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Hematological effects of mercury in hybrid birds *Isa brown*

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ABSTRACT

The aim of this study was to examine possible toxic effect of different concentration of mercury, for a 19 days treatment period, on the hematological indicators, in birds for eggs of hybrid Isa brown. Birds are divided in four groups. One group was used as control and three groups were treated with different doses of mercury chlorate (50mg Hg/l, 100mg/l and 200mg/l). The amount of mercury salts was given to birds with drinkable water. At the end of the experiment, blood is tacked in all 4 groups. The blood was taken in the crucibles with heparin in amount 100 UI heparin for each ml blood taken. In blood we have analyzed: RBC, HGB, HCT, MCV, MCH, MCHC, RDW, PLT, MPV, PCT and PDW. Statistical elaboration of hematological parameters was done with ANOVA method by determining the average of each indicator; SD, SEM and t-statistic.Probability is determined by a tabular method. From the results we can conclude that hematological indicators generally have differences ascertained statistically between the control and experimental groups and within experimental groups during the use of mercury, whereas the level of PDW does not present differences statistically ascertained.

Key Words: *Mercury, hematological parameters, Isa brown birds.*

INTRODUCTION

Mercury is non-essential ion for the poultry [1]. Hg is one of the major aquatic contaminants [2]. In the birds of 4 weeks of age conducted an experiment with 5 groups with supplementation with mercury by 0-500 mg/l. Researchers noticed that the toxic effects increased with the increase of the amount of mercury ions in the consumable food and drinkable water thus the changes in hematological parameters (HCT, MCV, HGB level etc) were in dependence of the amount of ions of used mercury and of the duration of the experiment [3]. Mercury influences also immunological occurrences [4]. Mercury influences on the increase of the levels of platelets in fish. The increase is dependant of the dose and the duration of usage [5]. The study of different biochemical and cellular constituents in blood is of fundamental importance in the physiological and physiopathological evaluation of animals, because morphological and other environmental factors [6]. The aim of this work was to determine the

effect of moderated levels of mercury, for a 19 days period, on hematological indicators, in birds for eggs of hybrid *Isa brown*.

MATERIALS AND METHODS

Organization of the experimental farm:
In this research we have investigated the birds of the hybrid *Isa brown*. In the experiment are placed birds of 4 weeks age of the *Isa brown* hybrid. Birds were placed in the cages and in each cage we placed two birds. Birds were treated for a 30 days period without using different supplements of mercury salts. The experiment was conducted in the village Konjuh, municipality of Lipan in Kosovo, with the following coordinates: sea high-level 568 m. LAT/LON N 420 32.4370. E 0. 210 08, 335'. Coordinates were measured with GPS. In the experimental period were created 4 groups with an equal number of birds. In each group are placed 6 birds. First group was treated as a control group while three other groups were experimental groups. Three groups were treated with different doses of mercury chlorate (group 2, 3 and 4), according to the Table 1.

Table 1. **Organizing groups in experimental farm.**

1. Groups	Controlle
2. Groups	Treated with 50 ppm Hg/l
3. Groups	Treated with 100 ppm Hg/l
4. Groups	Treated with 200 ppm Hg/l

The amount of mercury salts was given to birds with drinkable water. To birds, both during the preparatory period and experimental period, was used same portion of food.

Food that is used during the experiment:
The food portion during the experimental period was composed of a mixture of cereals, food of animal origin, products of oil industry, flour industry sub-products, dried plant products, minerals and vitamins, as presented in the Table 2.

Table 2. **Food ration used in all groups of birds.**

	%		%
Corn	61.5	Wheat chime	9
Soya oilcake	12.0	Sunflower oilcake	3
Fish flour	5	Animal fat	1
Jodge flour	4	Beer yeast	1
Bones flour	1	Bi-calcium phosphate	1
Sodium chloride	0.25	Premix	1

Taking of food by birds was *ad libidum*. At the end of the experiment was measured the quantity of the food remained un -eaten. The daily level of nutrition was determined by the difference between food given for consumption during the entire experimental period and the food remained at the conclusion of the experiment. Giving of water was done each day, by checking the quantity remained in the pot. The experiment continued for 19 days.

