

# Optimization of animal feeding against the background of the use of feed additives

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**Abstract.** In this experimental work, the effect of vitamin and mineral concentrate P52-1 of domestic production as part of barley and wheat compound feeds on the growth dynamics of young pigs and their health indicators for the experiment duration was studied. At the same time, the physiological parameters of the health of the studied animals were considered. Morphobiochemical studies of blood allowed to conclude that this feed additive had a positive effect on the metabolism of young pigs in the post-weaning period and during rearing. The result of the use of P52-1 was an accelerated increase in the mass of the test animals of the experimental group compared with the control group in terms of average daily and gross increments. At the same time, in the experimental group of animals, morphobiochemical indicators exceeded those of the control group, while they were within the normal range. The cultivation of young pigs using a multienzymatic premix, of domestic production, provides an average daily increase in animals of the experimental group of over 16%.

## 1 Introduction

Optimization of livestock production is determined by both the state of the farm's feed base and the rational feed use. The majority of livestock farms use cereal grain such as wheat and barley as the main feed, which are based on essential amino acids necessary for feeding pigs. [1,2,3,4]. Ensuring the diet full-value is carried out by combining feeds with the introduction of biologically active substances in the form of proteins, vitamins, enzymes, macro- and microelements, and their combination [5, 6, 7, 8]. Combined feeds, improving metabolism, contribute to the preservation of animal productivity, reducing the economic damage caused by poor-quality and defective feeds [9, 10, 11].

Balancing feed due to feed additives entails an increase in the product cost, therefore, preference in feeding farm animals as part of compound feeds in the current period is given to additives of domestic production, such as natural sorbents, enzymes, and others [12, 13, 14].

In this regard, it is more advisable to work with feed additives of domestic production or use non-traditional feed additives of natural sorbents, such as bentonite clays, saponin, zeolites, etc.

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Enzyme preparations, being biocatalysts, contribute to improving the digestibility of animal feeds, while reducing unit costs by replacing expensive and scarce feeds with cheaper and more affordable ones [15, 16]. Strengthening the digestibility of feed when feeding young pigs with feed with the participation of enzyme preparations can increase their live weight by 9-17% and reduce the cost of meat products, while maintaining livestock [17, 18, 19].

Optimization of animal feeding to increase the productivity of animal husbandry is carried out with the use of feed additives of domestic production, which can have a beneficial effect on the country's economy to maintain its producers.

The purpose of this study was to study the effect of vitamin and mineral premix P52-1 of domestic production as part of barley-wheat compound feeds on the growth and development of young pigs in the post-weaning period and on rearing at the age of 60-180 days.

## 2 Materials and Methods

The experiment was conducted in a personal subsidiary farm on the territory of the Chuvash Republic. In the experiments, the enzyme-containing premix P52-1 was used. Two groups of animals were formed according to the pairs-analogues principle - control-1 and experimental-2, each with 8 heads – with an average live weight of 16-17 kg under the same conditions of maintenance and zoohygienic parameters of the microclimate in accordance with the requirements of sanitary standards.

The feeding conditions of the experimental livestock were the same, the difference was the addition of the complex preparation P52-1 to the feed of the experimental group according to the manufacturer's recommendations in the amount of 1% per head per day. The components of the premix are involved in the metabolism of proteins, fats, carbohydrates, minerals and other processes in pig body.

Compound feed was made right in the personal subsidiary farm from barley and wheat grown on the farm, meat and bone meal, and salt in accordance with the required norms.

According to the increase in the weight of young pigs, the structure of the cereal diet changed in accordance with the animals' live weight:

- 21-40 kg – cereal feed in the ratio – barley-40, wheat-40;
- 41-80 kg – cereal feed in the ratio – barley-45, wheat-40.

Two-time feeding of animals (morning and evening) was carried out considering the technology used in the farm, with a constant supply of clean water.

