adawy

University of Alexandria-Faculty of Agriculture

Materials and Methods
A total of forty New Zealand White (NZW) male rabbits of 6 weeks of age with an average initial body weight 837.6 were used to study the effect addition of some medicinal and aromatic plants in rabbit diets on growth performance, digestibility and economical efficiency. Rabbits were distributed into 5 equal groups. The first group received diet without supplementation which served as control diet (C), while the P1, P2, P3 and P4 groups were supplemented with 1.0% Basil, Chamomile, Fennel or Ginger (used parts), respectively.

Results and discussion
Results showed that the final body weight (13 weeks of age), daily weight gain and performance index significantly increased in group fed diet P3 (1.0% fennel), while the lowest values were obtained in rabbits fed diet P4 (1.0% ginger). Rabbits fed diet P3 (1.0% fennel) showed significantly the highest daily feed intake (88.85g/day) comparing with the other experimental groups. The lowest feed intake was obtained in rabbits fed diet P4 (1.0% ginger). Also, the rabbits fed diet P3 (1.0% fennel) showed better feed conversion ratio (3.35) than those fed the other experimental diets. Digestibility values and feeding values such as TDN, DCP and ME were significantly higher with fennel and chamomile supplementation diets than those of the other experimental diets. The highest economical efficiency value was recorded in group fed diet P3 supplemented with 1.0% fennel, followed by those fed P2 diet supplemented with 1.0% chamomile. The lowest economical efficiency value was recorded in group fed diet P4 supplemented with 1.0% ginger.
Conclusion
Evidently, it could be concluded that feeding rabbits with diets supplemented with 1.0% fennel or chamomile caused relatively improvement in growth performance, nutrients' digestibility’s, nutritive values and economical efficiency, without any negative effects on growing rabbits. Meanwhile, 1.0% ginger supplementation in growing rabbit diets affected negatively on the previous measurements.
P23. Trace elements in dog food: a potential risk of toxicity?

Camila Elias¹, Elisabete De Nadai Fernandes¹, Márcio Arruda Bacchi¹, Peter Bode²

¹University of São Paulo; ²Delft University of Technology

Introduction
The quality of pet diets depends on adequate ingredients capable of providing optimal nutrition for promoting long-term health. Besides nutrients that are essential to the pet’s health, the ingredients can unintentionally introduce a variety of contaminants, including toxic chemical elements. In this context, the present study aimed at assessing trace elements in dry dog foods that might have potential toxicity.

Materials and Methods
Neutron activation analysis (NAA) was applied for evaluating ninety-five samples of dry dog food for puppies (n=32) and adults (n=63) of various brands and grades acquired in the local market of the city of Piracicaba, SP, Brazil. Both short and long irradiations were carried out in nuclear research reactors in Netherlands and Brazil, allowing a comprehensive chemical characterization of the samples due to the multi-element analytical capacity of the technique.

Results
NAA provided results for twenty trace elements in the dog food samples, including nutrients and non-essential elements. Aluminum, antimony and uranium presented higher levels in some samples, which may bring health risks to the dogs and deserve special attention. Aluminum and antimony results varied within wide ranges, respectively from <21 mg/kg to 11900 mg/kg, and from <0.01 mg/kg to 5.14 mg/kg, while uranium varied from 0.13 mg/kg to 3.99 mg/kg.
Discussion and Conclusion
The high contents of aluminum and antimony were associated to one or two brands, while the high uranium contents were observed in brands from five diverse producers. The large differences between minimum and maximum values indicate that the high contents of the three elements can be avoided by a careful selection of ingredients, combined with quality control actions. There are not maximum levels established for aluminum, antimony and uranium in dog food, however several evidences point that those elements can be a health threat at the levels found in this work, considering long-term ingestion. Further investigation is necessary to better understand the provenance of such potentially toxic elements as well as the consequences to dog health.
P24. In vitro bioaccessibility of copper in dog food

Camila Elias¹, Elisabete De Nadai Fernandes¹, Márcio Arruda Bacchi¹, Peter Bode², Helder Louvandini¹

¹University of São Paulo; ²Delft University of Technology

Introduction
Commercial dog foods should be a balanced diet that meets all nutritional requirements at different stages of the animal’s life. The knowledge of the nutritional value of dog food is fundamental to ensure that the animal is ingesting daily right amounts of nutrients. The imbalance of essential elements and the presence of toxic elements can cause nutritional problems and diseases. Copper is an essential element and is also one important factor to be studied regarding metabolic defects in dogs. Copper accumulation in the liver may cause progressive lesions in the organelles of hepatocytes, resulting in chronic hepatitis and cirrhosis. Thus, this study aimed to assess the in vitro bioaccessibility of copper in dog food.

Materials and Methods
The bioaccessibility of copper was estimated by in vitro simulated gastrointestinal digestion, based on consecutive incubation steps with pepsin and pancreatin. Fourteen samples of commercial dry extruded dog foods, with copper mass fractions varying between 9 mg/kg and 60 mg/kg, were processed in triplicate. The measurement of digested samples was performed using ICP OES.

Results
Copper bioaccessibility values ranged between 47% and 91%, with a median of 65%. Two adult dog foods showed the highest bioaccessibility values (91% and 90%), both from the standard dog food, while two samples from super premium segment presented bioaccessibility of 81% (puppy) and 80% (adult).
Discussion and Conclusion
In all dog foods, at least about 50% of the copper was solubilized by the digestion procedure, being therefore considered bioaccessible. No relation was observed between the bioaccessibility and the copper content in the dog food, which implies that, for the range evaluated here, more copper in the dog food means more copper available for absorption in the digestion system. Such behavior reinforces the importance of studying dog food as the supply of this mineral, especially for those dog breeds with a genetic predisposition to develop liver disease associated with copper accumulation.
P25. Weight loss in client-owned overweight cats significantly improves quality of life, begging score and activity levels: an international weight loss study

John Flanagan1, Thomas Bissot1, Marie-Anne Hours1, Bernabe Moreno1, Alexandre Feugier1, Alex German2,

1Royal Canin, Aimargues, France; 2University of Liverpool

Introduction
Feline obesity is a worldwide concern but, despite this, many cats never undergo a weight loss programme. A better understanding of the improvements that owners observe when their cats lose weight might help veterinarians to convince more owners to participate. This international, multi-centre study aimed to examine the efficacy of a dietary weight loss intervention for obese pet cats. A key objective was to determine the effects of weight loss on owner perception of their cats’ behaviour.

Materials and Methods
A 3-month (median 12 weeks, range 10-14 weeks) weight loss programme was conducted at 188 veterinary practices in 23 countries; 399 cats were enrolled. All were fed commercially available dry or wet weight loss diets, with all cats fed an energy allocation of 53 kcal/kg BW^0.711/day. The Royal Canin Ethics Committee approved the study, and owners gave informed consent. Owners completed behavioural questionnaires assessing begging, physical activity and quality of life (QOL). Linear mixed models were used to assess the respective influence of time and initial body condition score (BCS) on weight loss and behavioural factors.
Results
At baseline, mean age was 6.5±3.2 years and median BCS was 8 (range 7-9). Ninety-seven percent of cats lost weight (mean 10.5±6.2%) during the programme at a rate of 0.82±0.50%/week. Based upon owner questionnaires, activity and QOL improved (both $P<0.001$) after 3 months, while begging behaviour decreased ($P<0.001$). An interaction was found between initial BCS and both QOL and activity values ($P<0.001$, $P=0.02$, respectively); this was not the case for begging score ($P=0.28$). The BCS*time interaction was not significant for any behavioural factor.

Discussion and Conclusion
Most obese cats enrolled in this international multi-centre study lost weight. The fact that owners identified positive improvements in their cats’ behaviour might help to encourage other owners to enrol their cat in future weight loss programmes.
Introduction
Overweight dogs are at risk for developing chronic diseases associated with underlying metabolic aberrations. Cooked common beans comprise a unique combination of macronutrients, micronutrients, and phytochemicals that improve metabolism in obese humans and lab animals. The objective of this study was to evaluate the effects of cooked navy and black bean powders in dry dog foods for overweight companion dogs during weight loss using a randomized-controlled, 4-week clinical trial.

Materials and Methods
Thirty healthy, overweight/obese companion dogs were randomized to one of three diet groups: 25% navy bean-based; 25% black bean-based; or an isocaloric, nutrient-matched, control diet. Dogs were calorically restricted to achieve a weight loss of 0.5-2% body weight/week. Faecal and fasted blood samples were collected throughout the study and used to evaluate clinical biochemistry and liquid and gas chromatography metabolomic profiles.

Results
We have reported that bean-based diets were equally digestible to a control diet and that all groups had reduced serum cholesterol. Dogs consuming the bean-based diets had reduced triglycerides and lipoproteins. Six faecal metabolites were identified that increased in at least one of the bean groups: octadecanedioic acid; the phytosterol campesterol; and four triterpenoid phytochemicals, oleanolic acid, uvaol, soyasapogenol C, and a terpenoid compound not further identifiable on
this detection platform. Campesterol has previously been reported in beans, and the terpenoid compounds have previously been reported in legumes and associated with modulating lipid metabolism.

**Discussion and Conclusion**
This study demonstrates the potential of bean-based diets to modulate lipid metabolism via unique phytochemicals and supports the feasibility and utility of incorporating cooked dry beans in dog foods for improved health during weight loss. Future investigations focused on targeted lipid metabolites are needed to further elucidate the metabolic pathways associated with chronic disease control and prevention in dogs consuming bean-based dog foods.

* Early career researcher
P27. Effects of mixed grape and blueberry extract on oxidative status in aged dogs

Fragua V1, Veronique Leray2, Céline Baron1, Patrick Nguyen2, Anne Lepoudère1

1DIANA PET FOOD; 2ONIRIS, National College of Veterinary Medicine, Food Science and Engineering, Nutrition and Endocrinology Unit

Introduction
Cellular oxidative damage is thought to be one of the mechanisms underlying age-related cognitive impairment in dogs (Landsberg et al., 2012). The association of grape and blueberry extracts has never been tested in aged dogs. Our objective was to evaluate the effect of a polyphenol-rich extract from grape and blueberry (PEGB) on oxidative status in aged dogs.

Materials and Methods
Thirty-five Beagle dogs (8.0 to 14.5 years) were fed basal diet with PEGB: 0 ppm (Control); 240 ppm (PEGB1) or 480 ppm (PEGB2). Peripheral blood mononuclear cells were recovered before and at the end of the 75-days supplementation period. mRNA levels for catalase, Nrf2, SOD, GPx, NQO1, HIF1α, VEGF, NFκB and TNFα were semi quantified by real-time PCR and analyzed using one mixed-effect model. This model included fixed effects of baseline and diet, and dog as a random effect. All effects were evaluated at α=0.05 level.

Results
Results are shown in Table 1.

Discussion and Conclusion
These data established that PEGB has a potential effect by inducing NQO1 and SOD expression. This has been associated with lower susceptibilities to oxidative stress. However, further research on the appropriate dosage level and in vivo cognitive tests are needed to prove PEGB benefit on aging process in dogs.
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<th></th>
<th>Control</th>
<th>PEGB1</th>
<th>PEGB2</th>
<th>p-value</th>
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<tr>
<td></td>
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<td>SEM</td>
<td>Mean</td>
<td>SEM</td>
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</table>

Table 1. mRNA levels (Mean ± SEM) from 3 groups of aged dogs fed basal diet with PEGB included at 0 ppm (Control, n=11); 240 ppm (PEGB1, n=12) or 480 ppm (PEGB2, n=12) during 75 days.
P28. A significant relationship between head length growth rate and interventricular septum in adult cats

Lisa M Freeman¹, John E Rush¹, David J Connolly², Alexandre Feugier³, Ingrid van Hoek⁴

¹Cummings School of Veterinary Medicine at Tufts University; ²Royal Veterinary College; ³Royal Canin, Aimargues, France; ⁴Royal Canin SAS

Introduction
Faster early growth might increase the risk for hypertrophic cardiomyopathy (HCM) later in life. There is a significant relationship between head morphology and body weight (BW), and head width (HW) and left ventricular free wall (LVW) growth rates in young cats (van Hoek 2015). We evaluated the relationship of serum N-terminal pro-B-type natriuretic peptide (NT-proBNP) concentrations and echocardiographic measures with morphometric and biomarker measures during growth until adulthood.

Materials and Methods
Twenty-four female European short hair cats housed in colony in compliance with EU regulations and fed ad libitum since birth, were examined at 6, 12, 18 and 24 months of age. Measures were performed in conscious cats. Morphometric measures included BW, body condition score (9-point scale, BCS), head length (HL), and HW. Echocardiographic measures included in diastole (2D- and M-mode) interventricular septum (IVSd), left ventricular internal dimension, LVWd, and left atrium/aortic diameter ratio. Biomarker measures included NT-proBNP and insulin-like growth factor-1 (IGF-1). Growth rate was absolute (AG) and % relative (RG) growth for the periods 6-12, 12-18, 18-24 and 6-24 months, and 0-6 months for BW. Statistical analysis included Pearson’s and Spearman ranked correlation coefficients as appropriate with a 1% significance level and R²>0.4.
Results
Serum NT-proBNP concentrations at 24 months were significantly related to NT-proBNP measured at 6 ($R^2 = 0.40$) and 18 ($R^2 = 0.47$) months. IVSd (2D) was significantly related to growth of head length between 18 and 24 months (AG: $R^2 = 0.40$; RG: $R^2 = 0.41$).

Discussion and Conclusion
This study shows the relationship between HL growth rate and IVSd at adult age, and between NT-proBNP measured during growth. Further research is needed to investigate a possible association with cardiac pathology for growth rate and serum NT-proBNP concentrations during growth, which could help to identify cats at risk for cardiac disease.
P29. Overweight dogs walk less frequently and take shorter walks: Results of a large survey of dog owners from the United Kingdom

Alexander James German¹, Emily Blackwell², Mark Evans³, Carri Westgarth¹

¹University of Liverpool; ²University of Bristol; ³Independent veterinary consultant

Introduction
Canine obesity is now the number one health and welfare concern worldwide. Regular physical activity can improve health, and owners are advised to walk their dogs on a regular basis. However, limited information exists about associations between overweight status of dogs and their walking activity.

Materials and Methods
An online survey was conducted between June and August in 2014, coinciding with the broadcast of a National UK television programme, exploring dog behaviour. Information gathered included signalment, overweight status, and owner reported information on duration and frequency of dog walking. The University of Liverpool Ethics Committee approved the project, and owners consented to data use. Simple and multiple logistic regression analysis were used to determine associations between overweight status and dog walking activity.

Results
Data were available from 11,500 adult dogs, and 1,815 (15.8%) of these were scored as overweight by their owners. Overweight dogs were more likely to be neutered (P<0.001), and middle-aged or older (P<0.001). Various breeds were over-represented including (beagle, bull terrier, bulldog, Cavalier King Charles spaniel, Chihuahua, golden retriever, Labrador retriever, and Pug, P<0.001 for all). Both frequency and duration of walking were negatively associated with overweight status, with dogs
that were walked >1/day (OR=0.70, P<0.0001) or walked for >30min at a time (OR=0.65, P<0.0001) less likely to be overweight. On multiple regression analysis, duration and frequency were independently and negatively associated with the odds of being overweight, along with a range of other factors including age, neuter status, and breed.

**Discussion and Conclusion**
This study has identified associations between overweight status and dog walking behaviour. In the future, studies should determine the reason or this association, and whether changes in walking activity can influence on weight status.
P30. Variation in activity levels amongst dogs of different breeds: Results of a large online survey of dogs owners from the United Kingdom

Emily Pickup¹, Alexander James German¹, Emily Blackwell², Mark Evans³, Carri Westgarth²

¹University of Liverpool; ²University of Bristol; ³Independent veterinary consultant

Introduction
Regular physical activity is an important means of promoting health, both in people and their pets. Walking is the most common method used for dogs, but there is a lack of clarity on how much dog activity different breeds of dog require.

Materials and Methods
First, a literature review was conducted to identify evidence-based recommendations for dog walking amongst breeds. Data from an online survey of UK dog owners were collected between June and August in 2014. The University of Liverpool Ethics Committee approved the project, and owners consented to data use. The initial dataset (17,028 dogs) was first cleaned to remove erroneous data, and then edited to remove mixed breed dogs, leaving a total of 12,314 dogs from known pedigree breeds. Other information collected included age, sex, neuter status, UK Kennel Club breed grouping, and owner reports walking activity. Walk frequency and duration were estimated across different breeds, and compared with Kennel Club recommendations. Chi-squared tests and binary logistic regression analysis were used to examine associations between walking behaviour and either dog breed or breed grouping.
Results
The literature review revealed no evidence-based guidelines for the public on frequency and duration of walking for different dog breeds. The online survey data indicated differences amongst breeds in the amount of walking reported ($P<0.001$). Afghan Hounds were the least exercised breed, whilst breed reportedly exercised most included: English Setter, Foxhound, Irish Setter, and Old English Sheepdog (n=19). Gundogs were three times more likely to be walked once a day or more ($P<0.001$), whilst smaller dogs were more likely to meet their UK Kennel Club guidelines for dog walking ($P<0.001$).

