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Influence of some immunomodulation additives to growing-finishing diets on pig performance, carcass traits and some blood indices

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ABSTRACT

Eighty pigs of (Polish Landrace x Large White) x Hampshire crossbreed (40 gilts and 40 barrows) were allotted to four treatments and fed with basal diets for the growing (30-70 kg body weight, BW) and finishing periods (70-110 kg BW). The growing-finishing pigs in group I were fed diets supplemented with flavophospholipol at a dose of 10 mg kg^{-1}; group II, with the addition of animal plasma protein (30 g kg^{-1} of mixture); group III, with added immunized egg protein (2 g kg^{-1} of mixture); group IV, with the addition of mannanooligosaccharide (5 g kg^{-1} of diet). The pigs were housed in pens (two gilts or two barrows per pen). Feed and water were available *ad libitum*. The animals were weighed at the start of the experiment, in the middle of it, and at slaughter.

Average daily gains and feed utilization were significantly affected by animal plasma protein supplementation. Backfat thickness over the shoulder as well as leaf fat weights were reduced significantly in pigs fed the diets supplemented with mannanooligosaccharide. The lean of ham and loin eye area increased significantly in the group with egg protein added to the diet.

KEY WORDS: fattening pigs, plasma protein, mannanooligosaccharide, immunized egg protein

INTRODUCTION

Since restrictions on the utilization of antibiotics as growth promoters for pigs and other farm animals (Brzóska, 2000) are being imposed, a search for their alternatives has been underway for the last decade. Attention is focusing on probiotics (Grela and Semeniuk, 1999), organic acids (Gabert and Sauer, 1995), prebiotics, herbs and also on immunomodulators (Grela et al., 1998; Matras et al., 2001; Mosenthin, 2001). The results of investigations on piglets suggest that these factors can diminish diarrhoea, stimulate a beneficial microbial population in the gas-

trointestinal tract, improve nutrient digestibility and production performance (Jiang et al., 2000; Mosenthin, 2001).

Among ecologically safe feed additives that are being taken into consideration as antibiotic alternatives, mannanooligosaccharide (a prebiotic), animal plasma protein, and immunized hen egg protein (immunoglobulins) are of interest. The aim of these investigations was to determine the influence of these alternatives to antibiotics in the diets for growing-finishing pigs on growth performance, carcass traits and some indices of blood.

MATERIAL AND METHODS

Animals and experimental procedures

Studies were conducted on 80 piglets of (Polish Landrace x Large White) x Hampshire crossbreed, divided into 4 groups, 20 animals each (ten gilts and ten barrows). Fattening pigs were maintained in pens, 2 animals in each. Initial body weight was 28-30 kg and 110±2 kg at slaughter. Environmental conditions (temperature and humidity) in the piggery were in compliance with the standards for pigs (Rokicki and Kolbuszewski, 1996). The portions of feed (complete feed) were given according to standards; refusals were recorded.

Diets

The pigs of group I (control) were fed with the standard PT-1 mixture (growing period) and PT-2 (finishing period), containing 12.8 and 12.7 MJ metabolizable energy, 169 and 150 g crude protein, 8.9 and 7.6 g lysine, 5.4 and 4.6 g methionine and cystine, 7.6 and 6.9 g Ca and 5.4 and 4.1 g P, respectively. Their nutritive values were therefore similar to Polish standards (1993). The feeds contained the antibiotic, flavophospholipol (10 mg kg^{-1}). In the mixture for the other groups the antibiotic was replaced by either animal plasma protein, in an amount of 30 g kg^{-1} (group II), by a preparation of immunized egg protein (group III), 2 g kg^{-1}, or by 5 g mannanooligosaccharide per kg of diet (group IV). The chemical composition, including DM, crude ash, crude fiber, ether extract, crude protein, mineral (Ca and P) and amino acid composition, was determined according to conventional methods (AOAC, 1980).

