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ANIMAL HUSBANDRY

Use of Concentrated, Unhydrolyzed Feed Protein Granules for Reared Piglets

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Abstract—The efficiency of concentrated, unhydrolyzed feed protein granules included in the diets for sucking and weaned pigs has been studied. The granule's effects on the dynamics of production performance and product quality are analyzed. The concentrated, unhydrolyzed feed protein granules represent a soy protein concentrate of a new type, which is free of antibiotics, hormones, and genetically modified organisms. This additive may be included in the basal diet either separately or in a feed mixture as a source of an easily digestible protein with an original amino acid composition. The survey results have proven that the dietary granules contribute to increasing the average daily liveweight gain in piglets by 2.0–2.7%, reducing the feed costs per kg of liveweight gain by 2.2–6.6%, and producing additional total liveweight gain from 8.2 to 14.6%.

Keywords: sucking pigs, weaned pigs, production performance, meat quality, economic efficiency, concentrated unhydrolyzed feed protein granules

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INTRODUCTION

At present, the swine industry as a sector of agriculture has a broad range of experience of combining various plant and animal components to optimize the rations. Amino acid nutrition plays a special role in an animal's physiology and nutrition. The correct amino acid profile is sufficient for efficient and profitable pork production. The feed protein quality is indicated by the protein amino acid profile providing the ratio between the essential amino acids required for the normal growth and metabolic exchange and their availability [1–3].

It is well known that the postweaning feeding period is the most stressful for the piglets because of the diet changes from milk to the complete mixed diets. The feeds of animal and plant origin that have the complete range of essential amino acids are used as the source of protein [4]. The research papers of G. Flachowsky et al. (2015) indicate that the production of feeds with an animal origin represents a complex technological process requiring scrupulous veterinary and technology control [5].

In recent years, concentrated soy additives of a high crude protein level (up to 75%) have been used. Such feed additives are most commonly used in order to replace the feeds of animal origin and the fish meal [6, 7]. Nevertheless, it should be noted that the legumes included in the additive contain a range of antinutrient substances and require special treatment, which can decrease their quantity and increase the biological value of proteins to be used by the body.

The technology patented in 37 countries for producing concentrated, unhydrolyzed feed protein granules (CUFPG) with the use of 3D structuring to form the granules with subsequent extraction of low-molecular water-soluble components by the purified water can offer the opportunity to sufficiently exclude the antinutrient factors of carbohydrate, protein, and glycoside origin to a large extent. In addition, the laboratory continuous monitoring systems can contribute to using unadulterated and GM-free soybeans. The unique treatment method can provide the opportunity to manufacture a product containing 75% crude protein without using any chemical agents [8, 9].

The objectives of the survey are to measure the efficiency of feeding the dietary, concentrated, unhydrolyzed feed protein granules to sucking and weaned pigs and to assess the dynamics of production performance and product quality.

EXPERIMENTAL

Concentrated, unhydrolyzed feed protein granules have a high biological value, which can be proven by the additive composition and the availability of *limiting* essential amino acids (Table 1).

Table 1. Biological value of concentrated, unhydrolyzed feed protein granules

Parameter	Contained in 1 kg of product at natural moisture level
Crude protein, %	71.9
Protein disintegration, %	4.4
Crude fiber, %	2.4
Calcium, g	2.6
Phosphorus, g	6.5
Metabolizable energy, MJ	16.0
Amino acid content, g/kg	
Lysine	56.3
Histidine	20.6
Arginine	55.2
Aspartic acid	97.1
Threonine	33.0
Serine	64.1
Glycine	31.1
Alanine	33.0
Cystine	7.3
Valine	36.4
Methionine	7.4
Isoleucine	36.3
Leucine	61.6
Tyrosine	26.7
Phenylalanine	38.4
Tryptophan	14.0

The surveys were carried out at the *Raduga-Agro* pig farming unitary enterprise, Vetka raion, Gomel oblast, Belorussia. This complex is managed to rear Belorussian Large White pigs for pork, bacon, and fat. Weaning the sucking pigs is performed when piglets of no less than 20–21 kg liveweight are aged between 60 and 65 days.

For the experiment, four groups consisting of 20 sucking pigs each were formed. The experiment took 90 days. Clinically healthy animals selected for grouping were of the same breed and origin. The control group animals were provided only with the basal diet. The animals of experimental groups one and two were fed the basal diets supplemented with 15 and 10% CUFPG, respectively, of the total amount of feeds consumed in the starter and growth-regulating diets. The animals of experimental group three were provided with the basal diet supplemented with 10 and 5% CUFPG in the starter diet and the growth-related diet, respectively.

The daily feed intake was measured via the group's daily records of the provided feeds and the unconsumed residuals. The feed mixtures of the balanced rations (at the appropriate age) according to the STB 2111-2010 standards for nutrition of 3-SK-16 and 3-SK-26 starter feed mixtures were used as the basal diets. The observations for safety and health of piglets were performed via the daily records of the total number of livestock and the cattle loss analysis. The adequate pork quality characteristics were studied according to the GOST 7269-79 standard. The nutritional score was determined according to the GOST 31476-2012 standards named *Slaughtering Pigs. Pork Carcasses and Half Carcasses*. The control of the experimental pig production parameters was performed at the beginning of the experiment and at the age of 35, 60, and 90 days.

