Does the Energy of Peas Depend on Their Composition

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SUMMARY

High variation in crude protein and starch content is observed among peas collected in farms of Western Canada. This paper evaluates the impact of that variation on the energy value of peas to pigs.

INTRODUCTION

Feed producers are concerned by the high variation of composition observed among the pea samples collected throughout the Prairies. However, it is unclear whether this variation affects the energy value of the peas.

RESULTS AND DISCUSSION

A total of 50 pea samples were collected in Saskatchewan, Alberta and Manitoba in 2005. Their analysis confirms the high rate of variation in composition, especially in crude protein and in starch content (Table 1). This is in agreement with the observations of the Canadian Grain Commission (20 to 26% for crude protein, Nang & Daun, 2004). However, a detailed analysis of the results shows that the majority of the samples had a protein content ranging from 22 to 24% of the dry matter (Figure 1).

Table 1. Average composition of 50 pea samples collected in Western Canada in 2006 (g/kg DM).

	Mean	Standard Deviation	Minimum	Maximum
Dry matter	12.0	1.0	9.6	13.6
Crude protein (N x 6.25)	232	14	199	281
Starch	488	25	386	511
Fat	12.5	3.2	7.9	20.4
Total dietary fibre	227	15	188	249
Ash	28.2	2.1	24.5	33.7
Calcium	0.6	0.3	0.2	1.2
Phosphorus	3.7	0.5	2.8	4.8

In 1998, Zijlstra et al. determined the digestible energy (DE) of 11 pea samples collected in Western Canada and obtained DE values ranging from 3100 to 3740 kcal/kg. This represents a 20% variation, which is lower than the variation observed for crude protein and starch, for example. Unlike what is observed in cereals, no relationship could be established between the neutral detergent fibre (NDF) content and the energy value.

'Pea samples showed a large variation in protein content, approximately two-thirds of the samples ranged between 22-26% protein.'

Different hypotheses have been developed to explain why NDF is as poor determinant of energy. First, the NDF content of peas does not reflect their actual dietary fibre content. Peas contain, on average, 10-12 % NDF whereas the real dietary fibre content ranges from 19 to 25% of the dry matter (Table 1). The difference is due to the fact that the NDF method with detergents is not appropriate for pulse grains and to the presence of soluble fibre, namely pectin and oligosaccharides. No information is available on the effect of these undetected components. Second, more than 90% of the pea fibres are fermented in the digestive tract of the pig and we do not know how this

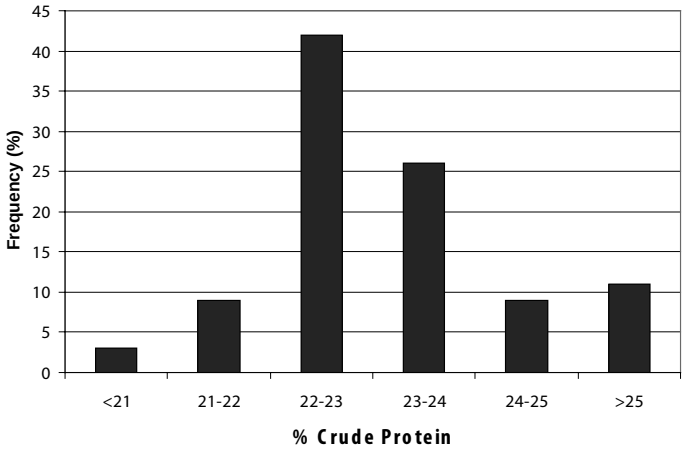

Figure 1. Variation in protein content among pea samples collected in western Canada.

affects the digestive processes. Finally, fibre fermentation provides energy to the pig, in the form of volatile fatty acids, but to an extent that still needs to be determined.

Researchers at Prairie Swine Centre are currently working on the estimation of the net energy value of pea samples differing in composition. They aim to use Noblet's equations of prediction. The latter are based on the composition and digestibility of the diet. Some equations are only based on composition (see example):

'The range of variation in energy content (8%) is thus much lower than the variation in protein or starch content of peas.'

NE = 2790 + 4.12 x EE + 0.81 x Starch – 6.65 x Ash – 4.72 x ADF
where EE (ether extract) is the fat content and ADF the acid detergent fibre (ligno-cellulose) content (Noblet et al, 1994).

This equation was used here to estimate the NE value of the 50 pea samples and the results range from 2,460 to 2,680 kcal NE/kg. The range of variation in energy content (8%) is thus much lower than the variation observed in protein or starch content of peas.

According to that equation, ash is the main factor that affects NE, whereas starch plays a limited role and protein has no effect at all. Peas are quite low in ash but the content is very variable. Wang and Daun (2004) observed higher variation than in the present study (1.3 to 3.4%) and ascribe the variation to potassium, which represents 40% of the total mineral content. The fat content is also an important component of energy but, as for ash, the levels in peas are very limited. The last component is ADF or ligno-cellulose but the latter is the most stable components of peas (from 6.5 to 8.6%; Wang & Daun, 2004).

CONCLUSION

In summary, it is likely that the variation in energy value of peas will be lower that what the variation in protein and starch contents might suggest because the latter don't affect energy digestion very much and that the components that could affect energy supply are either present in low amounts in peas (ash, fat) or don't vary significantly (ADF).

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