Discussion and Conclusion
The frequency of dog walking varies both within and amongst breeds, and many do not currently receive the recommended amount of exercise.
P31. Inclusion of yeast cell wall on diet modulates faecal microbiota and fermentation products in adult cats

Marcia de Oliveira Sampaio Gomes¹*, Joao Paulo Fernandes Santos², Adriana Augusto Aquino¹, Maria Beatriz Abreu Glória³, Mario Julio Avila-Campos⁴, Karine de Melo Santos¹, Aulus Cavalieri Carciofi⁵, Arquivaldo Reche Junior¹, Márcio Antonio Brunetto⁶

¹FMVZ, USP; ²University of Sao Paulo; ³UFMG; ⁴ICB – USP; ⁵FCAV Unesp; ⁶School of Veterinary Medicine and Animal Science, University of Sao Paulo, Pirassununga, SP, Brazil

Introduction
This study evaluated the effects of increasing levels of spray-dried yeast cell wall (YCW) in diets for healthy adult cats on the apparent digestibility of nutrients, faecal microbiota composition and fermentation products.

Materials and Methods
Fourteen cats with average weight of 4.40±1.05kg, age of 6.2±0.54 years, and body condition score of 5.0±0.27 were distributed in an unbalanced randomized block design with two blocks and three or four cats per diet in each block, and fed four experimental diets: 0% YCW (control); 0.2% YCW; 0.4% YCW and 0.6% YCW, totaling seven animals per diet. In each block a 21-d of adaptation to the diet preceded an 8-d of total collection of feces for digestibility trial and faecal score. On days 30 to 34 fresh faecal samples were collected to assess the composition, determined by real time PCR, and metabolic activity of the faecal microbiota. A 30-day washout period was used in between blocks.
Results
YCW ingestion did not affect intake of nutrients, faecal score, pH and output, and urine excretion ($P > 0.05$). The coefficient of apparent digestibility of mineral matter showed linear increase ($P < 0.05$). Regarding the microbiota composition and metabolic activity, a linear reduction in *Clostridium perfringens* and a quadratic in *Escherichia coli* was observed, and *Bifidobacterium spp.* and *Lactobacillus spp.*, butyric acid, valeric acid and putrescine, cadaverine, histamine and total amines increased linearly ($P < 0.05$) with the inclusion of YCW. Similarly, acetic acid, total short-chain and branched chain fatty acids tended to ($P < 0.10$) show linear increase, while isobutyric acid presented a quadratic behavior ($P < 0.10$).

Discussion and Conclusion
The ingestion of extruded diets with different YCW inclusions by healthy adult cats did not reduce nutrients digestibility, nor interfere with diet consumption, faecal and urine output, but positively modified the faecal microbiota composition and interfered in its metabolic activity.

* Early career researcher
P32. Retorting conditions affect palatability and physical characteristics of canned cat food

Esther Hagen-Plantinga¹, D F Orlanes², Guido Bosch³, Wouter WH Hendriks³, Antonius FB van der Poel³

¹Utrecht University; ²Wageningen University; ³Animal Nutrition Group - Wageningen University;

Introduction
This study aimed to examine the effects of different temperature/time conditions during retorting of canned cat foods on physical characteristics and palatability in cats.

Materials and Methods
Lacquer cans (400g, Ø 72 mm, h 10.4 cm) containing a raw mixture of a loaf-type commercial cat food were heated in a pressurized retorting system at three specified temperatures (113, 120, and 127°C) and at corresponding processing times (232, 103, and 60 min, respectively) to reach a similar lethality (F₀-value) of 30. Physical properties (viscosity, texture, particle size, pH) were determined for the three different foods. Ten European shorthair cats (1 male, 9 females, 5.0-7.3 y old, 2.6-5.7kg body weight) were used in a 10d three-bowl palatability test.

Results
Retorting at 113°C/232 min. resulted in differences (P<0.05) in all the physical parameters examined (< viscosity, firmness, adhesiveness, and > particle size). Significant pH differences were observed, with the 113°C diet having the lowest pH (6.53 vs. 6.63 and 6.66 for diets retorted at 120 and 127°C, respectively). Preference ratios for the foods retorted at 113, 120 and 127°C were 0.38, 0.31, and 0.31 (P<0.05).
Discussion and Conclusion
Retorting condition affects the physical characteristics of moist cat food. The higher palatability of diet 113°C/232 min might, in part, be related to the lower pH, as this may result in more efficient stimulation of the abundant acid unit taste receptors of cats. In addition, the longer retorting time likely promoted the formation of more and/or different aromatic compounds, which can positively influence food palatability in cats (Zaghini and Biagi, 2005).

References:
P33. Faecal microbiome in healthy cats: effect of XOS supplementation

Marta Lourenco¹, Sandra Debevere¹, Hermann Bourgeois², Mavis Ran², Myriam Hesta³

¹Laboratory of Animal Nutrition, Merelbeke, Belgium; ²Longlive Biotechnology Ltd., Qingdao, RPC; ³Ghent University

Introduction
A recent study using shotgun sequencing showed that dietary protein/carbohydrate ratio significantly affects species richness, diversity and the abundance of 324 genera in kittens (Deusches et al., 2014). Similarly, Hooda et al. (2013) showed distinct clustering based on the dietary protein/carbohydrates ratio in kittens. Bermingham et al. (2013a,b) showed significant changes in the microbiome of kittens and adults by changing diet type. Only one study investigated the effect of supplementing FOS or pectine using shotgun sequencing. Therefore, the aim of the present study was to investigate if the adding Xylo-Oligosaccharides (XOS) to a medium protein diet can affect the microbiome. The bifidogenic effect of XOS in dogs has already been illustrated (Dong, 2009).

Material and Methods
24 adult cats were included in a 7 weeks longitudinal blind study. A control and two XOS supplemented diets (0.4 & 0.04%) were tested during 4 weeks after an adaptation period of 3 weeks (control diet). At the end of the trial, fresh faecal samples were collected and analysed by Illumina sequencing.
Results and Discussion
On phylum level, the relative abundance of Firmicutes was followed by Actinobacteria. Both phyla were representing 98-99% of the phyla. The relative abundance of Proteobacteria and Bacteroidetes were much lower. Actinobacteria, Bacilli, Clostridia and Erysipelotrichia were most abundant at class level. Microbiome analysis showed a tendency for a linear increased species diversity and a significantly linear increase of richness by XOS. At phylum level, Actinobacteriacea were significantly decreased while Firmicutes significantly increased by XOS. At order level a significant linear decrease of Bifidobacteriales with a significant increase of Clostridiales was detected by XOS. On the genus level, data showed a clustering of animals on 0.4% XOS.

Conclusion
Results of this trial illustrate XOS can induce a shift in abundance and richness of microbiome.

References: available upon request
P34. From the DOGRISK study: correlating the prevalence of lipomas in dogs with their diet at the age of 2-8 months

Anna K Hielm-Björkman

University of Helsinki

Introduction
The etiology of lipomas is unclear. Epidemiologic nutritional research on association between lipomas in dogs and food ingested between 2-8 months of age has not been looked at before.

Materials and Methods
Dog owners where filling in data into the internet based DOGRISK food frequency questionnaire. Dogs with one or several lipomas situated anywhere on the body was compared to dogs where owners reported no lipomas. The diet analyzed here, were ingested at the age of 2-8 months. The 54 food items were divided into raw protein foods, processed protein foods, mixed dairy products, raw greens, fruits and berries, human leftovers and human type food served to dogs, raw bones, cooked/smoked bones, processed snacks, dried snacks, any type of supplemented oils, what dogs might eat outside, dry foods for dogs, and sausages or canned food for dogs. Amounts looked at where either never or maximum some times per year (=0) versus some times per week till daily (=1). Anything in between these frequencies were omitted from these analyses. Logistic regression with \( p < 0.005 \) were used.

Results
167 dogs with lipomas versus 1,843 dogs without any lipomas were included in the analyses. In the unadjusted multivariate food group analyses, the mixed dairy variable including milk, dairy products, ice-cream and cheese were significantly associated with the development of lipomas OR=1.4 (95% CI 1.0-1.9; \( p = 0.049 \)). Raw bones/meaty bones showed a significant inverse associations with lipomas OR=0.39 (95% CI 0.25-0.61; \( p < 0.0001 \), indicating a protective effect.
None of the other food groups showed any association with lipomas.

**Discussion and Conclusion**
These data indicate that there might be an association with for example calcium metabolism and the development of lipomas. More research, both as epidemiology and as diet intervention studies, are needed.
P35. Growth data of “German Wire Haired Pointer” puppies; compared with growth curves from North American dogs

Claudia Houben¹, Carina Salt²

¹Mars GmbH; ²WALTHAM Centre for Pet Nutrition

Introduction
When breeding dogs, the wide variation in size across breeds and the rapid rate of growth (25 to 50% of adult bodyweight within the first 3 months) make it challenging to assess whether an individual is growing as expected.

In a thesis running at the University of Veterinary Medicine Hanover we collected growth data of dogs in Germany and compared them with reference growth curves (RGC) created from data collected by Banfield Pet Hospitals, a network of primary care veterinary hospitals in the USA.

Materials and Methods
Bodyweight was measured in 25 GWH-Pointers weekly from birth until 8 weeks old, then 4 weekly until adulthood, by the same person / equipment. The RGCs were developed from bodyweight data recorded during consultations from healthy puppies, across a range of breeds. Separate RGCs were built for males and females across 5 size categories. The statistical techniques used were similar to those underlying the World Health Organisation (WHO) Child Growth Standards. The GWH-Pointer data was plotted on the appropriate RGC and agreement assessed visually by examining the number of centile curves crossed.

Results
The GWH-Pointer bodyweight data fitted well to the RGCs, suggesting that this breed grows similarly to comparable sized dogs in the USA.
Discussions and Conclusion
Because growth is a versatile process where puppies of different stature but similar weight may need different feeding regimes for healthy development, weight-based growth curves could provide a useful tool for vets to monitor growth. We plan to investigate if other body measurements can add benefit by allowing a fuller assessment of an individual’s development, as recommended by the WHO for child growth (Cole, 1988).

References:

P36. Genetic disease variant prevalence in over 100,000 purebred and mixed breed dogs

Donner J¹, Heidi Anderson¹, Stephen Davison², Bala Ganesan³, Angela M Hughes³, Cindy Cole³, Hannes T Lohi¹

¹Genoscoper Laboratories, Helsinki, Finland; ²Mars Veterinary, Waltham on the Wolds, Leicestershire, United Kingdom; ³Mars Veterinary, Portland, OR, USA

Introduction
Sequencing the canine genome and developing efficient genomic tools has greatly facilitated dog disease gene discoveries. There are hundreds of known canine mutations which have important veterinary diagnostic and breeding implications. This has transformed DNA-based diagnostics from single gene testing to more comprehensive panel-based mutation screening. Panel testing in large numbers of dogs, of diverse breed and geographical backgrounds, provides a unique view on the epidemiology of risk variants and their relevance for veterinary care, breeding programs and animal welfare aiding in the effort to provide individualized care and nutrition.

Materials and Methods
We developed a comprehensive panel assay enabling simultaneous testing for ~150 known canine disease variants across a wide variety of conditions. We present the results of testing ~100,000 US and European dogs (90,000 mixed breed and 10,000 purebred), forming the largest cohort for a canine disease frequency investigation to date.

Results
We found a high and equal overall prevalence of disease risk variants in both purebred and mixed breeds. Approximately every third dog tested carried at least one risk variant (four at most). About 70% of the mutations screened for were observed at least once in the cohort indicating that the remaining mutations are extremely rare, limited to
specific populations, or eradicated through selective breeding. Some of the most common mutations were degenerative myelopathy (DM), hyperuricosuria (HUU), exercise-induced collapse (EIC), multidrug resistance 1 (MDR1) and primary lens luxation (PLL).

Discussion and Conclusion
This study demonstrates the power and efficiency of panel screening for inherited disorders in dogs which has significant implications for veterinary medicine. Prevalence of risk variants in the general dog population is high and mixed breeds are equally susceptible to common inherited conditions emphasizing the need for genetic testing as a tool to improve the diagnostics, care and ultimately the welfare of all dogs.
P37. Potential mechanism of toxicity of hexahydroisohumulone in an in vitro canine model

Brett Jeffery\textsuperscript{1}, Denise Mitchell\textsuperscript{1}, K Choi\textsuperscript{2}, K Koci\textsuperscript{2}, J Riviere\textsuperscript{2}, Nancy Monteiro-Riviere\textsuperscript{2}

\textsuperscript{1}Mars Incorporated; \textsuperscript{2}Kansas State University

Introduction
Ingestion of hops by dogs has been reported to cause fatal intoxication consistent with malignant hyperthermia syndrome (MHS). Susceptibility to MHS is an autosomal dominant trait in dogs and has been reported in a variety of dog breeds. Administration of hexahydroisohumulone (HEX) - a component of hops has been linked to MHS.

Materials and Methods
This study investigated the organ-specific oxidative/nitrative stress and molecular mechanism of toxicity using the pathway-focused DNA array of hexahydroxyisohumulone (HEX) in dogs with 4 different canine cell systems: hepatocytes, canine proximal tubule cells (CPTC), bone marrow-derived stem cells (BMSC) and enterocyte-like cells and the pathway-focused DNA array.

Results
Extensive production of free radical species were found in HEX-treated hepatocytes and to a lesser extent in CPTC, BMSC and ELC. Transcriptional profiles showed 113 differential expressed genes in hepatocytes followed by CPTC (80), ELC (18) and BMSC (4). Among 15 functional pathways, HEX predominantly affected DNA damage/repair in hepatocytes and CPTC, but for ELC the ER stress/unfolded protein response dominated. HEX extensively suppressed antioxidant and phases I and II drug metabolizing enzymes. COX-2 and CHOP were the most abundant genes in HEX-treated hepatocytes and CPTC being involved in HEX-mediated adverse effect on apoptosis, oxidative stress, ER stress
unfolded protein response and mitochondrial metabolism. ELC were less able to protect against the adverse effect of HEX compared to liver due to limited life span and metabolic capacity.

Discussions and Conclusion
This work describes an approach to investigating the upregulation of genes potentially involved in HEX-induced MHS. This work also identifies COX-2 as a marker for HEX induced inflammation and potential carcinogenicity. However, further carcinogenic and genotoxic tests of HEX is needed to determine if HEX is genotoxic or a non-genotoxic carcinogen, and if COX-2 expression plays any role.
P38. Markers of inflammation and insulin resistance in dogs before and after weight loss versus lean healthy dogs

Jeremias J T¹, Paula Takeara¹, Iris Mayumi Kawauchi¹, Danilo Ferreira de Souza¹, Márcio Antonio Brunetto², Cristiana Fonseca Ferreira Pontieri¹

¹Grandfood Indústria e Comércio, Dourado, São Paulo, Brazil; ²School of Veterinary Medicine and Animal Science, University of Sao Paulo, Pirassununga, SP, Brazil

Introduction
Chronic low-grade inflammation in obesity is characterized by an increased production of pro-inflammatory cytokines that contribute to insulin resistance. Body compositions, markers of inflammation and insulin resistance in dogs were studied before and after weight loss versus lean healthy dogs.

Materials and Methods
Eleven owned adult obese dogs (median body condition score (BCS) 8 in a 9 point scale) followed a weight loss program with a high-protein and low-starch diet (ME, 2.97 kcal/g as fed) and reached an ideal BCS around 6 months (4-9). A control group of nine dogs which have always presented an ideal BCS were selected. Body composition was determined by the deuterium oxide dilution method. Serum concentrations of fructosamine, triglycerides, interleukin-2 (IL-2), interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), insulin, leptin, insulin-like growth factor-1 (IGF-1) and peptide YY (PYY) were analyzed. Data were analyzed by Student t-test and correlation between body fat and other parameters was performed.
Results
Median weight loss was 21.8% (14.8-28.6), and body fat decreased from 41.6% (30.7-58.6) to 29.1% (18.6-46.3) ($P<0.0001$). Dogs maintained lean body mass ($P>0.05$). Serum concentrations of triglycerides, IL-2, IL-6, TNF-α, insulin, leptin and IGF-1 decreased after weight loss ($P<0.01$), however, IL-2, IL-6 and TNF-α were not different from the control group ($P>0.05$). Obese dogs presented higher concentration of fructosamine, triglycerides, insulin, IGF-1 and leptin than the control group ($P<0.05$). After weight loss these concentrations were similar to the control group ($P>0.05$), except leptin ($P<0.0001$). No alteration on PYY was found. Leptin ($r=0.60; P=0.01$), fructosamine ($r=0.44; P=0.02$) and triglycerides ($r=0.40; P=0.04$) concentrations correlated with the change in body fat.

