

Influence of Termovet and Productive Acid SE preparations on blood parameters of broiler chickens

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Abstract. The studies' results of blood and biochemical parameters of its serum in broiler chickens exposed to high ambient temperatures are presented. Heat stress causes physiological changes in the poultry body, which negatively affects its health, feed intake and digestibility, productivity and product quality. To alleviate the poultry condition, a water-soluble powder of the Termovet preparation of acetylsalicylic acid (750 mg/1 g) was used for oral administration. As well as Productive Acid SE - a mixture of organic acids. The chicks' growing period was 34 days. The main period of the experiment began when the poultry reached an average live weight of 1680 g at the age of 4 weeks. Upon reaching an average live weight of 2030 g within 6 days before withdrawal from the experiment, the room was heated to 35 °C from 8 am to 6 pm. At this time, Termovet preparation was poured into the drinkers in the following doses: experimental group I - 100 mg/kg of live weight, experimental group II - 150 mg/kg. Both experimental groups were given Productive Acid SE last thing at night in a dose that provided water pH of 4. Research results have shown that the use of these preparations had a positive effect on the hematological and biochemical parameters of chickens when exposed to high temperatures.

1 Introduction

Heat stress causes physiological changes in the poultry body, which negatively affects its health, feed intake and digestibility, productivity and product quality. As a result, such production indicators as average daily live weight gain, feed conversion, and safety are significantly reduced. This leads to significant financial losses and a decrease in the profitability of poultry products' production.

Acetylsalicylic acid prevents thrombogenesis and has anti-inflammatory, antipyretic effects. It is an active ingredient in the Termovet preparation water-soluble powder [1, 2, 3].

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2 Materials and methods

The studies were carried out in laboratory conditions of the Research Institute of Agriculture of the Northern Trans-Urals, a branch of the Tyumen Scientific Center of the SB RAS. The object of the study was broiler chickens of the Arbor Acres+ cross. The experimental chickens were divided into three groups according to the principle of balanced analog groups with 40 heads in each group. The experiment lasted for 34 days. The main period of the experiment began when the poultry reached an average live weight of 1680 g at the age of 4 weeks. Upon reaching an average live weight of 2030 g within 6 days before withdrawal from the experiment, the room was heated to 35 °C from 8 am to 6 pm. At this time, Termovet preparation was poured into the drinkers in the following doses: experimental group I - 100 mg/kg of live weight, experimental group II - 150 mg/kg, control group - no preparation used. Both experimental groups were given Productive Acid SE last thing at night in a dose that ensures water pH of 4, which amounted to 1 ml/liter in this case (depending on the composition and pH of the water used).

All conditions of cage keeping, microclimate parameters were identical in all studied groups. The feed was recorded daily [4, 5, 6].

Termovet preparation is a water-soluble powder of acetylsalicylic acid (750 mg/1 g) for oral administration. Producer - "Divasa-Farmavic S.A." (Spain). Productive Acid SE contains the following acids: formic acid not less than 61%, lactic acid not less than 8%, propionic acid not less than 5%, citric acid not less than 3% and acetic acid not less than 2%. Developed by VIK - Animal Health LLC (Russia). The physiological state of poultry was accessed by monitoring the blood parameters of the morphological and biochemical composition during the main period of the experiment. The material for the study was blood taken from four typical chickens of each group by decapitation at 28 days and 34 days of age. The following was determined in the test material: blood cells number, leukocyte formula, biochemical parameters and minerals. The studies were carried out in the hemanalytical laboratory of the State Educational Institution of Higher Professional Education TyumSMA, Roszdrav.

All examinations were biometrically processed with significant difference calculation.

3 Results and discussion

In the body, blood maintains an internal connection between individual organs and tissues providing the required nutrients [7, 8].

Any changes in the body will directly affect the blood composition, which serves as an indicator of the body's reactivity and characterizes its overall resistance [9, 10, 11].

In this research work, the biochemical composition of blood serum in experimental groups of broiler chickens at the beginning and end of the experimental period was studied (table 1, 2).

Table 1. Biochemical blood serum composition of broiler chickens.

