Effect of processing of oilseed meals on ileal digestibility, performance and protein deposition in growing pigs

T.G. Hulshof[1,2], P. Bikker[1] and A.F.B. van der Poel[2]

[1] *Wageningen UR Livestock Research, Edelhertweg 15, 8219 PH, Lelystad, The Netherlands*
[2] *Animal Nutrition Group, Wageningen University, De Elst 1, 6708 WD, Wageningen, The Netherlands*

Introduction

Feed ingredients, e.g. oil seed by-products, generally have undergone several processing steps before inclusion in animal diets. Over-processing of feed ingredients and diets can lead to protein damage which is in most cases caused by the reaction between lysine and reducing sugars, i.e. the Maillard reaction (Bender, 1972). This protein damage can decrease the digestibility of crude protein and amino acids, reduce the bioavailability of amino acids and negatively affect performance in pigs (González-Vega et al., 2011). The aims of the first study were to determine the effects of processing of two oil seed by-products, i.e. soybean meal (SBM) and rapeseed meal (RSM), on standardized ileal digestibility (SID) of crude protein (CP) and lysine and performance in growing pigs. From the results, a second experiment was designed of which the experimental set-up is also given in this abstract.

Material and Methods

Ten barrows (initial BW 24.8 ± 0.28 kg) were suited with a SICV cannula (Mroz et al., 1996) and individually housed in metabolism cages. Four experimental diets were used, consisting of a basal N-free diet supplemented with 35% SBM or RSM in combination with 7 or 5% (as percentage of CP content) of the sugar-rich compound Xylig®, respectively. SBM and RSM were used as purchased or toasted after mixing with Xylig®, in order to induce negative changes in protein quality. The RSM diets were supplemented with synthetic lysine, threonine and tryptophan to levels corresponding to the levels in the SBM diets. Chromic oxide was added as indigestible marker to calculate the SID of CP and lysine. The experiment consisted of a cross-over design with three periods of 14 days. Feed was provided twice a day at 2.8 times maintenance energy. Ileal chyme was collected during 12 hours on days 9 and 11 of each period and analysed for CP, amino acids and chromic oxide. Feed conversion ratio (FCR) was calculated from average daily gain and feed intake as measure for nutrient utilization. SID of lysine for the RSM diets was calculated by assuming 100% digestibility of synthetic lysine. Results presented therefore represent the ileal digestibility of lysine for the RSM only. The proc mixed procedure in SAS (2008) was used to test for the fixed effects of feed ingredient, processing treatment, and their interaction on SID CP and lysine, and FCR, with period and animal in the random statement. P-values <0.05 were assumed to be significant.

Results and Discussion

The results of the SID CP, SID lysine and FCR are given in Table 1.

Table 1. Effect of feed ingredient, i.e. soybean meal (SBM) or rapeseed meal (RSM), as such and additional processing treatment (toasting after mixing with the sugar-rich compound Xylig®), on standardized ileal digestibility of crude protein (SID CP) and lysine (SID lysine) and feed conversion ratio (FCR) in growing pigs.

	SBM		RSM			P-value	
	As such	Processed	As such	Processed	SEM	Feed ingredient	Processing treatment
SID CP	83.9	71.6	75.7	65.7	1.32	<0.001	<0.001
SID lysine	85.7	66.8	77.5	61.2	1.17	<0.001	<0.001
FCR	1.87	2.55	2.15	2.56	0.037	0.522	0.020

There were no significant interaction effects for SID of CP (P=0.352), SID of lysine (P=0.271) and FCR (P=0.524) between type of feed ingredient and processing treatment indicating that processing has similar effects on these variables for SBM and RSM diets. The animals fed the RSM diets had a significantly

lower SID CP than the animals fed the SBM diets. This agrees with other studies that showed that rapeseed products in general have a lower digestibility of protein and amino acids than soybean products (Grala et al., 1998). The type of feed ingredient did not influence the FCR ratio despite the lower SID CP and SID lysine for the RSM diets, presumably because of the supplementation of the RSM diets with synthetic lysine, threonine and tryptophan. Processing of SBM and RSM reduced the SID CP and SID lysine and negatively affected the FCR. The lower efficiency of nutrient utilization for tissue deposition as indicated by the higher FCR might be caused by the reduction in protein and lysine digestibility. In conclusion, additional processing of SBM and RSM, i.e. mixing with a sugar rich compound and toasting, reduced the crude protein and lysine digestibility and nutrient utilization as indicated by the FCR ratio.
In the second experiment, we are interested in determining the protein and amino acid deposition for the unprocessed and toasted (after mixing with the sugar-rich compound Xylig®) SBM and RSM formulated on ileal digestible amino acids obtained from the previous experiment. In addition, we want to determine if adding synthetic amino acids to the toasted SBM and RSM diets can compensate for the effect of processing treatment.

Experimental design follow-up experiment

Three SBM diets and three RSM diets are formulated on: (1) ileal digestible amino acids in SBM or RSM supplemented to meet 90% of the lysine requirements, (2) similar dietary composition as (1) but with toasted SBM or RSM instead of SBM or RSM, respectively, and (3) ileal digestible amino acids in toasted SBM or RSM supplemented with synthetic amino acids to meet ileal digestible amino acid levels in (1). The diets are fed to nine female pigs (initial BW 17.1 ± 0.96 kg) each which are individually housed in order to determine individual feed intake. The experiment consists of a randomized complete block design with BW as block. Within a block, pigs were randomly allocated to one of six dietary treatments and pens. Feed allowance per pig is calculated based on BW and daily gain during the previous week. Feed is provided twice a day at 3.0 times maintenance energy. Five pigs were slaughtered at the start of the experiment to determine initial body composition. The other 54 pigs will be slaughtered at reaching a BW of 40 ± 2 kg to determine final body composition. Protein and amino acid content in the empty carcass and blood + visceral fraction will be determined and related to the protein and amino acid intake per pig. The experiment is currently running and preliminary data on BW and growth will be presented on the ANR Forum 2014.

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