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OBSERVATIONS ON HEMATOLOGICAL AND BIOCHEMICAL MARKERS IN *GALLUS DOMESTICUS*, CONSECUTIVE FOODER SUPPLEMENTATION WITH ORGANIC SELENIUM

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Abstract

Selenium prevents the formation of free radicals. Haematologically, selenium has an important role in protecting haemoglobin against peroxidising. In the present study 20 laying chickens of the Rosso breed were subjected to the experiment, being divided into two batches. The experimental batch was given feed diet 21/5 for laying hens together with 6 grams/kg M.F. (mixed fodder) Sel-Plex™, while to the control batch was given the same feed diet but without the added selenium. Before the start of the experiment as well as 30 days after, biological samples were collected and used to determine hematological and biochemical parameters. The results were bio-statistically interpreted. In the experimental batch significant growths were observed for the erythrocyte parameters: erythraemia, haemoglobinemya, haematocrite, MCV and MCH. Of the biochemical markers, significant growths were observed in the ascorbinemic acid, lipids and serum pseudocholinesterase. The following parameters dropped significantly, proteinemia and blood sugar.

Key words: *biochemestry, haemathology, laying hens, selenium.*

INTRODUCTION

Selenium has a role of protecting hemoglobin against peroxidation with the help of three enzimes: superoxide dismutase (SOD), glutathione peroxidase (GSH-Px) and catalase (Curcă, 2008; Răduță 2015).

A deficiency in this trace element can lead to peroxidation of cell membranes, and thus the production of prostaglandins.

The peroxidation of membranes will result in structural damage of many molecules, including the DNA molecule, and this phenomenon gradually results in the appearance of neoplastic diseases. (Ghergariu 1980; Curcă, 2005).

Disorders such as anemia and / or erythrocyte lysis were reported to be directly related to a deficiency in selenium, especially in rats, dogs, primates and also chickens (Curcă, 2005). Supplementation with selenium of the feed regime could lead to the prevention of conditions such as myopathy effusion, bleeding diathesis etc.

The bioavailability of selenium is much better when administered in its organic form (seleno-methionine), the total amount of selenium retained increases because these amino acids are not excreted in urine (Surai, 2006).

MATERIALS AND METHODS

The experiment was performed in the biobase of the Faculty of Veterinary Medicine of Bucharest, on two batches of laying chicks, each batch comprising of 10 subjects, before the laying period. Both batches received the same feed regime, 21/5 fodder, fodder recipe was as follows: 10% protein-vitamin-mineral complex, corn 48%, wheat 27%, soya 8%, 1% fish meal, sunflower meal 6% (Figure 1). The feed have the following nutritional characteristics: metabolizable energy 2870.15 kcal / kg, crude protein 15.60%, 0.29% methionine, lysine 0.70%, 2.68% fat, 1.07% calcium, phosphorus 0 70%.

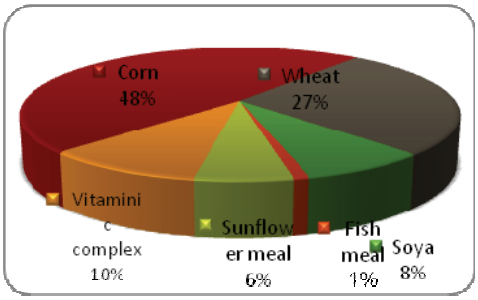

Figure 1. Combine feed composition

One of the batches received the feed suplemented with 6 grams/kg M.F., as Sel-Plex from AllTech, selenium yeast.
Before starting the experiment and 30 days after biological samples were collected by cubital vein puncture, using EDTA anticoagulant 1-2 mg/ml of blood, and heparin respectively, for haematological and biochemical determinations (Figure 2).

Fig. 2. Blood sample collecting from the cubital vein for haematological and biochemical determinations

The counting was performed with an automated Coulter Counter, CP-diff analyzer ACT 5 Beckman and the wet biochemistry analyzer ECOM Eppendorff 1022.
The statistical calculation of the investigation results was performed using the ANOVA statistical specialized program, and the data was processed using several programs from the Microsoft Office 2010 suite.
The results were tabulated, plotted and interpreted biostatistically (Table 1).

