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PURINA® PRO PLAN® SYMPOSIUM

Integrative Approach to Gastrointestinal Health

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PURINA® PRO PLAN® SYMPOSIUM 2025

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Gastrointestinal health plays a crucial role in the overall well-being of our canine and feline companions. As we come together for this symposium on the **Integrative Approach to Gastrointestinal Health**, our goal is to delve into the latest advancements in understanding and managing gastrointestinal conditions in our cherished pets. Additionally, we will address other vital topics, such as mental health and the enhancement of time efficiency through innovative digital solutions.

Throughout this symposium, we have had the privilege of bringing together esteemed specialists in the field of veterinary medicine and research. Their expertise and dedication have allowed us to delve into the fascinating world of gastroenterology, including fat digestion, hyperlipidemia, and microbiota analysis, as well as gaining insights into Protein-Losing Enteropathy (PLE), mental resilience strategies, and the latest advancements in AI tools for veterinary practice.

At **PURINA®**, we are dedicated to enhancing the lives of our beloved furry companions by advancing veterinary nutrition science, with a particular focus on gastroenterology in this instance. Through continuous research and collaboration with esteemed experts, we aim to create innovative solutions that cater to the distinct needs of both dogs and cats.

We extend our heartfelt gratitude to all the attendees and speakers of this event. We truly believe that through our collective global collaboration and the sharing of evidence-based knowledge, we can make a difference in ensuring that our beloved pets enjoy long, healthy, and happy lives. **Together, we hold the power to transform their well-being and enrich their journeys with us.**

I hope you enjoy the PURINA® PRO PLAN Symposium on the **Integrative Approach to Gastrointestinal Health.**

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In addition to her husband and children, Christina shares her home with a tortoiseshell cat named Juniper and a Gordon Setter-mix dog named Barley.

UNBLOCKING FAT DIGESTION: A COMPREHENSIVE APPROACH TO MANAGE ACUTE AND CHRONIC GASTROINTESTINAL DISEASES IN DOGS AND CATS

Dr Cecilia Vilaverde & Dr Christina Germain

Introduction

There are several nutritional strategies important for the management of gastrointestinal diseases[1], such as digestibility, protein, dietary fibre, and dietary fat. Dietary fat is an essential nutrient[2] that provides essential fatty acids and energy, in addition to contributing to the palatability of the diet. Modification of dietary fat, both in amounts and in type, can be helpful in diseases such as chronic inflammatory enteropathies[3] (especially protein losing enteropathies, PLE) and pancreatitis[4].

Definition and types of fatty acids

Dietary fat is an over-arching term used to describe the different types of fat that can be found in a pet food. The most common form of fat discussed from a nutritional perspective is triglycerides (proper term is triacylglycerols). Triglycerides are composed of glycerol and three fatty acids. A fatty acid is a basic unit of fat composed of carbon, oxygen, and hydrogen. Fatty acids correspond to the everyday names used for dietary fats, such as linoleic acid. Fatty acids can be named using multiple systems but are all based on different aspects of their chemical composition.

Digestion and absorption of fatty acids

Most fat found in the diet is in the form of triglycerides with fatty acids of 16 or more carbons in length. Dietary fat is digested and absorbed in the small intestine. The triglycerides must be first broken down (hydrolyzed) into smaller components. These smaller components are then mixed with bile salts, which can then be moved to and absorbed across the gastrointestinal tract (enterocyte membranes). The smaller components must then be reassembled into triglycerides, which can then be packed into chylomicrons. Chylomicrons are a lipoprotein that allows fats to be transported in blood. The packaged dietary fat then travels through the lymphatic system to the circulatory system for further transport throughout the body. The triglycerides, inside the chylomicrons, then have to be broken down by enzymes again before they can be transferred into muscles and other cells.

Role of fat on gastrointestinal diseases: amount

Pancreatitis:

The role of dietary fat in pancreatitis is far from clear, but fat moderation is a common recommendation during the management of acute canine pancreatitis and long term in chronic recurrent cases. Old studies using experimental high fat diets resulted in induction of canine pancreatitis (and worsening of experimentally induced disease)[5,6], plus epidemiological data[7] suggests ingesting uncommon food items and table scraps is associated with pancreatitis (requiring hospitalization), and those could be higher in fat than the dog's usual diet. Fat moderation can also accelerate gastric emptying, although additional factors also play a role here.

For canine acute pancreatitis, there are no standard recommendations, but low-fat intestinal diets are commonly recommended during treatment[8], although this is clinician dependent[9]. There is more consensus on providing a low-fat diet if the pancreatitis is associated with hyperlipidemia[10]. These provide 16-22% fat on a metabolizable energy basis (ME). Their main drawback would be that their

energy density can be lower than typical intestinal diets. There are also liquid low-fat diets that can be used with feeding tubes in inappetent patients. After recovery, patients can return to their usual diet.
For canine chronic or recurrent cases, it is important to do a good diet history, to identify any risk factors that need to be addressed (like scavenging, frequent use of table foods, or overweight) and to assess the dietary fat at diagnostics. Anecdotally, recommendation of a diet lower in fat than the one at diagnostics can be helpful, with some clinicians aiming for a 50% reduction[4]. Although there is a lack of prospective data to back this up, there are no nutritional downsides to using an intestinal low fat diet long term in adult dogs if palatable and consumed adequately.

As for cats, the role of fat amount in feline pancreatitis is even less clear, and fat moderation is not a common recommendation for this species, unless there is concurrent hyperlipidemia The ACVIM consensus paper in feline pancreatits[11] does not recommend it as a rule, although some of the members stated that they do recommend at least avoiding very high fat diets. Common diets recommended for feline pancreatitis are intestinal diets, which provide a dietary fat range of 30-52% (ME), so there is some choice within these options if one wants to aim for certain fat moderation when compared to the diet at diagnostics. Diet choice in these cases will also be affected by any present co-morbidity.

