

HIGH DOSES OF MICROELEMENTS AND ORGANIC ACIDS IN THE DIET OF WEANED PIGLETS

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Abstract

Maybe weaning, regardless of age, represent a strong stress caused by the loss of the sow milk, changing places and groups for transfer to the nursery and the changing structure of the meal. In such conditions of stress occurs long delay in growth, followed by serious disorders of the digestive tract, often in huge losses. The aim of this paper was to show the effect of high doses of zinc and copper, and citric acid in the diet of weaned piglets on the dynamics of growth, consumption and feed conversion, health status and cost of feeding. The experiment was conducted in production on a total of 381 piglets which was divided according to gender, age and body weight into two groups. Two mixtures were used, the starter and grower. Starter mixture was different, while the grower mixture was similar in both groups. Control group (I) were fed with diet containing 20% protein, while the experimental group (II) was fed with diet containing 18% protein with addition of extended premix, containing high doses of zinc, copper and citric acid. Based on the results it can be concluded that the use of citric acid and high stimulation doses of copper and zinc in the experimental group led to the improvement of all parameters. In the first 16 days, daily weight gain of piglets in the experimental group (II) was increased by 203.85% and feed conversion decreased by 25% compared to the control group. Mortality of the piglets decreased from 7.33%, as it was in the control group to 4.21% in group II. Price for one kilogram of weight gain in group (I) was 198.2 din/kg, while in group (II) price was 107, 7 din/kg. The inclusion of high stimulation doses of zinc and copper and organic acids led to a significant increase in daily gain, better feed utilization, reduced piglet mortality and lower feeding costs.

Key words: *piglets, nutrition, citric acid, zinc, copper.*

Introduction

Maybe weaning of piglets in intensive farm conditions production is great stress, without matter on their age in time of maybe weaning. Reason for this is transfer of piglets in diametrically different conditions in view of nutrition conditions, accommodation and transport. If the maybe weaning of piglets is done earlier their requirements in view conditions accommodation and meals are larger, and it is more difficult the provide adequate condition and for more is stress larger, and often leaves serious consequences which represent the negative reflection on later production. With the process of maybe weaning, piglets currently lose sows milk, which is the most important and only source of nutrient substances during the sucking period. In time of maybe weaning, enzymatic system of digestive tract of piglets is not adjusted for efficiently utilization of dry feed, which after weaning is only source of nutrient substances, which structure and utilization is incomparably lower in compared with sows milk (Kovčičin 1993, Hopwood and Hampson 2003). It inevitably leads to great delay in

growth, which can be followed by high economic losses, often influenced by inadequate medical treatment. Time of piglets weaning is reduced from about 8 weeks on average weaning time to an 22-26 day of age. On most farms weaning is done in age from 4 to 5 weeks, when body weight of piglets is about 6 to 7kg (Costa et al., 2004). Limited activity and ability of piglets digestive tract in time of weaning requires maximum adjustment of diet structure. It is very important to care about the level and source of protein and also on the source and level of energy in diet (Tokach et al., 2003). Organic acid as feed additives in piglets diets gave a very good results due that fact, their introduction in piglets diet is necessary before weaning and immediately after weaning. In previous period the most used is fumaric, citric, lactic, propionic and formic acid, and of inorganic phosphorus acid. In time of piglets weaning in stomach there is no secreted HCl in adequate amount which is necessary for maintenance of optimal pH value of gastric juice, and efficiently welding feed proteins. It is also necessary that the amount of pepsin begins diff sting of protein, which altogether causes disorder in feed digestion and occurrence in diarrhea. Addition to lowering pH values and activation of pepsin, supplemented acid blocks uncontrolled development of microorganisms, especially E coli, which can not be developed in acid environment (Cromwell, 2001). One of opportunities to solve these problems is usage of high dose of micronutrients such as copper and zinc. Copper within the normal range has numerous features in organism and high dose of 100-250 ppm exhibit stimulatory effects. Zinc is integral part of enzyme and hormone insulin. In conditions when there is no sufficient quantity of zinc in feed or his reabsorption comes down, it led to a reduced appetite, reduced weigh gain, higher feed conversion, disorders in metabolism of carbohydrates, fats and proteins, as well as disorders in reproduction. Pigs need in zinc varies in wide interval and they are result are of many factors. Use of very high concentration of zinc oxide in prevention of phenomena and diarrhea through feed of weaned piglets started before two decades (Mavromichalis et al., 2000; Hill et al., 2001; Carlson et al., 2004; Davis et al., 2004; Buff et al., 2005). Aim of this work was to detect the effect of high dose of zinc in form of zinc oxide and copper in form of copper sulphate and citrus acid in nutrition of weaned piglets on growth dynamics, feed consumption and feed conversion, the health status and economic cost of weaned piglets.