Indicator	Measurement units	Group		
		control	I experimental	II experimental
at the beginning of the experimental record period				
Glucose	mmol/l	14.30±0.58	14.53±0.90	13.15±0.40
Alanine aminotransferase	unit/l	6.47±1.31	8.47±3.57	5.73±1.73
Aspartate aminotransferase	unit/l	276.47±67.13	294.77±42.25	382.73±80.35
Total protein	g/l	32.23±1.76	28.30±1.17	30.67±2.09
Albumin	g/l	14.03±0.78	11.70±0.67	12.53±0.40

Urea	mmol/l	0.53±0.12	0.68±0.00	0.70±0.16
Creatinine	µmol/l	24.00±0.71	21.00±2.83	22.67±1.08
Uric acid	µmol/l	354.33±46.00	240.67±11.97	288.67±85.66
Calcium	mmol/l	2.71±0.01	2.74±0.01	2.60±0.03
Phosphorus	mmol/l	2.13±0.06	2.15±0.09	2.01±0.06
Potassium	mmol/l	4.58±0.51	4.62±0.19	4.93±0.20
Sodium	mmol/l	148.23±0.45	149.47±0.66	148.57±1.50
Calcium	mmol/l	1.46±0.01	1.47±0.01	1.45±0.01
at the end of the experimental record period				
Glucose	mmol/l	14.46±0.69	14.53±0.20	15.03±0.52
Alanine aminotransferase	unit/l	3.45±0.62	5.05±1.37	4.48±1.62
Aspartate aminotransferase	unit/l	401.95±73.56	364.95±50.00	352.65±97.90
Total protein	g/l	36.08±2.42	35.35±1.03	30.25±0.68
Albumin	g/l	14.75±0.81	14.93±0.56	12.80±0.41
Urea	mmol/l	0.43±0.05	0.44±0.07	0.57±0.11
Creatinine	µmol/l	16.25±1.59	17.50±1.80	16.75±1.09
Uric acid	µmol/l	219.50±52.70	186.25±64.83	137.00±43.90
Calcium	mmol/l	2.57±0.05	2.55±0.02	2.61±0.06
Phosphorus	mmol/l	1.79±0.07	1.86±0.14	1.98±0.10
Potassium	mmol/l	4.42±0.03	4.66±0.34	4.72±0.31
Sodium	mmol/l	152.20±1.52	154.08±1.17	152.90±1.40
Calcium	mmol/l	1.34±0.02	1.37±0.02	5.62±0.02

At the beginning of the experimental period, blood and serum indices were within the normal range both between groups and relative to the reference range in all groups of poultry.

At the end of the experimental period, the chickens of the control group showed more uric acid than the chickens of the I experimental group by 33.25 µmol/l. But it should be noted that this indicator was within the physiological norm in chickens of all studied groups.

The level of aspartate aminotransferase (AST) can be used to judge liver function. Normal values are up to 330 U/l in most poultry species. This indicator in the poultry of the control group was 401.95 U/l, in the I experimental group - 364.95 U/l, which was higher by 37 U/l. Both indicators were above normal, which can be explained by the negative impact of the stress factor of elevated temperature. It should be noted that AST was normal in both groups before exposure to the stress factor. The norm for this indicator is up to 330 U/l.

More uric acid was also noted in the blood serum of the control group chickens by 82.5 mmol/l in relation to the analogs of the II experimental group. In this case, the indicator of uric acid was within the physiological norm in chickens of all groups.

The serum aspartate aminotransferase index in chickens of the control group was by 49.3 U/l higher than in the II experimental group. Both indicators were above normal, which can be explained by the negative impact of the stress factor of elevated temperature. No statistically significant differences were found in the data in Table 1.

The results of hematological parameters of broiler chickens' blood are presented in Table 2.

Table 2. The study results of broiler chickens' red blood at the beginning of the experimental record period.

Indicator	Measurement units	Group		
		control	I experimental	II experimental
at the beginning of the experimental record period				
Leukocytes	10 ⁹ /l	20.06±1.23	15.70±1.82	17.29±4.18
Erythrocyte concentration	10 ¹² /l	2.45±0.17	2.26±0.11	2.34±0.14
Hemoglobin	g/l	111.67±2.94	101.00±2.45	106.00±6.01
Hematocrit	%	36.77±1.13	33.80±0.90	34.97±1.95
Average erythrocyte volume	fl	150.80±5.88	149.60±3.21	149.57±2.16
Average hemoglobin content in a single erythrocyte	g/l	45.83±1.98	44.67±1.04	45.47±0.20
Average hemoglobin concentration in erythrocyte	fl	304.00±1.41	299.00±2.55	304.33±2.94
Platelets	10 ⁹ /l	42.30±4.80	44.43±1.16	42.80±5.06
Pseudoeosinophils	%	44.33±3.56	51.67±4.55	50.67±9.34
Eosinophils	%	6.67±0.82	8.67±3.27	9.00±2.55
Monocytes	%	5.67±0.41	4.67±2.04	5.00±1.41
Lymphocytes	%	39.67±2.16	28.00±6.16	30.33±10.64
ESR	ml/h	2.00±0.00	2.00±0.00	2.00±0.00
at the end of the experimental record period				
Leukocytes	10 ⁹ /l	15.50±1.78	21.99±3.45	15.69±0.93
Erythrocyte concentration	10 ¹² /l	2.59±0.08	2.71±0.07	2.51±0.04
Hemoglobin	g/l	112.00±3.86	119.00±4.14	116.25±2.67
Hematocrit	%	36.85±0.96	39.73±1.41	37.13±0.86
Average erythrocyte volume	fl	142.63±4.28	146.65±2.31	148.20±3.52
Average hemoglobin content in a single erythrocyte	g/l	43.28±0.98	43.95±0.53	46.35±1.00
Average hemoglobin concentration in erythrocyte	fl	304.00±8.77	299.75±5.57	313.50±13.80
Platelets	10 ⁹ /l	9.70±1.44	12.22±1.14	12.52±0.94
Pseudoeosinophils	%	35.75±4.91*	33.00±2.05	18.50± 4.36
Eosinophils	%	6.50±1.20*	3.75±1.79	3.00±0.67
Monocytes	%	50.50±4.93	59.00±1.70	76.50±4.41**
Lymphocytes	%	6.50±0.33	4.25±1.44	2.00±0.58***
ESR	ml/h	2.00±0.00	2.00±0.00	2.00±0.00

