IgY TECHNOLOGIES

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Abstract

The piglets were fed 4 weeks the commercial feed mixture and those of the experimental group received egg yolk antibodies at 3 g per animal per day from day 1 to day 7. The monitoring of performance was completed by investigation of effects on the digestibility of crude protein (CP), crude fibre (CF), crude fat (F) and ash and bacteriological examination demonstrated haemolytic *E. coli.* Higher weight gains (C = 342 g/d, E = 427 g/d) were in the experimental group. More effective digestibility were observed in the experimental piglets during the period of supplementation (CP: C = 72.31, E = 76.09 %, CF: C =52.58, E = 55.01%, F: C = 56.32, E = 57.58 %) but, also in the subsequent period (CP: C = 76.41, E = 77.77 %, CF: C = 43.68, E = 55.30 %, F : C = 51.93, E = 57.50 %) when all piglets were feed identical diets. Haemolytic *E. coli* were negative in the experimental group at post weaning day 5 already.

Introduction

The ban of use of some growth promoting feed supplements issued in the recent years has lead to a considerable limitation of use of antibiotics in pig nutrition. Such limitations are justified by the effort to avoid the presence of residues in pork intended for human consumption. On the other hand, the economics of pig production require increasing the number of piglets reared per sow per year. An important factor, which can control this number, is the period from farrowing to weaning and the subsequent breeding.
Weaning exposes piglets to a number of changes including the transfer from the farrowing house into rearing facilities, social re-grouping, and above all, replacement of sow's milk by a feed mixture. After weaning, the gastrointestinal tract of piglets is colonised by all microorganism present in the new environment. Dominance is gained by the more aggressive, undesirable, and sometimes pathogenic species. This post-weaning period of one to two weeks is manifested by decreased performance and, in some cases, by outbreaks of diarrhoea that may be lethal. It is just this period when the effects of growth promoters, or preventive feed medication, are most marked. Efforts of feed supplement manufacturers concentrate on finding alternative ways, one of which is the use of IgY technologies.
Until weaning, the piglet is protected against the undesirable microorganism by lactogenic immunity provided by IgA antibodies representing the dominant component of milk antibodies (BLEHA, 1998). These specific antibodies block binding sites of the bacteria and prevent them from attaching to endothelial cells and propagation, thus enhancing their rapid elimination in faeces. Lactogenic immunity protects piglets particularly against intestinal infections. Adult animals produce IgA antibodies in lymphatic tissues of Peyer plaques and secrete them onto the surface of the intestinal mucosa and into the intestinal contents. The first IgA are detectable in intestinal crypts and mucus as late as at the age of three weeks.
The development of the immune system is not yet completed at weaning, however (KREJČÍ, ŠTĚPÁNEK, 2000),
The IgY technology (avian IgG antibodies are designated as IgY because they are stored in egg yolks) is based on functional similarity between mammalian IgA and hens' IgG antibodies and the ability of hens to produce, in response to appropriate immunisation, antibodies to selected agents pathogenic for other animal species. The efficacy of yolk antibodies against bacteria and viruses pathogenic for piglets and calves has been demonstrated in a number of *in vitro* studies and in infected animals (ERHARD et al. 1996, PIMENTEL 1999, BERGHMAN et al. 2006, PETTIGREW 2006). Thus, prerequisites for practical use in the prophylaxis and treatment of specific infections were provided. Yolks, or the egg mass, contain also antibodies to a number of agents that are facultative pathogenic both for poultry and for other species, such as *Escherichia coli, Clostridium*, rotaviruses, etc. Our experiments were focused on the use of yolk antibodies for the control of the intestinal microbial population of clinically normal piglets.