Discussion and Conclusion
Weight loss reduces the concentration of inflammatory and insulin resistance markers and most parameters become similar to dogs that have always been lean. Although IL-2, IL-6 and TNF-α decreased significantly with the weight loss, the values were low and were not different from lean animals.
P39. Markers of inflammation in cats before and after weight loss versus lean healthy cats

Jeremias J T1, Paula Takeara1, Iris Mayumi Kawauchi1, Danilo Ferreira de Souza1, Raquel Valim Labres2, Marcio Antonio Brunetto3, Cristiana Fonseca Ferreira Pontieri1

1Grandfood Indústria e Comércio LTDA, Dourado, São Paulo, Brazil; 2Alimentar Vet, Canoas, Rio Grande do Sul, Brazil; 3School of Veterinary Medicine, University of São Paulo, São Paulo/Pirassununga, São Paulo, Brazil

Introduction

While inflammation is a major link between obesity and diabetes in humans, there is little evidence that a similar phenomenon exists in cats. The aim of this study was to investigate the circulatory markers of inflammation in cats before and after weight loss and compare with lean healthy cats.

Materials and Methods

Ten obese adult cats (median body condition score (BCS) 8 in a 9 point scale) followed a weight loss program with a high-protein (133g/1000 kcal), low fat (31.6g/1000 kcal), low-starch diet (50.6g/1000 kcal), (ME, 3.16 kcal/g as fed) and reached an ideal BCS around 6 months (4-9). A control group of nine cats which have always presented an ideal BCS were selected. Body composition was determined by deuterium method. Serum concentrations of fructosamine, triglycerides, interleukin-2 (IL-2), interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), were analyzed. Data were analyzed by Student t-test and correlation between body fat and other parameters was performed.
Results
Median weight loss was 23.5% (15.0-30.0), and body fat decreased from 41.6% (30.7-58.6) to 29.1% (18.6-46.3) ($P<0.0001$). There was a decrease in serum concentrations of fructosamine from 264.5 (189.0-567.0) to 206.6 µmol/L (170.2-255.4), triglycerides from 94.5 (38.0-391.0) to 43.0 mg/dL (28.35-73) and IL-2 from 119.0 (1.4-1436.0) to 33.9 pg/mL (2.94-623.0) ($P<0.05$) after weight loss, however, triglycerides and IL-2 were not different ($P>0.05$) from the control group (66.0 mg/dL (28.0-73.0), 77.7 pg/mL (3.1-263.0); $P>0.05$). Obese cats presented higher concentration of fructosamine than the control group (186.5 µmol/L (158.0-222.0); $P=0.0027$) and after weight loss the concentration became similar ($P=0.1777$). No differences in IL-6 and TNF-$\alpha$ were found ($P>0.05$).

Discussion and Conclusion
Although IL-2, decreased significantly with the weight loss, IL-6 and TNF-$\alpha$ not change and all inflammatory markers were not different from lean healthy cats. We have shown that weight loss in cats does not lead to the same changes in circulating inflammatory markers that is seen in other species.
P40. Inflammatory markers in cats with chronic kidney disease fed a renal management diet

Juliana Toloi Jeremias¹, Camila de Oliveira Pereira², Iris Mayumi Kawauchi³, Danilo Ferreira de Souza¹, Paula Takeara¹, Marcio Antonio Brunetto⁴, Fernanda Vieira Amorim da Costa², Cristiana Fonseca Ferreira Pontieri³

¹Grandfood Indústria e Comércio, Dourado, São Paulo, Brazil; ²Rio Grande do Sul Federal University, Porto Alegre, Rio Grande do Sul, Brazil.; ³Grandfood Indústria e Comércio LTDA; ⁴University of Sao Paulo

Introduction
Alterations in cytokines can be found in cats with chronic kidney disease (CKD). The aim of this study was to investigate serum concentrations of inflammatory cytokines over 12 months in cats that were diagnosed with CKD and managed on a renal diet.

Materials and Methods
Six cats in CKD staging IRIS 2 (n = 3) or 3 (n = 3) received for 12 months renal diet: 58.9g protein/1000 kcal; 49.1g fat/1000 kcal; 1.96g EPA+DHA/1000 kcal; 1.10g/1000 kcal calcium and 0.74g phosphorus/1000 kcal. Measurements of interleukin-2 (IL-2), interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α) were performed at the beginning and after 12 months. Data were analyzed by Wilcoxon matched pairs signed rank test. It was considered significant values of $P \leq 0.05$. The results are expressed in median and range.

Results
There were no significant differences in inflammatory cytokines at the beginning and after 12 months. The values in serum concentrations were, respectively, IL-6: 115.4 pg/mL (12.3-7095.0) and 89.5 pg/mL (31.2-3654.0), ($P=0.1563$); IL-2: 4.3 pg/mL (1.47-45.48) and 30.6 pg/mL (1.92-101.1), ($P=0.0938$); TNF-α: 138.3 pg/mL (1.32-4222.0) and 76.08 pg/mL (4.92-1844.0), ($P=0.0938$), although decrease in IL-6 and TNF-α were observed.
Discussion and Conclusion
There is little information about inflammatory markers in cats. Many studies have indicated a relationship between increased inflammatory and higher risk of death and inappetence in CKD human patients. Changes in these parameters may reflect progression of CKD. However, in this study all parameters remained stable over 12 months, indicating a good control of the progression of CKD. Thus, the implemented enriched diet with EPA and DHA was effective in preventing development of renal injury in these six cats followed during one year.
P41. Impact of faecal dry matter excretion on faecal calcium losses in dogs eating complete moist or dry pet foods – food digestibility is a major determinant of calcium requirements

Ellen Kienzle¹, Thomas Brenten², Britta Dobenecker³

¹LMU München, ²Mars Petcare Europe; ³Ludwig Maximilians University;

Introduction
The calcium requirements for maintenance of dogs changed considerably in the last decades. NRC (1972) recommended 490 mg/kg BW^0.75 for a middle sized dog. Currently the recommended allowance is 130 mg/kg BW^0.75 (NRC 2006). An important factor for calcium requirements are faecal losses. In previous studies with experimental diets faecal calcium losses depended on calcium intake (Mack et al. 2015) and on faecal dry matter excretion (Kienzle et al. 2006). The predictive equation for faecal calcium losses in mg/kg BW was: Faecal losses = -33.8 + 13.6 faecal dry matter excretion (g/kg BW) + 0.78 calcium intake (mg/kg BW). The present study aimed at testing this equation in pet food.

Materials and Methods
Digestion trials were carried out with 25 dry and 15 moist foods (≥ 5 dogs/trial, 326 observations).

Results
Even though calcium intake was clearly above the recommended intake in all experiments there were trials with negative apparent calcium digestibility. Faecal dry matter excretion and faecal calcium losses correlated significantly (r²=0.86, p<0.001). There was a highly significant correlation (r²=0.87; p<0.001, fig. 1) between the experimentally determined faecal calcium excretion and the faecal calcium excretion predicted by the equation of Kienzle et al. (2006).
Discussion and Conclusion

Faecal dry matter excretion has a considerable impact on faecal calcium losses. In conclusion calcium requirements for maintenance may vary with food intake and digestibility.

References:
National Requirement Council (NRC) 1972 and 2006

Fig. 1: Experimentally determined and predicted faecal calcium excretion
Introduction
Cognitive abilities could be impaired at different time points during the ageing process. Several methodologies have been described in the literature to evaluate cognitive performance in dogs, but sometimes are not easy to apply in clinical practice. The objective of the study was to evaluate if CBC and serum biochemistry biomarkers could be related with the cognitive performance in aging dogs.

Materials and Methods
Thirteen senior dogs (10.2±0.49y, 8-14y) from different breeds were included in the study. Memory tests were performed every 2 months (T0, T1, T2) after 3 weeks training periods. Blood samples were obtained at every test point and CBC and a complete biochemical profile including oxidative status markers were analyzed. Average scores for test failures, first time test solving and second time test solving were calculated for each dog over the three tests and a paired ANOVA test was used to compare average scores between the three time points.

Results
Data showed a decrease in first time test solving (T0-T2, p<0.0001; T1-T2, p<0.01) and an increase in failures (T0-T2, p<0.01) and second time solving (T0-T2, p<0.001; T1-T2, p<0.01). There was a high variation in performance at T0, therefore the group was divided into 2 subgroups with different level of initial performance.
A PLSDA model (R²Y=0.698, Q²=0.628, p=0.0071) was created to look at differences between these groups with respect to baseline biological variables. Poorer performing dogs had lower levels of monocytes, creatinine and SOD and GPx activities, but higher levels AAH, fructosamine and albumin.

**Discussion and Conclusion**
These blood biomarkers could be useful for future studies on cognitive performance of aged dogs.
P43. Faecal microbiota composition changes after a body weight loss diet in beagle dogs

Anna Salas Mani¹, Isabelle Jeusette¹, Inmaculada Castillo², Neus Iraculis¹, Nuria Sanchez Alzúria¹, Sonia Fernandez¹, Lluis Vilaseca Reguant¹, Celin Celina Torre¹

¹Affinity Petcare; ²UAB

Introduction
Microbiota seems to have a crucial role in chronic disease like obesity. In human medicine an altered gut microbiota have been seen in obese versus lean humans. An obesogenic or anti-obesogenic microbiota has been postulated to have an influence on weight gain and adiposity but not clear differences have been seen between lean and obese dogs so far. The objective of this trial is to evaluate the effect of a weight loss program in the faecal canine microbiota.

Materials and Methods
Six adult beagle obese dogs (BCS 7.5-8/9) were included in a body weight loss program during 17 weeks with a low energy diet (%DM: crude protein, 33.7%; starch, 20.8%; crude fiber 10.65%; ash, 8.2% and ME, 2870 kcals/kg as fed). Daily allowance was established to maintain a weight loss rate between 1-2%/week. Body composition was assessed by dual-energy X-ray absorptiometry before and after weight loss. Samples were collected from each dog at both time points. DNA was extracted and 16S rRNA was amplified and sequenced (Illumina MiSeq) in order to identify and quantify the biodiversity of the bacterial groups.

Results
Body fat was reduced from 44±2% to 24.3±1.6% and body weight was reduced in a 18% from initial. In global, faecal microbiota was different before and after 17 weeks of eating a low energy diet and weight loss (ANOSIM test, p=0.01) and Shannon index of bacterial diversity was significantly increased (p<0.05).
The Dorea ($p=0.028$), Lactobacillus ($p=0.028$) and Clostridium ($p=0.028$) genus were significantly decreased and genus Allobaculum ($p=0.046$) was increased after the weight loss program. These bacteria have been related with low adiposity in previous studies.

**Discussion and Conclusion**
Promotion of weight loss in obese dogs with a low energy diet concomitantly modify their faecal microbiota leading to an increased biodiversity with a different representation of microbial genus.
Introduction
The accuracy of different methods for estimation of the body weight (BW) of Icelandic and warmblood horses was investigated in this study.

Materials and Methods
In total, 43 Icelandic and 38 warmblood horses were included. Each horse was weighed using a portable weight scale. Three different commercial weight tapes (WT) for estimation of BW were used and the results were compared to those of three formulas: 1) BW (kg) = 6.25 x girth circumference (cm) – 625 (Staun, 1966), 2) BW (kg) = girth circumference (m)^3 x 80 (Marcenac and Aublet, 1964) and 3) BW (kg) = girth circumference (cm)^2 x Length (cm)/ 11877 (Carroll and Huntington, 1988). Bland-Altman analysis was used to compare the actual BW with the estimated BW by the WT and formulas.

Results
The three WT all overestimated the BW of the horses (mean difference between measured and actual BW: 66.0±31.6, 67.5±38.4 and 40.2±29.7 kg). The two formulas using only girth circumference improved the estimate (mean difference between measured and actual BW: 1) -30.4±34.2 kg and 2) 11.4±29.6 kg), and the most accurate estimate of BW was achieved with formula 3 (mean difference between measured and actual BW: -5±25.4 kg).
Discussion and Conclusion
Weight tapes were not accurate compared to simple formulas using only girth circumference, and the most accurate estimate was made with the formula including the length of the horse. It is of special importance that the BW can be estimated accurately when adjusting feed plans or administering medicine to horses, thus, precaution should be taken when using commercially available WT.

References

* Early career researcher
P45. The effect of age and dietary resistant starch on digestibility, fermentation end products and post prandial glucose and insulin responses in dogs

Erico de Mello Ribeiro¹, Maria A*¹, Mayara Correa Peixoto¹, Thaila Cristina Putarov¹, Mariana Monti¹, Peterson Dante Gavasso Pacheco¹, Bruna Agy Loureiro¹, Aulus Cavalieri Carciofi¹

¹São Paulo State University

Introduction
Old dogs may have reduced insulin sensitivity, which could be improved by the intake of low processed foods. The effects of low starch cooking and resistant starch (RS) consumption on digestibility, fermentation products and postprandial glucose and insulin responses were evaluated on adult and old dogs.

Materials and Methods
One formulation with corn as the cereal was extruded to obtain elevated starch cooking degree (99%) with low RS content (0.21%), or lower starch cooking (63%) with high RS (1.5%). Eight adults (4.0±0.7 yr) and eight old (11.5±0.4 yr) dogs were fed the two diets, in a cross over design. Digestibility, fermentation products on feces, and a 12 hr glucose and insulin postprandial responses were evaluated. Data was submitted to repeated measures analysis of variance (P<0.05).

Results
For protein digestibility an interaction age*diet was verified (P=0.07), with lower digestibility for old dogs fed the High-RS diet (P=0.03). Age and food affected faecal pH (P<0.01), with lower values for old dogs and High-RS food. Butyrate, propionate, and acetate faecal concentration was higher for High-RS food (P<0.01). Old dogs presented lower faecal acetate and total short-chain fatty acids than adults (P<0.01).
Higher lactate and lower ammonia was verified on the feces of old dogs fed the High-RS food ($P<0.01$). Age* diet interaction was verified for postprandial glucose, with lower area under the curve (AUC) of glucose for old dogs fed the High-RS food ($P<0.05$). For insulin, only effect of age was verified, with higher AUC of insulin for old dogs ($P=0.036$).

**Discussion and Conclusion**
Low cooking and higher RS increase faecal butyrate, regardless of age. There was additional benefits to elderly dogs by the reduction of faecal ammonia. Higher insulin secretion is required to maintain glucose homeostasis on old dogs, and a less processed diet reduces blood glucose on this age group.

* Early career researcher
P46. Guava fiber: Characterization and effects on digestibility, gut fermentation, transit time and palatability for dogs

Mariana Monti¹, Bruna Agy Loureiro², Fernanda Sanches Mendonça³, Thaila Cristina Putarov³, Raquel Silveira Pedreira⁴, Peterson Dante Gavasso Pacheco³, Cecilia Villaverde⁵, Aulus Cavalieri Carciofi⁶

¹Veterinary Medicine and Surgery Department, UNESP – São Paulo State University, Jaboticabal, SP, Brazil; ²São Paulo State University (UNESP), Department of Animal Science, College of Agraria and Veterinariam Sciences; ³UNESP- Univ Estadual Paulista, Jaboticabal, SP, Brazil; ⁴São Paulo State University (UNESP), Department of Veterinary Clinic and Surgery, College of Agraria and Veterinariam Sciences; ⁵Universitat Autonoma de Barcelona; ⁶FCAV Unesp.

Introduction
Fiber is important for some pet food formulations intended to have low energy or gut health benefits. Fruit fibers are potential ingredient options, however, they are not yet studied adequately for dogs. The present study characterized the dried guava (Psidium guajava) residue of juice extraction, and evaluated its inclusion on extruded dog foods on nutrient digestibility, faecal traits, faecal fermentation products, gastrointestinal transit time (GTT), and food palatability.

