Digestible and Net Energy Content of Peas in Weaned Pigs, Growing Pigs and Gestating Sows

P. Leterme, R. Premkumar, P. Kish, and J.F. Patience

SUMMARY

The digestible energy (DE) content of pea varieties grown in the Prairies in 2005 and 2006 was measured in growing pigs (25 and 50 kg) and in gestating sows (200 kg). Based on the DE content and the chemical composition of the peas, the net energy (NE) content of the latter was also estimated. The DE contents ranged from 3.23 to 4.55 Mcal DE/kg DM in growing pigs and from 3.44 to 4.05 Mcal DE/kg DM in sows. The DE content was, on average, .208 Mcal DE/kg DM higher in 50kg-pigs, as compared to the 20kg ones. No marked difference was observed between growing pigs and sows. The NE content was, on average, 69% that of DE. No correlation could be established between the DE content and the chemical composition of the peas.

INTRODUCTION

Peas have become an essential feed ingredient in swine production, thanks to their high content in lysine and their good digestible (DE) and net energy (NE) content in pigs. Western Canada is a region of major pea production but the growing conditions are extremely variable from one year to another and one site to another. For example, a survey conducted in 2005 and 2006 showed that the crude protein content can vary from 19 to 29% of the dry matter and from 38 to 51% starch. However, little information is available on the variability in DE or NE content and on the factors that affect it. Namely, it would be interesting to dispose of prediction equations based on the chemical composition so that the actual value of pea samples could be predicted easily. The estimation could be improved even further if distinction could be made between DE measured in pigs and in sows. The latter have a better digestive capacity and the DE contents are usually higher in sows, as compared to growing pigs. The present study aimed at determining the DE and NE content in weaned pigs, growing pigs and gestating sows of different peas grown in Western Canada in 2005 and 2006 and at establishing prediction equations based on their chemical composition.

MATERIAL AND METHODS

Different pea samples were collected in 2005 and 2006 in farms of Alberta, Saskatchewan and Manitoba and evaluated in weaned pigs (25kg), growing pigs (50kg) and gestating sows (200 kg on average) through digestibility trials. A basal diet, composed of cereals, soybean meal and minerals (including Celite, used as an indigestible marker (acid-soluble ash)), was prepared. Part of the basal diet was then substituted by 30% (growing pigs) or 40% of ground (hammer mill) peas. The animals were fed with the experimental diets (8 pigs and 6 sows/diet) for a period of 2 weeks and faecal samples were collected by grab sampling during the last three days. The DE content of the basal diet and of the pea-based diets was determined and the DE content of the peas alone was then calculated by difference. The NE content was then calculated by means of the following equation (Noblet et al., 1994, J. Anim. Sci. 73, 344):

NE = 0.7 x DE + 1.6 x Oil + 0.48 x Starch - 0.9 x Crude Protein - 0.87 x ADF

with the content in nutrients expressed in g/kg DM.

RESULTS AND DISCUSSION

Table 1 shows the results of chemical composition and of DE and NE content of peas in gestating sows. The crude protein content ranged from 20 to 27% and the starch content from 42 to 51% of the dry matter. The variability in DE and NE content was also high: from 3.44 to 4.05 Mcal DE/kg DM and from 2.34 to 2.82 Mcal NE/kg DM. The variation was thus higher for the components (6 to 8.5%) than for the DE and content (5% on average). Attempts were made to establish a relationship between the chemical composition and the energy content so that the latter could be predicted from the composition. Unfortunately, no significant correlation could be established between any of the chemical components and the energy value. The relationship obtained between ADF (ligno-cellulose) and DE is illustrated in Figure 1 ($r = -0.39$). ADF is used to predict the energy value of cereals in pigs because it is highly indigestible and thus negatively affects the digestive processes. It is not the case for peas, probably because more than 90% of the pea dietary fibre is fermented in the gastrointestinal tract.

"Digestible energy content of peas is higher in finisher pigs than weaned pigs."

The DE and NE contents obtained in weaned and growing pigs are detailed in Table 2. The coefficient of variation was higher than that observed in gestating sows (8 vs 5%). The experiment was here limited to 5 varieties, which allowed us to study the varietal effect. Obviously, differences exist between varieties (Table 3): the average value obtained for 3 samples of the Admiral variety, for example, was 3.38 Mcal DE/kg DM whereas that of 5 samples of Cutlass reaches 3.90 Mcal DE/kg DM.

