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Reduction in grass eating behaviours in the domestic dog, *Canis familiaris*, in response to a mild gastrointestinal disturbance

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ABSTRACT

Grass eating behaviour in the domestic dog may be related to gastrointestinal distress. To explore this theory, the current study observed grass eating behaviours in dogs fed a standard diet with and without supplementation of a fructo-oligosaccharide (FOS). The FOS diet temporarily induced loose, watery stools to simulate a mild gastrointestinal disturbance. During both FOS Diet and Standard Diet periods, dogs were presented with couch (*Cynodon dactylon*) and kikuyu (*Pennisetum clandestinum*) grasses, and the time spent eating grass and the number of grass eating and vomiting events was recorded. Our study found that dogs spent significantly more time eating grass when fed the standard diet and producing normal stools than when they were fed the FOS diet and producing loose stools, suggesting that dogs do not use grass to self-medicate a diarrhoeal gastrointestinal disturbance. However, this does not preclude that other forms of gastrointestinal disturbance may be self-medicated by grass eating behaviours. Importantly, dogs did not use grass as an emetic, as there were only two vomiting events and 374 grass eating events observed. Alternatively, the reduction in grass eating may be attributable to a feeling of satiety caused by the fermentation of FOS. For further clarity, future research should examine the effect of other gastrointestinal disturbances, such as constipation (hard, dry stools) or nausea, on grass eating behaviour in the domestic dog.

1. Introduction

Grass eating is a common behaviour in domestic dogs, *Canis familiaris*, but there is very little research on this behaviour (Lindsay, 2001). Bjone et al. (2007) conducted the first controlled experiment on grass eating behaviour. In particular, they investigated the pattern of grass eating during the day and the relationship between grass eating and the ingestion of food. Bjone et al. concluded that grass eating is influenced by satiety and time of day: the subjects were less likely to eat grass when they were satiated and the amount of time spent eating grass decreased throughout the day.

Bjone et al. (2007) suggested that grass may be seen as a food source despite dogs having almost no capacity to digest the plant fibre in grass (Case et al., 2000; National Research Council, 2006). Kang et al. (2007) suggested that plant eating is due to a dietary deficiency, particularly fibre. Other researchers suggest that grass may be used to self-medicate some form of gastrointestinal distress (McKeown, 1996; Overall, 1997) as an emetic (Fox, 1965; Thorne, 1995; Houpt, 2005) or a laxative (McKeown, 1996). However, no scientific research has investigated these claims and gastrointestinal distress is a broad term that could encompass many "digestive upsets," such as nausea, constipation or diarrhoea. A diarrhoeal gastrointestinal disturbance can be readily induced in dogs by

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supplementing the diet with fermentable fibre (Flickinger et al., 2003; Twomey et al., 2003). Therefore, the effect of a mild diarrhoeal gastrointestinal disturbance on grass eating behaviours is investigated in the current study.

BeneoP95® (ORAFTI, Tienen, Belgium), formerly known as RaftiloseP95®, is a commercially available fructo-oligosaccharide (FOS) extracted from sugar beet. It passes undigested through the small intestine and readily ferments in the large intestine. BeneoP95® is sometimes included in commercial dog diets as a prebiotic to encourage the growth of beneficial bacteria in the colon (Fahey et al., 1990; Flickinger et al., 2003). In larger doses, FOS can degrade faecal consistency and induce loose, watery stools. Flickinger et al. (2003) noted that supplementation greater than 20% of dry matter in adjusted animals or greater than 10% in animals which have not adjusted to the supplementation may cause flatulence and loose stools. Therefore, 10% supplementation of BeneoP95® was used to induce a mild gastrointestinal disturbance (loose, watery stools) in the current study.

We hypothesised that a mild gastrointestinal disturbance of loose, wet stools would affect grass eating behaviours in dogs. In addition, we hypothesised that the dogs would prefer couch grass (*Cynodon dactylon*) compared to kikuyu (*Pennisetum clandestinum*) grass because dogs have been anecdotally documented to eat couch grass, which has the vernacular name "dog grass" (de Baïracli Levy, 1992; Engel, 2002). Both grasses have been used in previous research (Bjone et al., 2007).