Measurements

The animals were weighed at the start of the experiment, in the middle of it and at slaughter. Blood was sampled from 6 pigs in each group at 90 and 110 kg body

weight. The haemoglobin content (Hb), total protein, triglycerides, total cholesterol and HDL fraction were determined colorimetrically using diagnostic tests by Cormay. The glucose level was estimated using a Diascan S glucometer.

The pigs were stunned by electric shock and then killed by exsanguination. After slaughter, 6 right carcasses (3 gilts and 3 barrows) of each treatment were chilled overnight and the following data were recorded using the Polish Pig Progeny Station method: carcass weight, length, backfat thickness, loin and ham weight before the ham was further dissected into lean, subcutaneous fat and bone, loin eye area and weight of right-side leaf fat.

Statistical analysis

Chemical analyses in blood were performed in duplicate. The statistical significance of the difference between means of pig performance, blood indices and carcass quality of treatments ($P<0.05$) was calculated by the Student t-test. The results are given as the arithmetic means and standard error of mean (SEM).

RESULTS AND DISCUSSION

All of the animals completed the experiment. Neither diarrhoea nor other health problems were noted. The average daily gains of fattening pigs and feed conversion ratio (FCR) during the whole experimental period in the control group were 860 g and 3.12 kg kg^{-1}, respectively. The best production effects were achieved by the pigs in group II, fed the diet where animal plasma protein, instead of antibiotic was used (Table 1). The gains in this group were higher by 12.2% ($P<0.05$) and FCR was lower by 1.6%, in comparison with the control treatment. A positive effect of adding blood plasma protein on piglet rearing has been noted in many experiments, among others in the investigations carried out by Jiang et al. (2000), who, using a mixture with 10% animal plasma, achieved daily gains higher by 23% and FCR lower by 19% than in the control group. The immunized egg preparation or mannanooligosaccharide additives improved daily gains, but only in the first fattening period ($P<0.05$). The gains in these groups were then even lower than in group I. Matras et al. (2001) and Mosenthin (2001) show a positive effect of these additives. The results they cite, however, deal with piglets. The highest average FCR in the whole period was noted in the treatment with added immunized egg protein (group III). It is noteworthy that FCR in group II (treatment with animal blood plasma) and group IV (mannanooligosaccharide) was lower in the growing period in comparison with the control ($P<0.05$).

The cold dressing percentage of pigs was fairly equal in all experimental groups (from 77.8 in group III to 79.1% in group II). No considerable differences were

TABLE I

Daily gains, feed conversion ratio, carcass traits and some blood indices of fattening pigs

Item	Feeding groups				SEM[1]
	I	II	III	IV	
Daily weight gains, g					
growing period	783[a]	971[b]	835[c]	848[c]	12.4
finishing period	936[a]	959[a]	863[b]	904[ab]	10.8
whole period	860[a]	965[b]	849[a]	876[a]	11.4
Feed conversion, kg kg^{-1}					
growing period	3.19[a]	2.89[b]	3.01[ab]	2.97[b]	0.06
finishing period	3.05[a]	3.26[b]	3.56[c]	3.35[b]	0.05
whole period	3.12[ab]	3.07[a]	3.28[b]	3.16[ab]	0.05
Body weight at slaughter, kg	110.2	109.8	110.5	110.4	0.04
Cold dressing percentage, %	78.9	79.1	77.8	78.7	0.05
Carcass length, cm	83.1	83.6	83.5	84.2	0.12
Weight of ham, kg	6.76[a]	7.02[b]	6.96[b]	7.23[c]	0.09
Lean content in the ham, %	62.4[ab]	61.8[a]	64.4[b]	62.8[ab]	0.12
Loin eye area, cm^2	45.2[a]	48.8[b]	49.3[b]	45.8[a]	1.24
Backfat thickness of 5 measurements, mm	15.8[ab]	16.9[b]	16.4[b]	15.2[a]	0.08
Leaf fat, kg	0.75[ab]	0.71[a]	0.82[b]	0.69[a]	0.06
In the blood and in the blood plasma during finishing period (average at 90 and 110 kg)					
haemoglobin, mmol l^{-1}	9.07[a]	9.01[a]	8.85[a]	9.46[b]	0.06
protein, g l^{-1}	72.10[a]	72.14[a]	70.39[b]	70.42[b]	0.04
glucose, mmol l^{-1}	5.45[ab]	5.82[a]	5.25[b]	5.44[ab]	0.02
total cholesterol, mmol l^{-1}	2.64	2.66	2.65	2.58	0.06
HDL, mmol l^{-1}	0.99[ab]	0.92[b]	1.12[a]	0.92[b]	0.06
triglicerides, mmol l^{-1}	0.74	0.71	0.73	0.76	0.04