Protein losing enteropathies:

There are several papers that have looked into dietary fat moderation in PLE canine cases, including patients with suspected primary lymphangiectasia[3,12] and others[13–15]. For lymphangiectasia (primary or secondary), moderating dietary fat could reduce lymphatic flow and lacteal pressure, thus attenuating protein loss via lymph.

In these studies, the diets used were either intestinal low-fat diets (16-20% ME) or moderate fat (24-25% ME) elimination diets or home cooked diets, which can reach a lower dietary fat amount (<16% ME). Homemade diets were used in patients that did not respond to commercial options (and could have required more aggressive fat moderation and/or novel ingredients) or that did not like them. Using moderate (16-20% ME) to low fat (<16% ME) diets did result in improvement in many (not all cases), with or without additional medication. As such, fat moderation is the first recommendation for PLE dogs, and home cooked diets can be formulated in dogs that won't eat them or require more aggressive dietary fat decrease.

There are no studies in cats.

Role of fat on gastrointestinal diseases: types

For inflammatory intestinal diseases, the use of omega 3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) has been proposed[16], given their anti-inflammatory properties. Even though there is a lack of prospective controlled studies in both dogs and cats with chronic enteropathies, their use is very safe (especially when already included in a complete diet). The recommended dosage[16] in dogs provided by Bauer is of 125 mg of EPA + DHA per kg of metabolic body weight, and has been extrapolated from studies in dogs with canine atopic dermatitis.

The role of medium chain triglycerides (MCT) is being investigated in a variety of canine diseases, and there has been interest in some intestinal diseases, although there is a lack of clinical studies at this point. They are of interest in lymphangiectasia (primary or secondary to other diseases like chronic inflammatory enteropathy), where they could be a concentrated source of energy that is absorbed mainly via the portal system rather than the lymphatic one.

In one study with dogs with exocrine pancreatic insufficiency[17], using a diet enriched in MCTs for 3 months resulted in higher serum concentrations of some fat-soluble vitamins and cholesterol, with no difference in the clinical assessment by their caregivers. One study[18] in healthy dogs looked at diets differing in dietary fat levels and amount of MCTs and their effect on serum cTLI, cPLI, and gastrin, with no effects noted. This has not yet been assessed in dogs with pancreatitis, which might respond differently. Finally, one study[19] recruited 18 dogs with chronic enteropathy and gave them a home-cooked diet including coconut oil (10% ME) during 1 month, which resulted in improvements in CCECAI; however, there is no control group and the

diet also included other strategies (such as a limited ingredients and a novel protein source).

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Tackling Complex Hyperlipidemia Cases: Your Next Steps for Effective Management

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TACKLING COMPLEX HYPERLIPIDEMIA CASES: YOUR NEXT STEPS FOR EFFECTIVE MANAGEMENT

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Hyperlipidemia is an important emergent condition in dogs. However, in contrast to humans, hyperlipidemia has been traditionally considered a relatively benign condition in dogs and, therefore, clinical experience with and research regarding canine hyperlipidemia have been limited. Several studies in both humans and dogs have associated specific forms of hyperlipidemia with a much wider range of diseases than previously thought. Therefore, canine hyperlipidemia is emerging as an important clinical condition that requires a systematic diagnostic approach and appropriate treatment.

The term *hyperlipidemia* refers to an increased concentration of lipids (i.e., triglycerides, cholesterol, or both) in the blood (serum or plasma). More specifically, an increased blood concentration of triglycerides is referred to as *hypertriglyceridemia*, while an increased blood concentration of cholesterol is referred to as *hypercholesterolemia*. The term lipemia is used to describe a grossly visible turbid or lactescent appearance of serum or plasma. Lipemia is a result of moderate and severe hypertriglyceridemia (typically >300-400 mg/dL), but not hypercholesterolemia or mild hypertriglyceridemia.

Postprandial hyperlipidemia is physiologic and typically resolves within 7-12 hours after a meal. Therefore, determination of serum lipid concentrations should always follow a fast of at least 12 hours. Persistent fasting hyperlipidemia is abnormal and can be either primary or secondary to other diseases or drug administration. Secondary hyperlipidemia is the most common form of hyperlipidemia in dogs. Most commonly, secondary canine hyperlipidemia is the result of an endocrine disorder, such as hypothyroidism, diabetes mellitus, or hyperadrenocorticism. Hyperlipidemia (hypertriglyceridemia and/or hypercholesterolemia) has also been traditionally thought to be the result of naturally occurring pancreatitis in dogs. However, data from experimental studies suggest that hyperlipidemia is not a feature of experimentally induced pancreatitis in dogs. In addition, results of a recent study in dogs with naturally occurring pancreatitis indicate that when concurrent diseases (e.g., diabetes mellitus, hypothyroidism) and use of certain drugs that can cause hyperlipidemia are excluded, hypertriglyceridemia and hypercholesterolemia occur infrequently (18% and 24%, respectively) as a possible result of pancreatitis and are typically mild. Therefore, fasting hyperlipidemia (especially when severe) in dogs with pancreatitis likely reflects concurrent primary hyperlipidemia or hyperlipidemia secondary to other causes (e.g., an endocrine disease), and warrants further diagnostic investigation.

Several other causes of hyperlipidemia have been reported or suspected in dogs, including obesity, protein-losing nephropathy, high-fat diets, cholestasis, lymphoma, infection with *Leishmania infantum*, congestive heart failure due to dilated cardiomyopathy, parvoviral enteritis, and administration of certain drugs (e.g., glucocorticoids, estrogen, phenobarbital, and potassium bromide).

Primary lipid abnormalities are more commonly associated with certain breeds. Depending on the breed, the prevalence of a primary lipid abnormality can vary widely. Primary hyperlipidemia is very common in Miniature Schnauzers Primary hyperlipidemia in the Miniature Schnauzer is typically characterized by hypertriglyceridemia resulting from an abnormal accumulation of VLDL or a

combination of VLDL and chylomicrons. Although hypercholesterolemia may also be present, it is not found in all affected dogs and is always present in association with hypertriglyceridemia.

