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Study of physiological activity of microelements- and glutamine acid-containing chelate citrates

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ABSTRACT

Premixes prepared on the base of microelements and glutamine acid-containing chelate citrates and their composites with natural zeolite, clinoptilolite were tested in mixed feed for rabbits. Optimal composition and quantity of chelate microelements were determined on the base of test and major experiments. To study more thoroughly the results of the experiments the control slaughter was performed in 120 day old rabbits. Live mass indices of the first experimental group animals (when mixed feed was balanced with the premix that contained microelements and the composites of glutamine acid chelate citrates and clinoptilolite) slaughtered at 120 day age exceeded those of the 2nd (when mixed feed was balanced with premix that contained microelements and glutamine acid chelate citrates) and those of the control group (which was given the fodder used commonly at the farm) by 0.15 and 0.45 kg, respectively. As to the index of slaughter weight, here again the animals of the first experimental group occupied the leading position and this index equaled to 55,07%, that of the second group was- 54.54%, while that of the control group - 51,7%. Meat coefficient index in the first experimental group was 3,11, in the second group - 2,95, and in the control one - 2,89.

Study of masses of inner bodies of rabbits after their slaughter showed that the animals of the first experimental group were distinguished by the best indices while the animals of the control group showed the least indices.

For more profound study of meat productivity we investigated chemical characteristics of rabbit meat: water, fat, protein and ash. It was proved that here again the animals of the first experimental group show comparative advantage. Fat index in the meat of animals of the first experimental group equaled to 9,2% and exceeded the fat indices of the meat of animals of the second and control groups by 1,4 and 2,1%, while the fat index of animals of the second experimental group exceeded that of the control group by 0,7%. Water and protein were fixed in greater quantity in the meat of the control group animals which is logical.

Study of skin-and-fur quality, after slaughter of rabbits, proved that here, again comparative advantage was shown by the animals of the first experimental group. Indices of the animals of the second experimental group exceed those of the control one, but legged behind those of the first group.

Introduction

Humanity entered the new millennium with serious problems of hunger and insufficient nutrition. Of course these problems are rather acute for our country too. Irrespective of the fact that Georgia possesses rich agrarian potential, even its third is not fully assimilated. Therefore, today provision of the population with cheap and at the same time high quality and ecologically safe animal and poultry products is a rather urgent problem for the country. One of the main causes that determines low quantitative and qualitative indices of these products is deficiency of microelements in animal and poultry, since they participate in all vital processes. Besides, it is proved that in live organisms, microelements implement their functions in the form of chelate compounds and therefore, provision of animals and poultry with optimal content and ratio of

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microelements is the most important term among the measures which should be used to resolve this problem. This can be managed by creation of chelate form premixes containing essential microelements. This is proved by the results of researches of scientists working in this sphere [1–14] and the results of experiments performed by us for years [15–29], according to which at filling in the deficit of microelements in chelate form, assimilation capacity is far better than when the deficit of microelements is filled in with premixes of non-chelate forms. This is explained by the fact that microelements, when they are in chelate forms, are characterized by low toxicity, high capacity of assimilation and respectively, at their application in small doses, by increased rate of efficiency, which, in its turn, provides ecological safety, if microelements are used in this form. As to inorganic salts, they are characterized by high toxicity, low grade of assimilation and low efficiency which is conditioned by formation of hardly soluble and hardly digestible compounds in animal and poultry intestinal tract.

Besides, it is known that the premixes to be used to balance the mixed feed are not manufactured in our country and their import contributes to increase of the self-cost of farm produces significantly. At the same time their recipes don't take into consideration soil composition and climatic conditions of various regions and zones of our country.

Computational method

Experiments were designed to study the following:

- Live mass before slaughter
- Slaughter weight (carcass weight)
- Meat output coefficient
- Mass of rabbit internal organs after slaughter
- Chemical composition of meat, %
- Skin-and-fur quality

Results and analysis

Researches are continued for the creation of new generation premixes and for their further testing in experiments at the Laboratory of Agrarian Chemistry Problems [15–29]. Physical and chemical properties of chelate citrates which were synthesized for these purposes, containing microelements and glutamine acid of the general formula $M \cdot gl \cdot HL \cdot nH_2O$ (where M = Mn(1), Zn(2), Fe(3), Co(4), Cu(5); n = 0–1,5; gl-glutamine acid, HL-citric acid anion) have been studied and test and major experiments were performed on rabbits [15,16]. Three groups of rabbits were selected and it was performed according to the following scheme: 1st experimental group (when mixed feed was balanced with premixes containing microelements and glutamine acid chelate citrates and clinoptilolite composites), the 2nd experimental group (when mixed feed was balanced with premixes containing microelements and glutamine acid chelate citrates) and the control (which was given fodder used at the farm). The following was studied during the experiments: dynamics of rabbit live mass, average weight gain by rabbits: a) feed assimilation; b) feed compensation [15].

