ORGANIC SELENIUM (SEL-PLEX) EFFECTS ON PRODUCTIVE PERFORMANCE AND BLOOD PARAMETERS IN BROILER CHICKENS

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Abstract. *In this study 300 one day old broiler chickens were divided into 2 groups. First group (I) consisted of 150 chickens was decided to be a control group, second group (II) was the experimental one – organic Selenium (Sel-Plex) was added to ration in amount of 0,5 kg/ton of forage. Three blood sample collections were performed. Clinical status, body weight and mortality dynamics were monitored daily. The conclusion was made: losses due to chickens' mortality in the experimental group were 4% lower compared to the control group. Their body weight increased by 5% in comparison with the control group and in the same time 1,5% higher than in chickens in aviary.*

Sel-Plex has a beneficial effect in hemoglobin and erythrocyte level maintaining, but in the same time the statistically significant change (P > 0,05) of DAM content in serum and in red blood cells was not registered. It also stimulates the growth of post-vaccination antibody levels in New-Castle disease, lim 1:128-1:512.

Keywords: broiler chickens, Sel-Plex, gastroenteropathy, hematology, viability.

INTRODUCTION

Nowadays Selenium is definitely known as the essential part of some enzyme systems that take part in metabolic function diversity. It was proved during the studies that Selenium is a key component of glutathione peroxidase enzymes involved in antioxidant protection and metabolism of thyroidal hormones (Surai K.P., Surai P.F., 2007). Subsequent investigations confirmed that Selenium appears to be included into some other selenium-proteins that play an important physiological role. A decreased intake of Selenium in animal nutrition is correlated with the lack of growth, "white muscle disease", fertility reduction etc. The fact that diseases closely connected to Selenium deficiency are so wide spread, correlates with low Selenium content in plants and soil, demonstrating a strong relationship in food chain between soil-plant-animal (Surai Peter F., 2007).

Thus, if animals will have consumed forage going-on from soils poor in Selenium that would lead to gaps appearance and shortcomings would manifest this state. Balanescu S., Popovici M. (2008) conducted a study on Selenium level in forage used as a traditional nutrition in cattle and pigs in Republic of Moldova, that demonstrates a critical level of Selenium – (interval 0,1 -0,01 ppm) in 16 probes of forage, which consists 84,2%; marginal level (interval 0,1-0,15 ppm) – 5,25%.

Selenium represents an essential nutrient that could be met in nature in 2 inorganic forms (selenite or selenate) as well as in organic form of selenium amino acids. Since 2001 FDA (Food and Drup Association) probated Selenium organic-selenium methionine, which is more bioavailable. Plants, in contradiction with animals and humans are able to convert Sodium Selenium and selenium methionine. More than 80% from total Selenium in soy, wheat and corn are represented in this form (Surai Peter F., 2007).

MATERIALS AND METHODS

The survey regarding effects of Sel-Plex product on broiler chicken was carried out on the basis of Larsan Nor poultry farm population divided into 2 groups of 150 broilers belonging to Ros 308 cross.

The total amount of broilers in aviary is 24500 chickens. The aviary is a typical one for broiler chickens growing; its dimensions are 16x18m. The aviary was initially prepared according to growth technology approved at the farm. Microclimate conditions were also respected in accordance with 60-days growth technology.

Both groups were separated into special wire mesh isolators in a way that chickens were not able to move from one to another, but air currents could flow freely. Both groups had a free access to water and forage supplies. Feeding was carried out with combined forage according to the age category, the quality balanced coccidiostatic – Robentadina was included till the age of 35 days, water was given ad libitum. 300 broiler chickens were divided into 2 groups of 150 chickens in each of them.

I group (control) – was fed in the same way that chickens in the aviary. With the purpose of prophylaxis of gastrointestinal disorders Enrolac product was added to drinking water (enrofloxacine - 100%) at a dose of 12g per 100 ml of water.