It is known that premix P52-1, compiled considering the norms of animal needs for vitamins, trace elements and other active substances, contains vitamins – A, D<sub>3</sub>, E, and group B (B<sub>2</sub>, B<sub>3</sub>, B<sub>4</sub>, B<sub>5</sub>, B<sub>12</sub>), trace elements – manganese, zinc, copper, stabilized iodine, cobalt, santonin, and enzymes MEK-CX-2, and filler. The MEK-CX-2 multi-enzyme composition is a complex of biological catalysts containing  $\beta$ -glucanase, xylanase, pectinase, and is intended to increase the digestibility of nutrients by farm animals, since enzymes contribute to the destruction of the plant cell walls and intercellular substance, resulting in increased availability of grain feed substances. The enzyme additive "MEK-CX-2" is intended for the use of compound feeds with a predominant content of barley. Premix is made from natural ingredients and does not contain antibiotics, growth stimulants, hormonal preparations and genetically modified organisms, which is especially important, since their use in compound feeds does not always want the best.

The physiological parameters of animal health were considered. Monitoring was carried out considering changes in the weight of young pigs and diet structure. During these periods, the following morphobiochemical parameters of animal blood were studied:

amount of erythrocytes, leukocytes and hemoglobin, as well as the content of total protein, calcium, and phosphorus.

At the beginning and end of the experiment, blood samples were taken from animals of each group to study blood morphological and biochemical parameters.

The amount of hemocytes (erythrocytes and leukocytes) was determined using an automatic hematological analyzer Mindray BC-2800 Vet.

Hemoglobin, total protein, calcium, and phosphorus were determined by a laboratory medical photometer of the Bosch SA model using biochemical reagents from HighTechnology, USA.

Hemoglobin was determined in the blood by cyanmethemoglobin with ferricyanide at the endpoint at a wavelength of 540 nm using the HT-H232-240 reagent. The total protein was determined by the biuret method using reagent HT-T251-125 (wavelength 540 nm). Calcium (125ml+125ml+5ml standard) - by the OCF method at the end point at a wavelength of 570 nm using reagent HT-C216-250. The principle of the method: calcium reacts with o-cresol phthalein in the presence of 8-hydroxyquinoline to form a color complex (purple color) having absorption at 570 nm (550-580 nm). The intensity of coloring is proportional to calcium concentration.

Phosphorus (125ml+5ml standard) - by ammonium molybdate method at the end point at a wavelength of 340 nm using reagent HT-P344-125.

At the beginning of the experiment, the weight of the experimental weaning young pigs was in the range of 16-17 kg, morphological and biochemical blood parameters were also the same and within the normative data.

### 3 Research results

The diagram (Fig.1.) shows the growth rates of animals by live weight and average daily gains in different age periods.

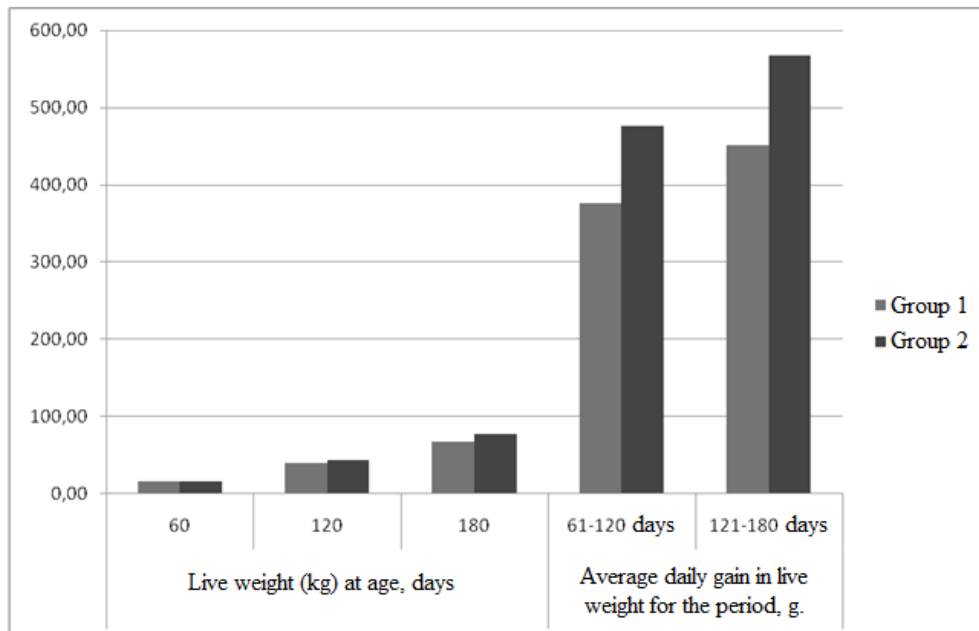


Fig. 1. Animal growth indicators

According to the data, at all studied stages, both the live weight and the average daily increase in the experimental group were significantly higher than in the control group.

