

Influence of Treated Rapeseed Meal on Growth Performance, Nutrient Digestibility and Blood Profile in Growing Pigs

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ABSTRACT— *This study was conducted to investigate the influence of replacing part of soybean meal (SBM) with 15% treated rapeseed meal (tRSM) on growth performance, blood parameters and nutrient digestibility in young growing pigs. A total of 12 crossbred growing pigs (Slovakian White x Landrace) with an average initial body weight of 15.70 ± 1.83 kg were divided into two dietary treatments according to their body weight and sex (six pigs in each group). The experiment lasted 34 days. The rapeseed meal was treated with the product that neutralizes the negative effects of glucosinolates contained in rapeseed by-products for pigs feeding. In the our study, we did not observe negative effects of tRSM on body weight, average daily gain and feed conversion ratio. In blood profile, serum urea, albumin, glucose and total cholesterol were not influenced by dietary tRSM treatment. Concentration of total proteins was decreased at the end of the experimental period in the experimental group ($P < 0.01$). For apparent total tract digestibility acid-insoluble ash was used as marker. Partially replacing of SBM with tRSM had no significant negative effects on the apparent total tract digestibility of dry matter, crude protein and crude fat. Finally, the inclusion of 15% of treated RSM in growing pig diets had no negative effects on growth performance, nutrients digestibility and selected blood characteristics.*

Keywords— pigs, rapeseed meal, growth performance, digestibility, blood characteristics

1. INTRODUCTION

European pig production, including Slovak republic, is to large extent based on imported protein feed sources such as soybean meal (SBM). Globally, SBM is the most common protein source in pig diets [1]. Because of its balanced amino acids content and high concentration of protein, SBM is generally considered a good protein source for non-ruminant livestock diets [2].

In some European countries, where soybeans are a low yielding crop, the interest has been directed towards protein sources grown in Europe, such as rapeseed by-products, as an alternative to soybean meal. Rapeseed meal (RSM) has a lower content of protein and certain amino acids – mainly lysine, and increased crude fiber content compared to soybean meal. Although lysine content of RSM is lower than SBM, sulphur containing amino acids such as cysteine and methionine are much higher. RSM is a co-product in oil and biofuel production, it is abundant and cheap and can serve as an alternative to SBM in diets for monogastric animals [3].

The using of these rapeseed meals is limited due to the presence of anti-nutritional factors in the form of mainly glucosinolates and erucic acid. Various technological procedures are used to reduce these unfavourable properties [4]. Several studies have been carried out on rapeseed meal with low concentrations of anti-nutritional factors as a alternative protein source with different nutritional characteristics in pig diets using different methodologies.

The effect of rapeseed meal in pig diets may be dependent on many of factors, such as new varieties of rapeseed, chemical characteristics, diet formulation, inclusion level and replacement strategy, amino acid or enzyme supplementation, methods used for treating of rapeseed meal, diet processing, and feeding methods applied [1]. Different processing of meals and also

diets may generate variation in nutritional value, digestible essential amino acids and contents of glucosinolates [5; 6] and this could partially explain variable responses in pig performance among different studies.

Therefore, the objective of this experiment was to evaluate whether 15% treated rapeseed meal (tRSM) can partially replace soybean meal (SBM) as a main protein source in growing pig diets. The double-low rapeseed (00-rapeseed) with low concentrations of glucosinolates and erucic acid was used in our study.

2. MATERIAL AND METHOD

Twelve crossbred piglets (Slovakian White × Landrace) with an average body weight (BW) of 15.70 ± 1.83 kg were used for a 34-day trial. Pigs were divided into two groups (6 pigs in each group). Both groups contained equal numbers of gilts (2) and barrows (4). The same basic ingredients for the control and the experimental groups were used in the study.

The diets were formulated based on cereal grains (corn, wheat and barley), soybean meal or treated rapeseed meal, vitamin + mineral premix and synthetic amino acids. Both diets had similar crude protein (CP) content. Dietary treatments were as follows: control, a SBM-based diet and experimental, a treated RSM-based diet (+15% tRSM; partial replacement of soybean meal). The rapeseed meal was treated with 2.5% LinaropAgri® LRA (LINAGRI s.r.o., Czechia), the product, which may reduce a negative effect of glucosinolates and therefore may improve the digestibility of rapeseed meal.

The nutritional characteristics of the treated RSM (97.5% rapeseed meal + 2.5% LRA) were the following: dry matter 897 g/kg, crude protein 349 g/kg, ether extract 16.1 g/kg and crude fibre 122g/kg as fed basis. The declared content of glucosinolates in the used rapeseed meal samle was max. 20 µmol/g. All diets met or exceeded the requirements of NRC [7]. Composition, analyzed and calculated nutrient content of diets are shown in Table 1. All animals were fed twice per day and pigs were given free access to water.

Individual body weight of pigs and feed consumption on a group basis were recorded at the beginning and end of the experiment to calculate average daily gain (ADG) and feed conversion ratio (FCR). The study was carried out in the animal quarters of the Department of Animal Nutrition and Husbandry at the University of Veterinary Medicine and Pharmacy in Košice in compliance with the EU regulations concerning the welfare of animals.

