

EVALUATION OF LECITHIN AS AN EMULSIFIER FOR WEANLING PIGLETS

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Abstract

The influence of supplementation of a lecithin emulsifier (0.1%) to the commercial feed mixture for piglets after weaning was studied. Totally 28 piglets in a control group (C – without lecithin) and 28 piglets in an experimental (E) group were monitored in a 28-day experimental period after weaning at 28 days of age. The weight of piglets and feed consumption were monitored in weekly intervals. For digestibility determination the faeces were collected from the floor of pens on the last two days of each week. The digestibility was determined by calculating the content of nutrients in feed and faeces concerning the content of the marker (insoluble portion of ash). The average daily weight gain (C = 383.3, E = 399.5 g) of the experimental group was statistically insignificantly higher while the feed conversion ratio (C = 1.959, E = 1.808 kg/kg, $P < 0.01$) was found to be statistically significantly lower. The positive influence on the digestibility of crude fat and ash was more significant in the first half of the experiment and the influence on the digestibility of crude protein, crude fibre and organic matter persisted during the experiment. According to the results presented in this study we can draw a conclusion that the supplementation of lecithin emulsifier to the feed mixture for piglets in the period after weaning has a positive impact on the utilisation of dietary nutrients.

Key Words: Nutrition, feed additive, digestibility, phospholipid

Introduction

Antibiotic growth stimulators significantly affect the efficiency of piglets in the post-weaning period. Their gradual elimination from feed mixtures calls for a necessity of looking for other supplementary substances that have a positive effect on the utilisation of feed by piglets with digestive systems not yet completely developed. Milk fat contains a large amount of short-chain fatty acids that are easily consumable and absorbable (Palmquist et al. 1993). The digestibility of milk fat of sows is set to be up to 95% (Heugten and Odle 2000). In addition, the fat is emulsified and it can be digested more easily in this form. Piglets lose this nutrition source at the moment of weaning and there arises a question how to substitute it adequately (Jensen et al. 1997). Gu and Li (2003) considered insufficient digestibility to be the major problem of adding fats into feed mixtures for piglets. It may be caused by the size of fat droplets. In an experiment performed by the authors mentioned above higher digestibility of not only fat but also of energy and proteins was detected after adding an emulsifier in the form of lysolecithin into the feed mixture for piglets. It was reported that a lecithin emulsifier could help piglets of the weight up to 22 kg to increase weight gains and improve feed conversion (Schwarzer and Adams 1996). The effect of lecithin is higher immediately after weaning (Soares et al. 2002). With respect to these experiments the use of lecithin emulsifier in feed mixtures for piglets after weaning can

be promising (Desouza et al. 1995; Gu and Li 2003). The aim of the experiment was to test the effects of lecithin on the efficiency of piglets in the post-weaning period.

Material and Methods

An experiment was conducted in the Institute of Animal Science in Praha-Uhřetěves, at a workplace in Kostelec nad Orlicí. Clinically healthy piglets of the Large White breed, coming from our farm, were used in the experiment. Piglets were weaned at 28 days of age and divided into experimental and control group according to starting weight, sex and origin. The average starting weight was 8.7 kg in both groups. Each group comprised 28 piglets (4 cages / 7 piglets). Piglets were kept in cages with non-stop access to food and water. The experiment lasted for 28 days.

The control group was fed a commercial feed mixture for piglets without growth stimulator. For the experimental group a lecithin emulsifier was added in an amount of 1 kg/t.

The weight of piglets and feed consumption were monitored in weekly intervals. For digestibility determination the faeces were collected on the last two days of each week. The digestibility was determined by calculating the content of nutrients in feed and faeces concerning the content of the marker (insoluble portion of ash). The digestibility was determined by calculating the content of nutrients in feed and faeces concerning the content of the marker (insoluble portion of ash). Dry matter was determined by weighing after drying at the temperature of 105°C for 4 hours. The content of crude

protein in the sample was calculated after determining the nitrogen content by coulometric titration according to the formula: crude protein = N × 6.25. Nitrogen in the sample was transformed after mineralization by sulphuric acid while boiling with catalyst to ammonium sulphide and by titration with hypobromite generated coulometrically from potassium bromide using biamperometric indication its amount was calculated. Fat was determined by weighing as the residue after extraction by means of diethyl ether. Fibre was determined as the solid residue after acid and alkaline hydrolysis by sulphuric acid and the solution of sodium hydroxide after having estimated the ash by weighing. Ash was determined as the residue after complete combustion of organic substances at 550°C by weighing. The insoluble portion of ash in HCl was determined as the residue of ash after dissolving ash in diluted hydrochloric acid by weighing.

No clinical symptoms of a disease were observed in any piglet during the experiment.

All experimental procedures were reviewed and approved by the Ethical Committee of the Institute of Animal Science.

Results were processed by the statistical programme TriloByte QC.Expert2.7.