Clinical importance of hyperlipidemia in dogs

As mentioned previously, canine hyperlipidemia has emerged as an important clinical condition that requires a systematic diagnostic approach and appropriate treatment. Although hyperlipidemia itself does not seem to lead directly to the development of major clinical signs, it has been reported to be associated with other diseases that are clinically important and potentially life-threatening. These include pancreatitis, hepatobiliary disease such as vacuolar hepatopathy and gallbladder mucocele, insulin resistance, renal lipidosis and proteinuria, atherosclerosis, ocular disease, and seizures and other neurologic signs.

Diagnostic approach to dogs with hyperlipidemia

Hyperlipidemia is typically diagnosed by measurement of fasting serum triglyceride and/or cholesterol concentrations. Because hyperlipidemia is most commonly the result of other diseases it can serve as an important diagnostic clue for dogs with other primary conditions. In addition, hyperlipidemia is often the only abnormality in dogs with primary hyperlipidemia. In order not to miss existing hyperlipidemia, it is recommended that measurement of serum cholesterol and triglyceride concentrations should be part of every routine chemistry profile.

After hyperlipidemia has been diagnosed, the next step is to determine whether the patient has a primary or a secondary lipid disorder. If hyperlipidemia is secondary, the specific condition responsible for causing hyperlipidemia should be diagnosed and treated. If secondary hyperlipidemia is excluded, a tentative diagnosis of a primary lipid disorder can be made.

A detailed history should be obtained and physical examination performed first. This is crucial because dogs with secondary hyperlipidemia typically show clinical signs of the primary disease (e.g., obesity, polyuria and polydipsia in dogs with diabetes mellitus or hyperadrenocorticism, hypoactivity and hair loss in dogs with hypothyroidism), which can help prioritize the selection of diagnostic tests and lead the way towards an appropriate diagnostic plan.

Treatment of canine hyperlipidemia

Treatment of secondary hyperlipidemia relies on the successful treatment of the underlying disorder after which hyperlipidemia usually resolves. Resolution of secondary hyperlipidemia after treatment of the cause should always be confirmed by laboratory testing (typically 4-6 weeks after initiation of treatment of the primary disease and periodically thereafter). If hyperlipidemia has not resolved, another underlying cause, alternative or additional therapy, or concurrent primary hyperlipidemia should be considered. In some dogs with secondary hyperlipidemia, especially those with hyperlipidemia due to diabetes mellitus, it might be difficult to optimally control their primary disease, and therefore, hyperlipidemia might persist despite treatment. If hyperlipidemia in those cases is severe, it might be necessary to take measures for its control. The management of persistent secondary hyperlipidemia relies on the same principles as for primary hyperlipidemia.

Dietary management

The first step in the management of primary or persistent secondary hyperlipidemia is dietary modification. Dogs with primary hyperlipidemia should be offered an ultra-low-fat diet throughout their lives, while dogs with persistent secondary hyperlipidemia should be offered low-fat diets on the basis of repeated testing and the effectiveness of control of the primary disease. It is generally recommended that diets that contain less than 25 g of total fat per 1,000 Kcal ME are used. Many commercially available diets are labeled as “low-fat” but their fat content can vary widely. In addition, although many diets have low total fat content, several other factors (e.g., type of fat, fiber content) that might potentially affect the effectiveness of those diets in the management of hyperlipidemia are usually unknown.

Polyunsaturated fatty acids of the n-3 series (omega-3 fatty acids; eicosapentanoic acid [EPA], and docosahexaenoic acid [DHA]) are

abundant in marine fish. Omega-3 fatty acid supplementation has been shown to lower serum triglyceride concentrations in experimental animals, normal humans, and humans with primary hypertriglyceridemia. In a study of healthy dogs, fish-oil supplementation led to a significant reduction of serum triglyceride concentrations, suggesting that this supplement may be helpful in the treatment of canine hypertriglyceridemia. Omega-3 fatty acids are used in dogs at doses ranging from 200 mg/kg to 300 mg/kg (total dose), PO, once a day, and their effect on serum triglyceride concentrations is dose-dependent.

Niacin is a form of vitamin B3 that has been used successfully for the treatment of hyperlipidemia in humans for many years. When used in pharmacological doses, niacin is a broad-spectrum lipid modifying drug. In dogs, niacin treatment has been reported in very few patients with primary hypertriglyceridemia. Niacin is usually administered to dogs at a dose of 50-200 mg/day.

Fibrates are weak agonists of peroxisome proliferator-activated receptor-α (PPARα), a nuclear transcription factor that regulates lipid and lipoprotein synthesis and catabolism. Bezafibrate has been evaluated in dogs and was found to be highly effective in reducing serum triglyceride and cholesterol concentrations in dogs with primary or secondary hyperlipidemia. Typical doses are 5-10 mg/kg once a day.

Statins (HMG-CoA reductase inhibitors) are among the most potent and commonly used lipid-lowering drugs and constitute first-line therapy for the treatment of hypercholesterolemia in humans. Statins are mainly cholesterol-lowering drugs with less potent effects on triglyceride metabolism. This makes them less than ideal for both human and canine patients with hypertriglyceridemia as the main lipid abnormality.

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Protein-Losing Enteropathy in Canines - Whera Are We in 2025?

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Julien completed his Veterinary Medicine degree in 2002, followed by a rotating internship and thesis at the University of Bern. He trained in Small Animal Internal Medicine through a joint program between the University of Bern and LSU, becoming a Diplomate of the American College of Veterinary Internal Medicine in 2008.

He worked as a lecturer in Small Animal Medicine at the University of Liverpool and later as a medicine consultant at IDEXX. Julien then moved to Australia, where he earned his PhD in gastroenterology at the University of Melbourne, before continuing as a Senior Lecturer in Small Animal Medicine until 2022. He then relocated to the University of Edinburgh.

His research focuses on gastrointestinal diseases, immune-mediated conditions, and monitoring pets on immunosuppressive drugs. As both a clinician and teacher, he is passionate about clinical research to enhance evidence-based medicine. Outside of work, Julien enjoys spending time with his family and exploring the outdoors.

PROTEIN - LOSING ENTEROPATHY IN CANINES - WHERE ARE WE IN 2025?

