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Lysine reactivity and starch gelatinization in extruded and pelleted canine diets

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Abstract

Fifteen dry adult canine diets (*i.e.*, dinners, extrudates, pellets) were collected from retailers in Wageningen, The Netherlands, and chemically and physically characterized. Quality measurements were lysine *O*-methylisourea (OMIU) reactivity and starch gelatinization degree (SGD). In general, extruded diets had a higher crude fat and starch content than pellets. Mean values for starch gelatinization were higher in pellets and ranged between 0.78 and 0.91. The mean reactive/total lysine ratio in extrudate samples was about 5–10% higher than in pellet samples, suggesting the presence in commercial diets of about 200 g bound lysine/kg in pellets and 120 g/kg in extrudates with bound lysine levels of canine dinners about 170 g/kg. Variation of analysed nutrients in pellets was larger than in extrudates. Inclusion of animal or vegetable ingredients, and the process variables during extrusion or pelleting, are the likely causative factors for the variation in lysine reactivity and starch gelatinization.

Keywords: Extrudate; Lysine; Pellet; Pet food; Starch

Abbreviations: ADF, acid detergent fibre; DM, dry matter; OMIU, *O*-Methylisourea; SGD, starch gelatinization degree

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1. Introduction

Commercial pet foods can be categorized into four basic types of dry, semi-moist, moist and snacks. Dry pet foods comprise the largest segment of the total pet foods sold worldwide and 0.95 of pet diets, in practice, are extruded (Spears and Fahey, 2004). The pet food industry predominantly uses extrusion to manufacture dry pet foods because of the ability to pasteurize, increase digestibility/availability, achieve a desired density and form the products in one application (Douglas, 2006). This high temperature short time process does, however, have detrimental effects on nutritional quality (Björck and Asp, 1983; Cheftel, 1986).

Pelleting and extrusion are thermo-mechanical processes that promote chemical changes such as Maillard reactions between the ε-amino group of lysine and the carbonyl group of other compounds (Björck and Asp, 1983; van Barneveld, 1993) and protein cross-linking reactions (Stanley, 1989; Arêas, 1992). Protein quality can be affected by these reactions since the products formed are not always utilized by the animal when digested and absorbed (Hendriks et al., 1999). In addition, carbohydrate quality may be modified by thermo-mechanical treatments through the gelatinization of starch (Lankhorst et al., 2006) or a shift to the development of resistant starch (Dust et al., 2004). Process conditions used during the pelleting or extrusion process determine digestibility/availability to a large extent. Indeed, it has been established that lysine reactivity was affected in dry commercial canine diets (Williams et al., 2006) and experimental extruded diets (Lankhorst et al., 2006), and to be dependent on the conditions used during diet manufacture. Compared to extrusion cooking, pelleting may generate less shear forces on the feed ingredients and operates at much lower product end-temperatures. Extrusion *versus* pelleting leads to a decrease in N digestibility and an increase in ash absorption in dogs fed diets with a high inclusion level of products of animal origin (Stroucken et al., 1996).

This study investigated variation in total and reactive lysine contents, gelatinization degree of starch and physical properties of dry canine foods commercially available in The Netherlands.

2. Materials and methods

2.1. Canine diets and sample preparation

Fifteen dry adult canine diets were obtained from supermarkets in Wageningen, The Netherlands. Diets included four extruded diets, four pelleted diets and seven dinners. The dinners were composed of differently processed ingredients such as extrudates, puffed cereals and flaked grains. All diets were ground (Retsch ZM100 mill, Retsch BV, Ochten, The Netherlands) to pass a 1 mm sieve and stored in air-tight plastic containers at 4 °C prior to analysis.

2.2. Chemical and physical analysis

The composition of the diets was determined by the standard analysis methodology (AOAC, 1990). Dry matter (DM) was analysed by drying samples to a constant weight at