

**INFLUENCE OF USE OF AMBER AND LEMON ACIDS AS A PART OF COMPOUND FEEDS  
ON THE GAIN OF A LIVE WEIGHT OF BROILERS**

**БРОЙЛЕР-БАЛАПАН САЛМАҒЫНЫҢ ӨСУІНЕ ҚҰРАМА ЖЕМНІҢ ҚҰРАМЫНДА  
ЯНТАР ЖӘНЕ ЛИМОН ҚЫШҚЫЛДАРЫН ҚОЛДАНУДЫҢ ӘСЕРІ**

**ВЛИЯНИЕ ИСПОЛЬЗОВАНИЯ В СОСТАВЕ КОМБИКОРМОВ ЯНТАРНОЙ И  
ЛИМОННОЙ КИСЛОТ НА ПРИРОСТ ЖИВОЙ МАССЫ ЦЫПЛЯТ-БРОЙЛЕРОВ**

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*On the basis of experimental data the way of increase of broilers meat efficiency by introduction to composition of compound feeds of the dietary supplements - amber and lemon acids, is developed. New data on conjoint use of the approved feed supplements are obtained. Their influence on morphological indicators of the blood of the poultry is studied. Recommendations about increase of the gain of a live weight of broilers when introduction to complete feeds are developed: amber acid - 30 mg and lemon acid - 150 mg on 1 kg of the live weight.*

*Тәжірибелік мәліметтер негізінде құрама жем құрамына биологиялық белсенді қоспалар – янтар және лимон қышқылын қосу жолымен бройлер-балапан етінің өнімділігін жоғарылату әдісі әзірленді. Сыналып отырған құрама жем қоспаларын бірге қолдану туралы жаңа мәліметтер алынды. Олардың құс қанының морфологиялық көрсеткіштеріне әсері зерттелді. Толық рационды құрама жем құрамына 30 мг янтар қышқылын және 150 мг лимон қышқылын 1 кг тірі салмаққа қосу кезінде бройлер-балапан салмағының өсуін жоғарылату бойынша ұсыныстар әзірленді.*

*На основе экспериментальных данных разработан способ повышения продуктивности мяса цыплят-бройлеров путем введения в состав комбикормов биологически активных добавок - янтарной и лимонной кислот. Получены новые данные о совместном использовании апробируемых кормовых добавок. Изучено их влияние на морфологические показатели крови птицы. Разработаны рекомендации по повышению прироста живой массы цыплят-бройлеров при введении в полнораціонные комбикорма: янтарной кислоты - 30 мг и лимонной кислоты - 150 мг на 1 кг живой массы.*

**Keywords:** [biologically active](#) dietary supplements, meat efficiency, live weight and safety of young growth.

**Негізгі сөздер:** биологиялық белсенді қоспалар (ББК), ет өнімділігі, балапанның салмағы және қауіпсіздігі.

**Ключевые слова:** биологически активные добавки (БАДы), мясная продуктивность, живая масса и сохранность молодняка.

### ***Introduction***

The poultry farming production in intensification problem in Kazakhstan, as well as in many countries of the world, is one of the most urgent now, cause it is directly connected with quality of food.

Increase of efficiency and quality of fowl in the conditions of the developed intensive poultry farming gains more and more value. It depends on numerous factors, including, in important degree, on feeding of an agricultural bird.

It is considered that using of the opportunities of a bird organism mostly depends on technology of feeding. Bird's feeding of the balanced complete feeds with use in their composition supplements of the mineral and vitamin premixes is more effective economically, and they are 2-3 times cheaper than standard compound feeds [1]. Now demand for the poultry farming products enriched with valuable nutrients is growing. For this purpose in the bird feeding are applied different additives promoting an improvement of a quality and a nutritional value of

the poultry-farming production. Therefore use in a feeding of the bird of the supplements rich with minerals and vitamins, for the purpose of increase of the quality of eggs and fowl, is of practical interest, both for the producers and consumers of production of poultry farming.

In scientific literature results of numerous experiments on use of biological active agents for improvement of conversion of a forage, increase of safety and efficiency of the poultry are published and generalized in various monographs [2-5].

