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WACŁAW KRASUCKI, EUGENIUSZ R. GRELA, JAN MATRAS, KATARZYNA SZAFRAN

The Influence of Immunized Hen Egg Yolk Preparation on Performance of Piglets

Wpływ immunizowanego preparatu z jaj na efekty odchowu prosiąt

The neonate piglets mainly depend on the maternal supply of antibodies via colostrum and milk until their own immune system and production of specific antibodies in the serum are better developed. In practice, however, passive protection against gastrointestinal pathogens by maternal immunoglobulins is often insufficient (2, 3). The failure of maternal immunity transfer to the suckling piglets results in a fast development of enterotoxic strains of *Escherichia coli* (ETEC) and porcine rotavirus. Subsequently, it leads to clinical symptoms of diarrhoea, which may comprise even up to 80% of the population (3, 6, 7, 8).

Nowadays, to meet increasingly stronger public demands for healthy pork, the usage of antibiotics/chemitherapeutics in commercial feed for pigs will be presumably reduced or banned. Among various commercially available sources of specific antibodies, using chicken egg yolk powder as a dietary supplement for prophylaxis and treatment of some infections intestinal diseases seems to be most advantageous from practical, financial and ethical point of view (5, 9).

The objective of this experiment was to evaluate the efficiency of specialized dried egg protein (SEP) when supplemented into a commercial weaner diet during particular phases of rearing on piglet growth and feed utilization.

MATERIAL AND METHODS

The piglets from 32 multiparous sows (Large White x Polish Landrace) were used in this experiment. The sows selected for delivering piglets in this study were not vaccinated with any form

of *E. coli* vaccine and had previous litters, which developed diarrhoea either during suckling periods and/or after weaning. On the 28-th day of age they were weaned and the piglets were kept until 56 days of age in a weaner unit (the same building as the farrowing unit). Microclimate for piglets over the suckling and postweaning periods was established to be within a thermoneutral zone. Both, the farrowing and weaner pens were equipped with the bite nipples to allow free access to water for the piglets throughout this study. No creep feed was available in the first 3 weeks of the suckling period.

All the litters (piglets) were randomly allotted to eight treatments (about 40 piglets each) to study the effect of SEP for reared piglets. This product was incorporated 1.1g/kg diet into a typical weaner diet at various phases of the rearing, i.e., exclusively before weaning (from 22 to 28 days of age) or before and after weaning (from 22 to 42 days of age or from 22 to 56 days of age) or exclusively after weaning (from 29 to 56 days age). In each phase two treatments: control diet (1, 3, 5 and 7, respectively) and diet supplemented with SEP (2, 4, 6 and 8, respectively) were applied.

The weaner diet for piglets consisted of a standard commercial prestarter mixture used from 21 to 35 days of age and a starter mixture used from 36 to 56 days of age. These mixtures were composed of corn, wheat, barley flakes, extracted soybean meal, fish meal, skim milk powder, fodder yeast and mineral-vitamin premix as major ingredients. Both prestarter and starter diets had similar metabolizable energy value (13.8 MJ/kg) and contained 19.2% and 18.2% crude protein, respectively.

The SEP was supplemented by spraying it over the pellets in a diluted form with rapeseed oil (proportion 1: 9). These diets were offered *ad libitum* in a dry form.

Measurements of both body weight changes in the piglets and feed intake throughout the experiment were performed in weekly intervals. Health status (incidences of diarrhoea, mortality, clinical disorders) of the piglets was monitored at all times. The standard method was used to determine the content of DM, ether extract, crude fiber, ash, and N in the basal diet (1). The content of Ca, Cu and Zn was assayed in the diets by atomic absorption spectrophotometry after ashing the samples at 460^0C and preparing mineral solution in 0.48 *M* HCl. Total P was determined colorimetrically by the vanadomolybdate procedure (1).

Experimental data were subjected to analysis of variance according to the following model:

$$X_{ij} = + A_i + B_j + (A \times B)_{ij} + e_{ij}$$

where: X_{ijk} = independent variable; = overall means; A_i = SEP effect (i = 1, 2); B_j = effect of SEP application period (j = 1...4); e_{ij} = error contribution with average 0 and δ^2.

RESULTS AND DISCUSSION

HEALTH OF THE PIGLETS

In general, no substantial losses of the piglets were encountered throughout this study, irrespective of the treatment.

