



Original Contribution

EFFECT OF FEED RESTRICTION AND LOW PROTEIN LEVEL ON THE PERFORMANCE OF GROWING PIGS

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ABSTRACT

Aim: The aim of the experiment was to investigate the effect of ration levels and protein levels on feeding patterns of weaned pigs ensuring good health and productivity. **Material and methods:** An experiment with 56 weaned Danube White pigs divided into 4 groups of 14 was carried out in Agricultural Institute – Shumen. The experiment started at 8,364 - 8,457 kg live weight and finished at 30,786 - 31,714 kg live weight, with a duration period of 56 days. During the first 14 days after weaning, the pigs from the third and fourth group were fed with limited ration – 20% less from that of first and second group. After that period, the reduced ration for the previous period was raised for the pigs from third and fourth group. Throughout the entire test period, pigs from the first and third groups received a compound feed of 18,50% protein and those from the second and fourth groups with 16,50%. **Results:** The limited ration provides up to lower growth rate in the first 14 days as feed conversion ratio is the same as that of animals fed ad libitum. Animals fed restricted and ad libitum with 16.50% protein in the compound feed had a similar average daily increase but did not achieve the growth rate of high-protein-fed pigs (18.50%) over the whole experimental period. Better daily gain and feed conversion ratio was found in pigs fed ad libitum with a high protein level (18.50%) in their compound feeds. **Conclusions:** The obtained results can find applications in solving various practical problems.

Key words: swine, ration, growth intensity, feed conversion ratio, feed consumption, feed utilization

INTRODUCTION

The digestive system of young pigs is not sufficiently developed for the absorption of solids in morphological and functional terms. With age, the enzymatic activity of the digestive glands changes significantly (1). The weaning period of pigs is often associated with bowel disease such as mucosal inflammation, intestinal dysfunction and diarrhea. Decades ago, antibiotics were used as a preventative measure against digestive problems after weaning pigs.

Because of the risk of antibiotic resistance and the potential harm to human health, an EC ban (2) for

use in animal husbandry was introduced in 2006. Therefore, pig science faces an open problem finding alternatives to digestive problems in pigs after weaning.

Pluske et al. (3) also has noted that both ration levels and protein sources were a major cause of diarrhea after weaning. Administration of lower protein levels (<18%) improved the digestive problems of pigs (4), but lower levels could have impaired performance (4-6).

Lu et al. (7) have tested probiotics as an alternative to post-weaning antibiotics to reduce stress and ensure intestinal health. Post-weaning diarrhea (PWD) according to Nadeau et al. (8) and Jørgensen et al. (9) was caused mainly by conditioned pathogens and enterotoxins. The authors indicated that improving intestinal microbiosis was a potential method of controlling PWD.

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One of the methods for dealing with nutritional issues is by limiting the level of ration immediately after weaning or by applying lower levels of protein and amino acids as an alternative to post-weaning technology (10). According to some authors, a restricted diet in the first days after weaning can be a prophylactic measure against digestive disorders and help the enzyme system of the digestive tract to better adapt to new feed. According to Nyachoti (10) and Wang et al. (11) undigested protein undergoes bacterial fermentation in the colon, which produces metabolites with toxic effects and promotes the proliferation of pathogenic bacteria. This can damage intestinal health. On the other hand, Wang et al. (11) indicated that rations for pigs with high protein content have led to excess amino acids and excretion of excess nitrogen in feces and urine. The crude protein reduction level should be up to 4% units, combined with added amino acids, to have a compensatory effect at a later date (10).

Subject of study were determining the optimal protein levels in compound feeds and the amount of ration immediately after weaning. Studies in this direction in our country have been too sporadic, which provoked our interest in this direction.

The purpose of the experiment was to investigate the effect of ration and protein levels in feeding patterns of weaned pigs ensuring good health and productivity.

MATERIAL AND METHODS

The experiment with 56 weaned Danube White pigs divided into 4 groups of 14 was conducted in Agricultural Institute – Shumen. A total 56 weaned piglets (Danube White Breed), initial live weight (LW) (8,364 – 8,457 kg) were assigned to

1 of 4 treatment, each with 2 replicates (pens) of 7 piglets. Piglets were weighted at the beginning and at the end of the experiment and daily feed intake was recorded with each group. The experiment ended at 30,786 – 31,714 kg LW. The experiment lasted for 56 days. In the first 14 days after weaning, pigs in groups 3 and 4 received a limited ration - 20% of that in groups 1 and 2 (**Table 1**). After this period, the ration of pigs from the 3rd and 4th group was increased by the reduced quantity in the first sub-period.

The compound feeds for all groups had the same component composition but differed in the amount of crude protein (**Table 2**). The compound feeds for pigs in groups 1 and 3 contained 18.50% protein and those for groups 2 and 4 – 16.50%.

The bio-concentrate contained high-protein sunflower meal, calcium carbonate, vegetable fats, mono-calcium phosphate, sodium chloride, vitamin premix and mineral premix. Its analytical composition is: Crude protein – 37.3%; Crude fat – 2.80%; Crude fiber – 8.8%; Calcium - 2.85%; Phosphorus - 1.00%; Lysine - 2.12%; Methionine + cystine - 1.20%; Threonine - 1.50%; Sodium - 0.40%.

The following indicators were controlled: live weight - at the beginning, 14 days after the beginning and at the end of the experiment, feed consumption - daily, and health - daily.

Data were processed by the methods of variational statistics and are shown as arithmetic and standard deviation. To determine group differences and multiple comparisons, data were analyzed by variance analysis (ANOVA). Significance was defined as $p < 0.05$.