Study of absolute weight gain only is less reliable to reveal the results. For more thorough study of the results we performed control slaughters of 120 day old rabbits, killing 3 rabbit from each group. Slaughters were carried out to study the indices such as: live mass before slaughter, warm and cooled carcass mass, meat output, soft meat, bone and tendon mass, meat output coefficient (Table 1).

The best index to determine meat output is study of meat output coefficient, which will show the amount of soft meat in the carcass and it is calculated by the ratio of soft meat and bones and tendon.

Table 1
Control slaughter of rabbits.

Indices	Groups		
Mass	I experimental	II experimental	Control
prior to slaughter	3,45 ± 0,12	3,30 ± 0,17	3,0 ± 0,11
warm carcass	1,90 ± 0,01	1,80 ± 0,05	1,55 ± 0,06
cooled carcass	1,85 ± 0,05	1,70 ± 0,11	1,44 ± 0,10
intestine output, %	55,07	54,5	51,70
soft meat, kg.	1,4 ± 0,06	1,27 ± 0,06	1,07 ± 0,08
soft meat, %	75.67	74,70	74,31
bone and tendon, kg.	0,45 ± 0,11	0,43 ± 0,06	0,37 ± 0,06
bone and tendon, %	24,33	25.30	25,69
meat output coefficient	3,11	2,95	2,89

Mass of internal organs of rabbits after slaughter (Table 2).

To investigate meat quality more thoroughly we have studies water, fat, protein and ash content in meat (Table 3).

Besides, after rabbit slaughter we studied quality of skin-and-fur (Table 4).

As to the study of culinary properties of meat, the so-called meat degustation (boiled and fried), we didn't consider it proper, since evaluation of meat is organoleptic. Reliable evaluation is made at determination of its chemical composition which is described in the Table 3 in details.

At the control slaughter of 120 day old rabbits, as is shown by the data of Table 1, the first experimental group animals (when the mixed feed was balanced with the premix that contained microelements and composite of glutamine acid chelate citrates and clinoptilolite) reveal high pre-slaughter live mass indices than those of the 2nd (when the feed mix was balanced with the premix that contained microelements and glutamine acid chelate citrates) and control group animals (which was given fodder generally used at the farm) by - 0,15 and 0,45 kg, respectively. As to the index of the carcass output here again the first group animals prevail, with the index 55,07%, in the second experimental group - 54.54%, and in the control one - 51,7%.

Study of meat output index showed that, in the first experimental group this index equaled to 3,11- in the second - 2,95, and in the control - 2,89 (Table 1).

Study of internal organs of rabbits after their slaughter (Table 2) proved that the animals of the first experimental group are distinguished by better indices, while the least indices are inherent to the animals of the control group.

Study of chemical composition of rabbit meat (Table 3) shows

Table 2
Mass of internal organs of rabbits, g.

Groups	Heart	Liver	Spleen	Kidneys	Lungs
I	13,0 ± 0.30	110,0 ± 2,88	1,6 ± 0,06	7,8 ± 0,09	18,5 ± 0,58
II	12,0 ± 0,58	108,0 ± 1,73	1,5 ± 0,06	7,7 ± 0,06	18,4 ± 0,56
Control	11,5 ± 1,15	107,0 ± 1,15	1,5 ± 0,02	7,7 ± 0,03	18,0 ± 1,15

Table 3
Chemical composition of meat, %.

Groups	Water	Fat	Protein	Ash	Calorie per kg soft meat, kcal/mJ
I	70,7	9,2	18,4	1,3	161 kcal
II	70,0	7,8	18,2	1,0	147 kcal
Control.	71,9	7,1	18,6	1,2	142,3 kcal

Meat calorie was calculated according to the formula: X = dry matter - (f+a) × 4,1 + f × 9,3, where X – meat calorie in kilocalories, d –dry matter, f – fat quantity, a - ash. If we multiply the obtained datum by the coefficient 4,19 we'll get meat calorie index in mJ.