Dr Julien Dandrieux, Dr med vet, PhD, DACVIM, ANZCVS, MRCVS

Introduction

Protein losing enteropathy (PLE) is characterized by loss of proteins through the intestinal tract. After exclusion of extra-intestinal causes of hypoalbuminaemia, some of the intestinal disease leading to PLE include lymphangiectesia, primary or secondary to chronic inflammatory enteropathy (CIE), neoplastic disease (lymphoma), infectious diseases (in particular fungal), and intestinal mucosal ulcerative damage. Overall, dogs diagnosed with CIE and hypoalbuminaemia have been shown to have a guarded prognosis.[1,2]

In this presentation, we will discuss what is the current thinking for dogs with PLE in particular dietary options and new treatment considerations. We will also discuss when corticosteroids should be considered and at which posology.

Role of Food in Protein-Losing Enteropathy

Previously, dogs diagnosed with PLE used to be treated aggressively with diet change, immune-suppressive treatment, and other ancillary treatments. This so-called de-escalation strategy was aimed at controlling the clinical signs, if possible, and then wean off the different medication sequentially. Although antibiotics were previously used in dogs with PLE, their use is now rarely recommended as they cause intestinal dysbiosis and can promote antibiotic resistance.
Over the years, several studies have shown that some dogs with PLE will respond to a diet change alone either with a low fat diet or a hydrolyzed diet.[3–5] Although the fat-content plays a central role in primary lymphangectesia, hydrolyzed protein might be beneficial in inflammatory condition.

This has changed the approach of our patients with PLE, starting with a work up to exclude extra-intestinal diseases, prior to consider a diet trial, if there are no imaging findings (in particular abdominal ultrasound) that would suggest infiltrative neoplastic disease such as a lymphoma. For this reason, the treatment for dogs with CIE with or without protein loss is very similar and a new classification has been recently proposed.[6]

One important consideration is to determine which dogs can be trialled on diet alone knowing that the disease can progress rapidly. Typically, the prognosis is considered guarded in dogs with PLE and median survival times (MST) of less than 6 months or a 1-year survival of less than 50% have been reported in several publications.[7–10]

In an animal that is overall clinically well and with a good appetite, a diet trial alone is definitely worth considering, but close monitoring of the clinical signs and resolution of the hypoalbuminaemia are required to ensure that the disease is controlled. The best diet choice is currently unclear and is likely animal-dependent. For this reason, the clinicians should discuss with the owners that several diet trials might be required prior to decide for treatment escalation and home-cooked diet might be needed to achieve sufficient fat restriction. If there is no response within a few weeks (clinical signs AND increase in the albumin) or if the animal deteriorates, more aggressive treatment is warranted. Biopsies should also be obtained (if not already performed) at this point to determine the underlying histopathological changes and rule out neoplastic disease.

Role of Inmunomodulators in Protein-Losing Enteropathy

Immunomodulation remains often a consideration for dogs with PLE, especially if the clinical signs are not controlled with a diet trial alone, in dogs with very poor appetite not responding to supportive treatment, or if there is rapid clinical deterioration. Prednisolone is typically a first-line treatment that is cheap and has a rapid onset of action. It can also be combined with a second-line immunomodulator with the view of a steroid-sparing effect, especially in large breed dogs. Although immunosuppressive dosage of prednisolone was routinely used in CIE, there is now concerns that it might lead to excessive side effects and potentially worsens the risk of thrombo-embolism. For these reasons, the author considers anti-inflammatory dosages rather than immunosuppressive for CIE dogs.

A recent study reported no difference in prednisolone pharmacokinetics between dogs with PLE and healthy dogs and there was also no difference in PLE dogs between responders and non-responders.[11] This suggest that parenteral treatment with dexamethasone for treatment induction or increased dosage of prednisolone are not required for dogs with PLE. There is data that suggest that large-breed dogs (over 20-25kg) have a higher blood concentration of prednisolone than small dogs and that large-breed dogs have a higher risk of adverse-events with glucocorticoid treatment.[12,13] For this reason, a dosage of 0.5 to 1mg/kg is used as an anti-inflammatory dose of prednisolone is dogs less than 25kg, whereas the dosage is adjusted to the body surface area in larger dogs (~20mg/m2) of prednisolone.

Although prednisolone was often combined with a second-line immunomodulator, one study suggested a similar outcome in dogs treated with prednisolone alone vs addition of a second-line.[14] For this reason, it remains unclear, if or when a second-line is always necessary.

Cyclosporine has been shown to be successful as a rescue protocol in some dogs not responding to prednisolone alone. This treatment has been used in PLE dogs refractory to steroid treatment with long-term (3 years) improvement in 7 out of 10 dogs in one study.[1]

Regarding second-line immunomoduator, one retrospective study compared PLE dogs treated with prednisolone and either azathioprine or chlorambucil.[15] Dogs diagnosed in the first part of the study were treated with a combination of prednisolone and azathioprine (group A) and dogs diagnosed in the second part of the study were treated with prednisolone and chlorambucil (group C). Dogs in group C remained on their first treatment (253 days (d) [5 to 494]) longer than dogs in Group A (median: 30d [range 2 to 599]). When all censored dogs (dogs still alive at the end of the study) were taken into account as treatment failures (worst case scenario), 6-month survival rate was 15% in group A and 79% in group C. Although this study had several limitations (retrospective nature, historical case controls, absence of diet standardisation), the difference in outcome between both groups suggested that prednisolone combined to chlorambucil is superior to combined to azathioprine. A prospective study would be necessary to confirm these findings.

Another interesting retrospective study assessed prognostic factors in dogs with PLE.[16] Final diagnosis (using a combination of histology, immunohistochemistry and clonality testing) was CE or lymphangiectesia in 62 dogs and small cell lymphoma (SCL) in 19 dogs. PLE dogs with a diagnosis of SCL had a significantly worst prognosis than dogs with CE or IL (MST < 500d versus >1,000d). Clonality, suggestive of SCL, was also found to be a significant negative prognostic factor (regardless of the group) with a MST of less than 200d compared to over 1,000d in the absence of clonality. Although SCL has been recognised for a long time in cats, it has only been recently described in dogs.[17,18]

About half of these dogs presented with PLE and for this reason, this differential might be relevant in some cases, especially, if not responding to standard treatment.

