

Nutrient digestibility in air-classified pulse protein concentrates and wet-fractionated soy protein concentrate for 15-d-old broiler chicks

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Introduction

Fractionation technology has the potential to yield value-added or differentiated products from raw agricultural commodities with increased usefulness for particular feed applications. Protein concentrates produced from pulse crops (e.g., pea, faba bean) or soybean meal could have particular usefulness for younger classes of monogastric livestock and poultry. This could enhance feed competitiveness of Western Canadian which is a major pulse producing region. Further, protein concentrates of plant origin could reduce reliance on recycled animal and marine protein sources, which have perceived food safety and sustainability concerns.

The purpose of the present study was to compare nutrient and energy digestibility in commercially-available, air-classified field pea (PPC) and zero-tannin faba bean (FPC) protein concentrates (Parrheim Foods; Saskatoon, SK) and wet-fractionated soy protein (SPC) concentrate (ADM Company; Decatur, IL) in 15 d-old broiler chicks.

Methods and Materials

On the day of hatch, male broiler chicks (Ross 308; n=225) were distributed among 18 battery cages and fed a commercial starter ration until 8 d of age. Cages were then assigned to 1 of 3 test diets for 7 d in a RCB design with 8 replicate cages per treatment.

Test diets consisted of 80% of a basal concentrate, which included 2% celite (source of acid insoluble ash) and 20% of 1 of 3 test ingredients (PPC, FPC or SPC). On d 15, birds were euthanized and ileal digesta collected. Excreta was collected for the 48-h period prior to digesta collection and both digesta and excreta were pooled to produce a single specimen of each per test cage. Nutrient digestibility in the basal concentrate had previously been measured permitting nutrient digestibility in the test ingredients to be calculated by the difference method.

Nutrient digestibility coefficients in test ingredients were compared using PROC MIXED of SAS 9.1 (SAS Institute; Cary, NC). Statistical models included test ingredient (PPC, FPC or SPC) as a fixed effect and block as the random term.

Results

Apparent total tract digestibility (ATTD) of DM and GE were similar between pulse protein concentrates, but tended to be lower than in SPC ($P < 0.10$; **Table 1**). Ileal crude protein digestibility however was greater for PPC compared to FPC or SPC ($P < 0.05$).

Table 1. Apparent total tract (ATTD) and ileal nutrient digestibility (AID) in air-classified faba bean and pea protein concentrates compared to wet-fractionated soy protein concentrate for 15-d old broiler chicks.

	Faba Protein	Pea Protein	Soy Protein	SEM	P - value
ATTD, %					
Dry matter	65.7	67.7	71.1	1.7	0.103
Gross energy	65.7	65.8	71.1	1.8	0.084
AID, %					
Crude protein	89.3 ^b	101.2 ^a	84.6 ^b	1.9	0.001
Amino Acids					
Arginine	89.7	89.9	87.3	1.4	0.373
Isoleucine	75.9 ^a	68.3 ^b	82.2 ^a	2.3	0.003
Lysine	91.4	90.9	87.9	1.7	0.302
Methionine	21.4 ^b	21.0 ^b	72.6 ^a	4.1	0.001
TSAA	2.5 ^c	24.6 ^b	62.8 ^a	3.4	0.001
Threonine	68.2	71.3	70.3	2.7	0.721
Valine	69.7	70.2	77.0	2.3	0.060

Except for the sulphur amino acids, apparent ileal digestibility (AID) of most other essential AA, including ARG, LYS and THR, did not differ among test ingredients ($P > 0.25$). Observed AID coefficients for MET and MET+CYS in the two pulse protein concentrates was considerably lower compared to the other essential AA. In contrast, AID of both MET and MET+CYS was 3-fold higher for SPC compared to either PPC or FPC ($P < 0.01$).

Calculated AME content and ileal digestible AA content of SPC was higher than either of the pulse protein concentrates (**Table 2**).

Table 2. Calculated digestible nutrient content in air-classified faba bean and pea protein concentrates compared to wet-fractionated soy protein concentrate for 15-d old broiler chicks (in % unless otherwise indicated).

	Faba Protein	Pea Protein	Soy Protein	SEM	P - value
AME, kg/kcal	2959 ^b	2925 ^b	3212 ^a	80	0.047
Crude protein	26.6 ^b	23.43 ^c	56.40 ^a	0.63	0.001
Arginine	2.64 ^b	1.75 ^c	4.20 ^a	0.04	0.001
Isoleucine	0.87 ^b	0.63 ^c	2.52 ^a	0.03	0.001
Lysine	1.60 ^b	1.54 ^b	3.68 ^a	0.04	0.001
Methionine	0.06 ^b	0.06 ^b	0.70 ^a	0.01	0.001
TSAA	0.02 ^c	0.19 ^b	1.16 ^a	0.03	0.001
Threonine	0.69 ^b	0.66 ^b	1.85 ^a	0.03	0.001
Valine	0.87 ^b	0.75 ^c	2.55 ^a	0.03	0.001

Higher digestible nutrient content in the SPC appeared to be influenced more by nutrient density as opposed to large differences in nutrient digestibility.

Conclusions

In general, all three of the protein concentrates appear to have excellent nutrient digestibility for young chicks. Due to lower AID of sulfur AA however, replacing soy-based protein in broiler diets with FPC or PPC should be accompanied by sufficient supplementation with MET to achieve an optimal digestible AA profile for chicks.

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