Material and methods

Piglets of two clinically normal litters were pooled and allotted to two groups of six animals to provide equal starting conditions for both. All piglets were fed the commercial feed mixture and those of the experimental group received egg yolk antibodies at 3 g per animal per day 1st week of experiment.The experiments were conducted using the commercial product IMUGUARD (Medipharm CZ) containing egg yolk antibodies to porcine rotavirus, *E. coli*, and other agents, and a culture of *Enterococcus faecium* M-74 (600 x 10^6 CFU per 1 g). The probiotic bacterium of this feed supplement supports the favourable component of the intestinal microbial population and replaces undesirable species removed by the action of yolk antibodies.

In the experiment, the monitoring of performance was completed by investigation of effects of yolk antibodies on the digestibility of organic matter, nitrogenous substances, fibre, and fat at the end of the 1st and the 4th week of the experiment. Faeces were collected from the floor of pens in the last three days of the 1st and 4th week and analysed along with feed samples. Digestibility was calculated by conversion to hydrochloric acid-insoluble ash. Rectal swabs were collected at intervals given in Table 3 and examined for the presence of haemolytic *E. coli.*

Results

The results of the experiment (Table 1) have confirmed higher weight gains and more effective feed utilisation in piglets treated with egg yolk antibodies. The highest difference was recorded at the end of the 1st week, when the weight gain in the experimental group was higher by 90.5% (164 vs. 86 g per day).

Daily weight gains increased during the subsequent weeks to reach 427 g in controls and 514 g in the experimental group at the end of week 4. Mean weight in the experimental group at the end of the observation period was higher by almost 2.4 kg (Table 1).
Better feed utilisation in the experimental group, evident from a decrease of consumption per 1 kg body weight gain, is supported also by digestibility data (Table 2). At the end of the 1st and 4th week, the experimental group showed higher digestibility of all nutrients.
Bacteriological examination demonstrated haemolytic *E. coli* at weaning in two piglets of each group. The findings were negative in all piglets of the experimental group at post□weaning day 5 already, while one piglet of the control group was positive still on day 14 (Table 3).

Table 1 - Results of feeding experiment

		Control	Experimental
starting weight x	kg/piglet	7.300	7.300
SD		0.837	0.820
final weight x	kg/piglet	16.864	19.253
SD		3.852	3.419
daily weight gain x	g/anim./day	342	427
SD		115	95
feed conversion ratio	kg/kg weight gain	2.349	1.510

Table 2 - Digestibility coefficients at the end of post weaning weeks 1 and 4

	Control		Experimental	
week	1	4	1	4
Crude protein % x	72.31	76.41	76.09	77.77
SD	1.27	1.40	4.08	1.20
Crude fat % x	56.32	51,93	57.58	57.50
SD	3.21	6.28	9.47	4.90
Crude fibre % x	52.58	43,68	55.01	55.30
SD	3.68	10.31	3.69	11.77
Ash % x	55.55	53.62	55.94	57.80
SD	2.17	2.22	4.49	4.36

Table 3 - Results of bacteriological examination for haemolytic Escherichia coli

day of experiment	**Control ***	**Experimental**
0	2/6	2/6
2	2/6	2/6
5	2/6	0/6
7	2/6	0/6
9	2/6	0/6
12	2/6	0/6
14	1/6	0/6

*Numbers of positive and negative samples are given in numerators and denominators, respectively

Conclusion

Higher weight gains and more effective feed utilisation were observed in the piglets not only during the period of supplementation, but also in the subsequent period when both the experimental and the control group were feed identical diets. This effect can be explained by the fact that the change in the composition of the intestinal microbial population runs rather chaotically under uncontrolled conditions. The change in feed composition and discontinuation of milk antibody supply provides conditions for the propagation of all bacterial species present in the environment and the desirable balance is gained after some time only. The resulting bacterial disbalance is manifested by post□weaning diarrhoea, higher susceptibility to diseases, and, above all, lower weight gains and less effective feed utilisation. Early and sufficient supplementation of the diet with a product containing yolk antibodies and the probiotic bacterium *Enterococcus faecium* enhances and accelerates a desirable change in the composition of the intestinal microbial population and increases feed digestibility and this effect is manifested by higher weight gains and more effective feed conversion.

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