Table 1. Experiment scheme

Indicators, %	Groups			
	1	2	3	4
Ration (until 14 th day)	100	100	80	80
Ration (after 14 th day)	100	100	100	100
Crude Protein (CP)	18.50	16.50	18.50	16.50

Table 2. Component composition of compound feeds

Components, %	Groups	
	1 and 3	2 and 4
Maize	25.25	32.21
Barley	10.00	10.00
Wheat	27.00	27.00
Bio-concentrate	29.60	22.50
Wheat bran	8.00	8.00
Lysine concentrate, 98%	0.15	0.29
Total, %	100.00	100.00
Metabolizable energy, MJ	12.62	12.68
Crude Protein, %	18.50	16.50
Lysine, %	1.00	1.00
Methionine + cystine, %	0.63	0.57
Threonine, %	0.68	0.59
Tryptophan, %	0.23	0.20
Crude Fat, %	2.52	2.51
Crude fibers, %	5.15	4.70
Ca, %	1.00	0.82
P, %	0.53	0.48

RESULTS AND DISCUSSION

Feed consumption in pigs (**Table 3**), in the first sub-period (14 days), was lower in groups 3 and 4 as shown the experimental scheme ($p < 0.001$).

Both energy and protein intake have had a significant effect on the rate of protein and fat deposition, and therefore weight gain (12). Limited ration resulted in lower growth during the first 14 days, both in the low protein group and in the high protein group in the compound feed. The conversion ratio per 1 kg of growth was similar in pigs with restricted feeding and those of animals from the free-fed groups.

In the second sub-period, pigs in groups 3 and 4 received more compound feed compared to groups that were fed ad libitum during the first 14 days ($p < 0.001$).

Growth intensity has increased more in animals with lower protein levels in rations. By the end of the trial period, we have seen to some extent the intensity compensation of growth and the leveling of productive results. Pigs that were fed the more ration protein in failed to fully compensate for the lower growth in the first sub-

period compared to those fed ad libitum. Growth compensation was more complete in low protein pigs (16.50%) in compound feeds than in those fed ad libitum at the same protein level.

Feed utilization in the 2nd sub-period was better in pigs with higher growth. The best in the group were animals fed ad libitum with 18.50% protein in the compound feed.

Pigs that received a compound feed of more protein (18.50%) consumed more feed, total for the entire trial period. This indicates that limiting the ration by 20% in the first 14 days did not affect the total amount of feed accepted for the entire trial period.

It can be assumed that pigs from the 4th group managed to compensate for growth retardation during restricted feeding, compared to those from the 2nd group. Animals with limited feed and fed ad libitum with 16.50% protein in compound feeds had a similar average daily gain but did not achieve the growth rate of pigs fed ad libitum with high protein (1 group). Our results are similar to those obtained by Reeds, P. J., et al. (13) that protein synthesis (g/d) increased by 2.17

for each 1 g increase in daily protein accretion and by 1.55 for each 1 g increase in daily protein intake.

Average daily gain and feed utilization was better in pigs fed ad libitum that received a high level

protein ration. Feed conversion for 1 kg gain during the entire trial period was in conformity with average daily gain – animals with lower gain had a lower feed conversion ratio, metabolic energy and nutrients.

Table 3. Feed intake, average daily gain and feed conversion ratio

Indicators	Groups	N	Mean	SE	p
Feed intake 1	1	14	0.540	6.93e-4	1 – 2***, 3***, 4***
	2	14	0.510	0.00666	2 – 3***, 4***
	3	14	0.434	0.00000	
	4	14	0.434	0.00000	
Feed intake 2	1	14	1.369	0.00000	1 – 3***, 4***
	2	14	1.369	0.00000	2 – 3***, 4***
	3	14	1.404	2.77e-4	3 – 4***
	4	14	1.394	0.00222	
Feed intake trial period	1	14	1.162	2.77e-4	1 – 2***, 4***
	2	14	1.154	0.00166	2 – 3***
	3	14	1.161	1.39e-4	3 – 4***
	4	14	1.154	0.00166	
Daily gain 1	1	14	0.249	0.01604	
	2	14	0.253	0.01863	
	3	14	0.216	0.02026	
	4	14	0.221	0.01538	
Daily gain 2	1	14	0.473	0.02465	
	2	14	0.453	0.03163	
	3	14	0.460	0.02977	
	4	14	0.472	0.02936	
Daily gain trial period	1	14	0.417	0.02170	
	2	14	0.403	0.02620	
	3	14	0.399	0.02440	
	4	14	0.409	0.02438	
Feed conversion ratio 1	1	14	2.307	0.17631	
	2	14	2.170	0.17417	
	3	14	2.218	0.18314	
	4	14	2.119	0.18391	
Feed conversion ratio 2	1	14	3.024	0.19256	
	2	14	3.306	0.33980	
	3	14	3.353	0.38587	
	4	14	3.143	0.24737	
Feed conversion ratio trial period	1	14	2.912	0.18844	
	2	14	3.072	0.26198	
	3	14	3.136	0.30124	
	4	14	2.986	0.22538	

*** - $p < 0.001$

CONCLUSIONS

Pigs fed restricted and ad libitum diet with 16.50% protein in the compound feed had a similar average daily gain but did not achieve the growth rate of pigs fed ad libitum with high protein (18.50%) over the whole experimental period.

Better daily gain and feed conversion ratio was found in pigs fed ad libitum with a high protein level (18.50%) in their compound feeds.

The obtained results can find applications in solving various practicals and scientific problems.

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