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Effects of spray-dried animal plasma on food intake and apparent nutrient digestibility by cats when added to a wet pet food recipe

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ABSTRACT

Spray dried animal plasma (SDAP) is a preferred binder in canned pet food products due to its high protein content and excellent physicochemical properties and because it is highly preferred by cats. Eleven mixed breed adult cats were used in a crossover digestibility design study to determine apparent nutrient digestibility of canned chunks and gravy food containing either 30 g/kg SDAP or 30 g/kg wheat gluten (WG) added to the emulsion as binders for producing chunks prior to addition of gravy and subsequent sterilization and canning. Cats were fed 400 g/d of each diet for a 7 d acclimation period followed by a 5 d fecal collection period. Cats fed the SDAP diet had improved ($P < 0.05$) apparent dry matter, crude fiber, ash, phosphorus, and calcium digestibility compared to the WG diet. Results indicate that components in SDAP may retain biological functions that exert beneficial effects on the digestive system of healthy adult cats even after sterilization and canning.

1. Introduction

Spray-dried animal plasma (SDAP) is a common ingredient that is preferred in canned pet food products due to its high protein concentration and technological properties. Spray-dried animal plasma has excellent water-holding capacity, foaming and emulsifying properties (Tybor et al., 1975; Etheridge et al., 1981; Caldironi and Ockerman, 1982; Polo et al., 2005) and gel strength when heated above 80 °C (Parés et al., 1998; Polo et al., 2005, 2007). In addition, because SDAP is an animal protein, strict carnivores such as cats prefer diets formulated with SDAP to those that use wheat gluten (WG) or other vegetable proteins (Polo et al., 2005, 2007). For the purposes of pet food manufacture, blood is hygienically collected from healthy animals approved for slaughter for human consumption. The liquid plasma is obtained after centrifugation of whole blood (either from bovine or porcine origin) and further concentrated by membranes before being dehydrated using spray-drying technology. The spray-drying technique is a mild dehydration process that maintains the functional physicochemical and biological properties of the product.

Spray-dried animal plasma is commonly used as a functional protein ingredient in diets of farm animals to improve performance and health conditions (Torrallardona, 2010; Boyer et al., 2015). In addition, SDAP has been demonstrated to

Abbreviations: SDAP, spray-dried animal plasma; DM, dry matter; CF, crude fiber; CP, crude protein; GE, gross energy; TDF, total dietary fiber; WG, wheat gluten.

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Table 1
Chunk recipe of the two wet pet food products used in the study.

Ingredients (g/kg)[a]	Recipe A SDAP	Recipe B WG
Chicken carcass (50:50 fresh:frozen)	474	474
Pig liver	30.0	30.0
Poultry meal	20.2	20.2
Spray-dried plasma	30.0	0.000
Wheat gluten	0.000	30.0
Sodium chloride (NaCl)	2.40	2.40
Sodium tripolyphosphate	2.00	2.00
Dextrose	1.40	1.40
Cat vitamin premix	0.700	0.700
Cat mineral premix	0.300	0.300
Total chunk	561	561
Potassium chloride (KCl)	1.20	1.20
Sodium carbonate (Na_2CO_3)	0.700	0.700
Chicken broth (C1301)	8.00	8.00
Water	429	429
Total gravy	439	439
TOTAL	1000	1000

