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Digestibility and palatability of dog foods containing different moisture levels, and the inclusion of a mould inhibitor

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ABSTRACT

The objective of the present study was to evaluate voluntary intake, first choice, digestibility, and faecal ammonia concentration of adult dogs fed dry extruded foods containing two different moisture levels, and the inclusion or not of propionic acid. Four treatments were compared: low-moisture food (81 g/kg) without propionic acid (LM0P), high-moisture food (102 g/kg) without propionic acid (HM0P), high-moisture food with low inclusion of propionic acid (0.65 g/kg) (HMLP), and high-moisture food with high inclusion of propionic acid (1.3 g/kg) (HMHP). No differences ($P>0.05$) in diet digestibility, energy metabolizability, or faecal consistency were detected. However, the dogs fed the HMHP diet presented lower faecal ammonia concentration ($P=0.003$) as compared to the others. Dogs fed the HMLP and HMHP diets presented higher ($P<0.001$) voluntary intake and first choice as compared to those fed the LM0P diet. It was concluded that the inclusion of 1.3 g/kg propionic acid in the diet did not affect its digestibility; however, it reduced faecal ammonia concentration. The diets containing propionic acid (0.65 or 1.3 g/kg) and high moisture level (102 g/kg) positively influenced food intake and food first choice.

1. Introduction

When evaluating dog foods, chemical composition values are important, but their digestibility and palatability values also need to be considered. Dietary nutrients are utilized better when the formulated diets are well balanced and manufactured with good-quality ingredients. Furthermore, research has shown that the use of food additives, such as probiotics, prebiotics, and organic acids, may improve dietary nutrient utilization (Kirchgessner and Roth, 1982; Swanson et al., 2002).

Most organic acids function both as acidifiers and preservatives, and are often added to pet foods to extend their shelf-life (Krabbe, 1996). In extruded pet foods, in particular, the moisture level needed to maintain kibble physical shape and to enhance food acceptance may promote mould growth during storage, producing toxins that may affect animal health. Propionic acid is an acidifier commonly used in pet foods due to its fungistatic and fungicidal properties. Studies in pigs demonstrated that organic acids may improve feed digestibility, particularly of the protein fraction (Partanen and Mroz, 1999; Kirchgessner and Roth, 1982). According to Eidelsburger (2001), organic acids reduce gastric pH, increasing the activation of pepsinogen into pepsin, thereby improving food digestibility. Organic acids may also present effects against microbes that

Abbreviations: AHF, acid-hydrolysed fat; BW, body weight; CF, crude fibre; CP, crude protein; CTTAD, coefficient of total tract apparent digestibility; DM, dry matter; GE, gross energy; ME, metabolizable energy; NFE, nitrogen-free extract; OM, organic matter; Wa, water activity.

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Table 1
Ingredient and chemical composition of the experimental diet.

Ingredient	(g/kg)
Corn	440.0
Brewers rice	40.0
Soybean meal	150.0
Meat and bone meal	150.0
Fish meal	10.0
Poultry viscera meal	140.0
Poultry fat	30.0
Poultry hydrolysate	30.0
Vitamin and mineral premix[a]	5.0
Sodium chloride	5.0
Analysed chemical composition	
DM (g/kg)	919
OM (g/kg DM)	900
CP (g/kg DM)	306
AHF (g/kg DM)	85
CF (g/kg DM)	23
Calculated chemical composition	
NFE (g/kg DM)[b]	486
ME (MJ/kg)[c]	14.6

DM = dry matter; OM = organic matter; CP = crude protein; AHF = acid-hydrolysed fat; CF = crude fibre; NFE = nitrogen-free extract; ME = metabolizable energy.

[a] Mineral and vitamin premix (content/kg): Vit. A – 16,900 IU, Vit. D3 – 2340 IU, Vit. E – 104 ppm, Vit. K – 1.3 ppm, Vit. B1 – 3.9 ppm, Vit. B2 – 6.5 ppm, pantothenic acid – 19.5 ppm, niacin – 32.5 ppm, choline – 1150.75 ppm, zinc – 156 ppm, iron – 104 ppm, copper – 13 ppm, iodine – 2.6 ppm, manganese – 45.5 ppm, selenium – 0.26 ppm, and antioxidant – 240 mg.

[b] NFE = DM − (Ash + CP + AHF + CF).

[c] ME = (0.01465 × CP + 0.03558 × AHF + 0.01465 × NFE) (Case et al., 2000).

colonize the gastrointestinal tract, including pathogens, such as *Clostridium perfringens*, with consequent reduction of the synthesis of toxic compounds, such as ammonia and biogenic amines (Eckel et al., 1992).

However, despite the positive effects related to mould inhibition (Krabbe, 1996) and to the improvement of nutrient utilization (Kirchgessner and Roth, 1982; Eidelsburger, 2001), the addition of organic acids to the diets may change diet flavour due to its acid characteristics, negatively influencing food acceptance by the animals (Partanen and Mroz, 1999).

The present study aimed at evaluating the effect of increasing levels of propionic acid used as a mould inhibitor and different moisture levels on the digestibility, faecal ammonia concentration, voluntary intake, and first choice of dry extruded dog foods.

2. Materials and methods

2.1. Animals and facilities

The trials were carried out at the Laboratório de Estudos em Nutrição de Cães of the Universidade Federal do Paraná, Brazil. During the trials, environmental temperatures between 25 and 28 °C and relative humidity around 75% were recorded.

Eight 5-year-old adult Beagle dogs (four males and four females), 13.4 ± 1.7 kg (mean ± SD) body weight, were used in the digestibility trial. Twenty 3–7-year-old male and female dogs of the following breeds: eight Beagles (13.1 + 1.2 kg), four Basset Hounds (22.8 + 1.9 kg), four Labradors (27.2 + 2.8 kg), and four Siberian Huskies (21.8 + 2.3 kg) were used in the palatability trial. All dogs had been previously vaccinated and dewormed. During the digestibility trial, dogs were individually housed in stainless-steel metabolic cages, measuring 0.7 m × 0.6 m × 0.5 m, while in the palatability trial, dogs were housed in individual kennels with solarium, measuring 5 m × 2 m. The experimental procedures were approved by the Animal Ethics Committee of Universidade Federal do Paraná.

2.2. Diets

A reference diet (Table 1) was formulated with nutritional levels exceeding those recommended by AAFCO (2004) for the maintenance of adult dogs. The ingredients were ground in a 0.8 mm hammer mill and then extruded in a single screen extruder (E-130, Ferraz, Máquinas e Equipamentos Ltda), with the conditioner set at 140 g water/kg of food, 2000 kg/h