Additional Treatment Considerations

As mentioned previously, prognosis in dogs with PLE is guarded and it is not unusual that dogs to not respond to diet trial and immunomodulators. Rescue treatment with octreotide has been described with some dogs improving, however cost of the treatment limits its use.[19]

There is also evidence of alteration in amino acids concentration in dogs with PLE.[20] This is in particular the case for tryptophan and raises the question of supplementation requirement although there is currently no evidence to support its benefit.

Similarly, hypovitaminosis D has been reported as a negative prognostic factor in dogs with PLE. However, it is unclear if supplementation is beneficial or vitamin D acts similarly to a negative phase protein in some dogs.

Conclusion

There is currently a lack of studies comparing different therapies for PLE and more research is needed to determine the best treatment modality. Some dogs will respond to dietary modification alone, but the challenge is to identify which dogs will do so. Prednisolone treatment remains a frequent treatment for dogs with PLE, but anti-inflammatory dosages are likely to be sufficient. Prednisolone dosage also needs to be adjusted for dogs over 25kg to reduce adverse effects.

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Join the Conversation: Comprehensive Approach to Microbiota Analysis Interpretation

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Linda Toresson graduated from the Swedish University of Agricultural Science in 1995, became a Swedish Specialist in diseases of dogs and cats in 2002 and a Swedish Specialist in Small Animal Internal Medicine in 2007. She has combined clinical practice, focusing on gastroenterology, at a referral animal hospital in Sweden, with research throughout most of her career. In 2018, Linda defended her PhD in gastroenterology at Helsinki University on oral cobalamin supplementation in dogs with chronic enteropathies.

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JOIN THE CONVERSATION: COMPREHENSIVE APPROACH TO MICROBIOTA ANALYSIS INTERPRETATION

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Introduction

The intestinal microbiome is a collective term of all microorganisms within the gastrointestinal (GI) tract. More than 95% of all microorganisms in the GI tract are bacteria, known to convert dietary compounds (such as fiber, protein and fat) or host molecules (e.g., bile acids) into metabolites that exert an important function on the intestine as well as on extraintestinal organ systems. Besides the metabolic effect, the intestinal microbiota also affects the immune system and mucosal defense in multiple ways, supports the integrity of the intestinal mucosal barrier and modulates the gut-brain axis, among other function. The intestinal microbiota in health and disease has been the focus of extensive research in human and veterinary medicine during the last two decades. It has been proven in several studies that dogs with CE often have a significantly decreased abundance of the intestinal core microbiome, compared to healthy dogs.[1–6]

The intestinal microbiome and metabolome is vital to GI health in multiple ways,[7] but the analysis and interpretation of test results from the intestinal microbiota can be challenging. The pros and cons of the most common methods will be discussed in the remainder of this section.

Bacterial culture

Only a small percentage of the intestinal microbiota can be cultured using traditional methods, meaning a significant portion of gut bacteria remain "unculturable" and can only be identified through molecular techniques. The intestinal microbiome consists mainly of anaerobic bacteria, of which many are obligate anaerobes that are very difficult to culture.8 Furthermore, many bacterial species require specific, complex nutritional needs and often rely on symbiotic relationships with other bacteria in the gut environment, making it challenging to replicate their exact conditions in a laboratory culture medium. However, bacterial culture are important from a research perspective. For instance, since only live bacteria can be cultured, bacterial culture can provide important information on how long frozen feces for FMT could be stored while still providing viable core bacteria, or to analyze viable bacteria in commercial probiotics to assess if the content matches the product claim.[9,10] Furthermore, cultured bacterial strains can be used to study interactions between species, etc.

Bacterial cultures have, however, very limited diagnostic value in the work-up of acute or chronic GI disorders. Even if potential opportunistic pathogens, like Campylobacter jejuni or Salmonella spp. can be cultured, the prevalence in healthy dogs or cats are similar to that of animals with GI disorders.[11] Thus, the cause-effect relationship is difficult to assess. Furthermore, fecal cultures sent to 3 different accredited European laboratories failed to distinguish healthy dogs from dogs with chronic diarrhea, based on culture.[12] Two out of 3 laboratories reported abnormal fecal microbiome in a more healthy dogs than in dogs with chronic diarrhea. A high level of interlaboratory variation for culture was found, and neither hemolytic E. coli, nor Clostridium spp. could be used to differ healthy dogs from dogs with chronic diarrhea. However, dogs with chronic diarrhea could be distinguished from healthy dogs by the dysbiosis index.

16S rRNA gene sequencing

16S rRNA gene sequencing is a molecular technique used to identify bacteria by analyzing the sequence

of their 16S ribosomal RNA gene by comparing the sequence to a database of known bacterial 16S rRNA gene sequences. The method is particularly useful for analyses of complex microbial communities, such as the intestinal microbiome. Many bacterial taxa can be identified simultaneously, and changes in bacterial communities between different groups can be identified. As an example, 16S rRNA gene sequencing was used to compare the intestinal microbiota in CE dogs with and without cobalamin deficiency and healthy dogs.[13] Dogs with CE and cobalamin deficiency had significantly altered microbial composition, compared to CE dogs without cobalamin deficiency and healthy dogs.

The cons of 16S rRNA gene sequencing are, besides a low taxonomic resolution on species level, the low interlaboratory and intralaboratory reproducibility between runs and that only a relative proportion of bacterial taxa are reported. For instance, dominant microbes can be primarily captured and experimental protocols might introduce bias towards specific taxonomic groups, particularly during initial steps like DNA extraction.[14–16] In one study, a pooled fecal sample from 5 donors were submitted to 6 different labs for sequencing. Based on results on beta-diversity (a term used to express the differences between different samples) a significant variation was observed between different labs.[14] One lab was not even able to identify the most abundant human core microbiota, or only detected part of it in a very low abundance, compared to the other labs. The large variation between different runs of the same sample[15] highlights the importance of running all the samples from a study at the same time point and in the same batch. This is not always possible, depending on the number of samples. Furthermore, it makes it difficult to interpret and compare data collected over a long time period, unless all samples are stored and run in the same batch. Consequently, 16s rRNA gene sequencing is an important research tool, but is less useful to assess the microbiome of an individual patient or guide a clinician towards a treatment plan.