Table 1: Ingredient composition, analyzed and calculated nutrient content of control and experimental diet in growing period (as-fed basis)

<i>Ingredients(%)</i>	Control diet	Experimental diet
Corn	24	30
Wheat	20.64	25.73
Barley	32	16
SBM, CP 46%	20	10
tRSM		15
Premix Vitamin-Minerals	3	3
Lysine	0.2	0.2
Methionine	0.08	
Threonine	0.08	0.07
<i>Analyzed content(g/kg)</i>		
Dry matter	884.6	886.3
Crude protein	172.85	172.81
Crude fat	19.98	22.56
Crude fiber	37.59	45.55
<i>Calculated content (g/kg)</i>		
Lysine	11.90	11.92
Threonine	7.21	7.26
Methionine+cysteine	6.50	6.66
Metabolizable energy (MJ/kg)	12.88	12.80

SBM – soybean meal; tRSM – treated rapeseed meal; CP – crude protein

The diets were analysed for their dry matter (DM), crude protein (CP), crude fiber and crude fat according to the EC Commission Regulation [8]. The amino acids content in both diets were calculated according to their requirements of limiting amino acids [7]. Blood samples were obtained from the cranial vena cava of both groups at the end of the experimental period (day 34). The serum parameters were determined using a fully automatic random access benchtop analyser Ellipse (Italy). The faeces were taken directly from the rectum at the end of the investigation. For apparent fecal digestibility determination acid-insoluble ash was used as marker. Fecal samples were analyzed for dry matter, crude protein and crude fat.

All data were reported as the mean \pm standard deviation. The differences between means were determined according to the unpaired t-test using Graph-Pad Prism statistical program (Graph Prism software, USA). By conventional criteria, differences ($P < 0.05$) were considered to be statistically significant.

3. RESULTS AND DISCUSSION

Body weights at the end the trial were not significantly affected by dietary inclusion of 15 % treated RSM as partial replacement to SBM. During the experimental period, ADG was slightly higher in pigs fed the experimental diet than those fed the control diet, but there were no statistically significant differences in ADG between groups ($P > 0.05$). The FCR was a little poorer in pigs fed the control diet (+ 0.03kg feed / kg gain) (Table 2).

The coefficient of fecal digestibility of DM, CP and crude fat was higher (dry matter +2.42%; crude protein +2.29%; crude fat +0.34%) in pigs from the control group (SBM-based diet) compared to pigs from the experimental group (tRBM-based diet). However, differences for the apparent fecal digestibility of DM, CP and crude fat were not statistically significant in the our study (Table 2).

Table 2: Influence of dietary treated rapeseed meal on growth performance and nutrient digestibility in growing pigs

	Control group	Experimental group
Number of pigs	6	6
Body weight (kg)		
Initial	15.80 \pm 1.88	15.58 \pm 1.79
End of trial	40.70 \pm 3.69	41.05 \pm 3.42
ADG (g)	732.9 \pm 93.9	752.0 \pm 93.0
FCR(kg feed / kg gain)	1.88	1.85
Nutrient digestibility (%)		
Dry matter	85.86 \pm 1.98	83.44 \pm 2.07
Crude protein	84.14 \pm 2.22	81.85 \pm 1.87
Crude fat	69.21 \pm 2.92	68.87 \pm 2.32

ADG - Average daily gain; FCR - Feed conversion ratio

Serum total protein concentration was decreased at the end of the experimental period in the experimental group compared to the control group ($P < 0.01$). Serum albumin, urea, glucose and cholesterol concentration was not affected by the dietary tRSM supplementation (Table 3). The detected mean values of analyzed parameters in blood serum of pigs from both groups were within the reference values according to Kraft and Dürr [9].

Table 3: Influence of dietary treated rapeseed meal (tRSM) on blood profiles of growing pigs

Parameters	Reference values*	Control group	Experimental group
Total proteins (g/l)	< 86	71.73 \pm 2.67 ^a	66.96 \pm 1.59 ^b
Albumin (g/l)	18 - 31	33.58 \pm 2.37	31.81 \pm 3.01
Urea (mmol/l)	3.3 - 8.3	4.19 \pm 0.52	4.33 \pm 0.30
Glucose (mmol/l)	3.9 - 6.4	5.56 \pm 0.33	5.46 \pm 0.25
Cholesterol (mmol/l)	2 - 3.3	2.18 \pm 0.29	2.02 \pm 0.14

a, b – significant differences ($P < 0.01$); *according to Kraft and Dürr [9]

In several previous experiments, it has been demonstrated that between 15% and 30% rapeseed meal can be included in diets fed to growing-finishing pigs without impairing growth performance [10; 11]. Also Yun et al. [12] reported that the inclusion of 4% of RSM in finishing pig diets had no negative effects on growth performance, nutrients digestibility and blood characteristics (Blood urea nitrogen and Creatinine).

Choi et al. [13] observed that RSM could be supplemented to growing-finishing diets up to 9% without detrimental effects on growth performance of growing-finishing pigs. The RSM, used in their experiment was supplemented to the diets with replacement of corn, SBM and soy oil.

The meta-analyses of Hansen et al. [1] showed no differences in ADG, and feed:gain of using a double-low rapeseed (00-rapeseed or canola meal) with low concentrations of glucosinolates and erucic acid in diets for weanling pigs and a minor reduction in overall effects size of ADG and gain:feed in growing-finishing pigs.

It is well known that RSM has higher fibre content that affects nutrient digestibility [14]. Many researchers have attempted to enhance the nutrient digestibility of RSM through decreasing fibre content and anti-nutritional factors such as glucosinolates by improving processing methods [15; 16]. Nutrient digestibility is influenced by a number of factors including the fiber from rapeseed hulls, anti-nutritional factors (tannins, erucic acid, and glucosinolates) and dietary formulation [17]. However, in the present study, inclusion of 15% tRSM did not affect nutrient digestibility significantly.

5. CONCLUSION

Our results suggest that treated RSM (with the product that suppresses the negative effects of glucosinolates) can be used as an alternative feed source without adverse effects on growth performance, serum parameters and nutrient digestibility if used in well-balanced diet for young growing pigs.

6. CONFLICTS OF INTERESTS

Authors declare that there are no conflicts of interest.

7. ACKNOWLEDGEMENT

This work was supported by the project KEGA no. 006UVLF-4-2020.

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