Flaxseed Meal in Swine Rations: Chemical Composition, Energy Content and Phosphorus Availability

L. Eastwood[1], P.R. Kish[1], A. Samaraweera[1], A. Owusu-Asiedu[2], A. Jasnier[3], J.F. Patience[1] and P. Leterme[1]

[1]Prairie Swine Centre, [2]Danisco Animal Nutrition, Wiltshire, UK., [3]ESITPA, France

SUMMARY

The chemical composition, digestible energy (DE), net energy (NE) and phosphorus (P) availability of flaxseed meal (FSM) were determined in separate digestibility studies. On a as fed basis, FSM contains 3.52 Mcal DE/kg and 2.445 Mcal NE/kg, has a crude protein content of 31.6% and an ether extract level of 12.2%. The presence of 2570 FTU/kg microbial phytase in diets containing 30% FSM increased the apparent digestibility of P by 40%.

INTRODUCTION

Flaxseed meal is a by-product of the flax processing industry. There is potential to use FSM as an ingredient for swine; however, prior to including it as a regular ingredient, its full nutritional profile must be determined. This includes determination of the DE and NE values, as well as determining the chemical composition of the meal and the availability of minerals such as phosphorus. FSM contains a high level of total P; however, up to 70% of this is bound by phytic acid and is thus unavailable for absorption by monogastric animals such as pigs. Evaluation of the effects of including microbial phytase into FSM based diets is important when looking at P availability.

"Inclusion of phytase into flaxseed meal diets can increase phosphorus digestibility up to 40%"

MATERIALS AND METHODS

The first objective was to determine the DE of FSM in both sows and growing pigs through digestibility trials, allowing for the estimation of NE. Individually housed pigs were fed diets containing 0 or 30% FSM (6 gestating sows (200-300 kg) and 8 barrows (70 kg) per diet). FSM was included at the expense of the basal diet which consisted of barley, wheat, soybean meal, and premix. Celite was included as an indigestible marker. Pigs were acclimated to their diets prior to a 3 day fecal collection period. The DE value of FSM was calculated by difference after analysis of the diets and the fecal samples. Net energy values were estimated according to the equation NE = 0.7*DE + 1.61*EE + 0.48*ST – 0.91*CP – 0.87*ADF (Noblet et al., 1994) where EE is ether extract, ST is starch, CP is crude protein and ADF is acid detergent fibre.

The second objective was to determine the effects of including exogenous phytase (Phyzyme XP 5000G; EC 3.1.3.26, Danisco Animal Nutrition) on P availability. Barrows with average weights of 45 kg were assigned to one of 5 dietary treatments (8 pigs per treatment), each containing 30% FSM with increasing levels of exogenous phytase (0, 575, 1185, 2400 and 2570 FTU/kg diet). The semi-synthetic basal diet was composed of pea starch (50%), Solka-floc® (4%), casein (6%), dextrose (6%), vitamin/mineral premix (2%), canola oil (2%) and FSM (30%). This ensured that

FSM was the only source of P, and celite® was included as an indigestible marker. Faecal samples were collected twice daily for 3 days after a dietary acclimation period. Faecal and diet samples were analyzed for total P content and these values were used to calculate the apparent P digestibility.

RESULTS AND DISCUSSION

Table 1 shows the chemical composition of FSM and the determined values for both DE and NE in growing pigs and gestating sows. There were no significant differences found between groups of pigs for both the DE and NE values. In general, sows have a greater capacity to obtain energy from fibrous components of ingredients, and thus ingredients usually have a higher energy value for sows than for growing pigs. Since FSM is high in soluble fibre, it is possible that this difference between age groups was reduced. The energy value of FSM will depend highly on the oil content of the by-product, which is in turn, highly dependent on the processing methods used to extract the oil. The FSM used in these experiments was produced by screw press and contained 12% total oil.

In the P availability component of this study, analysis of the control diet showed that FSM itself has an endogenous phytase activity level of 423 FTU/kg. In diets containing 30% FSM, the apparent digestibility of P increased from 21% to 61% ($P<0.0001$) by increasing the level of exogenous phytase from 0 to 2570 FTU/kg diet (Figure 1). This increase in digestibility accounted for an increase of 196% in

Table 1. Chemical Composition, DE and NE of FSM

Chemical Analysis	% D.M.
Dry Matter	8.4
Crude Protein	31.6
Ether Extract	12.2
Ash	5.5
ADF	12.7
NDF	22.9
Crude Fibre	9.3
Starch	0.0
Total Phosphorus	0.8
Gross Energy (Mcal/kg)	4.740
Digestible Energy - Grower (Mcal/kg)	3.526
Digestible Energy - Sows (Mcal/kg)	3.517
Net Energy - Grower (Mcal/kg)	2.448
Net Energy - Sows (Mcal/kg)	2.441

the amount of P absorbed by the pig (0.74 to 2.18g P/kg diet). Inclusion of up to 575 FTU/kg diet accounted for half of the total increase in P digestibility (20%), thus increasing absorption by 88% (0.74 to 1.39g P/kg diet).

CONCLUSION

Flaxseed meal contains, on average, 3.520 Mcal DE/kg and 2.445 Mcal NE/kg dry matter. There was no difference between age groups in terms of the DE or NE value of FSM. The crude protein content of FSM is 31.6% DM and the ether extract content is 12.2%. Inclusion of microbial phytase in diets containing 30% FSM significantly improves the apparent digestibility of P which reduces the need to rely on dietary P supplementation. Microbial phytase inclusion at a level of 2,570 FTU/kg diet improved P digestibility by 40%, half of which occurred with just 575 FTU/kg inclusion.

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Table 2. DE and NE Levels for Selected Ingredients (Kcal/kg as fed)

Ingredient	DE	ME
Flaxseed Meal	3,526	2,448
Canola Meal	2,885	1,610
Soybean Meal	3,490	1,935