

Economic assessment of anti-stress therapy in the production of meat in poultry farming

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Abstract. The paper presents the results of the effectiveness of anti-stress therapy and its economic assessment when growing broiler chickens in a poultry farming against the background of the use of a stress-protector antioxidant-complex (SPA0-complex) in broiler chickens. The pharmacological complex was used in the form of a drink at a dose of 185 mg/kg of live weight for 5 days during periods of the greatest influence of stress factors, namely at the stage of vaccination associated with the greatest immunological load (at 10-14 days of age) and (or) at the stage of final fattening. The effectiveness of anti-stress therapy was assessed by the morphological parameters of poultry blood, leukocyte indices, the yield of poultry meat and the quality of carcasses. The economic efficiency was assessed by the ratio of the economic effect and veterinary costs. A relative decrease in the total level of leukocytes and a change in leukocytes of different types was found: a decrease in agranulocytes and an increase in agranulocytes, a decrease in the value of the Krebs index, the leukocyte index of intoxication, an increase in the lymphocyte index, the ratio of agranulocytes and granulocytes and lymphocyte-granulocyte index. The use of the SPA0-complex in broiler chickens in the form of a drink at a dose of 185 mg/kg of live weight for 5 days due to the growth rate and an increase in live weight helped to reduce the impact of stress factors and led to an increase in meat yield by 2.34-4.92% and a decrease in injuries before slaughter, which was reflected in a decrease in the level of carcass defect from 20-40%. It influenced the value of the economic effect which amounted to 70.08-145.2 rubles. The value of veterinary costs for different anti-stress therapy regimens ranged from 9.35 to 101.32 rubles. The economic efficiency of using the SPA0-complex at a dose of 185 mg/kg of live weight per day for 5 days per one ruble of costs during the period of intensive vaccination was 16.7 rubles, during the period of final fattening it was 0.81 rubles and during periods of intensive vaccination and final fattening it was 1.52 rubles.

1 Introduction

In the agricultural-industrial sector of the Russian economy, the poultry industry is considered as a high-tech area that ensures the food security of Russia. Industrial poultry complexes are implementing a number of measures aimed at to boost profits by increasing production indicators not only in quantitative, but also in qualitative equivalents [1]. Growing poultry is accompanied by the need for vaccination [2, 3], which causes an immunosuppressive state associated with stress [4].

The introduction of modern veterinary technologies, including the use of innovative methods and means and those reducing stress [5], provides sufficiently high-performance indicators.

Thus, the effect of the use of veterinary drugs for vaccination of poultry [6, 7], the use of feed additives [8, 9] for the prevention of stress was proven [10]. The therapeutic effectiveness of the introduced innovations was confirmed by the growth of accounted target indicators in certain working conditions.

It is necessary to note that an objective, real

assessment of veterinary costs in the production of poultry is not always correctly performed. It brings into question the feasibility and need for a complex of veterinary measures to introduce certain veterinary methods and means into the production technology of products. Therefore, the economic assessment of innovations in poultry farming is an issue, requiring careful study and evaluation. This paper presents an economic analysis of the use of anti-stress therapy in the production of poultry meat in a micro-enterprise.

2 Materials and methods

The economic analysis of the results of studies on the use of the SPA0-complex in poultry kept in the conditions of a poultry farming of individual entrepreneur Turganov Zh.M. was carried out. During the experiment, four groups of 7-day-old broiler chickens were formed. One of these groups was a control one. The birds of this group were on the basic diet until the end of the growing period. Broiler chickens of the first, second and fourth experimental groups received the

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SPAO-complex during the periods of the greatest influence of stress factors, namely at the stage of vaccination associated with the highest immunological load (at 10-14 days of age) and (or) at the stage of final fattening.

The drug was administered with water at a dose of 185 mg/kg of body weight for 5 days. The chickens of the second experimental group were given the SPAO-complex in both periods, the third group was given at the stage of final feeding and the fourth group was given at 10-14 days of age. There were 10 chickens in each group. The effect of anti-stress therapy on the body of broiler chickens was determined by their blood, meat yield and carcass quality. Blood was taken at the age of 14 days from the saphenous axillary vein, at the age of 56 days - during decapitation. According to the generally accepted method, the total number of leukocytes was determined, a leukogram was taken and leukocyte indices were calculated [11, 12].

The slaughter was on the 56th day of the chickens' life and included all the necessary technological operations. In order to determine the impact of the SPAO-complex on the quality of meat, 10 heads from each group were analyzed for defects during the slaughter process.