2. Materials and methods

2.1. Subjects and housing

Twelve beagles (three males; nine females) of similar age (mean ± standard error (SE) = 3.7 ± 0.5 years) and weight (mean ± SE = 13.3 ± 0.3 kg) were housed at the University of New England Dog Research Facility (Armidale, New South Wales, Australia) in individual pens for the duration of the study. Dogs slept on trampoline style beds within the secure, centrally heated facility at night. During the day, dogs were placed in spacious, fully covered, outdoor runs and were socialized and exercised in compatible groups twice daily under supervision. All dog areas, including kennels, exercise yard, and outdoor runs, were concrete-floored and had no grass available. Grass was only available when provided by the experimenter (S. McKenzie) during observation sessions. The dogs were de-wormed using Drontal Allwormer® (Bayer Australia Ltd., Pymble, New South Wales, Australia) on the first day of the 5-day Habituation period. A veterinarian examined each dog to ensure it was healthy and fit to participate in the study.

2.2. Diet

The dogs were accustomed to the daily routine and standard diet during an initial Habituation period of 5 days. The dogs were fed once daily between 15:00–17:00 h in amounts calculated to meet maintenance energy requirements and adjusted as necessary to maintain ideal body weight. Fresh water was available *ad libitum*.

The standard diet consisted of extruded (Enduro Plus®; Petco Australia Pty Ltd., Buranda, Queensland, Australia) and canned food (Pedigree® Advance™ Adult Dog with chicken and rice; MasterFoods ANZ; Wodonga, Victoria, Australia). The extruded diet (Enduro Plus®; metabolisable energy = 1698 kJ/100 g) contained 25% crude protein, 14% crude fat, <5% crude fibre, and <1% NaCl.

The canned diet (Pedigree® Advance™; metabolisable energy = 523 kJ/100 g) contained 7% crude protein, 8% crude fat, 4% crude fibre, 4% ash, 1% salt as NaCl, and not more than 78% moisture. The canned food facilitated easy administration of the FOS supplement and only equated to, on average, 134 kJ (SE = 2 kJ) of metabolisable energy out of a total of 4276 kJ (SE = 88 kJ) for each dog.

The FOS supplement, BeneoP95® (ORAFTI, Tienen, Belgium), consisted of 92% oligofructose (average degree of polymerisation: 2–7), 3% H_2O, and a 5% mixture of glucose, fructose, and sucrose. This supplement was added to the diet at an inclusion rate of 10% dietary dry matter to create the FOS diet, which was intended to induce an osmotic-type diarrhoea originating from the large intestine.

2.3. Procedure

2.3.1. Study schedule and faecal collection

The standard diet was fed during the Habituation, Standard Diet and Washout periods while the FOS diet was fed during the FOS Diet periods. The order of the periods was Habituation, Standard Diet 1, FOS Diet 1, Washout, Standard Diet 2, FOS Diet 2 and Washout. All dogs were tested on this schedule for consistency, so that all dogs had the same number of days to adjust to dietary changes before observing grass eating behaviours.

The average whole gut transit time in dogs has been documented to be 37 ± 10.4 h across 13 different dog breeds, ranging from dachshunds to Giant Schnauzers (Hernot et al., 2005). Therefore, the FOS Diet and Standard Diet periods were each 48 h in length followed by a 72 h washout period.

During the Standard Diet and FOS Diet periods, faecal consistency was recorded and all faeces were collected for determination of faecal dry matter for each dog. The experimenter (S. McKenzie) collected this information during two collection periods each day (07:00–11:00 h and 15:00–18:00 h). Faecal consistency was measured using the Waltham Faeces Scoring System, a 9-point scale, ranging from 1 (hard, dry, crumbly) to 5 (watery diarrhoea; Moxham, 2001) with normal stools ranging between 1.5 and 2.5.

Faeces were collected into labelled plastic zip-lock freezer bags and stored at −20 °C for subsequent dry matter analysis. At the end of each Standard Diet and FOS Diet period, wet faeces weights were recorded for each dog before drying in foil trays at 80 °C (for approximately 3 days) to constant weight. Faecal dry matter was determined by the formula:

$$\%\,\text{dry matter} = \frac{\text{dry faeces weight}}{\text{wet faeces weight}} \times 100$$

2.3.2. Grass eating observations

Couch (*C. dactylon*) and kikuyu (*P. clandestinum*) grasses grown in 20 cm diameter (19 cm deep) pots in a