The Effect of the Adsorbent Primix-Alfasorb on the Morphological and Biochemical Blood Parameters of Breeding Gilts

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Abstract
The studies were conducted at the state enterprise "Moldsuinhibrid" (Republic Moldova) in 2011 using piglets of Landrace breed. The animals selected for the experiment on the basis of analogues (including origin, age, body weight and health status) were divided into four groups of 10 animals each. The basic diet for the piglets in the experimental groups was supplemented with the adsorbent Primix-Alfasorb at the level of 0.2, 0.4 and 0.6 kg per ton of mixed fodder.
It was established that the addition of the adsorbent Primix-Alfasorb in the mixed fodder had contributed to the increase in body weight in different age periods; to the end of the trial the live weight of the piglets in groups EG_1, EG_2 and EG_3 was higher by 8.72, 5.83, and 7.93 % compared with the control group.
The analysis of the blood of the experimental animals the diet of which was supplemented with the adsorbent Primix-Alfasorb, showed that all parameters were within the physiological norm, and the increase in the amount of total protein indicated a strengthening of the metabolic processes in the animals. It was determined that the optimum level of the addition of the adsorbent Primix-Alfasorb in the mixed fodder for piglets was of 0.2 kg/t.

Keywords: mycotoxins, adsorbents, piglets, blood parameters

1. Introduction

When organizing the feeding of farm animals it is important not only to balance their diets according to energy value and the content of all nutrients, that is to assure a full nutrition, but also to create an ecologically safe production of agricultural products. Particular attention should be paid to the quality of pork which has great importance in the diet of all groups of population [1].
Feeding is one of the factors that allow getting environmentally friendly animal products. However, the fodder for animals contains also toxic substances.

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Mycotoxins are products of vital activity of ubiquitous microscopic (molds) fungi that can destroy the fodder at all stages of its production, processing and storage. It is believed that at least 25% of all fodder resources are subject to contamination with mycotoxins, or to the damaging action of fungi [2].
Mycotoxicoses cause an increased death of animals, loss of productivity, deterioration of reproduction and products quality, additional fodder consumption, etc. In addition, they are dangerous to human health because of their possible accumulation in the meat products [3].
When pigs eat fodder affected by mycotoxins a violation of protein metabolism is observed in them. Other mycotoxins (trichothecenes, trihotekolon, verrukarol, deoxynivalenol) suppress the elongation and termination, i.e. they inhibit the binding of DNA with ribosomes and the

translocation process, or prevent the release of peptides from ribosomes. Mycotoxins that inhibit the translation initiation, have more pronounced toxic properties than the toxins that affect the later stages of protein synthesis on ribosomes [4].

Due to the fact that it is virtually impossible to completely prevent the contamination of fodders with microscopic fungi and their pollution with mycotoxins, the utilization of natural minerals in animal feeding is widely used as the main method of body protection from the adverse effects of these toxins [5].

Because of that, there is a need to find cheap and effective ways of removing toxic substances from the pigs' body, which will permit to produce pork with the least of their content.

2. Materials and methods

The research was conducted at the SE "Modsuinhibrid" (the Republic of Moldova) during the period of 06.02-06.07.2011, using piglets of Landrace breed.

In order to carry out the research four groups of animals were formed (on the basis of analogies with regard to their origin, age, body weight and health status) of 10 heads each.

The animals were kept under identical conditions; the differences in feeding consisted in the fact that the main diet for the piglets in the experimental groups was supplemented with the adsorbent Primix-Alfasorb at the level 0.2, 0.4 and 0.6 kg per ton of fodder (Table 1).

Table 1. The scheme of the trial

Groups	Number of animals per group, head	Feeding features
CG	10	Basic mixed forage (BMF)
EG_1	10	BMF + 0.2 kg/t Primix-Alfasorb
EG_2	10	BMF + 0.4 kg/t Primix-Alfasorb
EG_3	10	BMF + 0.6 kg/t Primix-Alfasorb

For hematological studies blood was drawn from three animals in each group in the morning on an empty stomach at the beginning and the end of the trial.

The blood samples were collected in heparin-coated and ethylenediamine tetraacetic acid (EDTA)-coated vacutainer tubes. The plasma samples in heparin-coated tubes were analyzed for morphological and biochemical parameters.

The data obtained in the trial were statistically processed according to the Student's criterion.

3. Results and discussion

The feeding of the experimental animals in the scientific and economic trial was done in accordance with the accepted regulations on the feeding of breeding piglets, taking into account body weight and age. The piglets were feed three times per day in accordance with the growth period using full and balanced fodder (Table 2).

