Small animal *Review*

Summary: In this month's Small Animal Review three published papers relating to animal gut health from other veterinary journals are summarised. The papers for this issue focus on the canine microbiome in gastrointestinal disease and the microbiota-related changes that occur as a result of canine diabetes mellitus, as well as a literature review on the impact of exposure to dietary emulsifiers on bowel and metabolic health.

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Mark Craig BVSc MRCVS Cert SAD, Referral Veterinary Dermatologist , Re-Fur-All Referrals, www.refurall-referrals.co.uk

Role of the canine gut microbiome and metabolome in gastrointestinal disease

In this review paper by Pilla and Suchodolski (2019), the authors summarise the current understanding of the intestinal microbiome in the dog, describing its role in regulating metabolism, protecting against pathogens and educating the immune system, thereby affecting most physiological functions of the dog. In the healthy dog, molecular methods have allowed the identification of non-culturable bacteria in the gastrointestinal (GI) tract. Estimates of the total microbial load now range between 10^{12} and 10^{14} colony forming units. The gut microbiome in the dog has been found to be relatively stable over a 2-week period, though longer-term variability has not been studied. Along the GI tract, bacterial sequences typically belong to one of five phyla: Firmicutes, Fusobacteria, Bacteroidetes, Proteobacteria, and Actinobacteria.

This paper reports how age, diet and environmental factors may play a significant role in maintaining a healthy microbiome. However, the alterations these factors cause are thought to be much less than the alterations found in diseased animals. GI dysfunctions are commonly associated with a disrupted microbiome. Intestinal inflammation, whether acute or chronic, is associated with significant differences in the composition of the intestinal microbiota. Obesity, metabolic diseases, cancer and neurological disorders are also associated with dysbiosis, although cause and effect are unknown.

An algorithm, the Dysbiosis Index, is described by the authors. The Dysbiosis Index is increased in dogs with chronic enteropathy. It allows vets to quantify gut dysbiosis, and monitor disease progression and response to treatment.

Systemic antibiotics, commonly given therapeutically in veterinary practice to remove pathogenic organisms, can have serious consequences for the gut microbiota. Alternative treatment strategies for gastrointestinal diseases including prebiotics, probiotics and faecal microbiota transplantation are reviewed.

Microbiota-related changes associated with diabetes mellitus in dogs

This study examined bile acid metabolism in dogs with naturally occurring, insulin-dependent diabetes mellitus (DM) and related these findings to changes in the intestinal microbiota. Jergens et al (2019) describe how the intestinal microbiota is increasingly recognised as a pivotal environmental factor in the development of metabolic diseases in humans, including obesity, insulin resistance and type 2 DM. Microbes in the gut play an important role in metabolic disturbances by increasing energy extraction from ingested foods, regulating host metabolism and generating low-grade intestinal inflammation. They also influence metabolism of bile acids (BA). Following ingestion of a fat- and protein-rich meal, primary BA travels down the intestines where they are modified by anaerobic bacteria into secondary BA. Accumulating evidence cited by the authors, demonstrates that BA is an important signalling molecule regulating hepatic glucose metabolism. Primary BA is also involved in energy metabolism. Results of this study indicate that dogs with DM have both intestinal dysbiosis and associated faecal unconjugated bile acid alterations. Diabetic dogs have increased faecal primary BA, and reduced levels of secondary BA. The pattern of dysbiosis and altered BA composition is similar to that seen in humans with type 2 DM. The authors conclude that the dog represents a novel model for investigating pathogenesis and therapy in human DM.

Impact of exposure to permitted emulsifiers on bowel and metabolic health

Partridge et al (2019) reviewed the evidence suggesting dietary emulsifiers such as polysorbate 80 (P80) and carboxymethylcellulose may affect human gut health by impairing intestinal barrier function, modulating the microbiota and triggering bacterial translocation across the intestinal epithelium. Associations with coronary heart disease, type 2 diabetes, inflammatory bowel disease, and metabolic syndrome in mice and humans are also discussed.

It is not known whether the above effects might apply to other emulsifiers, including natural lecithins (egg and soya), and even primary conjugated BA, particularly if the latter escape reabsorption and enter the distal ileum or colon. A controlled dietary intervention study in healthy humans is also proposed to investigate the underlying mechanisms and effects of a range of synthetic and natural emulsifiers and detergents, in vitro and in vivo, and to determine the effects of a commonly consumed emulsifier (soya lecithin) on gut and metabolic health.

Although this paper is concerned primarily with human health, it is relevant to animal health as emulsifiers are widely included in processed pet food to prevent separation of ingredients, and create the gravy or gel in canned foods, sachets and other moist pet foods.

References

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