During the post-weaning period, the animals of the experimental group increased their body weight by 100 g on average per day, or 20.0% ( $P < 0.05$ ) more compared to the control. Similar data were obtained on average daily gains in body weight and in the period from the age of 120 days to the end of the experiment. The average daily increase in live weight in young pigs of the control group during this period was equal to  $450.67 \pm 10.60$  g. At the age of 4 months, the young pigs of the second (experimental) group, who were on a diet with the addition of a biological preparation, had significantly ( $P < 0.05$ ) higher live weight indicators than in the control group and exceeded their control counterparts by more than 10% (4.49 kg).

Consequently, the addition of the preparation P52-1, containing a number of enzymes, effectively affected the growth rate and development of animals, due to which there was an enrichment in a living organism with  $\beta$ -glucanase, xylanase, and pectinlyase, thanks to which the digestibility of feed fed to young pigs increases in the digestive tract, therefore, the availability of nutrients is organized.

By the end of the research work – by the age of 6 months - the greatest intensity of growth was observed in the animals of the experimental group, as evidenced by the gross increase in live weight: 61.06 kg versus 51.17 kg in the control group. The results obtained in the experimental group at the end of the scientific experiment exceeded the indicators of the control group by 9.89 kg, or by 16% ( $P < 0.05$ ). At the same time, the average daily increase in live weight during the entire study period was 508.83 g in experimental and 426.41 g in control animals.

Clinical indicators such as temperature, pulse, and respiration for the entire observed period were within the normal range in animals of both groups subjected to testing.

Blood is the tissue of a living organism, thanks to which all organs and other tissues are supplied with nutrients.

**Table 1.** Some hemocytes

Indicators	Group	Age, days	
		60	180
Red blood cells, $10^{12}/l$	control	$5.26 \pm 0.13$	$5.45 \pm 0.11$
	experimental	$5.27 \pm 0.11$	$6.19 \pm 0.12$
White blood cells, $10^9/l$	control	$14.20 \pm 0.88$	$14.40 \pm 0.93$
	experimental	$16.88 \pm 0.79$	$15.05 \pm 0.73$

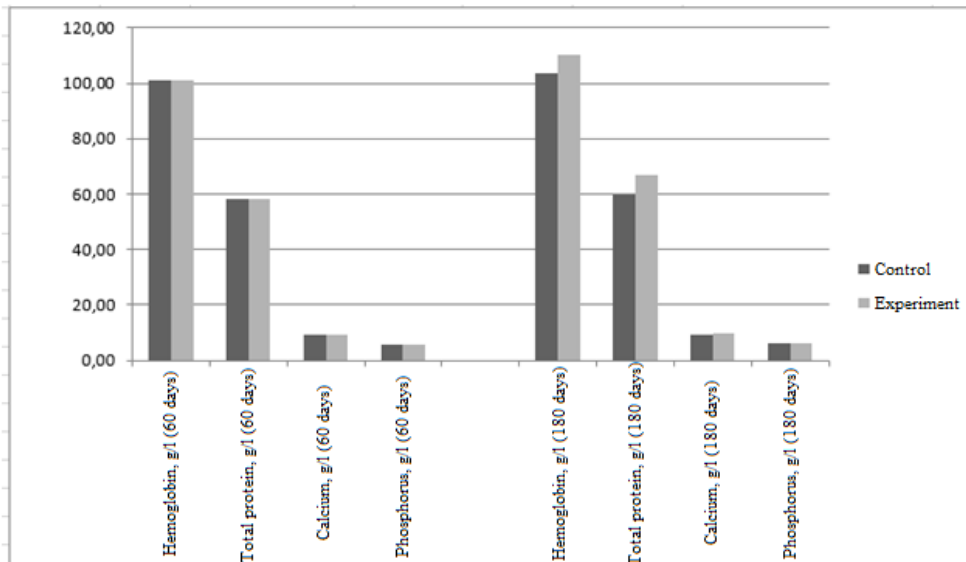
At the beginning of the experiment – after weaning – all the analyzed blood parameters of the tested animals had the same values and were within the normal range. During the scientific and experimental work, morphobiochemical blood parameters (Table. 2) of animals of both groups were also within their physiological norm, but the analyzed indicators of animals of the control group were inferior to the blood indicators of animals receiving the complex feed additive P52-1 as part of the diet.