DNA shotgun sequencing

Shotgun sequencing is another laboratory technique for determining the DNA sequence of an organism's genome. The genome is randomly fragmented into smaller pieces and these fragments are sequenced individually. Computer algorithms are then used to reassemble the fragments into the correct order, based on overlapping sequences, in order to reconstitute the genome. The method does not involve PCR amplification, thus eliminating one potential bias. Other pros of DNA shotgun sequencing are a better resolution at species and strain level vs 16s rRNA gene sequencing, and that it provides information about the whole genome, i.e. function, and microbial communities. The cons involve requiring very extensive computer processing power, a higher cost per sample, a reference genome is required and that it reports only relative proportions (no true quantification).[17] The correlation between DNA shotgun sequencing and quantitative PCR (qPCR) was assessed in a recent study.[18] Fecal samples from 296 dogs of various phenotypes were analyzed with both methods. Significant correlations were found between qPCR and sequencing. However, certain bacterial taxa were only detected by qPCR and not by DNA shotgun sequencing.

Dysbiosis index

The dysbiosis index (DI) is a commercially available, analytically validated quantitative PCR-based test designed to evaluate the canine and feline intestinal core bacteria in individual patients.[2,12,19] The DI assesses the fecal abundance of specific bacterial groups, offers reference ranges for them, and generates a single value that indicates shifts in the microbiome (https://tx.ag/DysbiosisGI). Results from the DI correlates with DNA shotgun sequencing.[18] A higher DI correlates negatively with species richness and is associated with lower microbial diversity. The DI is analyzed alongside the abundance of individual core bacteria, particularly Faecalibacterium and Peptacetobacter (formerly Clostridium) hiranonis. A reduction in those species plays a key role in an abnormal intestinal microbiome. It has been demonstrated in two separate studies that conversion from fecal primary bile acids into secondary bile acids require a log10 abundance above a threshold of 4.5 of P. hiranonis.[20,21] The DI is also highly reproducible across studies if the same DNA extraction and PCR protocol are used.

Assessing the microbiome with the dysbiosis index (DI) can be very beneficial in guiding the clinician to further treatment options in dogs with NRE. The test

complements the current standard diagnostic work-up and allows for additional staging of the disease. Treatment with proton-pump inhibitor (PPI) and/or antibiotics should be stopped prior to measurement of the DI. Proton-pump inhibitors are associated with a transient increase in the DI, but with normal abundance of P. hiranonis. The DI normalizes within 1-2 weeks after discontinuation of PPI. Broad-spectrum antibiotics (i.e., tylosin, metronidazole, enrofloxacin etc) induce severe dysbiosis with depletion of P. hiranonis.[22] Normobiosis often occur within 2-4 weeks after stopping antibiotics treatment in most dogs, but some have persistent dysbiosis lasting for several months.

Interpretation of the dysbiosis index

A DI below 0 is considered normal, unless specific bacterial taxa within the index fall outside the reference range, which would indicate minor dysbiosis. A DI between 0 - 2 suggests a mild to moderate imbalance in the microbiome, while a DI > 2 indicates significant dysbiosis in dogs. Very high DI can be found in some dogs with severe, persistent GI disease. In a recent retrospective study of dogs with partially refractory CE, the dogs who responded long-term to FMT had a significantly lower DI at baseline compared to non- or short-lasting responders.[23] These findings has been confirmed in an ongoing prospective FMT study by the same research group.

Dysbiosis, as determined by DNA shotgun sequencing, has been previously linked to changes in functional genes. Current research indicates that significant dysbiosis is associated with various intestinal dysfunctions in dogs with CE, such as increased fecal loss of transporter-dependent sugars, elevated primary bile acids, and altered fecal lipid profiles. Ongoing studies also show that the majority of dogs with CE and bile acid diarrhea have significant dysbiosis. Consequently, significant dysbiosis does not only reflect changes in microbial community composition - it is also linked to important impairment of normal GI function.

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Optimise your Day: Essential AI Tools for Everyday Life in Clinic

Dr Adele Williams-Xavier, BVSc MRCVS DipECEIM PhD, Founder, AiWX Consultancy

Dr Adele Williams, from the UK, is an artificial intelligence (AI) and clinical data expert in the vet profession. She is an equine internal medicine specialist, having a PhD and worked in various veterinary academic institutions.

Adele has led the creation of AI tools in the pet care space, and getting data right for building AI tools and getting meaningful insights out of data. She is fascinated by data and building tools to help improve the lives of animals and also making life in the veterinary profession easier.

Adele works as an AI and clinical data consultant to the veterinary profession, where she educates veterinary professionals, and advises veterinary businesses on AI and clinical data. She also advises veterinary technology start ups on development and deployment of vet tech products.

OPTIMISE YOUR DAY; ESSENTIAL AI TOOLS FOR EVERYDAY LIFE IN CLINIC

Dr Adele Williams-Xavier, BVSc MRCVS DipECEIM PhD, Founder, AiWX Consultancy.

Introduction

Artificial Intelligence (AI) is transforming many industries, including veterinary medicine. AI can be particularly useful in automating repetitive tasks and analysing complex data, leading to more efficient workflows, improved patient care, and better business management. This talk explores how AI can support veterinary professionals in their daily practice, focusing on practical applications that enhance efficiency and clinical decision-making.

Understanding AI in Veterinary Practice

AI comes in different forms, but the two most relevant for veterinary use are **predictive AI** and **generative AI (GenAI)**. Predictive AI is designed to provide reliable forecasts based on structured data, such as identifying patterns in patient records to predict disease risks. Generative AI, on the other hand, creates text, images, or even diagnostic insights, but its outputs are variable and can sometimes be inaccurate.