The economic analysis was carried out by a generally accepted method, the additional cost was calculated according to the author's method [10], developed for poultry farming. In the complex of veterinary costs associated with the use of the SPAO-complex, the cost of the drug was determined according to its actual costs, the monetary equivalent of the labor intensity of its administration, established experimentally by the time-tracking method. The cost-effectiveness of anti-stress therapy was assessed by the cost of additional products.

As a result of the assessment of the economic efficiency of anti-stress therapy, estimated by the cost of additionally obtained products, as well as by the number of veterinary costs, we found the following.

3 Influence of the SPAO-complex on the effectiveness of anti-stress therapy and its economic assessment when growing broiler chickens

The effect of anti-stress therapy on the bodies of broiler chickens showed a change in the level of the total content of leukocytes and their individual species. At the age of 14 days, in broiler chickens subjected to a high immunological load - vaccination against infectious bursal disease, infectious bronchitis of chickens and Newcastle disease, the content of leukocytes in the blood was within the physiological limit, but in poultry that received the SPAO-complex during this period, the level of leukocytes was 22.91-28.04% lower. That is, the use of anti-stress drugs helped to reduce the impact of the stress factor namely vaccination, which was reflected in the level of leukocytes.

At the stage of final fattening, similar changes were observed. Thus, in poultry that received the SPAO-complex during the period of intensive vaccination and at the final fattening stage the level of leukocytes was

30.95% lower, at the stage of final fattening it was 21.69% lower and only during the vaccination period it was 8.99% lower (Table 1).

Table 1. Level of leukocytes in the blood of broiler chickens ($X \pm s_x$, $n=10$)

Indices	Group			
	The 1st experimental group	The 2nd experimental group	The 3rd experimental group	The 4th experimental group
14 days				
Leukocytes, $10^9/l$	37.1 ± 1.97	27.4 ± 2.41	38.1 ± 2.03	28.6 ± 3.15
Granulocytes, %	40.1 ± 1.86	32.8 ± 1.95	40.6 ± 1.12	33.3 ± 0.98
Basophiles, %	2.6 ± 0.37	1.8 ± 0.75	2.7 ± 0.35	1.9 ± 0.71
Eosinophiles, %	9.2 ± 0.75	6.6 ± 0.60	9.1 ± 1.02	6.6 ± 0.69
Pseudo-eosinophiles (neutrophiles, heterophiles), %	28.3 ± 1.11	24.6 ± 2.25	28.8 ± 1.03	24.9 ± 0.74
Agranulocytes, %	60.0 ± 1.86	67.3 ± 1.95	59.5 ± 1.12	66.7 ± 0.98
Lymphocytes, %	53.7 ± 1.21	58.6 ± 1.50	53.5 ± 1.19	58.4 ± 1.49
Monocytes, %	6.3 ± 1.30	8.7 ± 0.86	6.0 ± 1.68	8.4 ± 1.56
56 days				
Leukocytes, $10^9/l$	37.8 ± 1.52	26.1 ± 2.29	29.6 ± 3.44	34.4 ± 2.68
Granulocytes, %	40.8 ± 1.14	32.7 ± 1.33	34.2 ± 1.43	37.9 ± 1.70
Basophiles, %	2.5 ± 0.53	1.5 ± 0.55	1.8 ± 0.48	2.1 ± 0.32
Eosinophiles, %	9.2 ± 0.63	6.5 ± 0.50	7.0 ± 0.50	8.3 ± 1.01
Pseudo-eosinophiles (neutrophiles, heterophiles), %	29.1 ± 0.94	24.8 ± 0.79	25.4 ± 1.17	27.5 ± 1.33
Agranulocytes, %	59.2 ± 1.18	67.2 ± 1.38	65.9 ± 1.43	62.1 ± 1.70
Lymphocytes, %	54.0 ± 1.30	59.4 ± 0.82	59.0 ± 0.62	55.8 ± 1.16
Monocytes, %	5.2 ± 0.54	7.8 ± 1.16	6.9 ± 1.60	6.4 ± 2.08

The species composition of leukocytes in broiler chickens of different groups is different: with the use of an anti-stress drug - the SPAO-complex, the level of basophiles, eosinophiles and pseudo-eosinophiles decreased and the level of lymphocytes and monocytes increased.