Table 2. The composition of the fodder for experimental piglets in the trial, %

Ingredients	Period of experience		
	up to 90 days	91-120 days	120-finis
Corn grain	16.0	24.0	26.0
Barley grain	16.7	38.8	37.5
Wheat grain	9.6	21.0	20.0
Grain of extruded corn	10.0	-	-
Barley grain	13.7	-	-
Wheat grain	10.0	-	-
Soybean meal	12.0	11.3	10.0
Wheat bran	6.6	-	-
Non-food fish flour	3.0	2.5	4.0
Premix	2.0	2.0	2.0
Salt	0.4	0.4	0.5

The piglets' live weight in the scientific trial was determined by weighing individual animals according to the periods of the experiment (Table 3).

Table 3. Piglets' live weight in the scientific experiment ($\overline{X} \pm S_{\bar{x}}$), kg

Groups	At the beginning of the accounting period	At the end of the first trial period	At the end of the second trial period	At the end of the trial
CG	11.60±0.145	23.84±1.457	38.34±2.086	94.09±3.179
EG_1	11.86±0.031	27.36±1.542	43.45±2.280	102.24±4.502
EG_2	11.87±0.106	24.94±1.415	39.90±1.338	99.52±4.543
EG_3	11.71±0.157	27.00±1.384	42.90±2.732	101.50±4.809

The analysis of data on the piglets' live weight showed, that during the first trial period, thepiglets' live weight in the experimental groups (EG_1, EG_2 and EG_3) was higher compared with the CG by 14.77%, 4.61% and 13.26%, respectively, (there is no significant difference), and the highest weight index was found in the group EG_1, where the animals were fed with fodder supplemented with Primix- Alfasorb at the level of 0.2 kg/t.

At the end of the second trial period the piglets' live weight in the experimental groups was also higher than in the control group. At the end of the trial it was determined that in the experimental groups EG_1 and EG_3 the piglets' live weight was 102.24 and 101.50 kg, that is respectively by 8.66% and 7.88% higher than in the CG, (there is no significant difference). The experiment investigated the effects of increasing dietary levels of the adsorbent Primix-Alfasorb on various blood parameters reflecting protein and fat metabolism, liver function, and purine base metabolism in growing pigs.

The animals' health, state of metabolism and productivity can be judged from the morphological and biochemical properties of the blood.

When analyzing the data of morphological parameters of pigs' blood at the beginning of the trial, it was observed that the content of hemoglobin, leukocytes and erythrocytes in the animals in all groups was within the physiological norm (Table 4). It should be noted that at the end of the trial no deviations from the physiological norm were observed in the content of hemoglobin and red blood cells in the blood of all experimental piglets, while under the influence of the addition of the adsorbent an increase in the number of white blood cells was observed in the experimental piglets in the first and second groups by 39.93%, and 34.53% ($P<0.05$) respectively compared with the control group (Table 5). The increase in white blood cells can be explained by the influence of physiological factors such as pain and stress in pigs at the time of blood sampling. The level of platelets in the animals' blood showed that there were no deviations from the norm on this index, which meant absence of immunologic diseases or severe inflammation.

Table 4. Morphological parameters of the experimental piglets' blood at the beginning of the trial ($\overline{X} \pm S_{\bar{x}}$)

Index	Groups			
	CG	EG_1	EG_2	EG_3
Hemoglobin, g/l	106.00±6.03	112.67±2.33	111.33±0.88	108.67±4.91
Red blood cells, 10^{12}/l	5.73±0.03	6.13±0.67	6.57±0.28	5.90±0.55
White blood cells, 10^9/l	15.60±2.26	15.5±1.72	16.13±0.55	17.87±0.88
Platelets, 10^9/л	523.67±40.13	463.00±13.23	475.33±34.26	528.00±23.30

Table 5. Morphological parameters of the experimental piglets' blood at the end of the trial ($\overline{X} \pm S_{\bar{x}}$)

Index	Groups			
	CG	EG_1	EG_2	EG_3
Hemoglobin, g/l	112.00±1.73	107.33±2.60	110.67±4.06	106.00±4.16
Red blood cells, 10^{12}/l	7.07±0.26	6.83±0.22	6.63±0.17	7.27±0.32
White blood cells, 10^9/l	16.13±1.53	22.57±1.02*	21.70±0.49*	16.07±0.83**
Platelets, 10^9/л	344.33±31.67	437.00±26,63	379.67±45,83	371.00±19.04

*significant ($P<0.05$); **significant ($P<0.01$)

The dynamics of changes in the content of total protein in the blood serum of the experimental pigs was also studied, because it is known that its level is a very important diagnostic parameter, especially related to the prominent changes in metabolism (Table 6, and 7). It is known that the concentration of the total protein in serum depends largely on the synthesis and the decay of the two major protein fractions–albumin and globulins. The analysis at the end of the trial of the proteinogram of the piglets in the experimental groups showed higher values of γ-globulin level in the first and second experimental groups by 9.69% compared with the control group.