RESULTS AND DISCUSSION

The research papers of A.A. Zorikov et al. [10] determined that approximately 50, 34, 28, and 28–24% of the gross energy of feeds are consumed by the sucking pigs for their growth and development, the lactating sows, the brood sows, and the fattening youngstock, respectively. The researches of D.V. Romanov et al. [11] prove that the first week in rearing the piglets is the most crucial period in their development. Creating the appropriate conditions and providing the animals with high-energy and easily digested feeds balanced in amino acid composition can offer the opportunity to promote the growth rates and to reduce the feed costs per unit of a product.

Table 2 shows that, on the 35th day of the experiment, the maximum average weight was recorded in the piglets of experimental group two, which was 0.4 kg more than that in the control group animals. The combined weight of the animals in the experimental groups was 5.4–11.1% higher than that in the control group animals. Weighing of piglets on the 60th day of the experiment revealed that the difference in the average weight between the control group animals and the animals in the experimental groups was in the range of 0.4 kg (experimental group two) to 0.6 kg (experimental group three). The combined weight of piglets in the experimental groups was 8.2–15.4% higher than that in the control group animals. In addition, the measurements for liveweight in the animals at 90 days of age showed that the piglets in the experimental groups had advantages over the control group animals in the average weight of one head, which was 0.2–0.4 kg more. The total liveweight of the animals in the experimental groups was 7.3–12.5% higher than that in the control, which is caused by the numbers of heads in the groups. The animal's average daily weight gain as the objective parameter of fattening was maximal in the piglets of experimental group two (0.262 kg) and exceeded the level in the control group animals by 1.6%. The animals in experimental groups three and one surpassed the peers in the control group in this parameter by 1.2% and 0.6%, respectively.

Table 2. Experimental pig production parameters, ($\bar{x} \pm S\bar{x}$, $n = 20$)

Parameter		Group			
		control	experimental group one	experimental group two	experimental group three
Start of the experiment	Average liveweight of a head, kg	0.78 ± 2.190	0.77 ± 2.217	0.78 ± 2.482	0.78 ± 2.592
	Total liveweight of pig group, kg	14.04	15.4	14.8	15.6
35th day of experiment	Average liveweight of a head, kg	6.2 ± 0.208	6.5 ± 0.158	6.6 ± 0.159	6.3 ± 0.182
	Total liveweight of pig group, kg	111.6	130	125.4	126.0
60th day of experiment	Average liveweight of a head, kg	15.7 ± 0.200	16.3 ± 0.100	16.1 ± 0.100	16.3 ± 0.100
	Total liveweight of pig group, kg	282.6	326.0	305.9	326.0
90th day of experiment	Average liveweight of a head, kg	24.0 ± 0.300	24.2 ± 0.200	24.4 ± 0.100	24.3 ± 0.100
	Total liveweight of pig group, kg	432.0	484.0	463.6	486.0
Average liveweight gain, kg		0.258	0.260	0.262	0.261
Safety, %		90	100	95	100
Feed costs per 1 kg of liveweight gain		46	43	44	45

Over the whole period of surveys, two piglets in the control group were lost, while only one piglet in experimental group two was lost. With respect to experimental groups one and three, their safety comprised 100%. The feed costs per 1 kg liveweight gain were maximal in the control group, comprising 46 MJ of metabolic energy. The experimental groups were characterized by a 1–3-MJ (2.2–6.6%) reduction in the feed costs per unit of a product.

Therefore, the concentrated, unhydrolyzed feed protein granules used in the industrial environments contributed to a 2.0–2.7% increase in the daily average weight gains of piglets, approximately 100% safety of livestock, and a 2.2–6.6% reduction in the feed costs per unit of a product.

The complex laboratory analyses of 20 meat samples (five samples taken from the animal groups each) were performed. It was determined that the color of the surface of the carcass in the animals of all the experimental groups was light red, while the muscles in the profile were slightly wet and light red. The meat was dense and elastic; the fossa formed by pressing on the meat with a finger quickly leveled. The samples had a specific flavor typical for meat of pigs. The sample-boiling test resulted in transparent and flavorful bouillon. The carcasses of the animals of all the groups were classified to the first nutritional category. The meat of piglets in the experimental groups was not generally different from the meat of the control group animals. It may be concluded that the meat of pigs provided with the CUFPG feed additive is of good quality.

The use of 10 and 5% concentrated unhydrolyzed feed protein granules in the starter and growth-related diets, respectively, can provide the opportunity to compensate for the protein deficiency. This results in improving the production parameters, which is consistent with the researches of G.N. Bobkova et al. [12]. The experiments of J. Čitek et al. [13] indicate that the feeds of plant origin have no negative effect on the final product in the pig industry; on the contrary, they improve its qualitative characteristics and taste properties.

CONCLUSIONS

Therefore, the use of 10 and 5% CUFPG in the starter and growth-related diets, respectively, could provide an increase in the overall liveweight gain in the range of 8.2 to 14.6%. The analysis of the meat samples taken from the animals of the experimental groups has verified that they correspond to the acting standards. The survey results prove that the soybeans treated by the patented technology have a positive effect on the pig's production performance and growth. The supplemented CUFPG can allow us to decrease the feed costs per unit of product, which corresponds to the researches of V.R. Plakhtyukova and O.Yu. Yunusova et al. [14, 15].

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of interest. The authors declare that they have no conflict of interest.

Statement of the welfare of animals. All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. The article does not concern any researches using animals as objects.

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SPELL: 1. liveweight, 2. postweaning