Materials and Methods
A sample of guava fiber (GF) was characterized regarding particle size (by laser diffraction), chemical composition, and physical chemical properties (thermogravimetric analysis, TGA). Four diets were formulated: control, no GF added, and GF3, GF6 and GF12 (with 3%, 6% and 12% GF inclusion, respectively). Twenty-four dogs were used, six per diet.
Digestibility was determined by total faecal collection and the GTT by radiopaque markers. Fresh feces were collected for volatile fatty acids, lactate, ammonia, and pH measurements. Diet palatability was evaluated by the two-pan test. Means were compared by polynomial contrasts ($P<0.05$).

**Results**

Guava fiber presented 213 ± 82.7µm diameter, 9.3% moisture, 1.9% ash, 3.2% crude protein, 6.8% starch, 2.3% fat, 70.3% dietary fiber (68.9% insoluble, 1.36% soluble), 36% cellulose, 17.3% hemicellulose, and 11.3% lignin. In TGA, GF was non-thermostable and produced viscosity during processing. Guava fiber inclusion did not change nutrient intake, but reduced dry matter, organic matter, crude protein and crude energy digestibilities ($P<0.01$). It induced a linear increase of faecal dry matter and production ($P<0.01$), without changing faecal score. The GF decreased linearly acetate and propionate faecal concentration ($P<0.01$), and the gastrointestinal transit time ($P=0.06$). The inclusion of GF reduced food palatability ($P<0.05$).

**Discussion and Conclusion**

Guava fiber has high amounts of insoluble non-fermentable fiber. Its inclusion, as other fiber sources, decrease nutrient digestibility but did not change faecal score at the present inclusion levels.

* Early career researcher
P47. Effects of different protein sources on fermentative parameters and nutrient digestibility of adult dogs

Maria Isabel Gonzalez Urrego¹, Mariana Monti², Laura Fantucci de Oliveira Matheus³, Danilo Ferreira de Souza⁴, Júlio Cesar de Carvalho Balieiro⁵, Marcio Antonio Brunetto⁶, Cristiana Fonseca Ferreira Pontieri⁷

¹USP; ²Veterinary Medicine and Surgery Department, UNESP – São Paulo State University, Jaboticabal, SP, Brazil / Grandfood Indústria e Comércio LTDA, Dourado, São Paulo, Brazil; ³São Paulo State University (UNESP), Department of Veterinary Clinic and Surgery, College of Agraria and Veterinariam Sciences; ⁴Grandfood Indústria e Comércio, Dourado, SP, Brazil; ⁵School of Veterinary Medicine, University of São Paulo, São Paulo/ Pirassununga, São Paulo, Brazil; ⁶University of Sao Paulo; ⁷Grandfood Indústria e Comércio Ltda.

Introduction
Benefits to colonic fermentation and flatulence could be promoted in adult health dogs by the amount and source of protein. This study checked if the combination of different protein sources in dry dog foods are capable of alters microbial fermentation and nutrients absorption.

Materials and Methods
Four diets (6.1g crude protein, 4.4g fat, 13.8g CHO as fed/1000kcal) were formulated for dog’s maintenance: V1 (poultry meal and wheat gluten); V2 (only wheat gluten); V3 (only poultry meal) and V4 (poultry meal, wheat gluten and hydrolyzed protein). Eight dogs, body weight of 11.3±0.21 kg and age of 2.7±0.74 years, arranged in 4x4 latin square design were adapted to diets for 20 days.
Afterwards, fresh feces were collected for digestibility; short chain fatty acids (evaluated by gas chromatography); faecal pH, biogenic amines (by high performance liquid chromatography (HPLC)), ammonia and faecal lactate (by Kjeldahl method). Means were compared by PROC GLM of SAS and by orthogonal contrasts, $P<0.05$.

**Results**

No animal exhibited adverse effects. No differences in body weight, faecal score and nutrient intake were found for all diets ($P>0.05$). Animals fed V2 and V1 presented a greater digestibility for dry matter ($P<0.01$), organic matter ($P<0.05$) and crude protein ($P<0.001$), being pronounced for the association between animal protein with wheat gluten. For short chain fatty acids, biogenic amines, lactate and faecal pH, no significant difference were found ($P>0.05$), tended to higher ammonia concentrations in dogs fed animal protein only, as would be expected.

**Discussion and Conclusion**

A lower protein digestibility for V4 was not expected. However, it occurs due to less starch gelatinization (77.7%) analyzed, in comparison with V1, V2 and V3 (98.5%, 87.4%, and 91.0%). The animal and wheat gluten protein sources improved protein and dry matter digestibilities. There was no effect of protein source on fermentation end products.

* Early career researcher
P48. Effectiveness of a dental chew on plaque, gingivitis and calculus formation in different dog breeds

Mariana Monti1, Danilo Ferreira de Souza2, Angela Camargo3, Paula Takeara4, Iris Mayumi Kawauchi4, Juliana Toloijeremias1, Márcio Antonio Brunetto5, Cristiana Fonseca Ferreira Pontieri6

1São Paulo State University (UNESP), Jaboticabal, SP, Brazil and Grandfood Indústria e Comércio, Dourado, SP, Brazil; 2Grandfood Indústria e Comércio LTDA, Dourado, São Paulo, Brazil; 3Veterinarian, dental and oral care specialist, Araraquara, São Paulo, Brazil; 4Grandfood Indústria e Comércio, Dourado, SP, Brazil; 5School of Veterinary Medicine and Animal Science, University of Sao Paulo, Pirassununga, SP, Brazil; 6Grandfood Indústria e Comércio Ltda.

Introduction
The use of a dental chew structured and formulated with a component to promote oral benefits by chemical and biological reactions was evaluated as an alternative method to prevent periodontal diseases. The expected results could be found on consumption, faecal score, palatability and oral health in dogs with different breeds.

Materials and Methods
An independent single-blind study was conducted with eighteen dogs (6 Beagles, 6 Yorkshires, 3 Golden and 3 Cockers), 5±1 years old, for a period lasting 8 weeks. The animals were divided into three groups of 6 dogs each: Control group, fed dry food only; Daily group, fed the same diet and, after second day meal, provided 1-dental chew; and a third group (3T), fed the same diet; 1-dental chew 3 times/week.
Dental prophylaxis were performed at T0 to equalize the animals of Control and Daily group and afterwards were evaluated the preventive effect of the dental chew according with models of calculus, plaque and gingivitis indices. The third group evaluated if the dental chew reduce preexisting calculus, plaque or gingivitis. Also were checked animal's faecal score, consumption and palatability by two-pan-test. The means were compared by T-student test considering ($P<0.05$).

**Results**
Daily provided was effective in prevent gingivitis index ($P<0.01$) and accumulation of calculus ($P<0.01$) in 10.8% and 57.8%, respectively, improving oral health. During the evaluation period no changes in plaque indices were found ($P>0.05$). In 3T group, dental chew was efficacious at reducing calculus ($P<0.01$) in 24.6% and gingivitis ($P<0.05$) in 15.4%. The dogs consumed the dental chew successfully and no alterations in faecal score were found ($P>0.05$). In palatability, the comparison of four competitors chew treats determined that dogs choose neither treat significantly ($P>0.05$).

**Discussion and Conclusion**
It can be concluded that dog’s periodontal health may be improved with the provision of the dental chew tested.

* Early career researcher
P49. Microbiota participates in the difference in digestive tolerance in dogs

Goudez R¹, Mickael Weber², Joana Nery³, Jan S Suchodolski⁴, Veronique Leray¹, Vincent Biourge², Patrick Nguyen¹

¹Oniris, National College of Veterinary Medicine, Food Science and Engineering, Nutrition and Endocrinology Unit; ²Royal Canin Research Center, Aimargues, France; ³Department of Veterinary Sciences, University of Turin, Grugliasco, Italy; ⁴The Gastrointestinal Laboratory, Department of Small Animal Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Texas A&M University, College Station, TX 77843

Introduction
Reports on food tolerance have repeatedly shown that when fed an identical diet, large dogs present with lower-quality feces than small ones. Among the reasons for that (recently reviewed¹), large breed dogs present with a highly developed caecum and colon, which could explain a prolonged colonic transit time and a higher colonic fermentative activity. In this study, we investigated whether the microbiota could have an effect.

Materials and Methods
Ten adult dogs from two breeds differing in digestive sensitivity were studied: five Miniature Schnauzers (MS; small-tolerant) and five German Shepherds (GS; large-sensitive). Two extruded isoformulated balanced diets were tested, containing 42% corn starch, either conventional (CCS; 0.2% resistant starch) or high-amylose (ACS; 29.7% RS). Feces were analyzed for fermentation products. Bacterial DNA was isolated from feces and amplicons of the 16S-rRNA were analyzed by 454-pyrosequencing.
Results
Feces quality was lower, and concentration of SCFA and lactate was higher in GS fed with ACS compared with CCS. With ACS, starch digestibility was higher in GS than MS fed.

The rarefection curves for bacterial species showed a lower diversity in MS than GS, independent of the diet. The diversity was lower when dogs were fed with ACS compared to CCS. PCoA plots based on Unifrac distances showed differences between breeds. The effect of diet was significant only in GS. At phylum level, bacterial communities were primarily composed of Firmicutes, and Actinobacteria and Bacteroidetes. With ACS, GS presented more Erysipelotrichi (*Turicibacter* and *Allobaculum*) and less Clostridia than MS.

Discussion and Conclusion
The microbiota of GS was more diversified and less stable than that of MS. *Turicibacter* and *Allobaculum* have alpha-glucosidase, and use starch and/or maltose. Resistant-starch-diet-induced microbiota changes might explain higher fermentation rate, and in turn softer feces in the larger dogs (GS) which microbiota is less stable.

1Weber, Biourge, Nguyen, JAPAN 2016, DOI.10.1111/jpn.12507
P50. Effects of immunoglobulin gamma against *Porphyromona gingivalis* on the oral health of cats fed with kibble diets

Patrícia Massae Oba¹, Fernanda Correa Devito¹, Joao Paulo Fernandes Santos¹, Rafael Nobrega Stipp², Marcia de Oliveira Sampaio Gomes¹, Aulus Cavalieri Carciofi³, Márcio Antonio Brunetto¹

¹School of Veterinary Medicine and Animal Science University of São Paulo; ²Piracicaba Dental School University of Campinas; ³FCAV Unesp

Introduction
Periodontal disease (PD) is the most common oral health condition in adult cats with an estimated prevalence of up to 65% in this species. Among the main causes, *Porphyromonas gingivalis* is a pathogen frequently detected in active periodontitis lesions. In this context, the use of immunoglobulin gamma against *Porphyromonas gingivalis* (IgY-PG) was evaluated as an alternative to conventional prevention and treatment methods.

Materials and Methods
Twenty adult mixed-breed cats aged 7.92 ± 1.98 years. The animals were divided into two groups with 10 cats each and fed two extruded diets differing only by coat. The control group received extruded diet, coated with 4g/kg of powdered egg, and the test group received extruded diet coated with 4g/kg of IgY-PG. The experiment followed a crossover design with two periods, each lasting 40 days and a wash out period of 30 days. The evaluated parameters were plaque, calculus and gingivitis index, and oral bacterial count prior to the beginning of the study and after 40 days of diet consumption. Values of $P<0.06$ were considered significant.
Results
Animals fed with the diet coated with IgY-PG presented significant plaque index reduction ($P = 0.055$). However, no difference was found for the gingivitis index ($P = 0.427$), the calculus index ($P = 0.066$) and $P. gingivalis$ did not differ between diets ($P>0.06$). The results showed improvement in the oral health of cats in this study.

Discussion and Conclusion
Calculus is the result of dental plaque mineralization produced by the oral microbiota. Plaque reduction suggests an impairment of the biofilm on tooth surface that could represent a shift on oral microbiota composition. The dietary consumption of IgY-PG improves the oral health of cats, and its long term use should be further investigated.

* Early career researcher
P51. The effect of grinding and freezer storage on amino acid concentrations in ground rabbit carcasses with and without gastrointestinal tracts

Tammy J Owens¹, Andrea J Fascetti², Jennifer Larsen²

¹Western College of Veterinary Medicine (WCVM), University of Saskatchewan; ²School of Veterinary Medicine, University of California, Davis

Introduction
The use of unconventional diets such as whole prey feeding has increased in popularity, and diets representative of the wild cat are often presumed nutritionally adequate. However, a previous study, intending to replicate the natural diet, fed whole ground raw rabbits to healthy cats, resulting in illness and death secondary to dilated cardiomyopathy from taurine deficiency. The reason for this remains unknown.

We investigated this problem with the hypothesis that freezer storage of ground rabbits results in reduction of essential amino acids, and not removing the gastrointestinal tract (GIT) would further reduce concentrations.

Materials and Methods
Fresh carcasses from 45-65 day old rabbits (n=21) were obtained from a local meat producer. Pelts and feet were removed and the entire carcass, either with (n=10) or without GIT (n=10), were ground in a Weston #22 meat grinder until consistent in appearance. Samples from each ground carcass were removed to measure amino acid concentrations using an automated analyzer, total nitrogen concentrations by AOAC 990.03 (combustion method), and moisture. The ground rabbit was then frozen in a standard domestic freezer (-18° Celsius) for 30 days and the measures repeated. One carcass was utilized to measure amino acid concentrations in individual organs and skeletal muscle samples for comparison.
Results
Statistical analysis is currently in process: initial review suggests taurine concentrations in whole ground rabbit are lower than anticipated and that differences after storage are minimal.

Discussion and Conclusion
Commercially produced rabbit may not be an adequate source of sole nutrition for the cat, highlighting difficulties associated with trying to reconstruct the natural feline diet. How this may vary from wild rabbit is an unanswered question. This may have contributed to taurine deficiency in the previously referenced study and can be used to better plan feeding trials in the future.

* Early career researcher
P52. Role of thermal energy in extrusion of dog food

Peterson Dante Gavasso Pacheco1, Putarov TC1, Júlia Guazzelli Pezzali2, Mayara Aline Baller1, Francine Mendes Peres1, Mariana Monti1, Bruna Agy Loureiro1, Sajid Alavi3, Aulus Cavalieri Carciofi1

1UNESP - Univ. Estadual Paulista - Jaboticabal, SP, Brazil; 2Universidade Federal do Rio Grande do Sul; 3Kansas State University

Introduction
Thermal energy is often the primary energy source in pet food extrusion. It is mainly implemented in the preconditioner, an equipment that has shown significant improvements in recent years. However, few studies have evaluated thermal energy effects and its ideal implementation for dog diets. The present study evaluated six levels of specific thermal energy (STE) input on processing parameters, in vitro digestibility, kibble macrostructure and starch cooking.

Materials and Methods
A diet for dog maintenance was formulated. Six levels of STE were implemented by modulation of steam and water addition, resulting in mash temperatures at preconditioner exit of 45˚C, 55˚C, 65˚C, 75˚C, 85˚C and 95˚C but with the same in-barrel moisture. The experiment was conducted in two extrusion systems (X20 – Wenger; MEX250 - Manzoni). After stabilization of the system (45 min), extrusion parameters were recorded every 10 min, with four samplings per treatment. Results were submitted to analysis of variance and compared by polynomial contrasts (P<0.05).

Results
On both extrusion systems, increase in STE promoted a linear reduction in specific mechanical energy (SME) and dough pressure, and a linear increase in extrusion temperature and total specific energy implementation (TSE; P<0.0001).
With regard to kibble macrostructure, increase in STE reduced linearly bulk and piece density, increased radial expansion, and promoted the formation of less hard kibbles ($P<0.0001$). Starch gelatinization (after preconditioner and extruder) and in vitro organic matter digestibility increased linearly ($P<0.0001$).

**Discussion and Conclusion**
Increase in STE implementation by direct steam injection promotes higher starch gelatinization in preconditioner, reduces SME required for processing, but increases the TSE implementation, starch cooking, in vitro digestibility and also influences the kibble macrostructure. Considering that steam is a less expensive energy source than electricity, and that less SME reduces equipment wear, the optimization of STE implementation is important during production of dog foods.

* Early career researcher
Introduction
Polyphenol-rich pomegranate peel (methanolic) extract (PPE) has shown the potential to be used as a gut health-promoting nutraceutical, based on an earlier study in rats. Here, the same is evaluated in dogs in an exploratory study.

Materials and Methods
Six mixed breed dogs were divided into 2 groups in a replicated-switch over design involving two periods of 30d each, and fed a control diet either alone (CON) or with PPE at 50 mg/kg BW (PPE). The dogs were fed a pressure-cooked semi-moist diet, nutritionally adequate as per AAFCO. The study protocol included bi-weekly blood collection and analyses, a digestion trial and faecal quality assessment.