The DE and NE contents were markedly higher in growing pigs as compared to weaned pigs: the difference was 208 and 138 kcal/kg DM, respectively. The correlation between the results obtained for growing pigs and weaned pigs was high ($r = 0.78$). The difference can be ascribed to a better digestive capacity of the larger pigs, namely their capacity to ferment more dietary fibre, thanks to a larger hindgut and a slower transit of the digesta. This better capacity of large pigs to digest fermentation is now recognized and the French tables of nutrition even propose different values of DE and NE contents for growing pigs and sows. However, in the present case, no difference in DE was observed between growing pigs and sows, possibly because the results were obtained from different samples and different experiments.

IMPLICATIONS

Peas grown in different conditions present different chemical compositions and DE contents. However, no relationship could be established here between composition and energy content. On the other hand, our results confirm that large pigs better digest peas than weaned pigs and that it makes sense to consider different energy contents for weaned pigs and larger pigs.

ACKNOWLEDGEMENTS

Strategic funding is provided by Sask Pork, Alberta Pork, Manitoba Pork Council and Saskatchewan Agriculture and food Development Fund. Specific funding for this project was provided by the Saskatchewan Pulse Growers.

Table 1. Chemical composition (g/kg DM), DE and NE content of field pea varieties in gestating sows (Mcal/kg DM)

Variety	Crude Protein	Starch	NDF	ADF	DE	NE
Admiral	235	462	154	70	3.60	2.48
Camry	199	485	143	67	3.68	2.59
Cooper I	214	503	132	65	3.45	2.43
Cooper II	216	473	137	72	3.60	2.51
Cutlass	217	458	151	72	3.81	2.63
Golden	264	429	184	101	3.83	2.57
Midas	222	506	182	79	4.05	2.82
Monterro	232	480	152	72	3.60	2.49
Mozart	228	472	139	69	3.52	2.44
Nitouche	253	490	158	80	3.57	2.46
Profi	237	476	159	63	3.88	2.69
Sage	239	463	205	91	3.96	2.72
Stratus I	240	424	178	83	3.44	2.34
Stratus II	262	417	162	83	3.77	2.54
Striker	269	435	186	76	3.66	2.47
Mean	**235**	**465**	**161**	**77**	**3.70**	**2.55**
SD	20	28	21	10	0.18	0.12
Min.	199	417	132	63	3.44	2.34
Max.	269	506	205	101	4.05	2.82

Table 2. DE and NE content (kcal/kg DM) of field pea varities in weaned and growing pigs

	DE		NE	
Variety	**25kg**	**50kg**	**25kg**	**50kg**
Admiral	3.36	3.31	2.43	2.45
Admiral	3.50	3.44	2.41	2.36
Admiral	3.26	3.18	2.44	2.28
Bronco	3.83	4.20	2.64	2.90
Bronco	3.93	4.11	2.75	2.88
Cultass	4.23	4.55	3.08	3.08
Cultass	4.30	4.40	3.01	3.06
Cultass	3.75	3.98	2.58	2.75
Cultass	3.63	3.61	2.52	2.51
Cultass	3.58	4.23	2.80	3.00
Eclipse	4.04	4.21	2.50	2.92
Eclipse	3.47	4.21	2.50	2.92
Eclipse	3.54	3.54	2.47	2.48
Eclipse	3.81	3.77	2.67	2.64
Eclipse	3.24	3.40	2.30	2.41
Eclipse	3.62	3.86	2.52	2.68
Golden	3.83	4.29	2.64	2.97
Golden	3.45	3.78	2.37	2.60
Golden	3.55	3.42	2.47	2.37
Golden	3.63	4.05	2.56	2.78
Golden	3.23	3.71	2.22	2.56
Mean	**3.71**	**3.92**	**2.57**	**2.71**
Min.	3.23	3.18	2.22	2.28
Max.	4.30	4..55	3..08	3.08

Table 3. DE content (kcal/kg DM) of 5 pea varieties in growing pigs

Variety	n	DE
Admiral	3	3.41
Eclipse	6	3.83
Golden	5	3.85
Bronco	5	4.16
Cutlass	5	4.15