RESULTS AND DISCUSSIONS

In the batch whose diet was supplemented with organic selenium statistically significant increases were found for the erythrocytes' parameters: erithremia, hemoglobin, hematocrite, MCV, MCH. (Table 1) (Fig. 3).
Among the biochemical markers were recorded statistically significant increases of: ascorbicnemia, serum lipids and pseudocholinesterase.
A statistically significant drop was observed in the following parameters: proteinemia and blood glucose.
There have been observed changes in some parameters in the batch that received feed supplemented with organic selenium regime, but without statistical significance (Fig. 4, Fig. 5).
A growth trend was experienced for lipase, GOT (Glutamic-Oxaloacetic Transaminase), acid phosphatase, alkaline phosphatase. Leucocitemia, amylasemia, piruvicemia, fosfolipidemia and cholesterol tended to decrease but not statistically significant.
Ration feed supplementation with selenium enhances erythropoiesis so eritremia presents an increasing trend compared to the control group by 15.28% (Mertz, 1987; Curcă, 2005 and 2007; Răduță, 2011).
The use of Sel-Plex™ as a source of supplemental dietary Se provides a more efficiently utilized form of organic selenium and facilitates a greater antioxidant enzyme presence in glutathione peroxidase, which more readily reduce peroxides and other free radicals that compromise cell membranes (Edens and Gowdy, 2005). Also, Atlavin and Apsite (2001) found that selenium metabolites in the body are closely linked with activities of glutamine peroxides which eliminate lipid hydroxyl peroxides in cellular structures. Similar results were reported by Srimongkol (2003) and Mahmoud and Edens (2003).
Hemoglobinemia, due to an increasing in young circulating erythrocytes, only increased by 8.91%, thereby leading to an increase in the mean corpuscular hemoglobin (MCH). This value is higher by 5.98% compared to the control batch highlighting a better load of the erythrocyte with hemoglobin, this data is confirmed and the values statistically significantly different from the control group (Smith and Picciano, 1987).
As a result of increased erythropoiesis, a larger number of young erythrocytes is issued in bone marrow, resulting in increased value of the hematocrit.
Increased hematocrit values highlights an improvement to the cellular mass detrimental to the plasma mass (Surai, 2002).
The trend of increasing mean corpuscular volume (MCV), which is due to the large number of young erythrocytes, which have a lower volume than the mature red cells which increases in this experiment with the value of 4.98% compared to the control batch, which

batch did not received feed rations supplemented in organic selenium (Aristide Popescu L. and N. Aristide Popescu, 1990; Răduţă et. al., 2015).

An increase in the concentration of mean corpuscular hemoglobin (MCHC) 2.71% is explained by the trend of increasing circulating hemoglobin and mean corpuscular volume growth. Leucocitemia shows a downward trend, but without statistical significance.

Biochemically, ascorbinemia presented a marked upward trend in the batch of chicks whose feed was supplemented with organic selenium, the mean ascorbinemia was 3021 mg / dl blood, with a growth of 16.64%.

Piruvicemia, had a decreasing trend, the decrease was of 5.2%.

Lipemia in the experimental batch reached the amount of 655.128 mg/dl blood serum, thus increasing by 35.552% compared to the control group.

Lipase from the chicks whose feed was supplemented with organic selenium had a tendency to increase, the value being 1.241 UL Cherrz Crendal, representing an increase of 7.63% compared to the control batch.

The growth trend of lipase, demonstrated by other researchers shows that a deficiency in selenium can lead to a deficient absorption of lipids and a low hydrolysis of lipids in the digestive tract, resulting in a marked decrease in the absorption of vitamin E and the deficit in this would lead to necrotising dystrophy of the pancreas (Poll, 1968; Apsite et. al., 1993; Mahan, 1995; Aye et. al., 1999; Agate et. al., 2000; Allan et. al., 2000).

The increase in lipase activity, GOT, acid phosphatase and alkaline phosphatase shows an increase in the permeability of cell membranes and particularly of the sarcolemma, so that the enzymes leave the cytosol passing into the bloodstream, a state reflecting the trend of establishing muscle degenaration without it being discernible in the pathological examination (Oster and Prellwitz, 1990; Bansal and Kaur, 2002; Pappas et. al., 2004; Cornell University College of Veterinary Medicine, 2011).

However a marked increase must be highlighted in pseudocholinesterase with 28.81% compared to the value recorded in the batch who received no dietary supplement, which shows an increase in hepatocyte function consecutive with a overloading of the liver by the lipid components of the feed ration, and on the other hand the inability of the selenium to prevent these nutritional imbalances (Apsite 1993, 1994). The amylase values in the batch of pullets whose diet was supplemented with selenium were 726,097 UA-Smith-Roe, representing a slight decrease of 5.04% compared to the control batch.