Thus, at the age of 14 days, in broiler chickens that received the SPAO-complex, the level of basophiles was 29.63-30.77% lower, eosinophiles - 27.47-28.26%, pseudo-eosinophiles - 12.01-14.58%. At the age of 56 days, the level of basophiles, eosinophiles and pseudo-eosinophiles in poultry that received the SPAO-complex during the period of intensive vaccination and at the final stage of fattening was 40%, 29.35%, 14.78% lower, at the stage of final fattening - 28%, 23.91% , 12.71% and only during the vaccination period it was 16%, 9.78% and 5.50% lower respectively.

The level of lymphocytes at the age of 14 days in broiler chickens which were the SPAO complex was

8.75-9.53% higher, monocytes - 33.33-45%. At the age of 56 days, the level of lymphocytes and monocytes was 10% and 50% higher in poultry which received the SPAO-complex during the period of intensive vaccination and at the final stage of fattening, at the stage of final fattening - by 9.26% and 32.69% and only during the vaccination period - by 3.33% and 23.08%, respectively.

Consequently, the SPAO-complex, influencing the body of poultry as an agent reducing the effect of stress factors, contributed to a decrease in the level of leukocytes and changes in the level of leukocytes of different types.

Due to the anti-stress therapy, the changes in the bodies of broiler chickens occurred, which were reflected in the values of leukocyte indices: a decrease in the Krebs index and lymphocytic index of intoxication, an increase in lymphocytic and lymphocyte-granulocyte indices and the ratio of agranulocytes and granulocytes (Table 2).

Table 2. Leukocyte blood indices of broiler chickens ($X \pm s_x$, n=10)

Indices	Group			
	The 1st experimental group	The 2nd experimental group	The 3rd experimental group	The 4th experimental group
14 days				
Krebs index	0.5±0.03	0.4±0.05	0.5±0.02	0.4±0.01
Lymphocyte index	1.9±0.11	2.4±0.27	1.9±0.08	2.3±0.07
The ratio of agranulocytes to granulocytes	0.7±0.01	0.8±0.04	0.7±0.03	0.7±0.03
Leukocyte intoxication index	0.4±0.02	0.3±0.04	0.4±0.02	0.3±0.01
Lymphocyte-granulocyte index	1.3±0.09	1.8±0.14	1.3±0.05	1.8±0.07
56 days				
The Krebs index	0.54±0.03	0.42±0.02	0.43±0.02	0.49±0.03
Lymphocyte index	1.9±0.10	2.4±0.09	2.3±0.10	2.0±0.10
The ratio of agranulocytes to granulocytes	0.71±0.01	0.76±0.02	0.74±0.02	0.73±0.02
Leukocyte intoxication index	0.41±0.02	0.33±0.01	0.34±0.02	0.38±0.03
Lymphocyte-granulocyte index	1.32±0.07	1.82±0.09	1.73±0.07	1.47±0.07

The value of the Krebs index, reflecting the stress effect on the body, during the period of intense immunological load at the age of 14 days in broiler chickens which were given the SPAO-complex, was 20% lower, the leukocyte intoxication index, which characterized the intensity of the stress reaction was 25% lower.

At the age of 56 days in poultry that received the SPAO-complex during the period of intensive vaccination and at the final stage of fattening, the values of the Krebs index and the leukocyte index of intoxication were 22.22% and 19.51% lower, at the stage of final feeding it was 20.37% and 17.07% lower and only in vaccination period it was 9.26% and 7.32% lower respectively.

The value of the lymphocyte index - the index of stress resistance, an indicator of the balance of the response to the effect of the stress factor at the age of 14 days in broiler chickens which were given the SPAO-complex was 21.05-26.32% higher, the ratio of agranulocytes to granulocytes was 14.29% higher, granulocyte index was 38.46% higher.

At the age of 56 days, in poultry which received the SPAO-complex during the period of intensive vaccination and at the final stage of fattening, the values of the lymphocyte index, the ratio of agranulocytes and granulocytes, lymphocyte-granulocyte index were 26.32%, 7.04% and 37.88% higher, at the stage of final fattening - 0% and 4.22% and 31.06% and only during the vaccination period - 21.05%, 2.82 and 11.36%, respectively.

In the groups where the SPAO-complex was used in broiler chickens in combination of the main diet, the live weight and the average daily gain in live weight were higher (Table 3).