*P ≥0.90; ** P ≥0.990, ***P ≥0.999

The obtained results show that the number of leukocytes in the chickens' blood in the control group was lower than that of the 1st experimental group by 6.49 x 10⁹/l and was lower than the reference values (20-40 x 10⁹/l). This indicator in chickens of the I experimental group was included in the reference range and was within the physiological norm.

The number of erythrocytes in the chickens' blood of both groups was below normal (3-4 x 10¹²/l). It should be noted that the hemoglobin content in the subjects' blood of the I experimental group was higher by 7 g/l in relation to the control group and was within the normal range (80-120 g/l) [12, 13].

The hematocrit index in chickens of both experimental groups was at the lower limit of

the norm. Moreover, in the chickens of the I experimental group it was higher than the minimum value (37%) by 2.73%, and in the control group - lower by 0.15%. The recommended hematocrit value is 37-50%.

The platelets number in the chickens' blood in the control group was inferior to the I experimental group by $2.52 \times 10^9/l$, and to the II experimental group - by $2.82 \times 10^9/l$.

The chickens' blood pseudoeosinophils of the experimental groups were slightly higher than the reference range (24-30%), and in the control group they were 2.75% higher than in the I experimental group. There were also more eosinophils in the control than in the I experimental group by 2.75%.

It should be noted that the number of monocytes at the beginning of the experiment was 4.7 - 5.7%, by the end of the experiment their ratio reached 50.5 - 76.5%, with a higher value in chickens of the II experimental group ($P \geq 0.990$). On the contrary, at the beginning of the experiment lymphocytes were at the level of 28.0 - 39.7%, and after the use of the studied preparations their level decreased to 2.0-6.5% with a minimum value in chickens of the II experimental group ($P \geq 0.999$).

4 Conclusions

1. At the beginning of the experimental period, blood and serum indices were within the normal range both between groups and relative to the reference range in all groups.
2. At the end of the experimental period, the amount of uric acid in the blood serum from the control group chickens increased by 33.25 mmol/l than that in the I experimental group and by 82.5 mmol/l in the II experimental group. The level of aspartate aminotransferase in the control group chickens was 401.95 U/l, and in the I experimental group - 364.95 U/l, which was 37 U/l higher and 49.3 U/l than in the II experimental group. The indicators were above normal, which can be explained by the negative impact of the stress factor of elevated temperature. It should be noted that AST was normal in both groups before exposure to the stress factor.
3. The number of leukocytes in the blood of the control group chickens was less by $6.49 \times 10^9/l$ than in the first experimental group and lower than the reference values ($20-40 \times 10^9/l$). This indicator in chickens of the I experimental group was included in the reference range and was within the physiological norm. The number of erythrocytes in the chickens' blood of both groups was below normal ($3-4 \times 10^{12}/l$). At the same time, the hemoglobin level in the blood of the I experimental group chickens was higher by 7 g/l compared to the control group but was within the normal range.
4. The hematocrit index in chickens of both experimental groups was at the lower limit of the norm. Moreover, in the chickens of the I experimental group it was higher than the minimum value (37%) by 2.73%, and in the control group - lower by 0.15%. The number of platelets in the blood of the I experimental group chickens was $2.52 \times 10^9/l$ higher than that in the control group.
5. The chickens' blood pseudoeosinophils of the experimental groups were slightly higher than the reference range (24-30%), and in the control group they were 2.75% higher than in the I experimental group. There were also more eosinophils in the control than in the I experimental group by 2.75%. The content of lymphocytes in the blood of the I experimental group chickens was 8.5% higher than in the control group.

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