Table 1. The modified parameters in statistical terms (the control group and the experimental group)

Parameters	T Test	Mean dif.	Critical dif.	P value	Dif.
E	M.vs.S	-,478	,254	**0.0009**	↑**S**
Hb	M.vs.S	-,990	,652	**0.0051**	↑**S**
Ht	M.vs.S	-2.170	1.469	**0.0061**	↑**S**
MCV	M.vs.S	-7.000	6.148	**0.0279**	↑**S**
MCH	M.vs.S	-2660	1232	**0.0003**	↑**S**
Ascorbinemia	M.vs.S	-4.28	,396	**0.0355**	↑**S**
Proteinemia	M. vs. S	,538	-468	**0.0266**	↓**S**
Glycemia	M.vs.S	59.400	32.089	**0.0011**	↓**S**
Lipidemia	M.vs.S	-171.826	135.324	**0.0157**	↑**S**
PCHE	M.vs.S	-,10.200	9.213	**0.0319**	↑**S**

Legend: E – erythremia (RBC); Hb – haemoglobin
Ht – Hematocrit; MCV – mean corpuscular volume
MCH – mean corpuscular haemoglobin; PCHE – pseudo-cholinesterase; M. vs. S – martor vs. selenium

Cholesterolaemia was 78.52 mg/dl blood serum, representing a decrease of 4.64% compared to the group that received normal feed ration without selenium supplements.

This can be explained through improved production of lipids metabolism without the production of intermediary metabolites by reducing protein levels and piruvicaemia.

In the experimental group a marked decrease could be observed for the blood glucose of 314.4 mg / dl blood, 15.89% lower than the control group.

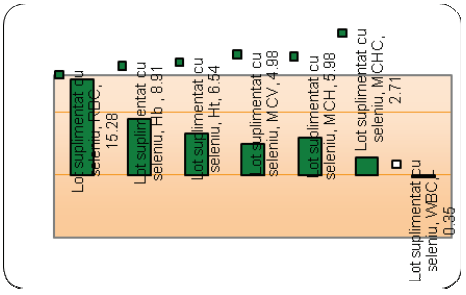

Fig. 3. The percentage changes of hematological parameters in chickens whose diet was supplemented with selenium compared with the values of the control batch

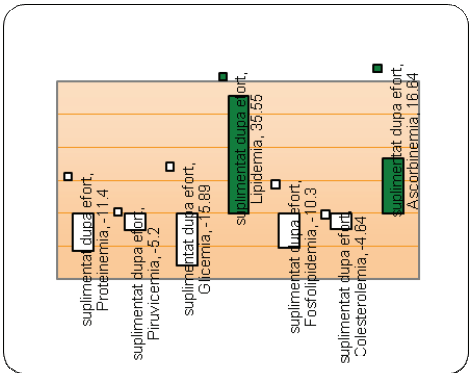

Fig. 4. The percentage changes of biochemical markers in chickens whose feed was supplemented with selenium compared with the values of the control batch

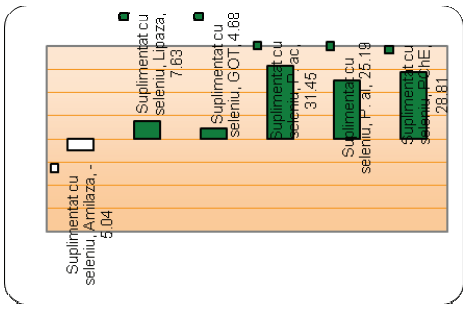

Fig. 5. The percentage changes of serum enzymes in chickens whose feed was supplemented with selenium compared with the values of the control batch

CONCLUSIONS

1. The study presents the beneficial effect of supplementation by Sel-Plex, through the improvement of hematological and biochemical parameters, which are factors in preventing states of myopathy exudative, hemoragic diathesis and encephalomalacia also ensuring better development of the body, an index of better feed conversion in the experimental group.
2. Also, one of the biological roles of selenium could be observed, that of its implication in the acceleration of the hematopoietic bone marrow activity, and so its role in the formation of new red blood cells.
3. By stimulating the erythropoiesis, increasing the red blood cell count, and the haemoglobin, selenium may help to a better tissue oxygenation, so to an increase of the basal metabolism, therefore promoting the growing processes, but also optimizing the productive parameters.
4. The increase or decrease of these biochemical parameters subsequently to the supplementation of the fodder with organic selenium will result into the prevention of oxidative stress and into a higher efficiency of fodder conversion rate.

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