Table 3. Dynamics of live weight of broiler chickens ($X \pm s_x$, n=10)

Bird age, weeks	Group			
	The 1st experimental group	The 2nd experimental group	The 3rd experimental group	The 4th experimental group
0	40±1.15	40±2.58	40±2.98	40±2.91
7	200±3.30	202±5.89	199±6.73	201±8.87
14	450±5.29	456±8.06	447±10.83	458±10.23
21	840±7.23	861±6.77	838±15.78	862±8.56
28	1350±10.30	1369±14.43	1346±12.60	1370±8.60
49	3100±31.84	3157±22.65	3106±11.05	3165±13.74
56	3340±22.17	3590±15.17	3545±18.04	3365±19.29
Meat yield, kg	2.47±0.16	2.66±0.11	2.62±0.13	2.49±0.14

The data in the table indicate that in broiler chickens, due to the anti-stress therapy, the increase in live weight was characterized by a more intensive rate. Thus, upon reaching 7 days of age, the live weight of birds in different groups did not practically differ - the difference between the average indicators of live weight in the groups was 0.55%. By the time of reaching the age of 14 days, the live weight of broiler chickens, which were given the SPAO-complex, showed a tendency towards an increase in the compared indicators and the difference in live weight was 4.0-4.92%.

The average daily gain in live weight of birds during the first seven days of life practically did not differ in different groups, but then, due to the use of the SPAO-complex in the period from 7 to 14 days of life of chickens it was 7.6- 8.51% (Table 4).

According to the data in Table 3, it follows that the poultry, which was given the SPAO-complex during high immunological load in growing period, had higher

live weight. Thus, at the age of 21 days the difference in body weight was 3.45-3.94%, at 28 days - 2.66-2.90%, at 49 days - 1.70-1.82%. That is, after the end of the use of the SPAO-complex, the potential for more intensive growth of broiler chickens remained. At the same time, the difference in the values of the compared index of poultry of different groups became less pronounced, which was confirmed by the dynamics of the average daily gain in live weight.

Table 4. Average daily gain in live weight of broiler chickens (g, $X \pm s_x$, n=10)

Bird age, weeks	Group			
	The 1st experimental group	The 2nd experimental group	The 3rd experimental group	The 4th experimental group
0-7	22.86±0.53	22.86±0.9	22.71±0.93	22.70±1.43
7-14	35.71±0.87	38.43±1.76	35.43±2.09	38.44±1.63
14-21	55.71±1.53	57.43±2.04	55.86±2.98	57.29±2.19
21-28	71.21±1.47	72.13±1.18	71.30±2.88	72.16±1.38
28-49	83.86±1.32	87.70±1.0	83.87±0.62	84.67±0.48
49-56	84.46±5.44	92.9±3.73	92.84±1.95	84.89±3.49

The poultry which was given the SPAO-complex during high immunological load in the growing period also had higher average daily gain in live weight throughout the entire growing period. Thus, at the age of 14-21 days, the average daily gain in live weight in chickens of different groups differed by 2.56-3.08%, at the age of 21-28 days - 1.16-1.32%, at the age of 28-49 days - 0.96-1.01%. That is, after the end of the use of the SPAO-complex, the potential for more intensive growth of broiler chickens remained, but it also tended to decrease.

The use of the SPAO-complex at the final stage of fattening during the comparison of the live weight of broiler chickens, showed an increase in live weight gain by 1.56% compared to the first experimental group. At the same time, the difference in comparison with the live weight of broiler chickens receiving the SPAO-complex during the period of high immunological load was minimal and insignificant - 0.05%. Apparently, the given growth potential was valid throughout the entire growing period. Nevertheless, the use of the SPAO-complex only at the final stage of fattening allowed achieving high rates due to the average daily gain in live weight. In the chickens of the 3rd experimental group it was 9.37% higher than in the chickens of the 4th experimental group.

Feeding broiler chickens with the SPAO-complex during a period of high immunological load by the end of the growing period had a minimal effect on productivity. The live weight of broiler chickens of the 4th experimental group was 0.79% higher than the control values. In broiler chickens that received the SPAO-complex only during the period of high immunological load (the 4th experimental group), the live weight by the end of the growing period did not differ from the control indicators, it was slightly higher (by 1.51%), the average daily gain in live weight was 0.51 % higher.

This fact allows making conclusion about the positive effect of the anti-stress drug - the SPAO-complex on the bird's body during their exposure to stress factors. There are publications reflecting the results of the studies on the SPAO-complex in a large poultry farm and proving the positive effect of anti-stress therapy on the parameters of the immune response, confirmed by an increase in poultry productivity [1].

The yield of poultry meat in the second experimental group in comparison with the first experimental group was 4.92% higher, in the third - 3.21%, in the fourth - 2.34%.

The slaughtered poultry of the second and third experimental groups had no defects. In the first and fourth experimental groups, the defects of carcasses were found in 20-40%.