II group (experimental) – were given the same antibiotics added to drinking water, but in the same time organic Selenium was administrated with the forage in the form of (Sel-Plex) at a rate 0.5 kg/tone of forage (during the experiment Sel-Plex was thoroughly mixed in 5 kg of concentrated feed at a dose of 0.5 g per kg).

During the investigations the following indexes were observed: clinical status, body weight dynamics and daily mortality. On days 7, 35, 58 of experiment blood samples were collected and some hematological parameters were determined. The content of malonic dialdehyde (MDA) was determined in serum and in red blood cells (by Gavrilov V.B. et. al. 1987, method). The total amount of red and white blood cells was determined in Goriaev camera, total amount of hemoglobin – by Drabchin method. In the same way the presence of titers of antibodies to New Castle disease in blood serum was determined by hemoglobin inhibiting method.

RESULTS AND DISCUSSIONS

Clinical status evolution begins from the 1st day of life which demonstrates that chickens from both groups were depressed, mostly sitting and sleeping in piles. Food and water were consumed in small quantities. From the 2nd day the chickens were significantly activated active water and feed consumption began. From the 3rd day from both groups and those in aviary began to show diarrhea cases, that chickens had dark colored droppings, although they were active and

consumed forage normally. They could have been observed only after the dirty feathers around the cloaca. During 3th-7th day of life number of chickens showing diarrhea symptoms increased significantly: the average quantity of chickens with diarrhea symptoms in the aviary was 15-20%. The same results were obtained in both control and experimental groups. No crucial differences were registered in that period between the mentioned groups. The number of affected chickens hadn't been changed between 7th and 14th days of study. From the 20th day the number of chickens suffering from diarrhea began to decrease significantly, thus on the 21th day 7% of affected chickens were observed in the aviary, in the I group (control) – 6,6%, in the II group (experimental) – 4,66%. In the same time chickens from the II group (experimental) consumed more active forage and were cheerful. After 35th day chickens from the experimental group were more developed, while the chickens from the group I (control) were of different body size.

Data represented in the table 1 demonstrate mortality percent in groups of chicken from 1st to 52nd day of observation period.

Table 1

CHICKEN POPULATION MORTALITY BY OUTPUT

Group	**n**	**Number of chicken deaths in periods (days)**															
		1-7		8-14		15-21		22-28		29-36		37-38		39-45		46-52	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Group I (control)	150	4	2,66	3	2	2	1,33	1	0,67	1	0,67	1	0,67	1	0,67	2	1,33
Group II (exper.)	150	4	2,66	2	1,33	1	0,67	0	0	0	0	1	0,67	1	0,67	1	0,67
TOTAL losses:		Control														15	10
		Experimental														9	6

A large number of cadavers were examined through the necropsy daily and morpho-pathological causes of death were determined as far as possible. The obtained results demonstrate the fact that generally the maxim quantity of dead chickens was registered during the 1st week of life. This fact can be explained by the reason of no viability of some chickens coming from incubator. In the same time a large number of gastro-intestinal diseases were registered during this period. Those chickens generally recover till the end of the 3rd week; therefore we are able to notice a decrease in chickens' mortality. Starting with 42nd day the quantity of cadavers begins to grow again, the main reason of this is respiratory tract diseases.

It was observed that the number of cadavers of chickens from the experimental group affected by diarrhea is not so big, thus it was found out that the cause of the death of two chickens during the 1st week was peritonitis and non-absorption of a yolk sac.

Mortality in chickens from the control group was bigger in comparison with the experimental group, but main reasons were represented by peritonitis and gastro-intestinal diseases. After the week of study the electronic body weight measuring procedure of chickens was performed. 10 chickens were weighed at one time, the total number of 30-40 chickens, then the average weight was calculated.

Table 2

BODY WEIGHT DYNAMYCS

Group	***n***	***Average body weight / chicken (g)***								
		Week								
		initial	1	2	3	4	5	6	7	8
I-control	150	42	88	290	477	795	1325	1730	2200	2700
II- experimental	150	43	88	291	520	830	1360	1790	2290	2840

Initially a body weight of a chicken in the first day of weighing was approximately 42g.