Supplement of SEP positively influenced the reduction of diarrhoea incidences and diarrhoea days. By application of SEP to piglets exclusively before weaning from (22-28 days), the diarrhoea incidences were 7.0% vs. 11.9% for the control pigs and the duration of diarrhoea was shorter by 1.1 days. A similar tendency was

observed by applying SEP to piglets from 22 to 42 days of age and from 22 to 56 days (both before weaning and after weaning). Also, by application of SEP to piglets from 29 to 56 days of age (exclusively after weaning), fewer piglets suffered from diarrhoea in particular weeks, and its duration was by 1.3-2.1 days shorter. These results correspond to K e l l n e r et al. (4).

BODY WEIGHT AND DAILY GAINS OF PIGLETS

A statistical comparison of growth rate in the piglets on treatments 2, 4, 6 and 8 (exclusively with SEP) is presented in Table 1. When comparing treatments 2, 4, 6 and 8 (exclusively with SEP), the growth rate of piglets receiving this product from 22 to 56 and from 29 to 56 days of age was approximately 1.2% higher. The difference, however, was statistically insignificant.

Tab. 1. Comparison of growth rate of piglets fed SEP (treatments 2, 4, 6 and 8)

Item	SEP treatments				SED	LSD
	2	4	6	8		
Body weight:						
Initial 21 days	5.98	6.12	6.08	-	0.07	0.18
28 days	7.34	7.40	7.48	7.39	0.09	0.13
Final 56 days	16.29	16.28	6.61	16.63	0.14	0.37
Average daily gain:						
29-56 d, g	319.6	317.1	326.1	330.2	3.8	9.9

Tab. 2. The main effects of SEP on the performance of piglets irrespective of the period of its application

Item	Treatment		SED	LSD
	Control	SEP		
Body weight, kg:				
Initial 21 d	6.01	6.06	0.04	0.12
28 d	7.28	7.40	0.05	0.13
Final 56 d	15.99^{A}	16.45^{B}	0.07	0.20
Average daily gain:				
29 – 56 d, g	311.1^{A}	323.2^{B}	1.9	5.4

A, B Means within rows, with different superscript letter differ ($P < 0.01$).

Overall, the effect of SEP on the growth rate of the piglets (irrespective of the period of its supplementation) is presented in Table 2. The average daily gain of piglets receiving the prestarter and starter diets with SEP was equal to 323 g, as

compared to 311 g in the piglets fed without SEP supplementation. This difference was statistically significant ($P < 0.01$).

FEED INTAKE AND FEED CONVERSION RATIO

A comparison of the feed intake and feed conversion ratio (FCR) in piglets as restricted to SEP only is presented in Table 3. The FCR in the piglets of treatment 6 was slightly better in comparison with the other treatments containing SEP, but the differences were statistically insignificant.

Tab. 3. Comparison of feed utilization by piglets among particular treatments with SEP over the whole rearing period

Item	SEP treatments				SED	LSD
	2	4	6	8		
Feed intake: 29-56 d, g head^{-1} d^{-1}	478.1	480.2	479.8	493.2	28.6	62.4
Feed conversion ratio:* 29-56 d, kg kg^{-1} gain	1.50	1.51	1.47	1.49	0.10	0.24

*FCR feed conversion ratio (kg feed per kg of gain).

Tab. 4. The main effects of SEP on feed utilization during the entire experiment (irrespective of the period of its application)

Item	SEP treatments		SED	LSD
	Control	SEP		
Feed intake: 29-56 d, g head^{-1} d^{-1}	478.1	482.8	20.2	62.4
Feed conversion ratio:* 29-56 d, kg kg^{-1} gain	1.54^{a}	1.49^{b}	0.07	0.21

$^{a, b}$Within rows, values with different superscript letter differ ($P < 0.05$).
*FCR feed conversion ratio (kg feed per kg of gain).

The main effects of SEP (irrespectively of the period of its supplementation) on the feed intake and FCR are presented in Table 4. The piglets fed SEP had a slightly better FCR ($P < 0.05$).

CONCLUSIONS

1. Supplementation of SEP in doses of 0.11% into prestarter and/or starter diets had a positive effect on the health of reared piglets by decreasing incidences of

diarrhoea from 13.5% to 4% and by reducing its duration by 1.2 days. No mortalities were noticed due to diarrhoea in the groups receiving SEP.