Results
There was no effect of PPE on intake and digestibility of organic nutrients, but digestibility of crude fiber showed an improving trend ($P=0.070$) with dietary PPE use. Faecal ammonia was reduced ($P<0.001$) due to PPE supplementation (3.2±0.2 vs. 6.5±0.3 µmol/g) while lactate was increased (36.5±1.4 vs. 22.5±1.0 µmol/g; $P<0.001$). Faecal short chain fatty acids (SCFAs) viz. acetate, propionate and butyrate were higher ($P<0.01$) in PPE supplemented dogs accompanying a reduced ($P<0.01$) level of branched-chain fatty acids. Resultantly, total SCFA was higher in PPE than CON (695±30 vs. 547±23 µmol/g) group. Compared to CON, the PPE-supplemented dogs showed a reduction ($P<0.05$) in plasma levels of glucose, triglycerides and LDL cholesterol. The erythrocytic reduced-
glutathione (P=0.047) and catalase (P=0.011) were increased due to PPE supplementation.

**Discussion and Conclusion**
These data confirms the potential role of PPE in modulating the gut health of dogs while reiterating its antioxidant role, typical to polyphenols. There was no apparent adverse impact on the intake and nutrient utilization by the dogs. Further long-term studies are warranted to establish unequivocally the gut-health modulating role of PPE.
P54. Comparative assessment of canine-origin *Lactobacillus johnsonii* CPN23 and dairy-origin *Lactobacillus acidophilus* NCDC15 in terms of nutrient digestibility, faecal fermentative metabolites, and select health indices in dogs

Sachin Kumar¹, Ashok Kumar Pattanaik¹, Shalini Sharma¹, Reema Gupta¹, Sunil E Jadhav¹, Narayan Dutta¹

¹ICAR-Indian Veterinary Research Institute

**Introduction**

One of the important criteria for selection of a probiotic is host-species specificity, often regarded as a prerequisite for extracting the maximal benefits. It is, therefore, generally accepted that a successful canine-origin probiotic organism should ideally be derived from the canine GI tract. A canine-origin probiotic *Lactobacillus johnsonii* CPN23 developed and characterized (GenBank Accession No. KP065494) in our laboratory is tested in the present study using adult dogs.

**Materials and Methods**

Fifteen Labrador adult female dogs were distributed into three equal groups and fed on a basal diet with no probiotic (CON) or with a probiotic of either canine- (*Lactobacillus johnsonii* CPN23; cPRO) or dairy- (*Lactobacillus acidophilus* NCDC15; dPRO) origin, both at 10⁸ cfu/day, for 9-weeks. The basal diet was nutritionally adequate as per AAFCO. The experimental protocol included a digestion trial and faecal quality assessment, temporal assessment of erythrocytic antioxidants, and immune response studies at the end.

**Results**

Digestibility of fibre was improved (*P*=0.034) in cPRO. Faecal fermentative metabolites lactate and ammonia were altered (*P*<0.05) favourably indicating positive influence of probiotics use, and the effects were more pronounced with cPRO. The faecal concentrations of short-chain fatty
However, branched-chain FA levels were reduced ($P<0.05$) in cPRO in comparison to CON. The faecal clostridial population exhibited a reducing trend ($P=0.071$) in cPRO dogs. The erythrocytic lipid peroxidation and the levels of antioxidants including reduced glutathione, catalase and glutathione S-transferase remained unaltered by the probiotic use; however, the activities of superoxide dismutase and glutathione peroxidase were higher ($P<0.05$) in cPRO. There was an improvement ($P=0.053$) in the cell-mediated immune response in cPRO group compared to CON.

Discussion and Conclusion
Results indicated that the use of canine-origin probiotic may provide an edge over the dairy-origin one, when used in the feeding of dogs.
P55. Effects of increasing levels of yeast (Saccharomyces cerevisiae) on digestibility, faecal fermentation and immunological parameters in diets for adult cats

Laura Fantucci de Oliveira Matheus¹, Mariane Ceschin Ernandes¹, Joao Paulo Fernandes Santos¹, Karine de Melo Santos¹, Raquel Silveira Pedreira²*, Paula Takeara², Mariana Monti², Cristiana Fonseca Ferreira Pontieri³, Márcio Antonio Brunetto⁴

¹University of Sao Paulo; ²Grandfood Indústria e Comércio, Dourado, SP, Brazil; ³Grandfood Indústria e Comércio Ltda.; ⁴School of Veterinary Medicine and Animal Science, University of Sao Paulo, Pirassununga, SP, Brazil

Introduction
Prebiotic action of yeast may alter its composition when submitted to thermal processing. This study evaluated the effects of increasing levels of inactive and enriched yeast in culture medium on the apparent digestibility of nutrients, faecal fermentation products and immunological parameters in healthy adult cats.

Materials and Methods
Twenty seven adult cats, average weight of 4.19 ± 0.83kg, distributed in a completed randomized block design (age), consisting of three experimental treatments, CO (control diet), LSC 0.3 (control diet with 0.3% yeast with active metabolites) and LSC 0.6 (control diet with 0.6% yeast with active metabolites). The trial phases were: adaptation to diets (1st to 10th day); feces collection (10th to 20th day) for digestibility; collection of fresh feces (21st to 25th day) to determine the faecal pH and fermentation products (biogenic amines, ammonia, lactic acid, short chain fatty acids and branched chain fatty acids); blood collection (26th day) for evaluation of immunological parameters. P values <0.05 were considered significant.
Results
Higher digestibility was observed for fiber ($P=0.0126$) and ash ($P<0.0001$) in LSC groups compared to the CO. The LSC 0.3 treatment showed higher digestibility than CO and lower than LSC 0.6. Regarding the fermentation products in the stool, lactic acid ($P=0.0040$) showed higher concentrations in the feces of the groups receiving LSC compared to CO, isovaleric fatty acid ($P=0.0144$) differed only in LSC 0.3 No significative differences in the faecal concentration of cadaverine, spermidine, histamine, putrescine, tyramine and total biogenic amines ($P>0.05$) were found. Immunological parameters were not significant for CD4+ and CD8+, CD4+/CD8+ ratio, basal oxidative burst and phagocytosis index ($P>0.05$).

Discussion and Conclusion
Yeast addition in the evaluated levels presented low prebiotic potential on the parameters tested.

* Early career researcher
P56. Nutritional analysis of recipes of home-prepared diets for dogs and cats published in Portuguese

Vivian Pedrinelli1, Marcia de Oliveira Sampaio Gomes2, Aulus Cavalieri Carciofi2

1FMVZ/USP; 2FAV Unesp

Introduction
Recently a trend to use home-prepared diets emerged in Brazil. This present study evaluated, using computer software, home-prepared diets for dogs and cats published in Portuguese in different media, such as books, websites and articles, with the intention of analyzing the nutritional adequacy of home-prepared diet recipes available in Brazil.

Materials and Methods
A total of 106 diets were evaluated, 80 intended for dogs, 24 for cats and 2 for both dogs and cats. A commercial software (Optimal 2000) was used to analyze the diets. An ingredient chemical composition database was built based on the Brazilian Table of Food Composition (TACO), and when not available, United States Department of Agriculture (USDA) Nutrient Database was used. The estimated chemical composition of each recipe was compared with the recommendations of the Fédération Européenne de L’industrie des Aliments pour Animaux Familiers (FEDIAF, 2014) guidelines (as unit/1000 kcal). Only 35 of the 45 nutrients recommended by the FEDIAF were evaluated, because 10 of the nutrients were not available in all the ingredients chemical compositions included in the database.

Results
Most recipes had no precise determination of ingredients and quantities. None of the diets were complete. All diets had at least one nutrient below the FEDIAF recommendations, and none of the nutrients analyzed were above the recommendations in all of the diets.
Among the nutrient deficiencies, the most frequent were: iron (59% of dog diets; 100% of cat diets); vitamin E (82% for dogs; 92% for cats); zinc (74% for dogs; 88% for cats); magnesium (98% for dogs; 42% for cats); calcium (68% for dogs; 73% for cats); copper (81% for dogs; 73% for cats); choline (85.4% for dogs; 53.8% for cats).

Discussion and Conclusion
These recipes expose the animals to several nutritional deficiencies, and it is important to clarify the owners of the risks involved in providing home-prepared diets for their pets. A better training of the professionals that intend to prescribe home-prepared diets is advisable.

* Early career researcher
P57. Aging cats require lower energy intake to maintain the rate of weight loss

Juliana Toloj Jeremias¹, Paula Takeara¹, Raquel Valim Labres², Iris Mayumi Kawauchi¹, Danilo Ferreira de Souza¹, Marcio Antonio Brunetto³, Cristiana Fonseca Ferreira Pontieri¹

¹Grandfood Indústria e Comércio Ltda, Dourado, São Paulo, Brazil; ²Alimentar Vet, Canoas, Rio Grande do Sul, Brazil; ³School of Veterinary Medicine and Animal Science, University of São Paulo, São Paulo/ Pirassununga, São Paulo, Brazil

Introduction
Conventional treatment of obesity aims to minimize the loss of lean body mass during weight loss (WL) and to facilitate body weight maintenance. This study aimed to evaluate body composition during WL process in aging cats.

Materials and Methods
Ten aging naturally obese cats (5 males and 5 females), median age 12 years (9-13), body condition scores (BCS) of 8 (in a 9 point scale), body fat 39.7% (27.2 - 48.0) were studied. Cats were fed a high-protein (133 g/1000 kcal), low fat (31.6/1000 kcal) and low-starch diet (50.6 g/1000 kcal), (ME, 3.16 kcal/g as fed). Body weight was registered weekly and energy intake (ME/kg body weight⁰.⁴) adjustments were made to keep WL rate around 1% per week. Body composition was determined before and after WL by deuterium oxide dilution method. Data were analyzed by Student t-test.

Results
WL median was 21.6% (17.0-23.8), and median WL rate was 0.90% (0.63-1.43) per week. The median energy intake that induced weight loss was 70 kcal/kg body weight⁰.⁴/d (59.5-90.2). Body fat decreased from 39.7% (27.2-48.0) to 32.3% (15.6-41.9) (P<0.001). The lean body mass reduced
from 3.18 kg (2.47-4.13) to 2.81 kg (1.96-3.96) ($P<0.001$). On average, cats consumed 3.66g protein/kg BW/d.

**Discussion and Conclusion**
Previous studies have shown that aging cats need 5g protein/kg BW/d to maintain lean body mass. In this study, the amount of energy necessary to achieve the desire rate of WL was too low and corresponded only to 31.5% of the maintenance energy requirement. As a result, the daily protein intake was lower than recommended and the cats lost lean body mass. In conclusion, energy restriction to achieve a weekly rate of loss equivalent to 1% of body weight is not appropriate for aging cats under a 133g protein/1000 kcal diet. A higher protein level is recommended for WL protocol in aging cats.
P58. Body condition score, muscle condition score and amino acid metabolism in dogs with chronic kidney disease fed with renal diet

Mariana Yukari Hayasaki Porsani¹, Dóris Pereira Halfen¹, Douglas Segalla Caragelasco¹, Márcia Mery Kogika¹, Juliana Toloi Jeremias², Cristiana Fonseca Ferreira Pontieri³, Márcio Antonio Brunetto⁴

¹Universidade de São Paulo; ²Grandfood Indústria e Comércio, Dourado, São Paulo, Brazil; ³Grandfood Indústria e Comércio Ltda.; ⁴School of Veterinary Medicine and Animal Science, University of Sao Paulo, Pirassununga, SP, Brazil

Introduction
This study aim were to evaluate the body condition score (BCS), muscle condition score (MCS), serum (AAs) and urinary (AAu) concentration of amino acids in dogs with chronic kidney disease (CKD) under renal diet during a follow-up period.

Materials and Methods
Ten CKD dogs in IRIS staging 3 (n=8) or 4 (n=2) were follow-up for 6 months, and fed with a commercial renal diet (8.36g protein/1000 kJ; 10.56g fat/1000 kJ; 0.52g calcium/1000 kJ and 0.017g of phosphorus/1000 kJ). BCS was measured a 9-point scale and the MCS score employing a 4-point scale. AAs and AAu were measured in the beginning (T0) and after 6 months (T6). For the evaluation of acid-base balance were measured the blood pH and the bicarbonate concentration every month. For all variables were considered significant values of $P<0.05$ and a trend towards significance values of $P>0.05$ and $≤0.10$. 
Results
There were no changes in BCS (5.70/5.30 respectively; \( P = 0.3750 \)) and
MCS (2.20/2.40; \( P = 0.6250 \)) between T0 and T6. The blood pH (7.33/7.34;
\( P = 0.7049 \)) and bicarbonate concentrations (21.3/19.6m Eq/L; \( P = 0.0729 \))
remained without significant changes. Serum phenylalanine (76.64/66.23
\( \mu \text{mol/L}; P = 0.0273 \)), tryptophan (199.59/150.65 \( \mu \text{mol/L}; P = 0.0253 \)) and
ornithine (17.72/15.15 \( \mu \text{mol/L}; P = 0.0443 \)) showed a significant decrease
in T6. Serum Citrulline (95.47/117.23 \( \mu \text{mol/L}; P = 0.0577 \)) shows strong
tendency to significance. AAu remained unchanged during the 6-month
evaluation as well as serum and urine branched chain amino acids leucine,
valine and isoleucine (87.65/86.22 \( \mu \text{mol/L}; P = 0.9113 \); 113.68/122.68
\( \mu \text{mol/L}, P = 0.5277 \); 44.11/45.83 \( \mu \text{mol/L}, P = 0.7475 \); respectively and
AAu 11.83/21.09 \( \mu \text{mol/L}, P = 0.6470 \); 15.93/19.79 \( \mu \text{mol/L}, P = 0.9412 \);
23.17/31.99 \( \mu \text{mol/L}, P = 0.0975 \), respectively).

Discussion and Conclusion
A poor prognosis in dogs with CKD have been associated with the loss of
MCS, BCS and disorders in acid-base balance. Feeding dogs with a high
quality protein sources in reduced levels and the control the acid base
balance could minimize the risk disability of essential amino acids and
muscle loss.

* Early career researcher
P59. A new model for evaluating energy requirements in dogs: allometric equation from 319 independent dogs

Guilhem Divol¹, Nathalie Priymenko²

¹ENVT; ²TOXALIM, Université de Toulouse, INRA, ENVT

Introduction
Reports concerning maintenance energy requirements (MER) of dogs are common but most of the data deal with laboratory or utility dogs, with an average headcount of less than 25 subjects per study. This study aimed to clarify energetic requirements of adult healthy pet dogs using a wide sample of 319 subjects.

Materials and Methods
Every student from Ecole Nationale Vétérinaire de Toulouse, France, had to collect on an adult dog (≥1 year, healthy, at ideal body condition and weight, owned and fed the same way for two months) from his entourage an accurate detailed description of the pet and its feeding habits, with recording of all ingested food. The metabolizable energy content of food was calculated with NRC1974 for homemade food and NRC1985 factors for complete industrial food, respectively. Multiple regression analysis was used to examine the independent effects of age (year) and weight on the energy requirements (kcal). Effect of ownership, breed, gender, sex, neutering status, bedding location, temperament, diet were assessed with Kruskal-Wallis H tests then Wilcoxon signed rank for all factors with more than two distinct levels using R Core Team software (version 3.2.2).
Results
A total of n=319 dogs of 4.911±3.488 years old and of 23.18±13.55 kg body weight were used. The following model was built for describing MER:

\[ \text{MER} = 132.3 \times \text{BW}^{0.7298} \times \text{Age}^{-0.04968} \quad (r^2 = 0.8161) \]

Surprisingly, there was no effect of the gender and only neutered females was lower than the entire female MER \((p<0.01)\), which justifies a correcting factor of 0.85 for neutered females.

Discussion and Conclusion
Here, the exponent of weight in the considered sample was slightly different of the widely admitted 0.75 Kleiber’s one. MER is function of weight, but also of age in dogs showing a slight decrease with time.

* Early career researcher
P60. Macronutrient intake of dogs, self-selecting diets varying in composition and containing excessive energy

Mark Thomas Roberts1*, Nick J Cave2, Emma Bermingham1, Wayne Young1, Catherine M Lloyd-West3, David G Thomas2

1Food Nutrition & Health Team, Food & Bio-based Products, AgResearch Grasslands, Palmerston North, New Zealand; 2Institute of Veterinary Animal Biomedical Sciences, Massey University, Palmerston North, New Zealand; 3Bioinformatics & Statistics Team, AgResearch Grasslands, Palmerston North, New Zealand

Introduction
Understanding dietary selection is complex and affected by many factors including length of study, macronutrient range and amount of food offered. Only one study has looked at dietary protein:fat:carbohydrate (PFC) regulation in the dog, indicating a preferred ratio of 30:63:7% metabolisable energy (Hewson-Hughes et al., 2012; Behavioural Ecol, 24, 293). The aim of our current work was to further scrutinise macronutrient intake regulation, by providing a greater dietary range, energy content, and longer duration.