Analyzing the 8 assessments of body weight it was noted that at the end of the first week chickens from both groups had equal body weights (88g).

Sel-Plex administration with forage improved general condition of the chickens, comb forage consumption, promoting bodyweight of 2840 g, which is 5 % higher than in the control group and 1,5% higher in comparison with chickens in aviary (2750 g).

However, when comparing the results with the weight standards of the breed the fact that the growth is slow down becomes evident, that does not necessarily indicate the problem of a single nature. In the table below (Table 3) hematological and biochemical parameters' evolution in broiler chickens is represented at their 7th, 35th and 58th day of experiment. Blood samples at the 7th day were collected by decapitation method, at 35th and 58th day – from axial vein.

Table 3

HEMATOLOGICAL PARAMETERS' EVOLUTION IN BROILER CHICKENS AT 7^{th}, 35^{th} AND 58^{th} EXPERIMENTAL DAYS

Indexes	**Reference values** S.Ghergariu et.al.2000 (4 week age.)	**Initial 7^{th}**	**35^{th}**		**58^{th}**	
		control	**control**	**experim**	**control**	**experim**
		n M±m	n M±m	n M±m	n M±m	n M±m
Hemoglobin (g/L)	82,8±0,61	109,2±6,9	100,8±5,556	105±13,3 $P_{1,2} > 0,05$	117,1±6,505	129,23±5,51
Red blood cells (x $10^6/mm^3$)	2,31+0,2	2,88±0,22	3,09±0,125	3,18±0,125	2,60±0,099	2,68±0,076
White blood cells (x$10^3/mm^3$)	20-30	35,45±0,218	53,35±0,125	49,55±0,125	52,8±0,099	48,8±0,076
DAM ser (nmol/L)	-	10,14±3,01	8,13±4,57	9,66±3,96	4,72±0,81	5,72±1,06
DAM (nmol/g Hb)	-	0,52±0,08	0,704±0,073	0,715±0,0555 $P_{1,2} > 0,05$	0,698±0,08	0,77±0,164

Legend: 5 blood samples were collected from I and II group.

Haemoglobin amounts (g/L) were rather high at the beginning of the experiment compared with test ones, but still similar in every group (tab.3). Significant differences in Hb-amounts were observed on 58th day ($P_{1,2}$<0,01) in control and experimental groups. In general during the experiment Hb-amount was raised in both control and experimental groups compared with test one (82,8±0,61 g/L).

Comparative results of RBC-amount in both groups compared with initial results were less evident ($P_{1,2}$>0,05). Even so RBC-concentration raised gradually on 35th day and made 3,09±0,125 and 3,18±0,12 $10^{6/}mm^3$ in poultry in control and experimental groups, respectively. On 58th day Hb-amount was a bit lower than on 35th day, but still higher than initial results (2,3±0,2 $10^{6/}mm^3$ - S. Ghergariu et. al. 2000). Also the differences between groups weren't significant (P>0,05).

As a review of Hb and RBC evolution it could be mentioned that Sel-Plex (as a source of organic selenium) has a beneficial effect on restoration of these rates.

WBC evolution on 35th day of experiment shows great differences with its level 53,35±0,125 and 49,55±0,12 10^3 mm^3 in control and experimental (cured with Sel-Plex) groups. Also it's statistical significant ($P_{1,2}$<0,001).

On 58th day an evident leucocitosis condition was revealed, 52,8±0,09 and 48,8±0,07 10^3mm^3 in control and experimental groups, respectively (p<0,001). It can be mentioned that leukocytosis was induced by application of Sel-Plex in the experimental group and by gastrointestinal inflamations in the control one (P<0,001). Yet it is necessary to examine this tendency in following experiments.

