Nitrogen Retention and Nutrient Digestibility in Diets Formulated Using the Net Energy System

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Summary and Implications

Diets with an increasing amount of co-products and formulated with a constant or declining net energy (NE) content were compared for ATTD of gross energy and for nitrogen retention. Forty gilts 38.5±1.2 kg BW were individually allocated and fed *ad libitum* with the experimental diets for a 69d period. Fecal and urine samples were collected two times for growing and for finishing periods. ATTD decreased when co-products were added, even when NE content held constant. Nitrogen retention was lower when co-products were added to the diet. In conclusion diets containing up to 36% co-products and formulated using NE resulted in poorer NR than a corn-soybean meal control diet. Formulating to a constant NE did not maintain nitrogen retention.

Introduction

Rising feed costs demand that our industry pursue strategies to lower the cost of production. One option is the adoption of the NE system. In the U.S many producers are hesitant to proceed without more definitive data; therefore the scientific theory that supports the advantage of NE system over the metabolizable energy (ME) system needs to be validated in practice. The objective of this experiment was to compare the apparent total tract digestibility (ATTD) of energy and the nitrogen retention of diets formulated using the NE system with increasing quantities of co-product ingredients

Materials and Methods

There were 5 dietary treatments: A simple corn-soybean meal was used as a control (CTL), then two diets were formulated; one with NE constant relative to CTL (18NE-CON), and another allowed to decline (18NE-DEC), these diets included 6% each of corn DDGS, corn germ meal and wheat middlings. A last set of diets were formulated with 12% each of the same co-products, with NE content held constant (36NE-CON) or allowed to decline (36NE-DEC). Constant NE treatments achieved the CTL NE content by adding fat. Diets were formulated for both growing and finishing periods. Forty crossbred gilts (PIC 337 sires x C22 or C29; pig improvement /company, Hendersonville, TN-dams with an average body weight of 38.5±1.2 kg) were randomly assigned to one of the five treatments for a total period of 69 days. The test period was divided in a growing (40 to 70 kg) and finishing (70 to 110 kg) periods. Pigs were kept in individual pens then transferred to metabolism crates for the final 13 days of each period. In crates animals had a three day adaptation period. Urine and fecal samples were collected during 72h at days 4-6 and 11-13d. All animals had access to feed and water *ad libitum* for all test period. Results were analyzed using PROC MIXED of SAS (SAS Inst. Inc., Cary, NC).

Results and Discussion

In the growth period, ATTD of gross energy (GE) decreased in all co-product diets compared to the CTL (85.3 vs. 79.9% for average of 18NE and 36NE; $P<0.01$). There were no differences between NE-CON and NE-DEC (80.5 vs. 79.3%; $P>0.05$). In the finishing period, ATTD of GE also decreased in co-product diets compared to CTL (87.1 vs. 82.6% for average of 18NE and 36NE; $P<0.01$). Unlike growing period, the 18NE diets had a higher ATTD of GE compared to 36 NE diets ($P<0.05$). There were no differences between NE-CON and NE-DEC (82.7 vs. 82.5%; $P>0.05$). Nitrogen retention (NR) declined on all co-product diets in the growing period (40.6 vs. 35.5% for average of 18NE and 36NE; $P=0.01$) and tended to decline in the finishing period (35.0 vs. 30.2% for average of 18NE and 36NE; $P=0.08$). There were no differences between CON and DEC diets at 18NE or 36NE ($P>0.05$).

In conclusion, diets containing up to 36% co-products and formulated using NE resulted in poorer NR than a corn-soybean meal control diet. Formulating to a constant NE did not maintain nitrogen retention.

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Table 1. Apparent total tract digestibility, energy content and nitrogen utilization determined for growing and finishing period, diets contained 0, 18 or 36% of co-products, with a constant or declining NE content.

Item	CTL	18NE-CON	18NE-DEC	36NE-CON	36NE-DEC	SEM	*P*-Value
Growing period							
ATTD of GE	85.3[a]	81.8[b]	80.5[bc]	79.2[bc]	78.1[c]	0.7	0.005
NE Mcal/kg, DM [7]	2.66[a]	2.64[a]	2.53[bc]	2.62[ab]	2.45[c]	0.03	0.011
Nitrogen Exc %	59.4[b]	65.2[a]	64.0[a]	63.4[a]	65.6[a]	0.70	0.01
Nitrogen Ret %	40.6[a]	34.8[b]	36.0[b]	36.6[b]	34.4[b]	0.70	0.01
Finishing period							
ATTD of GE	87.1[a]	83.9[b]	84.3[b]	81.4[c]	80.6[c]	0.4	0.0006
NE Mcal/kg, DM [1]	2.68[ab]	2.69[ab]	2.64[b]	2.70[a]	2.56[c]	0.02	0.0055
Nitrogen Exc %	65.0[b]	70.0[a]	68.8[ab]	70.6[a]	69.7[a]	1.12	0.08
Nitrogen Ret %	35.0[a]	30.0[b]	31.2[ab]	29.4[b]	30.3[b]	1.12	0.08

[a,b,c] Assess significant differences ($P>0.05$) or statistical trends ($P>0.10$) between dietary treatments

[1]Noblet et al., (1994) equation 3: NE = 0.843 x DE – 463