By the end of the scientific work, the content of erythrocytes in animals of the experimental group under the action of feeding the multienzymatic preparatio P52-1 increased by 14% and exceeded the blood values of animals of the control group by 12%. Red blood cells are the most numerous type of cells which main task is to transfer hemoglobin to the tissues and carbon dioxide from the tissues to the lungs. If the number of red blood cells decreases, this can lead to a shortage of hemoglobin in the blood, regardless of the available iron (ferritin) reserves. White blood cells are the most important indicator of the immune system of a living organism. A decrease in the number of white blood cells may be associated with viral infections, toxic effects on the body, and an increase may indicate an inflammatory reaction, acute infection, as well as leukemia. White blood cells

are actively involved in the immunological response of the body. The increase in the content of leukocytes in the blood of animals of the experimental group by the end of the observed period was not so significant (by  $0.65 \cdot 10^9/l$ ), while in control animals this indicator was within the normal range, but was shifted upward by 15% and amounted to  $16.88 \pm 0.79$ , differing from the indicator of experimental animals by 11%, it may have been the result of exposure to some inflammatory reaction or acute infection.

Among the biochemical blood parameters, hemoglobin can be attributed to one of the main ones, due to which all organs of the animal – brain, heart, muscles are supplied with vital oxygen, which activates redox processes in the animal body.

Vitamin B<sub>12</sub> plays an important role in the realization of hemoglobin functions.



**Fig. 2.** Biochemical blood parameters

According to the diagram shown in Figure 2, the results of the effect of the studied additive in the diet are traced: an increase of the hemoglobin content in the blood of experimental animals by 8% and amounted to  $110.23 \pm 2.27$  g/l versus  $103.81 \pm 2.23$ , and the total protein content – by 10% and corresponded to  $66.77 \pm 1.10$  g/l.

According to the content of calcium and phosphorus in the blood serum, mineral metabolism in the body of growing animals is judged. These elements in the blood serum of both experimental and control group animals during the studies were within the physiological norm and did not differ significantly.

Thus, the study of the effect of vitamin-mineral premix P52-1 of domestic production as part of barley-wheat compound feeds on the growth and development of young pigs in the post-weaning period and during rearing at the age of 60-180 days allows to conclude that this additive had a positive effect on the metabolic processes of young pigs in the post-weaning period and during rearing, which was reflected in an increase in both the average daily increase in live weight and the gross increase in live weight of the experimental group compared to the control group. Side effects and complications when using the product in the recommended doses were not detected, contraindications were not established, while the animal safety was 100%.

## 4 Conclusions

According to the results of experimental data, it can be concluded that the optimization of animal feeding against the background of the use of feed additives of domestic production leads to an increase in the average daily and gross increase in live weight and animal safety.

In the experimental group of animals under the action of the multienzymatic premix P52-1, mineral and protein metabolism was maintained at an optimal level compared to the control group, which ensured enhanced growth and development of animals in the experimental group.

Morphological parameters of young pigs' blood during the experiment were higher than in the control, but were within the accepted standards, which ensured more intensive growth.

The cultivation of young pigs using a multienzymatic premix, of domestic production, provides an average daily increase in animals of the experimental group of over 16%.

Thus, the inclusion of the enzyme preparation P52-1 in the diets of young pigs had a positive effect on their body: it improved the morphological and biochemical parameters of blood and increased the growth rate.

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