[a] Frozen animal by-products (chicken carcass and pork liver) from CORSA Petfood, S.L. (Barcelona, Spain). Fresh poultry carcass from Costa Angelet (Vilanova del Vallès, Barcelona, Spain). Sodium chloride (NaCl) food grade from Unión Salinera de España (Barcelona, Spain). Sodium tripolyphosphate food grade from Payon (Engis, Belgium). Dextrose from Cargill (Saint Germain en Laye, France). Poultry meal from Avifood (Tarragona, Sain). Potassium chloride from k+s Kali (Kassel, Germany). Sodium carbonate from Quimivita (Barcelona, Spain). Chicken broth from Essentia (Ankeny, US). Spray-dried plasma (AP820P) from APC-Europe (Granollers, Spain). Wheat Gluten Vital from Roquette (Lestrem, France). Chicken broth (C1301) from Essentia Protein Solutions (Ankeny, IA, USA). Vitamin and mineral premixes supplied by Affinity Petcare in Sant Cugat del Vallès (Barcelona, Spain). Vitamin premix contains: 38,400 MIU/kg vitamin A as retinyl acetate; 2560 MIU/kg vitamin D3 as cholecalciferol; 136 g/kg vitamin E as di-alpha-tocopheryl acetate; 24 g/kg vitamin B1 as thiamine mononitrate; 12.8 g/kg vitamin B2 as riboflavin 80% spray-dried; 32 MIU/kg vitamin B5 as calcium pantotenate 98%; 12.8 g/kg vitamin B6 as pyridoxine hydrochloride; 4.8 g/kg vitamin B9 as folic acid 96%; 64 mg/kg vitamin B12 as cianocovalamin on CaCO3 flour; 128 g/kg niacin as nicotinic acid; 112 mg/kg biotin as biotin 2% on CaCO3 flour; 320 mg/kg vitamin K as k3 menadione nicotinamide bisulfite and 45% calcium carbonate (carrier). Mineral premix contains: 8000 mg/kg cooper as cupric sulphate; 1310 mg/kg iodine as potassium iodine; 131 g/kg zinc as zinc sulphate; 100 mg/kg selenium as sodium selenite; 78 g/kg iron as ferrous sulphate; 36.5 g/kg manganese as manganous sulphate and sepiolite or calcium carbonate as carriers.

improve nutrient digestibility by pigs (Torrallardona, 2010), poultry (Campbell et al., 2003), fish (Gisbert et al., 2015) and dogs (Quigley et al., 2004).

The inclusion of SDAP in dry dog food kibble either before or after extrusion improved dry matter (DM), crude fiber (CF) and total dietary fiber (TDF) digestibility, and decreased fecal DM excretion (Quigley et al., 2004). The extrusion process used in the manufacturing of dry food kibbles and the sterilization process used in the manufacturing of canned food involves high temperature and pressure that may denature major proteins present in SDAP (APC Inc., unpublished data). However, improved digestibility observed in dry kibbles when SDAP was added before extrusion suggested that changes in digestibility were independent of the functional proteins or that certain bioactive components in SDAP survive extrusion.

Therefore, the main purpose of the study was to determine the effect of SDAP when included in a canned pet food recipe on intake and apparent digestibility of major dietary components in adult cats.

2. Materials and methods

2.1. Ethic statement

The facility of Kennel "De Morgenstond" (Dussen, The Netherlands) was used for the digestibility study. The facility was maintained according to the Dutch regulations (Animals Act, 2011) and the cats were housed in compliance with the Directive 2010/63/EU of the European parliament and of the council of 22 September, 2010 on the protection of animals used for scientific purposes. A consent permission was obtained from the owner of the cats. The animal experimental procedure was in accordance with the Association of American Feed Control Officials guidelines (AAFCO, 2001). The zootechnical procedures used in this experiment (i.e. weighing) were carried out by experienced and authorized personnel and did not cause animal suffering. Technicians at the kennel were unaware of the composition of diets.

2.2. Diets

Two experimental recipes of chunks in gravy were produced in the pilot plant of APC-Europe, S.A. (Granollers, Spain) according to the recipes indicated in Table 1. Each diet provided complete and balanced nutrition for the maintenance of adult cats (AAFCO, 2001; FEDIAF, 2013).

Frozen animal by-products (previously were ground through a 3 mm screen) were mixed with the different additives (salt, sodium polyphosphate, dextrose, mineral premix, vitamin premix) in a pilot plant meat bowl-chopper (Cato S.A., Spain) at maximum speed (2600 rpm). After mixing, poultry meal and then SDAP or WG (used as control binder) was also added