Results and Discussion

The results of the feeding experiment (Table 1) – a statistically insignificant increase in the average daily weight gain (AWG) by 4% (C = 383.8, E = 399.5 g/day) and a highly significant decrease in the feed conversion ratio (FCR) by nearly 8% (C = 1.959, E = 1.806, P<0.01) prove the predicted positive effect of lecithin emulsifier in piglets.

Increasing digestibility of crude fat (Table 2) in the control group may be explained by the gradual adaptation of piglets' digestion system to feed mixture. The difference in digestibility between the two groups varied during the experiment. At the end of the first week the digestibility of crude fat in the experimental group was 8.3% higher than in the control group, and it was gradually decreasing to 2.4% in the last week. With the time elapsing from weaning the digestibility was also

increasing in both groups. In the control group it was the highest in the fourth week, the experimental group reached this peak already in the third week. We can deduct from these results that the lecithin emulsifier has a positive influence on the digestibility of crude fat mainly in the period just after weaning while its importance decreases in time (along with the adaptation of piglets to feed mixture).

Contrary to the large difference in the digestibility of crude fat between both groups of piglets at the beginning of experiment and at the end of experiment, the difference in the digestibility of crude protein is very small (Table 3). It was always larger in the experimental group; the difference did not vary significantly. The increase in the crude protein digestibility was statistically significant for the whole experimental period (P<0.01), in the second (P<0.05) and in the third (P<0.01) week, and was close to significance in the fourth week (P<0.1). These results indicate that the influence of lecithin emulsifier on crude protein digestibility lasts longer than its influence on crude fat. In this case we could see the effect still 4 weeks after weaning.

In our experiment, similarly like the digestibility of crude protein, the digestibility of crude fibre and organic matter was also influenced insignificantly. On the other hand, the lecithin emulsifier influenced the digestibility of ash similarly like the crude fat in the period after weaning (table 4).

Our results support the results of the experimental utilisation of phospholipids obtained so far and published by Schwarzer and Adams (1996) and our previous results (Daněk et al. 2005), and provide information about the influence of lecithin emulsifier on nutrient digestibility in relation with time after weaning.

The addition of lecithin emulsifier into feed mixtures for piglets caused a statistically significant decrease in the feed conversion ratio. At the same time an increase in the digestibility of crude fat, crude protein, crude fibre, ash and organic matter was recorded. The positive influence on the digestibility of crude fat and ash was more significant in the first half of the experiment while the influence on the digestibility of crude protein, crude fibre and organic matter persisted during the whole experiment.

Table 1. Results of feeding experiment

		control group	experimental group	improvement index (%)
Number of piglets		28	28	
Starting weight kg	x	8.700	8.700	100
	SD	1.256	1.586	
AWG g/day	x	383.8	399.5	104.1
	SD	98.4	95.0	
FCR kg/kg	x	1.959 ^A	1.806 ^B	92.2
	SD	0.063	0.045	

Values marked by different capital letters are statistically highly demonstratively different (P<0.01)

Table 2. Digestibility coefficients (%) of crude fat

		control group	experimental group	improvement index (%)
1 st week	x	58.14	62.99	108.3
	SD	9.04	11.33	
2 nd week	x	67.99	71.15	104.6
	SD	4.41	5.42	
3 rd week	x	73.54	75.84	103.1
	SD	7.08	7.98	
4 th week	x	74.01	75.76	102.4
	SD	6.15	5.86	
summary	x	68.42	71.38	104.3
	SD	9.21	9.25	

Table 3. Digestibility coefficients (%) of crude protein

		control group	experimental group	improvement index (%)
1 st week	x	77.25	81.02	104.9
	SD	5.90	3.42	
2 nd week	x	78.34 ^a	82.47 ^b	105.3
	SD	4.27	3.09	
3 rd week	x	78.72 ^A	82.51 ^B	104.8
	SD	3.33	0.93	
4 th week	x	79.69 ^A	82.78 ^B	103.9
	SD	4.04	0.56	
summary	x	78.50 ^A	82.20 ^B	104.7
	SD	4.36	2.36	

Values marked by different capital letters are statistically highly different ($P < 0.01$), values marked by different small letters are statistically significantly different ($P < 0.05$)

Table 4. Digestibility coefficients (%) of ash, crude fibre and organic matter

week	ash			crude fibre			organic matter		
	C	E	Index	C	E	Index	C	E	Index
1	56.78	62.67	110.4	50.59	53.60	105.9	82.31	84.37	102.5
2	65.45	68.65	104.9	53.29	56.18	105.4	83.95	84.83	101.0
3	67.72	68.54	101.2	58.32	63.86	109.5	84.22	85.22	101.2
4	69.56	70.49	101.3	61.87	64.45	104.2	84.55	85.56	101.2
summary	64.88	67.59	104.2	56.01	59.52	106.3	83.76	84.99	101.4

C = control group

E = experimental group

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