The Rat as a Model Animal for Digestion in the Dog

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ABSTRACT

The suitability of the laboratory rat as a model animal for studying protein digestion in the dog was investigated. The work was conducted in two experiments.

In the first study ileal and faecal endogenous excretion of amino acids and nitrogen was measured in adult rats and dogs. Two groups of five adult dogs (two females and three males) and two groups of six adult rats (three males and three females) were fed either a protein-free (PF) or enzyme hydrolysed casein (EHC)-based diet, containing Cr_2O_3 as an indigestible marker. After an 8-10 d equilibration period, 4½ h after the start of hourly feeding, the animals were euthanased and the ileal content was collected from the terminal 20 cm of the ileum and freeze-dried. Faecal digesta samples of the rats and dogs fed the PF diet were obtained one day before digesta sampling from the terminal ileum. The freeze-dried digesta collected from the EHC fed animals were ultrafiltrated before analysis. The amount of endogenous amino acids and nitrogen excreted per gram of dry matter intake at the end of the ileum for the PF and EHC fed animals and over the entire digestive tract for the PF fed animals were determined. Data were analysed using ANOVA with species, diet and the interaction between species and diet as variables. There was no interaction between species and diet on the endogenous ileal excretions of any of the amino acids or nitrogen. Significant ($P < 0.05$) higher endogenous amino acid and nitrogen excretions were found in the dogs compare to the rats when fed the PF and EHC-based diet. Faecal endogenous excretions were higher than ileal endogenous excretion in both species for all amino acid. The pattern of endogenous amino acid excretions was similar in both species with the endogenous excretions of amino acids measured by the ultrafiltration method significantly ($P < 0.05$) higher than the PF method in both species.

In the second experiment the digestibility of a commercial dry dog food was compared between the rat and the dog. A group of five adult dogs (three females and two males) and six adult rats (three females and three males) were fed a commercial dry dog food, containing Cr_2O_3 as an indigestible marker for 10 and 8 days, respectively. On the final day, 4½ h after the start of hourly feeding, the animals were euthanased and the ileal content was collected and freeze-dried. A faecal sample was collected from each animal

one day before ileal digesta sampling. The diet and digesta samples were analysed for amino acids, nitrogen, organic matter and the apparent digestibility of dry matter, organic matter, nitrogen and amino acids were determined at a faecal and ileal level. The true ileal digestibility of nitrogen and amino acids were calculated and all the data were analysed using ANOVA. In the dog, the apparent faecal digestibility of aspartic acid, threonine, serine, proline, glycine and total nitrogen was significantly ($P < 0.05$) higher than the apparent ileal digestibility values whereas for methionine the apparent ileal digestibility value was significantly ($P < 0.05$) higher than the apparent faecal digestibility value. Apparent and true ileal digestibility for most amino acids were significantly ($P < 0.05$) higher in the dog when compared to the rat. Regression analysis showed that there was a significant ($P < 0.001$) linear relationship between the apparent and true ileal digestibility of amino acids between the rat and the dog. Ileal digestibility of amino acids in the dog (Y) could be predicted from respective rat values (X). The following equations were obtained for apparent digestibility: $Y = 0.32 + 0.65\ X$ and true digestibility: $Y = 0.45 + 0.53\ X$.

The present study showed that the rat may be a useful model for studying protein digestion in the dog. However, to make a more general conclusion regarding the use of the rat as a model animal to study protein digestion in the dog, a wider range of dog foods need to be investigated to determine the "strengths" of the regression equation shown above.

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