One well-known example of Generative AI is ChatGPT, a **Large Language Model (LLM)** that generates conversational responses. While these tools can be useful for summarising medical literature or drafting client communications, they are not always reliable for clinical decision-making. Unlike predictive AI, which offers measurable results, Generative AI's outputs can change each time a question is asked, making them difficult to validate. For this reason, any AI-driven clinical support tool must be carefully monitored and reviewed by a veterinary professional before being used in practice.

AI in Client Communication & Appointment Scheduling

A veterinary practice's first point of contact with clients is often the reception desk, where phone calls, emails, and website inquiries are handled. AI-powered **virtual assistants** can improve efficiency by automating responses to common queries, triaging cases based on urgency, and even booking appointments directly into the practice management system. This ensures that clients receive timely responses while reducing the workload on reception staff.

Additionally, AI-driven chatbots integrated into a clinic's website or mobile app can provide **basic triage services**, guiding pet owners on whether their pet needs urgent care or can wait for a scheduled appointment. Such systems can be programmed with safeguards to recognise serious conditions that require immediate veterinary attention, ensuring patient safety. AI can also optimise **staff scheduling**, factoring in shift patterns, availability, and holidays to create efficient rotas automatically, saving managers valuable time.

AI in the Consultation Room

Once a pet arrives at the clinic, AI can streamline the consultation process. One of the most impactful applications of AI is **ambient listening technology**, which can record and transcribe conversations between vets and clients. Unlike simple voice dictation, AI-powered transcription tools can structure clinical notes automatically, reducing the need for manual note-taking.

By using AI to capture and organise consultation notes, vets can focus more on patient care rather than spending time typing. This also enhances client communication, as verbalising clinical observations during an exam helps owners understand the vet's thought process. Additionally, having a recorded transcript can serve as a valuable reference for future visits or as documentation in case of client disputes. However, it is crucial to obtain client consent before using any AI-driven recording tools to comply with privacy and data protection regulations.

AI in Clinical Decision Support

AI can assist vets in formulating problem lists, suggesting **differential diagnoses**, and recommending **diagnostic tests** based on patient symptoms. This can be particularly useful for less experienced vets and complex cases, which may benefit from an AI-generated checklist to help consider all possible conditions. Some AI tools can also support **dose calculations** and **treatment recommendations**, acting as a reference tool similar to having an entire veterinary library available instantly.

However, while AI can be helpful, it is not a replacement for veterinary expertise. Many AI-based clinical support tools are not yet licensed for medical use, and their suggestions should always be critically reviewed before being applied in practice. AI systems are prone to "hallucinations," where they generate incorrect or misleading information. For this reason, all AI-assisted decisions should be validated by the veterinary team before they are recorded in clinical notes or used to guide treatment plans.

AI in Diagnostics & Imaging

AI-powered **computer vision** is already making an impact in medical imaging, with applications in cytology, radiography, and pathology. AI can analyse cytology slides, urine sediment samples, and radiographs, highlighting abnormalities that may require further investigation. By acting as a second pair of eyes, AI can help detect subtle changes that could be missed by the human eye, improving diagnostic accuracy. While these tools are showing promise in veterinary medicine, there is currently scope for improvement in diagnostic accuracy.

Despite these advancements, AI should not replace a vet's judgment. The quality of AI's output depends on the data it has been trained on. Poor-quality or biased training data can lead to incorrect results, making human oversight essential. AI should be used as a **decision-support tool**, assisting vets rather than making final diagnostic calls.

AI in In-Patient & Surgical Care

In-patient monitoring is another area where AI can enhance veterinary workflows. AI systems can track vital signs over time and alert clinicians to significant changes in a patient's condition. Some AI tools can even assess **behavioral indicators of pain**, providing an objective measure to assist in pain management.

During surgical procedures, AI could support **anaesthetic monitoring**, setting alerts for deviations in heart rate, respiration, and other vital signs. In the future, AI-assisted surgery may become a reality, providing guidance for complex procedures and improving surgical precision.

Beyond clinical applications, AI can also assist with **hospital management**, helping to optimise **kennel assignments, disinfection schedules**, and **patient care protocols** based on risk assessment.

AI in Stock Control & Inventory Management

Veterinary clinics often struggle with stock management, requiring regular manual inventory checks to avoid running out of essential medications. AI-powered inventory systems can automate this process, tracking stock levels, predicting demand, and even placing **automatic orders** before supplies run low. Additionally, AI can flag medications that are nearing expiration, allowing practices to use them before they go to waste.

AI in Billing & Client Follow-Ups

At the end of a consultation, vets often spend time

entering clinical notes and processing invoices. AI can help by **automating billing**, ensuring that all procedures, medications, and tests are accurately recorded in the practice management system. This reduces the risk of missing charges and improves financial efficiency.

AI can also improve **post-consultation communication** by summarising medical notes into **client-friendly language**. Owners often forget details from consultations, so providing an **AI-generated summary** ensures they have a clear understanding of their pet's treatment plan.
AI can also automate **follow-up communications**, such as checking in on a patient's progress via SMS, email, or app notifications, ensuring continuity of care.

AI in Business & Marketing for Veterinary Clinics

Beyond clinical applications, AI can play a valuable role in veterinary business management. AI tools can analyse **financial data**, track key performance indicators (KPIs), and generate insights to improve practice efficiency. AI-driven **client engagement tools** can personalise marketing efforts, targeting pet owners with relevant health tips based on their pet's breed or medical history.

AI can also generate **social media content**, creating educational posts for a clinic's website or social platforms. By automating content creation, clinics can maintain a strong online presence without dedicating excessive time to marketing efforts.

Challenges & Ethical Considerations in AI Adoption

While AI presents many opportunities, practices must carefully evaluate AI tools before integrating them into workflows. Data privacy and GDPR compliance are critical, especially when dealing with client and patient information. AI reliability is another concern, as some tools may provide **inconsistent** or **inaccurate** results.