SEM[1] – standard error of the mean

[a, b, c] – P=0.05

noted in carcass length. The highest ham weight was achieved in group IV (mannanooligosaccharide) and the lowest, in group I (control, with antibiotic); the differences are significant (P<0.05). The best muscled (lean content in the ham and loin eye area) were the animals of group III (egg protein). The least fatness (backfat thickness and leaf fat weight) were the pigs of group IV (mannanooligosaccharide). The somewhat better carcass characteristics achieved in comparison with controls could be due to stimulation of the immune system (immunized egg protein) or modification of microflora of the gastrointestinal tract (prebiotic, Zimmermann et al., 2001).

The highest haemoglobin content was noted in the blood of group IV animals. It was considerably higher than in the other groups (Table 1). The protein content of blood plasma was higher in treatments I and II in comparison with the other two treatments ($P<0.05$). The lowest glucose concentration in the blood was noted in group III (egg protein). The total blood cholesterol level (average 2.63 mmol L^{-1}) and triglyceride content (average 0.74 mmol L^{-1}) was not influenced by the diet additives. The highest HDL content (1.12 mmol L^{-1}), ($P<0.05$) was detected in treatment III (egg protein). The values of blood parameters, with the exception of triglycerides, found in this experiment are in physiological norms (Winnicka, 1997).

CONCLUSIONS

Animal plasma protein, immunized egg protein, and mannanooligosaccharide are realistic potential antibiotic alternatives in diets for growing-finishing pigs. Among the investigated additives, plasma protein proved to be the most effective. In this treatment, the average daily gains and feed conversion ratio were considerably better than in the other treatments over the whole experimental period. The addition of immunized egg protein and also mannanooligosaccharide improved the performance of pigs in comparison with the antibiotic only during the first period of fattening.

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STRESZCZENIE

Wpływ dodatków immunomodulacyjnych do mieszanek dla tuczników na ich wzrost, jakość tuszy i niektóre wskaźniki krwi

Osiemdziesiąt tuczników (40 loszek i 40 wieprzków), mieszańców ras (wbp x pbz) x Hampshire, podzielonych na 4 grupy, żywiono mieszankami standardowymi typu PT-1 (30-70 kg masy ciała) i PT-2 (70-110 kg). Tuczniki grupy I otrzymywały dodatek flavomycyny w ilości 10 mg kg^{-1} paszy. Dla zwierząt w grupie II zastosowano dodatek białka plazmy krwi (30 g kg^{-1} paszy), w grupie III – białko immunizowanych jaj (2 g kg^{-1} paszy), w grupie IV mannanooligosacharydy w ilości 5 g kg^{-1} paszy. Tuczniki trzymano w kojcach po 2 loszki lub 2 wieprzki. Paszę i wodę zwierzęta otrzymywały do woli. Zwierzęta ważono przy masie ciała 30, 70 i 110 kg (przy uboju). Krew do badań pobrano przy masie ciała 90 kg i przed ubojem.

Najlepsze przyrosty dzienne i zużycie paszy oraz najgrubszą słoninę uzyskano po zastosowaniu dodatku białka plazmy krwi. Najmniejszą grubością słoniny grzbietowej i masą sadła cechowały się tuczniki otrzymujące dodatek mannanooligosacharydów. Dodatek immunizowanych jaj spowodował zwiększenie umięśnienia tusz.