Materials and Methods
15 adult dogs were given access to three wet diets, twice daily over 10 days. Each dog was provided with 500% metabolisable energy requirement for each diet, per day. The diets were nutritionally complete for adult maintenance, and formulated to P:F:C ratios of 13:86:1, 18:28:54 and 58:41:1 % metabolisable energy. Statistical analyses were conducted, using random coefficients regression modelling of macronutrient responses for each dog against measurement days.
Results
Protein increased from 29% total energy day 1, to 45% day 10 ($p<0.01$), whilst fat intake reduced from 68% day 1, to 50% day 10 ($p<0.001$). No significant difference in carbohydrate intake was observed over the study (mean 3%). When protein/fat ratio was determined, a significant increase was observed from 0.45 day 1 to 0.90 day 10 ($p<0.001$). Energy consumption decreased from a mean of 387% day 1, to 145% day 10, ($p<0.001$).

Discussion and Conclusion
Our findings suggest that dogs still possess a "feast or famine" mentality wherein, energy dense fat is prioritised over protein initially. Thereafter a transition is evident, with a shift to a more balanced energy contribution from both macronutrients. The study also shows that when given the option, dogs will not select carbohydrate to be a significant portion of the diet. The health implications of such dietary selection are of interest.

* Early career researcher

Kirk Breuninger¹, Nathaniel Spofford¹, Mingyin Yang¹, Emi Kate Saito¹, Silke Kleinhenz¹

¹Banfield Pet Hospital, Vancouver WA

Introduction
Banfield Pet Hospital is the largest network of primary care veterinary clinics in the world, with over 925 hospitals operating in 42 states, the District of Columbia, and Puerto Rico. Medical information for pets seen at Banfield hospitals is recorded electronically and uploaded and integrated nightly to an enterprise data warehouse at the company’s home office in the Pacific Northwest. Banfield’s annual State of Pet Health (SOPH) report presents population-based health data from the nearly 3 million dogs and cats seen at Banfield hospitals each year. The 2016 report provides disease prevalence estimates for some of the most common and medically important conditions affecting dogs and cats in the United States: diabetes mellitus, dental disease, heartworm disease, fleas and ticks, gastrointestinal parasites and otitis externa.

Materials and Methods
Demographic and diagnostic information related to the selected diseases were extracted from the database for all canine and feline patients seen at a Banfield hospital from January 1 through December 31, 2015. National and state prevalence estimates and age-adjusted 10-year trends (2006 through 2015) were calculated for the selected diseases.

Results
Findings of interest over the 10 year period include decreases in the estimated prevalence of heartworm disease and intestinal parasites and increases in canine diabetes mellitus among some breeds. Sizable increases were noted in the prevalence of feline stomatitis (+68.8%) and feline tooth resorption (+1586.7%).
Discussion and Conclusion
The pet health trends observed since 2006 may be of particular interest to the veterinary industry, as they provide insights into areas of progress and opportunity in continuing efforts to improve pet care. Possible causes for the increased prevalence of feline stomatitis and feline tooth resorption will be presented.
P62. Assessment of canine and feline body composition by veterinary healthcare teams in Ontario, Canada

Amanda Santarossa H1, Parr JM1, Adronie Verbrugghe1

1Department of Clinical Studies, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

Introduction
Research in the United Kingdom found that veterinarians rarely assess body composition in dogs, despite the simplicity of body condition scoring (BCS) and body weight (BW) measurements. Both World Small Animal Veterinary Association (WSAVA) and American Animal Hospital Association (AAHA) nutritional assessment guidelines recommend using BCS, BW and muscle condition scoring (MCS) for every patient, at every examination. The objective of this study was to determine how, and how often, Ontario veterinary healthcare teams (VHTs) assess body composition in companion animals.

Materials and Methods
An online survey was distributed to Ontario VHTs via email, social media and veterinary association websites. Survey questions included: how often body composition is assessed; methods used; determining ideal BW for weight management plans; and demographic data. Descriptive statistics were used for analysis.

Results
Data was collected from 180 survey responses completed by Ontario VHTs. Only 66.7% of respondents noted they always assess body composition, with the remaining 33.3% selecting often, sometimes, rarely or never. BCS (99.4%) and BW (99.4%) are used most often, with MCS (33.9%) used less frequently. Respondents noted BCS (62.9%), BW (22.8%), and MCS (21.0%) to be the most accurate methods. However, respondents (94.4%) would use an alternative, more accurate method, if available. For weight management, 89.9% and 64.4% of respondents...
determine ideal BW for patients on a weight loss or weight gain plan, respectively, using a variety of methods.

**Discussion and Conclusion**

WSAVA and AAHA recommend that body composition is assessed in every examination; however, only 66.7% of respondents always assess body composition. Although BCS, MCS, and BW are easy and practical to use, practitioners would prefer a more accurate method. Until such method is available, practitioners should implement the WSAVA and AAHA nutritional guidelines in their practice to evaluate nutritional status, assess body composition and determine ideal BW.

* Early career researcher
P63. Effects of increasing levels of yeast (*Saccharomyces cerevisiae*) in diet of adult dogs on digestive and faecal fermentation parameters

Karine de Melo Santos¹, Maria Isabel Urrego¹, Laura Fantucci de Oliveira Matheus¹, Manuel Agustin Silva¹, Paula Takeara², Mariana Monti², Cristiana Fonseca Ferreira Pontieri³, Márcio Antonio Brunetto⁴

¹University of Sao Paulo; ²Grandfood Indústria e Comércio, Dourado, SP, Brazil; ³Grandfood Indústria e Comércio Ltda.; ⁴School of Veterinary Medicine and Animal Science, University of Sao Paulo, Pirassununga, SP, Brazil

Introduction
The co-products of *Saccharomyces cerevisiae* yeast are considered important raw materials in animal nutrition as they have potential action on intestinal health. This study evaluated the effects of increasing levels of inactive and enriched yeast in culture medium, on the apparent digestibility of nutrients, faecal fermentation products in healthy adult dogs.

Materials and Methods
Eighteen healthy adult dogs, with average weight of 15.8 ± 7.37 kg, distributed in an completed randomized block design (weight), consisting of three experimental treatments, CO (control diet), YAM 0.3 (control diet supplemented 0.3% yeast with active metabolites) and YAM 0.6 (control diet supplemented 0.6% yeast with active metabolites). The assay periods were divided into: adaptation to diets (1st to 14th day); feces collection (15th to 21th day) for digestibility; collection of fresh feces (22nd to 24th day) to determine fermentation products (biogenic amines, ammonia, lactic acid). *P* values <0.05 were considered significant and compared by Tukey test.
Results
The inclusion of yeast did not affect the apparent digestibility of dry matter, mineral matter, and ether extract in acid hydrolysis ($P>0.05$). The control group presented lower digestibility for fiber compared to the yeast treatment ($P<0.05$). The digestibility of nitrogen free extract in control group were greater than YAM 0.60 ($P<0.05$). The protein digestibility of YAM 0.3 group was lower than control group ($P<0.05$). Regarding fermentation products, lactic acid and ammonia were not affected by prebiotic ($P>0.05$). No significative differences in the faecal concentration of cadaverine, spermidine, histamine, putrescine, tyramine and total biogenic amines ($P>0.05$) were found.

Discussion and Conclusion
According to this study, the additive level was not sufficiently to detect prebiotic effects on digestibility of nutrients and faecal fermentation products.

* Early career researcher
Introduction
Canine cognitive dysfunction (CCD) is an age-dependent neurodegenerative condition characterized by decline in learning and memory. The neurodegenerative features of CCD in aging dogs and cats are similar to human aging Alzheimer’s disease (AD). Discovering neuroprotective disease modifying therapies against CCD and AD is a major challenge. Strong evidence supports the role of the amyloid beta peptide deposition and oxidative stress (OS) in the pathophysiology of CCD and AD. Oxidative damage can lead to neuronal dysfunction in the brain due to modifications to proteins, lipids and DNA/RNA. In both human and canine brain, oxidative damage progressively increases with age. Dietary antioxidants from natural sources hold a great promise in halting the progression of CCD and AD.

Materials and Methods
Ayurvedic system of medicine of India has been using various plant species since 4000 years for treating central nervous system disorders. Some medicinal plants such as Bacopa monniera (BM), Withania somnifera (WS) and Emblica officinalis (EO) have a long history of use in brain therapy but there is a dearth of studies on their neuroprotective effects. The objective of this study was to investigate whether BM, WS and EO extracts can protect against amyloid beta peptide and hydrogen peroxide-induced toxicity.

Results
We demonstrate that a treatment with BM, WS and EO extracts significantly protected the human neuroblastoma cell line SK-N-SH against amyloid beta peptide and hydrogen peroxide in various cell
survival assays. Furthermore, a treatment with BM, WS and EO extracts significantly reduced the generation of reactive oxygen species (ROS) in SK-N-SH cells. Finally, our results show that BM, WS and EO extracts are also potent activators of Nrf2, a master regulator of cellular antioxidant response.

Discussion and Conclusion
Thus, our findings indicate that plant extracts may act as an antioxidant and may have beneficial effects in the CCD and AD therapy.

* Early career researcher
P65. Previously undescribed vitamin D Epimer found in cats using HPLC method

Megan Chere Sprinkle*, Robert L Backus1

1Veterinary Health Center, University of Missouri, Columbia, MO, USA.

Introduction
While analyzing vitamin D concentrations in feline serum using a validated High Performance Liquid Chromatography (HPLC) protocol, we discovered an unexpected peak, later identified as a C-3 epimer of 25-hydroxycholecalciferol (3-epi-25(OH)D3). To our knowledge, this epimer has not been previously described in cats.

Materials and Methods
Solid-phase extracts of serum (1 mL) from eight, lean (4.3-7.0 kg), adult (5-10 years old), neutered male domestic short-hair cats maintained on an extruded commercial dry diet was analyzed for 25(OH)D3, 25(OH)D2 and 3-epi-25(OH)D3 using reverse- and normal-phase HPLC methods. Peaks co-eluting at retention times of 3-epi-25(OH)D3 standard had characteristic vitamin D “triene” UV spectral profiles. For species comparison, serum was collected from eight university-owned dogs and banked serum was utilized from three rats for analysis of the epimer using the identical protocol.

Results
Amplitudes of the 3-epi-25(OH)D3 peaks relative to the native 25(OH)D3 were substantial in the cats and the rats. Epimer concentrations in the cats and rats ranged from 18ng/mL to 30 ng/mL representing 29% to 76% of native 25(OH)D3 (34ng/mL to 61ng/mL). However, 3-epi-25(OH)D3 was not observed in any of the canine samples where our limit of detection was 5 ng/mL.
Discussion and Conclusion
These data indicate that the C-3 epimerization pathway is quantitatively significant for vitamin D metabolism in domestic cats, but actual epimer concentrations vary among individuals. The HPLC protocol was validated by analyzing the serum of rats, a species for which the epimer has been previously described and is being investigated for unique functionality. Lack of identification of the epimer in dogs suggests a species difference in vitamin D metabolism that may require consideration when providing vitamin D supplementation.

* Early career researcher

Kelly Swanson¹, Ping Deng¹, Leslie Hancock²

¹University of Illinois; ²Big Heart Pet Brands

Introduction
A wide variety of animal protein-based ingredients are commonly used in pet food products. The raw ingredients and processing procedures used may greatly affect protein quality and digestibility. Testing the quality of alternative protein sources is necessary and contributes to the sustainability of pet foods. The objective of this study was to determine the chemical composition and protein quality of novel animal-based protein sources intended for use in dog and cat foods.

Materials and Methods
Eight animal protein-based ingredients, including pork peptone, calamari meal, chicken meal, alligator meal, lamb meal, venison meal and two different duck meals were evaluated in this study. The ingredients were analyzed for dry matter (DM), organic matter (OM), crude protein (CP), acid-hydrolyzed fat, amino acids (AA), and gross energy (GE) using standard methods.

Results
All ingredients had high DM content (93.6% to 97.7%). Calamari meal and pork peptone had lower ash (4.4% and 3.6% of DM, respectively), but greater CP (88.1% and 80.5% of DM, respectively) and GE (5.55 and 5.32 kcal/g of DM, respectively) compared to alligator, lamb, venison, chicken, and duck meals (11.8 to 24.5% ash; 58.7 to 65.9% CP; 4.6 to 5.2 kcal GE/g). Acid-hydrolyzed fat was lower in calamari meal (8.7% of DM) compared to the other proteins tested (15.5 to 15.9% of DM). Total and essential AA were highest in calamari meal (74.7%; 35.8%) and pork peptone (73.0%; 32.4%), lowest in duck meal #1 (49.8%; 21.1%) and
venison meal (49.9%; 22.3%), with others being intermediate (52.7% to 61.8% total AA; 21.3% to 27.0% essential AA).

Discussion and Conclusion
This study demonstrates the considerable variability that exists in the chemical composition among protein sources, justifying further in vivo testing of novel protein sources intended for dog and cat foods.
P67. Effects of pea and barley versus corn lesser processed on glycemic control of diabetic dogs

Teixeira F*1, Daniela Pedrosa Machado1, Juliana Toloì Jeremias2, Cristiana Fonseca Ferreira Pontieri2, Mariana Ramos Queiroz1, Márcio Antonio Brunetto1

1School of Veterinary Medicine and Animal Science, University of São Paulo, São Paulo/Pirassununga, São Paulo, Brazil; 2Grandfood Industria e Comercio LTDA, Dourado, São Paulo, Brazil

Introduction
Source and starch processing interfere on dogs’ glycemia. Few researches evaluated these aspects in diabetic dogs. In this study we aimed to compare the effects of corn-based diets lesser processed and pea and barley-based diet on glycemic control of diabetic dogs.

Materials and Methods
Ten adult naturally diabetic dogs receive three diets: Ba (mix of rice, pea and barley) PB (pea and barley) and LPC (less processed corn) that contain (/1000 kJ) respectively 29.2, 23.2 and 21.4g of protein; 14.1, 12.3 and 13.2g of starch; 6.7, 9.8 and 9.6g of fat; 14.5, 12.9 and 11.9g of total dietary fiber. LPC was ground by lesser screens of hammer mill and extruded by greater flow die output area, to generate lower gelatinization index of starch (94.9, 95.6 and 85.1%, respectively). Glucose curve was performed by a continuous glucose measurement system for 48 hours, after 60 days of each diet treatment. Dogs received the same insulin dosage in all study period. Statistical tests were performed and p<0.05 was considered significant.

Results
Table 01 shows the mean values of glycemic variables with standard deviation.
Discussion and Conclusion
The PB diet resulted in some better glycemic parameters when compared to LPC. Starch cooked to 85% was not enough less processed to minimize postprandial glycemic response.

* Early career researcher

<table>
<thead>
<tr>
<th>Glycemic variables</th>
<th>Ba</th>
<th>PB</th>
<th>LPC</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting glycemia (mg/dL)</td>
<td>162.8 ± 75.1</td>
<td>165.5 ± 86.9</td>
<td>229.7 ± 81.1</td>
<td>0.07</td>
</tr>
<tr>
<td>Mean glycemia (mg/dL)</td>
<td>202.8 ± 61.7</td>
<td>176.4 ± 82.7</td>
<td>210.7 ± 53.6</td>
<td>0.27</td>
</tr>
<tr>
<td>Minimum glycemia (mg/dL)</td>
<td>100.1 ± 57.6</td>
<td>86.2 ± 55.4</td>
<td>94.1 ± 58.0</td>
<td>0.76</td>
</tr>
<tr>
<td>Maximum glycemia (mg/dL)</td>
<td>321.1 ± 56.7(^{ab})</td>
<td>273.9 ± 108.9(^a)</td>
<td>335.8 ± 52.4(^b)</td>
<td>0.02</td>
</tr>
<tr>
<td>Difference between minimum and maximum glycemia (mg/dL)</td>
<td>221.0 ± 54.6</td>
<td>187.7 ± 91.6</td>
<td>241.7 ± 83.0</td>
<td>0.09</td>
</tr>
<tr>
<td>Time in hypoglycemia (%)</td>
<td>5.0(^a)</td>
<td>26.8(^b)</td>
<td>6.2(^c)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Time in hyperglycemia (%)</td>
<td>11.9(^a)</td>
<td>9.7(^b)</td>
<td>10.9(^ab)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Area under curve</td>
<td>584095.0</td>
<td>508198.4</td>
<td>606811.0</td>
<td>0.27</td>
</tr>
<tr>
<td>Area under the increment glycemic curve first day</td>
<td>56224.0(^a)</td>
<td>24986.4(^b)</td>
<td>-22059.2(^a)</td>
<td>0.01</td>
</tr>
<tr>
<td>Area under the increment glycemic curve second day</td>
<td>59037.5(^a)</td>
<td>19229.2(^b)</td>
<td>-32494.8(^b)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Frutosamine (mol/L)</td>
<td>587.1 ± 74.0</td>
<td>549.6 ± 118.8</td>
<td>629.9 ± 136.0</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Legend: Ba = mix of rice, pea and barley; PB = pea and barley; LPC = less processed corn.