Materials and methods

Experiment is derived under practical conditions on pigs farm "Stari Tamiš" in Pančevo. In experiment were involved 381 weaned piglets, which were according to body weight, gender, and age divided in two groups of 191 and 190 individuals. Every group is placed in 28 boxes in two-level cages. In each boxing is placed by 7 piglets of the same gender. Both groups of piglets are held in same farm chamber, under identical microclimatic condition. During the experiment piglets are measured after 16 days and on end experiment. After weaning and groups formation piglets were fed mixtures which composition is given in table 1. During the experiment, two nutritional mixture were used, starter and grover. Starter mixture was of different composition, while grover mixture was the same composition in both groups. In control group starter mixture was of standard quality, which is the used on farm, while in other group was used mixture which effect is examined. Used starter mixture was different. Weaned piglets in group with new starter were fed ad libitum, without feed restrictions. In control group piglets were fed starter mixture of standard composition with limitation in first 7 days, gradually increase feed quantity. After 16 days piglets of both group were fed with grover mixture of same composition that is used on farm.

Table 1. Composition and nutritional values of mixtures in experiment

Mixture	Starter		Grover
	I	II	Both groups
Corn	21.00	59.30	63.45
Wheat	20.00	0.00	0.00
Alfalfa	2.50	0.00	0.00
Soybean meal	8.00	15.00	16.00
Fullfat soy	14.00	10.00	13.00
Sunflower meal	0.00	0.00	4.00
Fish flour	6.00	4.00	0.00
Milk in powder	5.00	0.00	0.00
Whey	5.00	0.00	0.00
Yeast	2.00	0.00	0.00
Oil	4.00	0.00	0.00
Lysine	0.00	0.00	0.10
Sugar	10.00	0.00	0.00
Dicalcium phosphate	1.00	1.40	1.15
Chalk	0.00	0.30	1.00
Salt	0.50	0.00	0.30
Premix, 1%	1.00	0.00	1.00
Premix, 10%	0.00	10.00	0.00
In total	100.00	100.00	100.00
Feed prices, din/kg	59.34	42.73	24.67

* - In price are count only rates of individual feedstuffs: corn 17, wheat 19, 30 alfalfa 30, soybean meal 37, Fullfatsoy 40, sunflower meal 13, fish flour 135, powder milk 250, whey 137, yeast 60, oil 80, lysine 240, sugar 90, dicalcium phosphate 60, chalk 4, salt 10, 1% premix 108, premix 10% 167 dinars.

Gained results in experiment are processed as average value treatment and displayed in table form. Data on daily gain are processed with statistical method of variance analysis and tested with t - test. Statistical data processing was done in program software "Statistics 10".

Results and discussion

Of total piglets number involved in experiment, in first 16 days died 5 piglets, 2.62% in group I and 4 piglets or 2.15% in group II, which was on the treatment with the new premix in diet (Table 2). In second part of the experiment, mortality of piglets in the group I were higher, 9 piglets or 4.84%, while in group II died 4 piglets or 2.20%. During the whole experimental period in group I died 14 piglets or 7.33%, which is considerably more than in the second group, where died 8 piglets or 4.21%.

Table 2. Quantity of piglets and mortality in experiment

Group	Control		Experimental	
	20		18	
Protein level in mixture, %	Premix 1%		Premix 10%	
	N	%	n	%
Number of piglets on beginning	191	100	190	100
Mortality in first 16 days	5	2.62	4	2.15
Mortality after 16 days	9	4.84	4	2,2 0
Mortality in total	14	7.33	8	4.21
Number of piglets at the end	177	92.67	182	95.79

Regardless of the total number of piglets in the group was small, it would be on the basis that it reliably appreciate the difference in the amount of mortality, the results do indicate a tendency to decrease, with the expanded use of new premix, which was used in the mixture which reduced the level of proteins involved citric acid and high levels of zinc and copper.