The amount of malonic dialdehyde, which is considered as a final product of lipid peroxidation, has its average maximal rates on 7th day (10,14±3,01 nmol/L in serum). Next two tests showed a continuous decrease and average rates in control group were 8,13±4,57 nmol/L and 9,66±3,96 nmol/L on 35th day, and it's not statistical significant ($P_{1,2}$>0,05). The third test (58th day) showed much more significant descrease and the rate was 4,72±0,81 and 5,72±1,06 nmol/L in control and experimental groups. DAM level in RBC (nmol/g Hb) on 35th and 58th day of investigation had an increase tendency compared with the results obtained on 7th day. Thereby the results show the fact that application of Sel-Plex doesn't decrease the level of peroxidation in RBC as it was expected.

But in previous investigations (S. Bălănescu, D. Holban, E. Voinitchi, 2004, 2005) on chicken revealed the reduction of DAM in blood (serum, RBC). And because it is an indirect marker of lipid peroxidation, it indicates the decrease of peroxidation processes intensity in RBC. Obtained results confirm that stress factors intensify the formation of free oxygen radicals and the processes of lipid-production (Bernabucci U. et al, 2005). Afterwards this phenomen was expressed by the increase of DAM rate in serum till 7th day and its decrease during next 58 days of growth.

Concerning the action of Sel-Plex on oxidative status in poultry from experimental group compared with the control one no significant modifications of DAM in serum and RBC were noticed. Data is statistical insignificant (P>0,05).

The result of serological tests (tab. 4) shows us the efficacy of vaccination against New-Castle Disease. We see that administration of organic selenium (Sel-Plex) with mixed fodder (0,5kg/t) during 1-58 days (52) stimulates the increase of post vaccination antibody titer from 1:128-1:152 at first test (32 days). On 46th day antibody titer was 1:64-512 in experimental group of chicken.

Chicken from control group at first test (32 days) show the post vaccination antibody titer between 1:16 (2 chicken); 1:32 (3 chicken). On 46th day – 1:16 (2 chicken); 1:32 (3 chicken); 1:64 (2 chicken); 1:128 (3 chicken).

Researches held on cattle by A. Leonide (2008) showed a possibility of organic selenium to have an influence on humoral immunity answer when used in amount of 0,7kg a day per animal.

The results of this research demonstrate us the necessity of application of organic selenium (Sel-plex) with mixed fodder for broilers to move the investigation of gastrointestinal dysfunctions and so to obtain a better growth of broilers.

As there are very little facts about the evolution of oxidative status at broilers in special literature it is very hard to make comparisons.

In table 4 there is data about the rate of post vaccination antibody titer against New-Castle Disease. On 18th day chicken were vaccinated with La Sota vaccine (Romania, Pasteur Institute). On 32th day the blood was taken from 5 chicken, and on 46th day from 10 chicken from each group (experimental and control ones). Serum was tested with haemagglutination-inhibition test (CRDV, Chisinau).

Table 4

Antibody titer rate

Group	***n***	***Chickens' age (days)***	1:16	1:32	1:64	1:128	1:256	1:512	1:1024
I-control	5 10	32 46	2 2	3 3	2	3			
II-experimental	5 10	32 46			2	1 2	2 3	2 3	

CONCLUSIONS

1. The administration of organic selenium (Sel-Plex) with mixed fodder (0,5kg/t) during 1-58 days has a positive effect on growth and development of broilers.
2. Mortality rate from 1st day till slaughtering was lower (6%) in experimental group to compare with control one (10%).
3. Jn 58th day bodyweight of chicken was 2.700 kg and 2.840 kg in control and experimental group, respectively. So, the difference between groups is 5%, and it's also with 1,5% higher than the bodyweight of poultry in floor housing.
4. Analysing the evolution of Hb and RBC we can tell that Sel-plex (as an organic selenium source) has a positive effect on increasing of their amounts.
5. There were no significant modifications on DAM rate in serum and RBC under the influence of Sel-plex.
6. Sel-plex stimulates a significant increase of post vaccination antibody titer against New-Castle Disease (1:128-1:512), so it has an immunopotentiating activity.

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