Application of the synthetic vitamin products allows to increase efficiency of cultivation of broilers in the industrial conditions. At the same time the question of the optimum choice of these or those vitamin products very much is particularly acute, i.e. it is necessary to consider intervitamin relationship in the birds organism in order to use biologically active agents with maximum efficiency [6-8].

Today poultry farms are organizing the individual technology of bird production,

considering its direction, climatic features, physiology, etc.

The increasing attention is paid to increase of the doses of a vitamin E in compound feeds for broilers and laying hens. Use of the vitamin E as a part of compound feeds for the agricultural bird is studied rather widely. Vitamin E – the only antioxidant adsorbed by intestines capable to get into fatty tissue. This property of a tocopherol exerts impact on improvement of quality of meat, increasing by 2-3 times firmness of a fat from disintegration at storage [9]. It is established that use of vitamin E has the stimulating effect on bodies of immunity of birds, increases the weight and the size of internals in comparison with control group [10].

Use of the products of a metabolic action, including amber acid, increases safety of the bird, resilience and efficiency, promotes increase in exchange energy, improves breath in the organism and in grain of meat [11]. Introduction to the organism of amber acid promotes increase of resistance of the organism, bactericidal and lysozyme activity of serum of blood for 10,4% and 18,2%, stimulates an embryonal and post-embryonal development, increases deductibility of chickens for 10% [6-9]. Preparations of amber acid are available on free sale which are considered as dietary supplements to the poultry (dietary supplements).

The role of the lemon acid is also recognized useful to the organism. Introduction of acid stimulates secretory functions of a pancreas, strengthening release of gastric juice, increasing appetite and promoting the best assimilation of the forage. Despite a number of researches, lemon acid hasn't found broad application in poultry farming. The optimum doses and schemes of their application are still insufficiently studied, especially at broilers cultivation.

Proceeding from the above, production of broilers meat when using diets are based on the grain crops of local production with additives of amber and lemon acids is rather actual problem.

The purpose of the researches was development of the way of increase of live weight of broilers due to inclusion in

composition of their compound feeds of such dietary supplements as amber and lemon acids.

For achievement of a goal the following research problems were solved:

- establishing of the optimum dose of feeding of compound feeds and a combination of their feeding with the studied dietary supplements;

- determination of growth energy, safety of a livestock and expense of the forage on a unit of production of broilers.

#### ***Research objects and methods.***

The objects of the researches were standard chickens of cross-country "Broiler" from daily age. Duration of cultivation of a bird made 42 days.

Researches were conducted in the Educational Research Laboratory of the Department "Safety and Quality of Foodstuff" of the Almaty Technological University. A production testing was carried out in the conditions of the poultry farm Alatau Kus LLP of Almaty region.

For the first experience 3 groups have been created (up to 20 heads in each group): one control and two experimental, and for the second experience 10 groups have been created (up to 15 heads in each group): one control and 9 experimental at contents in cellular KBU-3 batteries.

According to the scheme of experience chickens of all groups received the main diets (MD) consisting of the compound feed prepared in the conditions of production according to the start recipe (to 14 – day age) and growth (from 15 days to 35 days) and the finish (from 36 days to 43-day age).

Researches were conducted on stages: at the first stage use of amber and lemon acids has been studied. At broilers of experimental groups were studied tolerance of the organism.

At the second stage research of the optimum dose of feeding broilers of compound feeds in combination with the studied dietary supplements were carried out. Authors have studied the live weight and safety of young growth, process of growth and development.

In two research and production experiences influence of dietary supplement in a

complex with the main diet of a forage on the safety and the gain of the live weight of broilers was studied.