\(^{a,b,c}\): Means in the row not sharing a common letter differs \((P<0.05)\)
P68. Study of nasoesophageal tube feeding position in dogs and cats in enteral nutrition support

Teixeira F1, Brana Sanctos Alô Bonder1, Mariana Ramos Queiroz1, Mariana Tiai Kihara2, Aulus Cavalieri Carciofi2

1School of Veterinary Medicine and Animal Science, University of São Paulo, São Paulo, Brazil; 2School of Agricultural and Veterinarian Sciences - São Paulo State University, Jaboticabal, Brazil

Introduction
The nasoesophageal tube feeding is practical and there is no need for anesthesia, but there is risk of severe misplacement. The purposes of the study were: to list the most frequent inappropriate tube placements observed by X-ray in dogs and cats; to assess the association between inadequate positioning and patient characteristics; and to compare results between species.

Materials and Methods
It was a retrospective survey of dogs and cats that used nasoesophageal tube feeding positioned by experienced veterinary nutritionist. We conducted a descriptive analysis of tube positioning observed in X-ray; $\chi^2$ analysis to verify association between placement and characteristics (species, age, sex, body condition score, size (for dogs), diagnosis or affected body system) ($p<0.05$); and correlation analysis to specify which character was more associated with a particular position.

Results
It was included 261 dogs and 32 cats. 71.9% of cats presented the tube between the 6th and 9th intercostal space (ICS), 12.5% before the 6th, 15.6% after 9th and 0% coiled tube or in the trachea. In dogs, respectively: 49.4%; 31.0%; 12.3%; 4.9% and 2.3%. There was significant association between tube placement and size of dogs which greater correspondence positioning “in the trachea” in small animals, “correct” in mini and large,
Discussion and Conclusion
Positioning error: nasoesophageal tube before 6th ICS e after 9th ICS in cats and dogs, "wrapped" and "in the trachea" only in dogs. "In trachea" of dogs are similar to that seen in humans (Ghahremani; Gould, 1986). These data suggest that dogs have greater risk than cats for misplaced nasoesophageal tube feeding and that the radiography after tube placement was important to prevent serious conditions when the tube position predisposes aspiration.

* Early career researcher
P69. Effect of fish oil and alpha tocopherol on sperm lipid peroxidation in dogs

Analia Risso*, Mónica Marmunti¹, Mariana Gavazza¹, Alejandro Palacios², Francisco Pellegrino², Alejandro Relling²

¹Facultad de Ciencias Veterinarias UNLP, ²None

Introduction
Mammalian sperm contains a high proportion of polyunsaturated fatty acids (PUFA) sensitive to lipid peroxidation (LP). The objective of this study was to evaluate the effects of dietary fish oil and vitamin E (VE) supplementation on sperm sensitivity to LP in dogs.

Materials and Methods
Using an incomplete replicate 3x3 Latin square design, five male dogs were randomly allocated into three groups and fed a control diet (C), C supplemented with 54 mg fish oil/Kg metabolic body weight per day (FO), and FO plus 400 mg VE per day (FOE) for 60 days. Semen samples were collected on days 0 and 60. Lipid peroxidation was initiated by adding ascorbate–Fe++ to semen samples and evaluated using chemiluminescence (CL) (counts per minute/mg of protein). Fatty acid profile was determined by gas chromatography. Data were analyzed using a mixed model with repeated measures (SAS 9.0).

Results
When the control and ascorbate–Fe++ dependent samples were compared, a significant increase in the light emission (CL) was observed. On day 0, total CL increased in all groups from 429.4±40.10 cpm in control samples to 990.5±87.19 cpm in the peroxidised samples (with ascorbate–Fe++) (p<0.05). On day 60, such increase was from 380.05±35.10 to 900±54.76 (p<0.05) in C, from 436±21.00 to 536±35.00 (p=0.09) in FO, and from 303.5±30 to 532±31.00 (p=0.08) in FOE. The total concentration of omega 3 was higher in FO and FOE compared with C (p<0.05).
Discussion and Conclusion
In this study, supplementation with fish oil alone or together with VE did not increase LP in dog sperm. These results could indicate a protective effect of omega 3 on sperm. However, more studies are needed to investigate the effects of fish oil with standardized diets on dogs and types of LP products produced.

* Early career researcher
Physiological effects of stress related to helicopter travel in FEMA search and rescue canines

Erin Beth Venable¹, Natalie Beth Gulson Venable¹, Tzu-Wen Liu², Kelly Swanson²

¹Southern Illinois University; ²University of Illinois

Introduction
Working canines are deployed by FEMA as part of a National Disaster Response plan. The stress associated with helicopter flight and the resulting physical concerns are unknown. Our objective was to test the hypotheses that 1) helicopter travel affects the physiology and faecal microbiota of working canines, but that 2) physiological consequences of helicopter travel will not negatively impact their work performance.

Materials and Methods
Nine FEMA certified canines in Miami FL were loaded onto helicopters and flown for 30 minutes in May, 2015. Core body temperature, visible signs of stress, and saliva swabs (for cortisol) were collected at baseline, loading, mid-flight and post-flight. After flight, canines completed a standardized search exercise to monitor work performance. Faecal samples were scored and collected prior to and 3 days following flight for microbial DNA extraction and Illumina sequencing. Canines were fed Canidae® Grain Free PURE Land for three weeks before and during the entire study.

Results
Visible indicators of stress, as defined by Beerda et al. (1997) were observed at loading and at mid-flight and corresponded with an increase in salivary cortisol from 0.54 ug/dL (baseline) to 0.64 ug/dL (loading), \( P<0.05 \). Additionally, rectal temperature increased from 101.5° F (baseline) to 102.8° F (mid-flight) and 103.5° F (post-flight) \( P<0.05 \).
Travel stress did not affect search performance ($P>0.05$). Alpha and beta diversity measures of faecal microbiota were not affected ($P>0.05$).

**Discussion and Conclusion**
Our data suggest that although helicopter travel is stressful for working canines, it does not impact their search performance or the stability of faecal microbiota.
P71. Carbohydrate metabolism in Golden Retriever dogs affected by progressive muscular dystrophy

Thiago Henrique Annibale Vendramini*, Andressa Rodrigues Amaral¹, Marina Pandolphi Brólio¹, Joao Paulo Fernandes Santos¹, Márcio Antonio Brunetto¹, Carlos Eduardo Ambrosio¹

¹School of Veterinary Medicine and Animal Science, University of São Paulo, São Paulo/Pirassununga, São Paulo, Brazil

Introduction
Skeletal muscle is responsible for approximately 40% of total body mass and plays a major role in energy balance stimulating the uptake, disposal, and storage of glucose. This study aimed to evaluate and compare the plasma glucose, serum insulin and fructosamine concentrations and insulin resistance in animals with severe muscle atrophy caused by golden retriever muscular dystrophy (GRMD).

Materials and Methods
Eighteen adult dogs (28±12 kg body weight) were randomized into three experimental groups: control (G1), carrier females (G2) and affected dogs (G3). In order to obtain sequenced samples of blood glucose, insulin and fructosamin concentrations, the oral food intake postprandial response test was performed and homeostasis model assessment (HOMA) index was calculated with basal glucose and insulin values. Results were previously checked for normality of residues by Shapiro-wilk test and analysed by SAS. Statistical significance level was set at $P<0.05$.

Results
Higher baseline glucose levels ($P=0.0047$) were seen in G2 and G3 compared to G1. Fructosamine concentrations were in accordance to reference values for all animals. Insulin levels were lower in G3 compared
to G1 ($P=0.0065$); however, no evidence of insulin resistance was found according to HOMA index. As for the evaluation of postprandial responses, fluctuations of glucose ($P=0.0007$) and insulin ($P=0.0149$) were observed in G1 and G2, while in G3, values remained constant.

**Discussion and Conclusion**

The reduced production of insulin and its metabolic consequences (gluconeogenesis and fat lysis), can partially explain the muscle catabolism, fatty infiltration, and increased liver size previously described in literature. The cause of the impairment remains obscure.

The results allowed us to identify metabolic changes related to carbohydrate metabolism in GRMD dogs, reinsuring the importance of an adequate food management for them.

* Early career researcher
P72. Sugarcane yeast and corn gluten as protein sources for cat diets

Katiani S Venturini1, Thaila Cristina Putarov2, Miryelle Freire Sarcinelli2, Francine Mendes Peres3, Janine Alves Batista2, Euclides Braga Malheiros3, Aulus Cavalieri Carciofi4

1Universidade do Estado de São Paulo- Unesp/FCAV; 2UNESP; 3UNESP - Univ Estadual Paulista, Jaboticabal, SP, Brazil; 4FCAV Unesp

Introduction
Sugarcane yeast (Saccharomyces cerevisiae) has been evaluated as protein source for different animal species including dogs1. The present study evaluated the inclusion of 5% of two sugarcane yeast (SY1 and SY2) preparations, and corn gluten meal (GM) in a cat food based on poultry by-product meal (PM).

Material and Methods
Four diets with similar nutrient composition were used: control based on PM, and 5% inclusion of SY1, SY2, or GM. Twenty-four cats were used, six for each diet. The coefficient of total tract apparent nutrient digestibility and the nitrogen balance were determined by the quantitative feces and urine collection method. Food palatability was measured by the two-pan test. Uric acid metabolism was studied measuring its serum and urine concentration, and daily renal excretion. Data were analyzed by analysis of variance and Tukey test (P<0.05).

Results
No differences among diets were verified for dry matter, organic matter, protein, fat, and energy digestibilities. Faecal characteristics and production did not differ. The inclusion of SY1, SY2, or GM also did not alter nitrogen balance or uric acid metabolism (P>0.05). Cats preferred the SY1 and SY2 foods in comparison with the control PM diet (P<0.01), but not the GM supplemented food.
Discussion and Conclusion

In the tested dosage, the nutritional contribution of the SY and GM to diets was low and results should be interpreted with caution. The SY proven to be palatable to cats, increasing diet preference. Protein sources of microbial origin have high nucleic acid content, which is degraded on the purine metabolism pathway to uric acid. Results suggest that on dosage tested, SY do not interfere on digestibility, feces formation, uric acid excretion and increase food palatability.


* Early career researcher
P73. Effect of enzyme supplements on macronutrient digestibility in healthy adult dogs

Villaverde C1, Jenifer Molina1, Edgar G Manzanilla2, Jennifer Larsen3

1Universitat Autonoma de Barcelona; 2TEAGASC; 3University of California, Davis

Introduction
Some enzyme supplement products claim benefits for healthy dogs to compensate for alleged suboptimal production of endogenous enzymes and the loss of enzymes in commercial pet foods secondary to processing. Our objective was to determine macronutrient and energy digestibility in healthy dogs fed a commercial diet supplemented with plant and animal-sourced enzyme products at the dosage recommended by their respective manufacturers.

Material and Methods
The study was approved by the Universitat Autonoma de Barcelona ethics committee. Fourteen healthy sterilized adult Beagle dogs (average age 8 years) were divided into two equal groups and fed the basal diet with either the plant or animal-sourced enzyme supplement using a crossover design. Three digestibility trials (basal diet, and after each period of supplementation) were performed by total faecal collection method. Serum TLI (trypsin like immunoreactivity) was measured at the end of each trial. Data were analyzed by repeated measures, where basal digestibility was included as covariable. The alpha level of significance was set at 0.05.

Results
There were no differences between enzyme treatments (Table 1). When comparing basal to enzyme supplementation, the sole difference was a higher fat digestibility for the basal diet compared to the animal-sourced
enzyme treatment, which could be a period effect and was likely not biologically significant (94.6% vs 93.5%). Serum TLI was not affected by supplementation with either enzyme product.

**Discussion and Conclusion**
Exogenous enzyme supplementation did not significantly increase digestibility of a typical commercial dry diet in adult dogs and their routine use is not recommended.

<table>
<thead>
<tr>
<th></th>
<th>Animal-sourced enzyme</th>
<th>Plant-sourced enzyme</th>
<th>SE</th>
<th>P-value (treatment)</th>
<th>P-value (covariate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>79.6</td>
<td>79.3</td>
<td>0.53</td>
<td>0.666</td>
<td>0.236</td>
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<tr>
<td>Organic matter</td>
<td>83.6</td>
<td>83.4</td>
<td>0.40</td>
<td>0.736</td>
<td>0.082</td>
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<td>Crude protein</td>
<td>79.1</td>
<td>78.1</td>
<td>0.52</td>
<td>0.107</td>
<td>0.024</td>
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<tr>
<td>Crude fat</td>
<td>93.5</td>
<td>93.9</td>
<td>0.24</td>
<td>0.218</td>
<td>0.005</td>
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<tr>
<td>Gross energy</td>
<td>84.4</td>
<td>84.3</td>
<td>0.36</td>
<td>0.828</td>
<td>0.066</td>
</tr>
</tbody>
</table>
P74. Characterisation of the effect of dietary calcium on the plasma metabolic profile in adult Labrador Retrievers

David Allaway¹, Phillip Watson¹, Antje Wagner-Golbs², Sandra González Maldonado², Alison Colyer¹, Jonathan Stockman¹, Penelope J Morris¹

¹WALTHAM Centre for Pet Nutrition; ²Metanomics Health

Introduction
The health implications of long-term feeding of high calcium (Ca) diets are not well understood in adult dogs. Metabolomic profiling of plasma was undertaken to identify unanticipated consequences of excess dietary Ca on metabolism.

Materials and Methods
Adult Labrador Retrievers (n=10) were fed a control diet for 60 days (Ca 1.7g/1000 kcal; Ca:P 1.6) before being transitioned to a diet providing Ca at the current AAFCO maximum (Ca 7.1g/1000 kcal; Ca:P 1.6) for a period of 40 weeks. Fasted blood samples were taken every 8 weeks. Post-prandial samples were taken on 3 occasions (at the end of control diet feeding, after consuming high Ca diet for 1 day (acute) and after 24 weeks (chronic)). Plasma metabolites were measured on the MxP® Broad Profiling Platform (Metanomics Health GmbH), normalized to the median of pooled samples and following QC, univariate/multivariate statistical analyses were performed on log10-transformed data.

Results
Comparing the fasted plasma metabolomes (180 metabolites) at each time point, no “between diet” differences (q-value<0.05) were observed. Comparing the post-prandial time points, only “phosphate (inorganic and organic)” was different between the 2 diets at both the acute and chronic sample points (fold-change 1.35-1.44 between 2-4 hrs post-meal). Only
lysine and tyrosine were also significantly different (between control and acute, at 3 hrs post-meal).

Discussion and Conclusion
No significant effect of diet occurred in the fasted state comparing at each time point. The difference in phosphate in post-prandial comparisons can be explained as it was supplemented to maintain dietary Ca:P. The noted amino acid differences are likely a consequence of the high Ca diet containing slightly more protein. This data-driven approach supports the view that concern over the dietary Ca upper limit is unwarranted.
P75. The impact of time of neutering on weight gain and caloric intake in female kittens

David Allaway¹, Matthew Gilham¹, Alison Colyer¹, Phillip Watson¹, Penelope J Morris¹

¹WALTHAM Centre for Pet Nutrition

Introduction
Neutering is considered a significant risk factor for obesity, with studies showing that cats fed ad libitum gain bodyweight and fat mass post-neutering¹. In a study to determine the Total Energy Requirements of kittens (15-52 weeks) the impact of neutering and time of neutering on intake and bodyweight was investigated.

Materials and Methods
Females (n=14), neutered at 19 (early neuter, EN) or 31 (conventional neuter, CN) weeks of age (n=7/group), were individually fed a ration to ensure excess was offered (if >90% offered was consumed, the ration increased 10%), with the proviso that the ration was restricted (reviewed weekly) to maintain an ideal body condition score (BCS), measured twice weekly.