In first period piglets in I group are achieved average only about kilogram increment by individual, which is considerably lower of increment of this same piglets had in sucking period. Another group of pigs, which is in a mixture with a new premix, during the first 16 days, increased the average body weight of 1.71 kg, an increase of about 70%. In the second part of the experiment, pigs in both groups were fed a grower with a mixture of the same composition, which significantly reduced the difference in weight gain per head which was 15.48 kg in group I and 15.66 kg in group II. Looking at the total duration of the experiment, weight gain in the first group of piglets was 16.51 and in II group 17.37 kg, which is 5.21% higher (Table 3).

Table 3. Body weight and daily gain of piglets

Group	Control		Experimental	
Protein level in mixture, %	20		18	
Premix	Premix 1%		Premix 10%	
Period of experiment	Body weight	Gain, kg	Body weight	Gain, kg
Body weight, kg				
- The beginning	5.74	0.00	5.79	0.00
- After 16 days	6.77	1.03	7.50	1.71
At the end of experiment	22.25	15.48	23.16	15.66
Total weight gain	0.00	16.51	0.00	17.37
Daily weight gain	g/day	Index, %	g/day	Index, %
- After 16 days	52.00	100.00	106.00**	203.85
- 16 days to end of experiment	377.00	100.00	382.00 ^{ns}	101.33
Average	290.00	100.00	305.00 ^{ns}	105.17

** - Increase daily increment in Group II significantly on $p < 0.01$, ns - not significantly

Daily weight gain of piglets in the first 16 days of the experiment, when piglets were fed diets of different composition and the group was very low and amounted to 52 g. By including a new premix in group II achieved yield was twice as high and amounted to 106 g, which is a very large increase of 203.85%. Statistical analysis shows that large differences in weight gain at this stage of the experiment statistically significant. In the second part of the experiment as well as the average performance differences between groups in weight gain were significantly smaller and not statistically significant.

Expanded use of premix at the same time changing the structure of the mixture in the first 16 days after weaning led to better feed utilization and significantly higher consumption per feeding day (Table 4).

Table 4. Conversion and feed consumption of piglets in first 16 days

Group	Control	Experiment
Protein level in mixture, %	20	18
Premix	Premix 1%	Premix 10%
Feed conversion, kg/kg	3.34	2.52
- Index, %	100.00	75.45
Feed consumption, kg/day	0.174	0.267
- Index, %	100.00	153.45

In I group piglets feed intake per kilogram of weight gain was very high and was 3.34 kg, which is about 25% more than in the II group, where the feed consumption was 2.52 kg. These tests in terms of the expanded use of new premix in a relatively inexpensive mixture of simple structure, led to a significant reduction in cost for feed (Table 5).

Table 5. Costs for feed in experiment

Group	Control	Experiment
Premix	Premix 1%	Premix 10%
Feed price, din/kg	59.34	42.73
Index,%	100.00	72.01
Feed consumption, kg/day	3.34	2.52
Index,%	100.00	75.45
Growth price, din/kg	198.20	107.70
Index,%	100.00	54.34

* - The price of food is calculated only price of feeds and premixes

In Group I, in which used a mixture with a higher protein level, which was included whey, milk powder, sugar and fish meal is more expensive than the mixture in the second group is composed by a simpler, and because of that, and with a much lower price. While the price of the mixture in the first group was 59.34 din/kg in group II, the price was 28% lower and amounted to 42.73 din/kg. Turning expensive and complex mixtures in the first group did not improve feed efficiency. As stated previously in this group of piglets is consumed by about 25% more feed when compared with group II, in which he used a mixture of simple and cheaper with the use of extended premix. Price for one kilogram of gain in the first group was 198.2 din/kg, and group II price increment was 107.7 din/kg. The difference in the cost of feed is a consequence of the increased mortality of piglets and much lower growth in group I, compared with group II piglets. Inclusion of high stimulus doses of zinc and copper in a number of studies led to a significant increase in daily gain and improved feed conversion. Summarized results of Hill et al. (2000, 2001), Case and Carlson (2002), Davis et al. (2004), Carlson et al. (2004), Hollis et al. (2005), Buff et al.(2005), Mavromichalis et al. (2000) show that the use of 2000 mg/kg of zinc leads to a daily weight gain of about 22%, which was confirmed in our tests, but in these studies the effect of zinc on the feed conversion ratio was significantly lower and the average reduction in feed consumption was only about 2 %. In contrast, in our studies, the reduction of feed consumption per kilogram of gain was very high at about 25%.

Conclusion

Based on the above it can be concluded that the use of the new premix with organic acids and stimulating dose of zinc and copper to reduce the level of protein in feed has led to significant increase in daily gain, better feed utilization and significantly reduce piglets mortality and reduction cost of diet.

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