Successful AI adoption also depends on **staff buy-in**. If AI tools are introduced without proper training or consultation, they may be resisted by the team, leading to wasted investment. It is important to educate staff on AI's benefits, provide hands-on training, and continuously evaluate whether AI tools are delivering value.

Conclusion

AI has the potential to optimise veterinary practice, improving efficiency, reducing workload, and enhancing patient care. However, AI should be seen as a **supportive tool**, not a replacement for veterinary expertise. By carefully selecting and implementing AI technologies, clinics can harness their benefits while maintaining high standards of medical care and ethical responsibility.

For veterinary practices interested in AI adoption, **AiWX** provides consultancy services to guide clinics through AI selection, training, and implementation.

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Transforming Stress into Strength: Tips for Maximizing Your Potential in Challenging Times

Laura Woodward, MVB; CertVR; CertSAS; DipCouns; MRCVS

Laura Woodward has been a surgical veterinarian for over 20 years, spending much of that time at the Village Vet Hampstead Hospital in London.

Prior to this, she worked at the University College Dublin Small Animal Surgery Department, various referral centres in the UK, and several charities in India, Australia, and the UK.

In addition, Laura is an accredited psychotherapist and runs her own counselling practice in London, primarily treating vets, vet nurses, and doctors.

She was invited to publish the book Mental Wellbeing and Positive Psychology for Veterinary Professionals with Wiley-Blackwell, which was released in October 2023 and is available on Amazon.

TRANSFORMING STRESS INTO STRENGTH: TIPS FOR MAXIMIZING YOUR POTENTIAL IN CHALLENGING TIMES

Laura Woodward, Veterinarian, Psychotherapist, and Author of Mental Wellbeing and Positive Psychology for Veterinary Professionals.

We are taught so much at University about anatomy, physiology, biochemistry, and pharmacology over 5 years abut 7 species in such minute detail and with such intensity, that I'm still able to draw the Krebbs cycle diagram 25 years after qualifying. The details are fantastic. Then many of us choose to go into even more detail in our favourite discipline; for you this is gastro enterology, for me, orthopaedics and soft tissue surgery.

How much did you learn about psychology? Our psychology specific to veterinary professionals at university? How much time do we now spend studying our minds and our behaviours when we're busy reading, researching, publishing, speaking, making PowerPoints?

I'm pretty sure it's disproportionate i.e. We probably spent on average a thousand times more time thinking about work than we have done thinking about joy and our mental health this past month.

I'm a positive psychologist and I'm very much against what I call 'toxic positivity'. Ie "turn that frown upside down" mentality.

We all have stresses and difficulties and catastrophes in our lives. People die, we get sick, work can be a nightmare, and we are vulnerable to pain from all of these events and more.

This interactive presentation with some story-telling, shows how to accept that in real life, we have difficulties, challenges and catastrophes, and we can experience true joy and happiness at exactly the same time as we have all of this going on.

This happiness is not achieved by denying that the pain hurts, or by pretending that bad things haven't happened. This isn't about shutting our emotions in a box and locking the lid tightly. This is about allowing ourselves to feel everything, to notice these emotions, to give them a name, to look them in the eye, and to realise that we can still laugh, we can still dance, we can still feel true peace and have fun. Even while at work.

How?

Positive psychology is a huge topic. I'm just introducing some ideas here to make it practical and useful for us. I'm a busy surgeon. I have no free time. I certainly don't want anything extra to interrupt my workflow during a day when I have a massive ops list and all the administrative tasks of working in a corporate organisation.

I understand the pressures of vets, nurses and specialists. These are my psychotherapy clients, these are my work colleagues, and this is me too.

Every strategy I propose here can be done by any of us. These are time-friendly tools which are evidence-based to make our lives (and thus the lives of those around us) better and happier.

Optimism

I'll describe what optimism is (and isn't). Human negativity bias. The effect of social media.

Scholarly articles demonstrating that optimism is a factor in cancer recovery, problem solving and perseverance. [1,2,3]

How to boost optimism in yourself and in your team. Time-friendly methods.

Resilience

Resilience is very misunderstood. Some people dislike the word because it suggests that we should keep a (sometimes called British) stiff upper lip and just get on with it. Or that we should 'bounce back' from adversity. This is not what positive psychologists define as resilience. Resilience is being prepared for adversity because it will come. We can have adversity and happiness running alongside each other. In real life there is simply no other way

If we wait until all the adversity has gone before we can be happy, we will never get there.

How to boost resilience

Self-compassion

Self-care is caring for yourself. Self-compassion is caring about yourself; caring about yourself as if you were a dear friend.

We forget that we need to do more than just have a spa day or a nice coffee to boost our wellbeing. We need to think about the reasons behind that self-care. We need to be openly kind to ourselves. Noticing why we deserve love and attention. Being kind to ourselves.

Use of language

Using examples of where and when to use affirmative language to ourselves in our own heads, I will show that this is one of the most effective and fun tools to use when things are tough and also when things are just fine or even great.[4]

This is one of my favourite topics in this presentation. It's amazing the things we say to ourselves in our own heads which we would never say to someone else, because it's just rude, or cruel, or both. Like the self-criticism and demanding way in which we demean ourselves and make impossible lists of tasks to get done is fascinating.

Also, this exercise is fun and can be so amusing.

Happiness

This presentation has to be evidence based or we (as vets and nurses) tend to ignore it or not take it seriously.

Happiness has been shown to make us more productive than if we work hard while unhappy.[5] More contentment at work makes us take less time off work, it stops us having high staff turnover, it increases our profitability.

Understanding

Feeling understood is as beneficial to our mental health as is feeling loved.[6]

Social connection

Our social connection is as accurate a predictor of our mortality as is hypertension, smoking and obesity.[7]

My aim with this presentation, and during the round table discussion towards the end of the day, is to equip the delegates with simple, quick and effective evidence-based strategies to incorporate into even the busiest of days at work or at home, to vastly improve their mental wellbeing and happiness levels. Thus making them more productive, better citizens of the workplace, and nicer to be with.

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