Four out of ten examined carcasses (40%) had defects: scratches on the back (20%), bruises (10%) and pinprick bleeds (10%).

Consequently, the use of the SPAO-complex to broiler chickens in the form of a drink at a dose of 185 mg/kg of live weight for 5 days due to the growth rate and an increase in live weight helped to reduce the impact of stress factors and led to an increase in meat yield and a decrease in injuries before slaughter.

The results of the economic analysis were influenced by the obtained performance indicators, along with the level of veterinary costs.

The veterinary costs consisted of the cost of the SPAO-complex, the consumption of which depended on the live weight of birds. The use of the SPAO-complex at the first stage provided the application of its solution to birds of the second and fourth groups with an average body weight of 200 g, at the second stage – the application to the poultry of the second and third groups with an average body weight of 3100-3200 g. Moreover the costs of the solution of the pharmacological complex were taken into account. In average a veterinarian spent 10 minutes preparing the solution per livestock in the experimental group. Veterinary costs for wages, taking into account extra wages, were calculated based on the salary fund of veterinarians. A monthly salary of a veterinarian is 25,000 rubles; a year salary is 300,000 rubles and 172.67 rubles per hour based on the annual fund of working time (1737.4 hours). That is the cost of labor time was 2.9 rubles for one period of the application of the SPAO-complex solution to each group.

Table 5. Veterinary costs of the introduction of anti-stress therapy, rubles

Costs	Group		
	The 2 nd experimental group	The 3 rd experimental group	The 4 th experimental group
Material	93.77	86.18	5.58
For wages	5.8	2.9	2.9
Salary wages	1.75	0.88	0.88
Veterinary, total	101.3	89.95	9.35

The highest veterinary costs were in the second experimental group, where the poultry was given the

solution of the SPAO-complex twice during the feeding period: during the intense immunological load and at the final stage of fattening. They were 1.13 times higher than in the third experimental group and 10.83 times higher than in the fourth.

As a result of anti-stress therapy, it was possible to obtain additional products - poultry meat.

This indicator was the highest in the second experimental group, which influenced the additional cost of production, which was 53.20% higher than in the third group, and 2.11 times higher than in the fourth group. This had influence on the value of the economic effect, which was also the highest in the second experimental group: 2.07 times higher than in the third group and 1.35 times higher than in the fourth one.

Despite this aspect, due to significant veterinary costs, the economic efficiency of anti-stress therapy per one ruble of costs was highest in the group where veterinary costs were minimal - in the fourth experimental group. The value of economic efficiency per one ruble of costs was maximal in the fourth experimental group and higher by 10.99 times than in the second group and by 20.75 times than in the third group.

Consequently, the yield of products due to anti-stress therapy compensated the veterinary costs, but the profit obtained in this case was different.

The results of the experience of our research allow concluding that the use of the SPAO-complex at different stages of growing broiler chickens in the conditions of a poultry farming of Turganov Zh.M. individual entrepreneur in the form of a drink at a dose of 185 mg/kg of live weight for 5 days during a period of high immunological load and at the final stage of fattening contributed to the increase in live weight.

The maximal gain in live weight was in broiler chickens, which were given the SPAO-complex in two periods: the period of intense immunological load and at the stage of final fattening. The action of the SPAO-complex used during the period of intensive immunological load was maintained throughout the entire growing period, and the SPAO-complex used during the final fattening period allowed achieving higher productivity indicators. More pronounced changes were observed during the use of the SPAO-complex to broiler chickens in the period of high immunological load and at the final stage of fattening.

4 Conclusion

The application of the SPAO-complex to broiler chickens in the form of a drink at a dose of 185 mg/kg of live weight for 5 days due to the growth rate and an increase in live weight helped to reduce the impact of stress factors and led to an increase in meat yield and a decrease in injuries before slaughter.

As a result of the action of the SPAO complex, there was a relative decrease in the total level of leukocytes and a change in leukocytes of different types: a decrease in agranulocytes and an increase in agranulocytes, a decrease in the value of the Krebs index, the leukocyte index of intoxication, an increase in the lymphocyte

index, the ratio of agranulocytes and granulocytes, lymphocyte-granulocyte index.

The use of the SPAO-complex at the final stage of fattening and (or) during a period of high immunological load increased the meat yield by 2.34-4.92%, at the final stage of fattening it reduced the level of carcass defect from 20-40% to 0.

More pronounced changes were observed during the use of the SPAO-complex to broiler chickens in the period of high immunological load and at the final stage of fattening.

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