During research the following indicators were considered:

- safety of a livestock — by a daily assessment of a clinical condition and the accounting of the fallen bird with establishment of the reasons of a case;

- the live weight of a bird - by individual weighing in a daily allowance, 1, 14, 28 and 42 daily age;

- the pure gain of the live weight (V) was calculated on a formula:

$$V = V_2 - V_1,$$

where  $V_2$  - the live weight of chickens at the end of the cultivation period,

$V_1$  - the live weight of chickens at the beginning of the cultivation period;

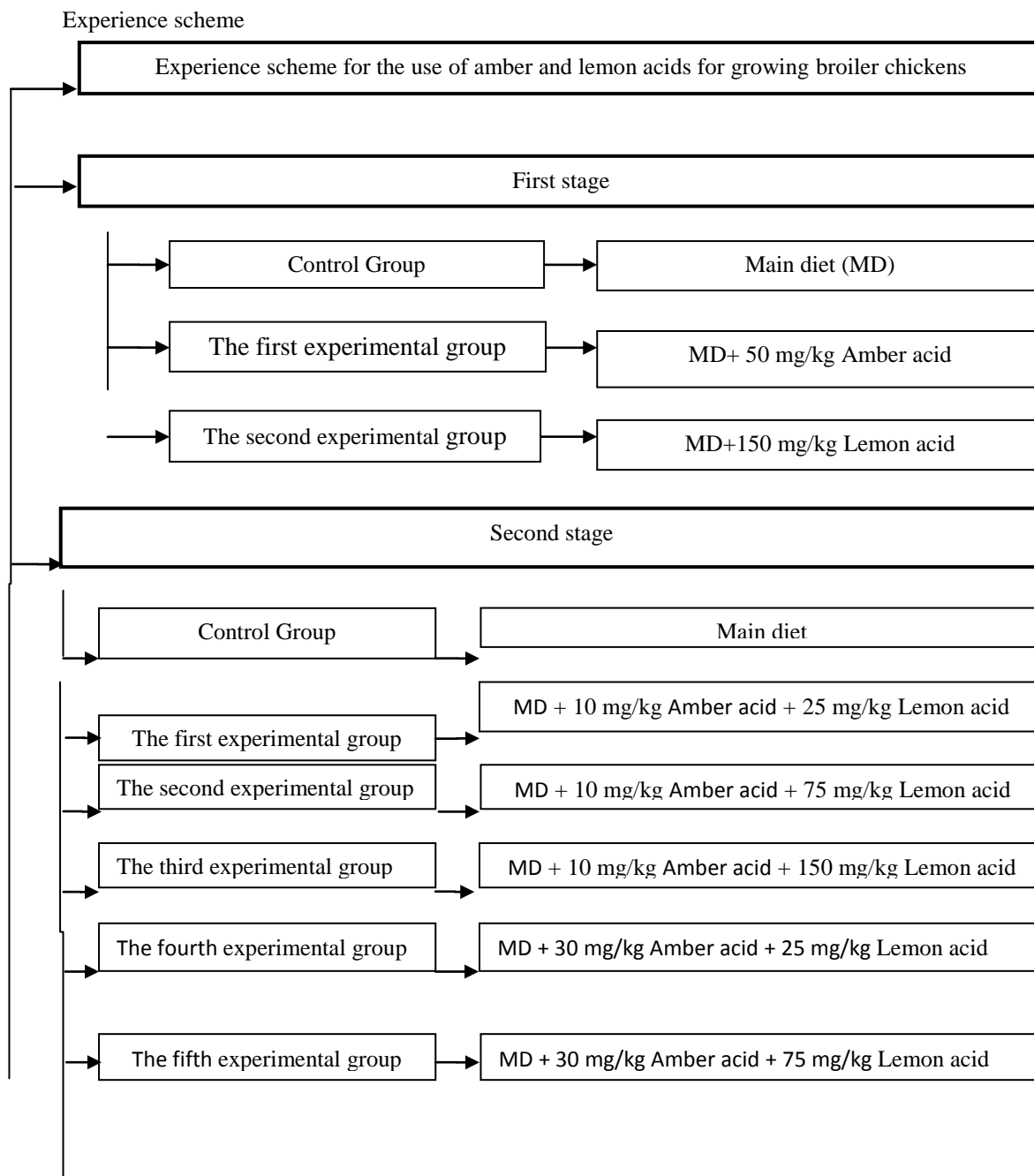
- the average daily gain of the live weight ( $V_1$ ) was counted on a formula:

$$V_1 = (V_2 - V_1) : t,$$

where  $V_2$  - age of chickens at the end of the period of cultivation, days;  $V_1$  - age at the beginning of the period of cultivation, days;  $t$  - time.