Results
EN kittens gained weight gradually to 38 weeks of age (Figure 1) but required earlier diet restriction. CN kittens’ bodyweight gain slowed from week 24, they weighed less from week 30 ($p<0.05$) and had a lower energy intake (kcal/kg bwt$^{0.67}$, $p<0.05$) between weeks 24-31. Following neutering (week 31), with adjustments in accordance with feeding protocol, intake and weight increased rapidly. All kittens had a BCS that required intake restriction at some stage and all had an ideal BCS by week 46.
Discussion and Conclusion

Although early neutering did not prevent the need for intake regulation, acute hyperphagia and rapid weight gain following neutering was reduced. Earlier neutering may achieve a gradual weight gain through growth and extend the time that dietary restriction can be initiated. Further research to understand neuter-associated weight gain is required.

¹Alexander et al., 2011

Figure 1. Average weekly bodyweight of female kittens neutered at 19 weeks (white) and 31 weeks (yellow) when fed a ration adjusted to ensure excess was offered unless restricted to maintain ideal body conditions score. Bars represent 95%Cl.
P76. Development of body mass and enzyme activities of granivorous nestling birds during growth

Petra Wolf¹, Josef Kamphues²

¹University Rostock; ²University of Veterinary Medicine Hannover, Foundation

Introduction
Whereas precocial birds like Galliformes begin self-employed feed intake immediately after hatch, nidicolous birds are fed by their parents (feed is ingested by adults before being given to nestlings). In this study with nestlings of granivorous pet birds we investigated the body weight gains and development of enzyme activities as well in order to optimize the composition of diets used for hand rearing of nestlings.

Materials and Methods
Investigations were carried out with budgerigars (Melopsittacus undulatus; BG) and lovebirds (Agapornis spp.; LB) as well fed a commercial hand-rearing diet (data per kg fresh matter: 924 g DM, 234g crude protein, 13.3 MJ ME; minerals and amino acids corresponding to usual recommendations, no addition of enzymes). Body mass was daily determined by a scale. Activities of lipase (colorimetric method) and amylase (enzymatic test) in digesta were measured directly on the day of hatch (1st day of life, before fed by parents) as well as on the 12-15th day of life and in full-grown youngs (>40 days).

Results
Both species increase their body mass within the first two weeks of life by a factor of 10 and reached a body mass of adults at day 25 (BG) and 30 (LB). Enzyme activities were low immediately after hatch (Lipase 28.5 U/g in BG, 10.7 U/g in LB; Amylase 29.0 U/g in BG, 67.3 U/g in LB) but increased markedly (lipase by a factor of 25 and amylase by a factor of 40-70) up to the 40th day of life. Moreover, in further/consecutive
experiments it was discovered that regurgitated material from parents contained enzymes.

Discussion and Conclusion
The rapid growth in nestlings requires a high digestive capacity that depends predominantly on enzyme activities within the first days of life. Therefore, an addition of enzymes to hand-feeding diets could be advantageous.
AFFILIATIONS & RESOURCES

AAVN

ACVN

ECV CN

ESVCN

WikiVet

WALTHAM Research Grants
WALTHAM regularly has grants and funding available that span a range of areas, including pet nutrition, veterinary science and human-animal interaction.

https://www.waltham.com/grants-awards/nutrition/

WALTHAM RESEARCH GRANTS

- WALTHAM Foundation
- ESVCN & WALTHAM Nutrition Research Grant
- AAVN & WALTHAM Nutrition Research Grant
- ESVCN & WALTHAM Student Nutrition Research Award
- AAVN & WALTHAM Student Nutrition Research Award
- WALTHAM & BUCKEYE Equine Research Award
- Comparative Gastroenterology Society (CGS) & WALTHAM Research Grant
The WALTHAM Foundation was established in 2001 with the aim of promoting innovative and humane studies that advance the understanding of the nutrition, welfare and healthy longevity of companion animals worldwide and which benefit the public. Grants are selected on the basis of their scientific merit, ethical integrity and contribution to companion animal welfare, health and longevity.

Applications will be due on March 1, 2017

For further information visit:
https://www.waltham.com/grants-awards/
ESVCN & WALTHAM Nutrition Research Grant

Available annually, the ESVCN and WALTHAM Nutrition research grant supports early career researchers that are ESVCN members. In 2016 the grant was for 22,500€. The grant is announced at the beginning of the year through the ESVCN and WALTHAM websites. Grants are usually for projects spanning 2 years.

https://www.waltham.com/grants-awards/nutrition/

http://www.esvcn.eu/society/awards

BACK TO WALTHAM RESEARCH GRANTS
Available annually, the AAVN and WALTHAM Nutrition research grant supports early career researchers that are AAVN members. In 2016 the grant was for $25,000. The grant is announced at the beginning of the year through the AAVN and WALTHAM websites.

https://www.waltham.com/grants-awards/nutrition/

http://www.aavn.org/aavnwaltham-research-grant.pml
ESVCN & WALTHAM Student Nutrition Research Award

The ESVCN scientific committee will choose the best research project presentation at the ESVCN Congress. The recipient will receive a cash prize and trip to the AAVN/ACVIM meeting in the USA to share their research.

Who is eligible?
Students, residents, PhD candidates working towards a degree or board certification in the field of dog and cat nutrition who present their work at the ESVCN Congress.
AAVN & WALTHAM Student Nutrition Research Award

The AAVN scientific committee will choose the best research project presentation at the AAVN Congress. The recipient will receive a cash prize and trip to the ESVCN meeting in Europe to share their research.

Who is eligible?
Students, residents, PhD candidates working towards a degree or board certification in the field of dog and cat nutrition who present their work at the AAVN Conference.
BUCKEYE® Nutrition and WALTHAM™ are together offering the WALTHAM™ BUCKEYE® Nutrition Equine Research Grant, up to a total of $20,000 per annum – which may be awarded to one project or split between several. These grants are intended to help fund a clearly defined piece of original research focusing on the nutrition, health, behavior or welfare of horses with the intention of publishing the findings in a peer-reviewed scientific journal so that horses around the world may benefit.
Since 2006, WALTHAM and the Comparative Gastroenterology Society (CGS) have partnered to promote high quality research in gastroenterology by providing up to $8,000 for the CGS WALTHAM Research Award which is an annual competitive grant chosen by CGS members and complying with the ethical principles of WALTHAM.

This grant will only be available to members in training and good membership standing. Members in training are defined as members that are in a clinical or post-graduate training program. However, members who are already board-certified in any specialty will not be eligible for membership-in-training status, even if they are currently enrolled in a graduate program.

For further information, please visit: https://www.waltham.com/grants-awards/nutrition/ or http://vetmed.tamu.edu/cgs/grants-awards

Submission deadline: 1 November 2016

Funding decision: 1 February 2017
The European Society of Veterinary and Comparative Nutrition (ESVCN) is affiliated to the European Society of Veterinary Internal Medicine (ESVIM), and has a close connection with the European College of Veterinary and Comparative Nutrition (ECVCN).

The ESVCN is a non-profit organisation with the following objectives:

• to generate interest, stimulate research and disseminate knowledge in veterinary nutrition and nutrition-related diseases;

• to promote pre- and post-graduate education in veterinary nutrition;

• to stimulate the application of clinical nutrition in veterinary schools by cooperation between nutritionists and clinicians;

• to cooperate with other societies with related interests.

ESVCN membership is open for anyone (worldwide) who is interested in the area. Membership is not restricted to veterinarians.

Go to ESVCN website [http://www.esvcn.eu/society](http://www.esvcn.eu/society)

Every year the ESVCN hosts a congress, and in 2017 this will be hosted by the Royal Agricultural University and WALTHAM Centre for Pet Nutrition.
The European College of Veterinary and Comparative Nutrition (ECVCN) is recognized throughout the veterinary profession for its progressive leadership and for the high standard of professional excellence of its members, the Diplomates.

In order to become a Diplomate, veterinary surgeons, known as Residents, must undergo a rigorous training programme in either food producing or companion animal nutrition, supervised by recognized veterinary specialists e.g. other Diplomates or Professors of Nutrition at a number of universities.

The objective of the European College of Veterinary and Comparative Nutrition (ECVCN) is to advance the quality of animal health care in Europe by increasing the competency of those who are active in the field of veterinary nutrition.

The ECVCN was founded in 1998 from the European Society of Veterinary and Comparative Nutrition.

The college obtained full recognition by the European Board of Veterinary Specialisation (EBVS) and currently counts 36 active Diplomates. The ECVCN is responsible for the training of the residents who want to become Diplomate.

To help young residents, the ECVCN organises each year a 2-day Resident Class just prior to the ESVCN congress.

To learn more about the ECVCN, visit http://www.esvcn.eu/college

BACK TO AFFILIATIONS AND RESOURCES
The American Academy of Veterinary Nutrition (AAVN) was founded in 1956 and is the American Veterinary Medical Association’s (AVMA) oldest allied group. The stated objectives of the AAVN are:

1. To provide a concerted means for discussion and exchange of information on matters of common interest as applied to the field of nutrition in its relationship to animal health;
2. To promote greater veterinary interest in and better understanding of current developments in nutrition as affecting animal health;
3. To promote research in the fields where nutrition may have a relationship to disease; and
4. To promote closer cooperative relationships with those who share the veterinarian’s responsibility of maintaining optimum animal health through adequate nutrition.

Active membership in the AAVN is offered to veterinarians, nutritional/animal scientists, members of the allied health professions, and certified/licensed veterinary technicians. Student memberships (including interns, residents, and graduate students) are also available.

Each year the AAVN holds an Annual Clinical Nutrition and Research Abstract Symposium in conjunction with the American College of Veterinary Internal Medicine. In addition, the AAVN provides a full day nutrition program at the North American Veterinary Conference.

The AAVN website provides a Members Only section. An email listserv is available to all paid and student members, which encourages the membership to exchange information and further discussion on relative topics.

For more information, or to join the AAVN, please visit

http://www.aavn.org/homepage.pml
The primary objective of the American College of Veterinary Nutrition (ACVN) is to advance the specialty area of veterinary nutrition and increase the competence of those who practice in this field by establishing requirements for certification in veterinary nutrition, encouraging continuing professional education, promoting research, and enhancing the dissemination of new knowledge of veterinary nutrition through didactic teaching and postgraduate programs.

Go to ACVN website http://www.acvn.org/
WikiVet

The WikiVet site provides an extensive knowledge base of online resources which has been developed based on feedback from veterinary educators and focus groups of learners. The site now has over 5,000 pages of detailed content making it the largest online veterinary educational resource available.

WikiVet was first created by a consortium of UK veterinary academics in 2007, and established as a charitable educational foundation in 2015. WikiVet is a not-for-profit collaborative resource to support and enhance veterinary education worldwide using web based technologies. It provides an innovative and dynamic framework integrating an expanding veterinary encyclopaedia with related learning materials. WikiVet aims to become the most respected and largest online educational resource for the international veterinary community.

WikiVet objectives are:
• To provide a comprehensive knowledge base covering all aspects of veterinary science for all domestic species;
• To address the entire veterinary and related curriculum in order to provide a reliable and trusted resource for students anywhere in the world;
• To use the new opportunities offered by e-learning to support professional lifelong learning;
• To foster a new community of veterinary educators, learners and practitioners using social media with a common interest in veterinary education;
• To create a sustainable model which ensures the long term viability and growth of the site.
Funded by charitable donation, commercial activity and generous volunteer support, WikiVet continues to grow its user base with more than 50,000 registered users and over 2 million site visits per year from 90 different countries.

Go to WikiVet website
https://en.wikivet.net/Veterinary_Education_Online
CONFERENCES

ESVCN Congress 2017

ACVIM Forum 2017

AAVN Symposium 2017
The ESVCN annual congress covers a wide variety of topics in nutrition across the animal kingdom, attracting a diverse range of contributions in order to stimulate scientific discussion leading to novel insights.

The Royal Agricultural University (RAU) and WALTHAM Centre for Pet Nutrition invite you to the 21st ESVCN congress, which will be held at the RAU, Cirencester, UK.

The RAU is nestled in the heart of the peaceful Cotswold countryside, a mile from the historic Roman town of Cirencester. The Royal Agricultural College (RAC), now the Royal Agricultural University (RAU), is the oldest agricultural college in the English speaking world and has been at the forefront of agricultural education since 1845.

Whether your interest is primarily in companion, farm, zoo or wild animals, we look forward to seeing you there!

Further details available at https://www.rau.ac.uk/esvcn2017
2017 ACVIM Forum

Mark your calendar for the 2017 ACVIM Forum in National Harbor, MD June 7-10 at the Gaylord National Resort and Convention Center. This spectacular waterfront resort, with a stunning 19-story glass atrium and sweeping views of the Potomac River, is steps from National Harbor’s premier entertainment and shopping district and only eight miles south of the nation’s capital. In fact, some of Washington DC’s most exciting tours depart from Gaylord National, including trips to Washington’s major memorials and monuments. This unique property offers a variety of dining, entertainment and retail options, both within the hotel as well as in the surrounding area. We look forward to seeing you in National Harbor!

Submissions for interactive or scientific sessions for the 2017 ACVIM Forum will open in July. Please check the ACVIM Forum website for details: http://www.acvim.org/ACVIM-Forum/ACVIM-Forum-Home

Video: https://www.youtube.com/watch?v=KvuYUe3aj38
AAVN Symposium
7 June 2017
National Harbor, Maryland, USA

The 2017 AAVN Clinical Nutrition & Research Abstract Symposium (sponsored by Royal Canin US) will be held in National Harbor, Maryland USA, on June 7, 2017 in association with the American College of Veterinary Internal Medicine.

The Symposium will consist of both oral and poster presentations.

The Call for Abstracts will be announced in November 2016.

For additional information please contact Wilbur B. Amand, VMD, AAVN Executive Director (Wbamand@aol.com).
Yammer

What is Yammer?
Yammer is a private social networking service which has all the great features of other well-known social media platforms with the added benefit that only selected users can participate – in this case, all the delegates attending WINSS 2016. You’ll be able to read posts (or start one yourself!) see photos, share information, send private messages and make comments, all within the secure, private group of the WINSS 2016 Yammer community.

Why is WINSS using Yammer?
WINSS is a great opportunity to learn, meet other delegates and network. As always, we encourage you to network and ask questions during the course of the day and during evening events. By using Yammer you can extend those opportunities beyond the traditional symposium structure. For example, you can ask questions about a presentation, chat or arrange to meet with someone you’d like to connect with or share your feedback at any time using Yammer; day or night, before, during and after the symposium.

What can I post?
Anything related to WINSS or companion animal nutrition! Ask or answer questions, create connections, share your thoughts about the symposium, post job vacancies, tell others about your research, seek advice or support on research challenges, but most importantly – please get involved! The greater the number of delegates who join in and post, the more successful the WINSS 2016 Yammer community will be.

What can’t I post?
As you’d expect, we politely ask you not to post personal attacks, offensive or deliberately inflammatory posts. Any such posts will be removed by the organisers. In addition, please refrain from product advertising or promotion of businesses and services.

Take me to Yammer!
BIOGRAPHIES

Prof. Adam Drewnowski

Dr Judy MacArthur Clark, CBE

Prof. Gary Butler

Dr Alex German

Prof. Olav Rooyackers

Robin Banerji
BIOGRAPHIES

Charlotte Conway

Dr Adronie Verbrugghe

Robert C. Backus

Dr Joseph J. Wakshlag

Dr Yann Quéau

Prof. Wouter Hendriks
BIOGRAPHIES

Dr Jennifer A. Larsen

Prof. Myriam Hesta

Dr Maryanne Murphy
CAREER DEVELOPMENT WORKSHOPS

DAY 1

13:00-16:00
Career Development Workshop
Robin Banerji
Exchange, 11th floor

DAY 3

16:00
Career Development Workshop – Challenges and rewards of developing a career in companion animal nutrition
Exchange, 11th floor
PLENARIES

DAY 2

09:00  Plenary: Nutrient Density - addressing the challenge of obesity  
       Prof. Adam Drewnowski  
       Grand Ballroom, 7th floor

13:30  Plenary: The 3Rs – research in an ethical context  
       Dr Judy MacArthur Clark  
       Grand Ballroom, 7th floor

DAY 3

08:45  Plenary: Promoting healthy growth in children  
       Prof. Gary Butler  
       Grand Ballroom, 7th floor

09:30  Plenary: Promoting healthy growth in pets  
       Dr Alex German  
       Grand Ballroom, 7th floor

DAY 4

08:45  Plenary: The impact of age, disease and nutrition on human muscle mass and function (sarcopenia)  
       Prof. Olav Rooyackers  
       Grand Ballroom, 7th floor
NETWORKING OPPORTUNITIES

Welcome Reception

Poster Session Index

Gala Event

Yammer