2. The average daily gain of piglets fed SEP was by 12 g (3.9%,P <0.05) better irrespective of the rearing period of its supplementation.

3. Feed intake by piglets fed SEP was slightly higher (by 1%), whereas the FCR was by 3.2% (P<0.05) better.

4. The highest efficiency of SEP in preventing diarrhoea in piglet performance was noted when supplementing this product at over 22-56 days of age.

REFERENCES

1. A O A C.: Official Methods of Analysis (14 th Ed.). Association of Official Analytical Chemists, Arlington, VA, 1984.
2. B a l j e r G.: Entstehung und Bekämpfung von E. coli- Durchfallerkrankungen bei Ferkeln und Kälbern. Aktuelle Themen der Tierernährung und Veredelungswirtschaft, 1993.
3. I b u r g M.: New Strategies for the Protection of Neonates Against Diarrhea. Lohmann Information, 20, 1997.
4. K e l l n e r J., E r h a r d M.H., R e n n e r M., L ö s c h U.: Therapeutischer Einsatz von spezifischen Eiantikörpern bei Saugferkeldurchfall – ein Feldversuch. Tierärztl. Umschau., 49, 1994.
5. K i c h u r a T .S.: Improving Pig Performance with Hyperimmune Eggs. In: Proc. Ann. Meeting of the American Association of Swine Practitioners, 1997.
6. L ö s c h U., S c h a n n e r I., W a n k e R., J u r g e n s L.: The Chicken Egg, an Antibody Source. J. Vet. Med., series B 33, 1986.
7. M o r g a n R. L., I s a a c s o n R. E., M o o n H. W., B r i n t o n C. C., T o C. -C.: Immunization of Suckling Pigs Against Enterotoxigenic *Escherichia coli*- Induced Diarrhoeal Disease by Vaccinating Dams with Purified 987 or K99 Pili: Protection Correlates with Pilus Homology of Vaccine and Challenge. Infection and Immunity 22, 1978.
8. N a g y B., M o o n H. W., I s a a c s o n R. E., T o C. -C., B r i n t o n C.C. Immunization of Suckling Pigs Against Enteric Enterotoxigenic *Escherichia coli* Infection by Vaccinating Dams with Purified Pili. Infection and Immunity 21, 1978.
9. Y o k o y a m a H., P e r a l t a R. C., D i a z R., S e n d o S., I k e m o r i Y., K o d a m a Y.: Passive Protective Effect of Chicken Egg Yolk Immunoglobulins Against Experimental Enterotoxigenic *Escherichia coli* Infection in Neonatal Piglets. Infection and Immunity 60, 1992.

STRESZCZENIE

Badania przeprowadzone zostały na 320 prosiętach rasy wbp x pbz pochodzących z 32 miotów. Porównywano wpływ okresu stosowania dodatku preparatu zawierającego immunoglobuliny żółtka jaj (SEP) od kur szczepionych uprzednio m.in. przeciw *E. coli* na wzrost i wykorzystanie paszy przez prosięta. Mieszanki paszowe z dodatkiem preparatu (1g/kg) stosowano w następujących okresach odchowu: 22-28 dni (grupa 2), 22-42 dni (grupa 4), 22-56 dni (grupa 6) i 29 –56 dni (grupa 8). W każdym z tych okresów, w odpowiednich grupach kontrolnych 1, 3, 5, i 7, stosowano analogiczną mieszankę prestarter lub starter bez dodatku preparatu SEP.

Dodatek preparatu odpornościowego do mieszanek prestarter i starter wywarł pozytywny wpływ na zdrowotność i wyniki odchowu prosiąt, obniżając z 13,5% do 4,0% wystąpienia biegunki oraz skracając czas jej trwania średnio o 1,2 dnia. Nie zanotowano padnięć prosiąt spowodowanych biegunką w grupach otrzymujących preparat SEP. Niezależnie od okresu podawania tego preparatu przyrosty prosiąt były o 12 g wyższe (3,9%, P,05) w stosunku do grup kontrolnych. Pobranie paszy prosiąt otrzymujących mieszankę z tym dodatkiem były nieco wyższe (średnio o 1%), podczas gdy współczynniki wykorzystania paszy o 3,2% (P,05) wyższe. Największą efektywność stosowania preparatu SEP odnośnie do zapobiegania występowania biegunek i wzrostu prosiąt stwierdzono przy podawaniu tego preparatu w okresie 22-56 dni życia.