- intensity of growth of young growth was determined by the relative gain of live weight (P %) calculated on Minot-Brody's formula:

$$P = (V_2 - V_1) : (0,5x (V_2 + V_1))100\%;$$



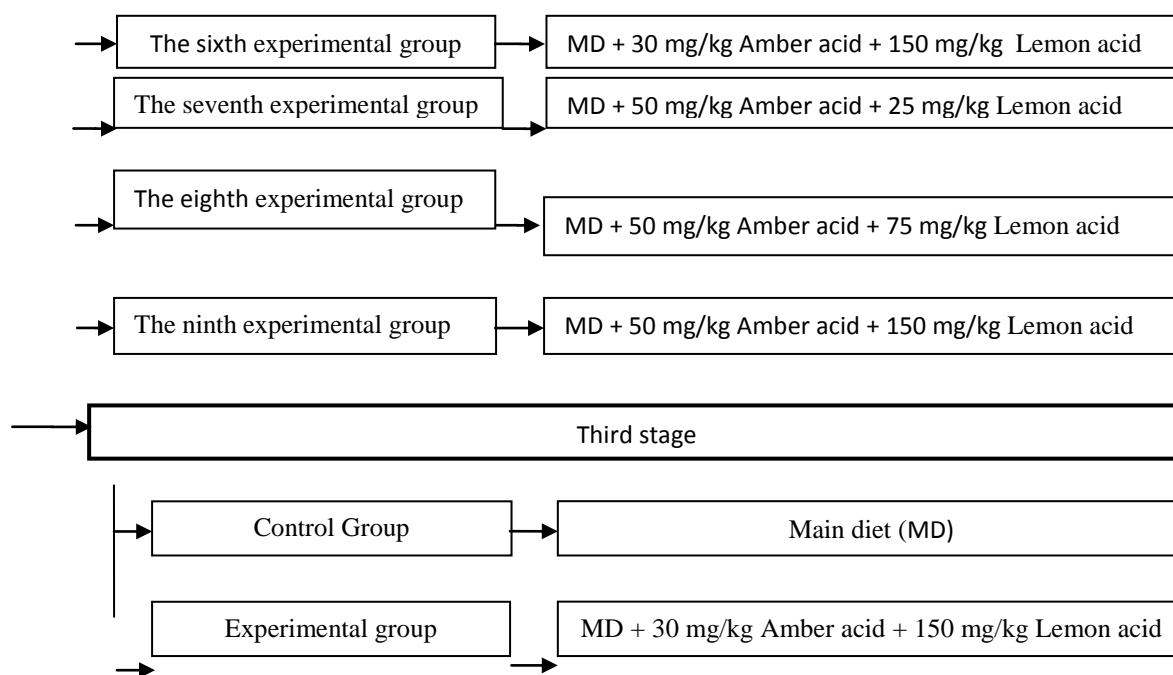


Figure 1

## Results and Discussions

Use of amber and lemon acids as a part of compound feeds of broilers (the first stage).

In the first experience influence of amber acid on zootechnical indicators at broilers (tab. 1) was studied.

Table 1 - The main zootechnical indicators of broilers when using amber acid as a part of compound feed

Indicators	Groups	
	Control	1 experimental
Live weight of one unit, g: at the beginning of experience	40,4±0,4	40,6±0,35
At the end of experience	1900±5,2	2006±5,4
% to control	100,0	105,6
The pure gain, g	1859,6	1965,59
% to control	100,0	105,7
The average daily gain during the full period, g	44,3	46,79
% to control	100,0	105,6
Safety of chickens, %	88,8	92,2

The live weight of chickens of daily age at the condition on experience has made 40,0-50,0 g. By the end of the period of cultivation broilers of the experimental group surpassed the analogs from control. The weight of one chicken at the end of experience was 2006 g., in control – 1900 g..

The pure gain of chickens of the experimental group was higher, than in control, on 105,99 g (1859,6 and 1965,59).

The average daily gain during cultivation in the experimental group of broilers has made 46,79 g, in control – 44,3 g (+5,6%).

Thus, the obtained results demonstrate that amber acid stimulates growth and development of the bird.

