THE USE OF BREATH HYDROGEN TESTING TO EVALUATE CARBOHYDRATE MALABSORPTION IN DOGS

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Abstract

The use of the breath hydrogen test in this thesis has focussed primarily on the study of carbohydrate assimilation in healthy dogs and in dogs with gastrointestinal disease. The gastrointestinal handling of dietary carbohydrates and the rationale, applications, and limitations of the breath hydrogen test have been reviewed. Studies were undertaken to investigate the effect of food particle size on carbohydrate digestion and the effect of dehydration on breath hydrogen concentrations in healthy dogs. In addition, breath hydrogen testing was used to assess the assimilation of four commonly used commercial carbohydrate sources in dogs with gastrointestinal disease. In each study, expired breath samples were collected at regular intervals after the ingestion of a carbohydrate test meal. The excretion of hydrogen in the breath was compared between groups, mainly by analysis of the areas under the breath hydrogen concentration versus time curves.

The reduction of food particle size was found to cause starch granule disruption and significantly decreased the amount of malassimilated rice. The assimilation of corn, however, did not appear to be altered by reducing the food particle size. Instead, an earlier rise of breath hydrogen concentrations occurred, indicating more rapid orocolic transit and/or fermentability of the smaller corn particles.

Five percent dehydration, induced by food and water deprivation, was found to significantly elevate breath hydrogen concentrations and was associated with a significantly greater number of flatus-contaminated breath samples. This increased breath hydrogen excretion associated with increased flatulence in dehydrated dogs was attributed to a greater "net" production of hydrogen within the gastrointestinal tract.

Finally, breath hydrogen concentrations were not found to vary significantly between four different extrusion cooked carbohydrate sources (wheat, potato, corn, rice). However, it could not be concluded that these carbohydrates were assimilated to a similar extent as *in vitro* fermentation results revealed marked differences in the amount of hydrogen produced per gram of carbohydrate fermented at different fermentation times. Individual dogs with gastrointestinal disease appeared to differ in their ability to assimilate the four different carbohydrate sources. In addition, dogs with exocrine pancreatic insufficiency were found to malabsorb significantly more carbohydrate than the dogs with mild inflammatory bowel disease.

In conclusion, food processing to reduce carbohydrate particle size appears to increase the assimilation of rice. Methods to reduce the particle size of rice should be considered in the formulation of veterinary therapeutic diets for the management of diarrhoea. Mild dehydration

appears to increase breath hydrogen excretion. This suggests that breath hydrogen tests should not be performed on animals that are suboptimally hydrated until their hydration deficits have been restored. The marked individual variation of carbohydrate assimilation noted in dogs with gastrointestinal disease, suggests that clinicians should consider altering the carbohydrate source offered to dogs with intractable malassimilation, with the aim of finding the carbohydrate best tolerated. Finally, direct comparison of breath hydrogen concentrations should not be used to compare the digestibility of different complex carbohydrates unless an accurate means is available of comparing the amount of hydrogen produced per gram of substrate fermented *in vivo*.

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