Table 6. Biochemical parameters of the gilts' blood at the beginning of the trial ($\overline{X} \pm S_{\bar{x}}$)

Index	Group			
	CG	EG_1	EG_2	EG_3
Total protein, g / l	65.33±6.42	63.50±1.66	59.00±1.15	65.37±11.76
Albumins, %	28.97±1.33	28.77±1.68	29.60±1.80	28.97±5.38
Globulins of,%:				
α-globulins	18.3±2.55	21.97±1.33	20.07±1.78	20.90±3.84
β-globulins	38.27±4.60	34.07±3.28	33.90±1.44	38.73±10.67
γ-globulins	14.47±1.51	15.20±0.82	16.43±0.98	11.40±1.66
AST, mmol/l	179.00±8.66	142.33±17.84	166.67±9.49	95.33±45.04
ALT, mmol/l	213.67±45.62	220.00±42.67	218.33±17.90	172.67±59.69
Calcium, mmol/l	3.05±0.33	3.19±0.15	3.34±0.19	3.17±0.11
Inorganic phosphorus, mmol/l	3.82±0.28	3.36±0.11	3.01±0.27	3.67±0.71

Table 7. Biochemical parameters of the gilts' blood at the end of the trial ($\overline{X} \pm S_{\bar{x}}$)

Index	Group			
	CG	EG_1	EG_2	EG_3
Total protein, g / l	58.33±3.19	62.50±6.39	62.73±2.22	63.23±1.47
Albumins, %	32.60±1.78	32.37±1.56	33.13±1.71	32.60±1.64
Globulins of,%:				
α-globulins	30.66±3.79	29.47±2.13	28.37±2.46	30.90±4.17
β-globulins	16.03±0.78	15.57±1.08	15.87±0.75	16.27±0.70
γ-globulins	20.63±1.66	22.63±0.55	22.63±0.87	20.27±1.45
AST, mmol/l	53.33±6.01	51.00±16.62	52.67±3.38	62.33±2.03
ALT, mmol/l	61.00±9.17	51.00±4.00	72.00±1.53**	61.67±2.03*
Calcium, mmol/l	2.41±0.15	2.94±0.18	2.73±0.21	3.09±0.50
Inorganic phosphorus, mmol/l	4.27±0.08	3.57±0.17*	3,37±0.22*	3.13±0.08***

*significant (P<0.05); **significant (P<0.01); ***significant (P<0.001)

The content of the total protein in the blood of the piglets in the experimental groups (EG_1, EG_2 and EG_3) was, respectively, 62.50, 62.73 and 63.23 g/l, which was higher by 7.15, 7.54, and 8.40% compared with the control group (there is no significant difference).

In addition, it is well-known that a violation of protein metabolism is observed in pigs when they eat fodders affected by mycotoxins. That could be explained by the fact, that according to their mechanism of action mycotoxins are inhibitors of protein synthesis [6].

In our trial the content of the total protein in blood plasma was higher in the experimental groups in which the piglets were fed with fodder supplemented with the adsorbent in comparison with the CG. The increase in the amount of the total protein and albumin in the experimental animals in the experimental groups, in which the additive of the adsorbent was used, indicated a strengthening of the protective mechanisms of the body.

Thus, the inclusion of the adsorbent Primix-Alfasorb in the diet for growing piglets enhances the natural resistance of their body, as it was proved not only by the haematological parameters, but also by the increase in daily gain of their body weight.

4. Conclusions

It was determined that at the end of the trial the live weight of the growing piglets in EG_1, which received in their diet the adsorbent Primix-Alfasorb at the level of 0.2 kg/ton, was higher than the live weight of their analogues both in the other experimental groups (EG_2 and EG_3) and in the control group, by 2.73, 0.73, and 8.66% respectively.

The analysis of the blood of the experimental animals which were fed with a fodder supplemented with the adsorbent showed that all the morphological and biochemical parameters were within the physiological norm. It should be noted that an increase of the total protein in the blood of the animals in the experimental groups was observed, which indicated a strengthening of redox and plastic processes in the body.

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