Amber acid has exerted positive impact on the viability of a livestock as well. In the first 20 days of cultivation safety of chickens in the experimental group was higher, than in control. From 25th day - distinctions on withdrawal of a bird weren't. For the entire period of cultivation withdrawal of chickens in control group has made 13,3%, in experimental - 6,7%.

In the second experience studying of influence of lemon acid on zootechnical indicators of broilers (tab. 2) is carried out.

The live weight of chickens of daily age at conditions of experience has made 40,3 - 40,4 g. ( $P > 0,1$ ).

By the end of the period of cultivation broilers of the experimental group surpassed on live weight the analogs from control group. The weight of a unit of the chicken at the end of experience was 2121 g., in control - 2086 g. (+1,6%,  $P < 0,05$ ).

Thus, results of the experiences show that lemon acid, also as well as amber acid, stimulates growth and development of the bird.

It was noted the higher increase in live weight at chickens of experimental group which to 43-day age has increased by 52,5 times, at chickens of control - by 51,7 times.

The pure gain of chickens of experimental group was higher than in control by 34,9 g (2080,6 and 2045,7) or 1,7%.

Table 2 - Zootechnical indicators of broilers when using amber acid as a part of compound feed.

Indicators	Groups	
	Control	2 experimental
Live weight of 1 unit, g: at the beginning of experience	40,3+0,21	40,4+0,16
At the end of experience	2086+1,9	2121+1,1
In % to control	100,0	101,6
The pure gain, g	2045,7	2080,6
In % to control	100,0	101,7
The average daily gain during the full period, g	48,7	49,5
In % to control	100,0	101,6
Safety of chickens, %	93,0	93,9

The average daily gain during cultivation of chickens of experimental group has made 49,5 g., in control 48,7 g. (+1,6%).

Thus, the obtained results demonstrate that when using lemon acid increase in a gain of live weight of chickens of experimental group is observed. Addition of lemon acid to standard compound feed has exerted positive impact on safety of broilers. From 1 to 20 day of cultivation withdrawal of a bird was more in experimental group (6,7%). During first 22 days safety in the

control group began to decrease and at the end of experience has made 86,7%, in experimental group - 93,3%.

For establish of tolerance of the bird organism on morphological indicators of blood three groups of animals – control and two experimental - have been created. The morphological composition of blood of the chickens receiving biologically active agents is given in tab. 3.

Table 3 – Morphological composition of blood of chickens receiving the main diet with additives of amber and lemon acids

Indicators	Research days	Groups		
		control	I experimental	II experimental

Hemoglobin, g/l	1	95±0,30	101±0,55	104±0,46
	14	101±0,39	108±0,63	108±0,75
	30	102±0,68	109±0,30	103±0,55
Erythrocytes, one million*10 <sup>12</sup> /l	1	2,8±0,29	3,0±0,19	2,8±0,35
	14	2,9±0,15	3,05±0,39	3,0±0,74
	30	3,3±0,25	4,9±0,35	3,5±0,26
Leukocytes, one thousand*10 <sup>12</sup> /l	1	22,3±1,25	21,7±1,07	20,6±1,28
	14	20,0±0,98	20,9±0,98	19,5±1,19
	30	22,5±0,75	20,9±1,04	20,5±0,84

The analysis of data of table 3 shows that at broilers of control group hemoglobin level the first days has made 95 g/l whereas the first experimental – 101 g/l, and the second experimental – 104 g/l. At 14-day age – 101 g/l, 108 g/l, 108 g/l respectively. At 30-day age – 102 g/l, 109 g/l and 103 g/l respectively.

The quantity of erythrocytes at 30-day age at chickens of the first experimental group has increased by 5,1%, the second experimental – by

0,3% in comparison with control. The number of leukocytes was in limits of physiological norm.

Research of optimum doses of dietary supplement when feeding broilers (the second stage).

Results of the researches on studying of influence of various doses of amber and lemon acids on growth and development of broilers in dynamics are presented in tab. 4.

Table 4 – Influence of various doses of amber and lemon acids on change of live mass of broilers (n=15)

Group	The weight of chickens, in age, days (M±m)			Fallen chickens, Year	
	1	28	42	Quantity.	%
Control	40,4±0,4	1048±0,5	2086±1,9	2	13,3
I Experimental	40,4±0,4	1058±0,5	2088±1,5	2	13,3
II Experimental	40,6±0,4	1061±0,5	2097±1,5	1	6,7
III Experimental	40,5±0,4	1064±0,5	2108±1,5	1	6,7
IV Experimental	40,6±0,4	1065±0,5	2111±1,5	1	6,7
V Experimental	40,3±0,4	1074±0,5	2120±1,5	0	0

VI Experimental	40,4+0,4	1090+0,5	2128+1,1	0	0
VII Experimental	40,5+0,4	1053+0,5	1998+1,5	3	20,0
VIII Experimental	40,6+0,4	1050+0,5	1986+1,5	2	13,3
IX Experimental	40,5+0,4	1047+0,5	1981+1,5	3	20,0

Analyzing the obtained data, it is possible to tell with confidence that the most optimum dose are 30 mg of amber acid and 150 mg of lemon acid on the one unit in a day to the MD since first day of life. The greatest gain of weight of chickens of this group and the smallest percent of withdrawal testifies to it.

Research of morphological and biochemical indicators of blood was carried out at broilers of control and sixth group as the best on indicators of live weight (fig. 2).

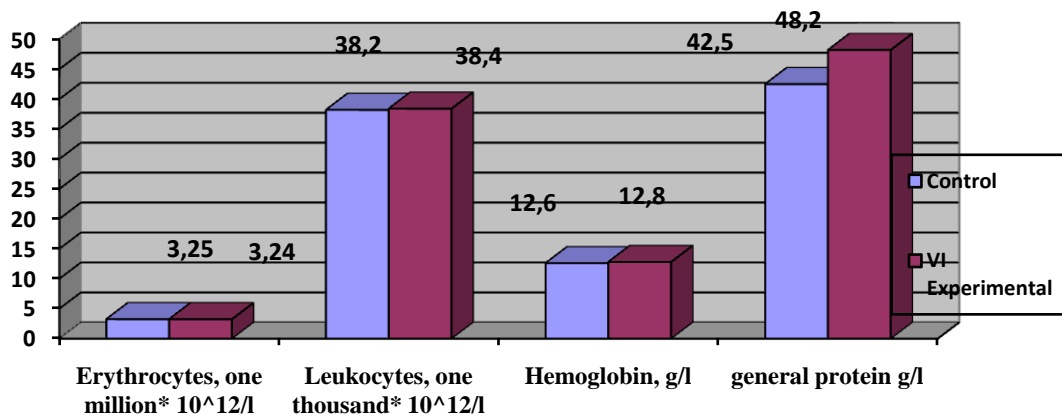


Figure 2 - Dynamics of the hematological indicators of the broilers blood



The analysis of the data provided on the graph shows that morphological indicators of blood during experience were in limits of physiological norm.

Feeding of compound feed with addition to dry weight of the MD of broilers of 30 mg of amber acid and 150 mg of lemon acid on the one unit a day has promoted increase of content in serum of blood of the general protein. It speaks about improvement of comprehensibility of protein and increase in intensity of a protein exchange in the organism. Content of the general protein in the blood serum at the chickens of the third experimental group was higher on 12,8% in comparison with a bird of control group, i.e. has made 48,2 g/l against 42,5 g/l in control.

### **Conclusion**

On the basis of the conducted researches on use the PK-5-1-9478-109, PK-5-2P-170 and PK-6-P-180 complete feeds with additions of amber and lemon acids at cellular cultivation of broilers it is possible to draw the following conclusions:

- additions of these acids hasn't exerted negative impact on safety of broilers, the forage ratability, and also on morphological indicators of blood which met physiological standard;

- optimum norms are doses: amber acid - 30 mg and lemon acid - 150 mg on 1 kg of live weight in the first 30 days of life of broilers that has exerted beneficial influence on their meat efficiency and safety;

- results of hematological researches have shown that inclusion in a diet of broilers of the studied additives doesn't cause the negative phenomena, and on the contrary promotes improvement of exchange processes in the organism of bird.

The gain of the live weight is only indirect indicator of meat efficiency. The final assessment of meat efficiency of broilers is

made after slaughter and anatomic cutting of carcasses of a bird.

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