Blood samples and hematological analysis:
At the end of the experiment, birds were taken to the autopsy room at the Veterinary Institute in Prishtina, and the blood was taken in the vein of the arm (*v. Brachialis*) with the crucibles with heparin in amount 100 UI for each ml blood taken. In blood we have analyzed: RBC (erythrocytes), HGB (hemoglobin), HCT (hematocrit), MCV (mean corpuscular volume), MCH (mean corpuscular hemoglobin), MCHC (mean corpuscular hemoglobin concentration), RDW (red blood cell distribution width), PLT (platelets), MPV (mean platelet volume), PCT (plateletcrit) and PDW (platelet distribution width). Tests are done at the Faculty of Agriculture and Veterinary at University of Prishtina. The determination of these indicators was done with an automatic device for hematological counting, type *ABX MICROS 60* (Manufactured by *HORIBA ABX SAS*).

Statistics:
Statistical elaboration of hematological parameters was done with the method *ANOVA* by determining the average of each indicator, standard deviation (SD), standard error of the average (SEM) and accuracy of difference through a t-statistic. Probability was determined by a tabular method.

RESULTS AND DISCUSSION

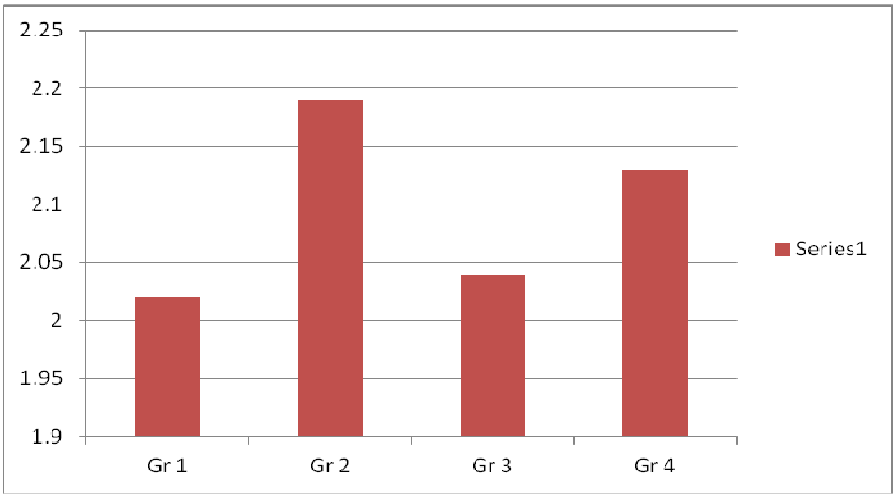
The data obtained are presented in the tabular manner (table 3), while for evaluation of the effects of $HgCl_2$ are developed figures 1-4.

Table 3. Average values (M) of the standard error of the average (SEM) of hematological parameters of the control and experimental group with cadmium in *Isa brown.*

	Gr Control	Gr.2 Exp	Gr.3 Exp	Gr.4 Exp	t-statistics					
	1	2	3	4	1:2	1:3	1:4	2:3	2:4	3:4
RBC10^6/*mm*	2.02±0.09	2.19±0.1	2.04	2.13	1.3	0.27	0.91	1.45	0.51	1.01
HGB *L g/dl*	8.7±0.31	9.43±0.32	8.9±0.15	9±0.25	1.57	0.53	0.83	1.45	0.89	0.5
MCV *fl*	136.5±2.42	131. ±1.63	133.6±1.17	129.8±2.4	1.77	1.05	1.96	1.16	0.52	1.44
MCH *pg/L*	43.3±0.61	43±0.67	43.1±0.3	42.6±0.73	0.24	0.17	0.7	0.14	0.46	0.7
MHCH *g/dl*	31.75±0.28	32.78±0.36	32.1±0.2	32.86±0.37	2.29	1.27	2.44	1.47	0.16	1.64
RDW%	8.81±0.91	7.38±0.4	7.4±0.07	7.2±0.17	1.44	1.53	1.75	0.08	0.42	1.17
HCT %	27.5±0.93	28.8±1.04	27.4±0.42	27.6±0.95	0.9	0.1	0.04	1.21	0.86	0.15
MPV *1/2mπ*	6.31±0.14	6.1±0.1	6.28±0.09	5.36±0.11	0.87	0.2	5.36***	0.88	5.45***	6.58***
MPV *1/2mπ*	6.31±0.14	6.1±0.1	6.28±0.09	5.36±0.11	0.87	0.2	5.36***	0.88	5.45***	6.58***
PCT %	0.1±0.002	0.24±0.001	0.26±0.002	0.42±0.0003	4.32**	3.88**	7.89***	0.7	5.54**	4.31**
PDW%	5.46±0.39	6.65±0.04	6.53±0.1	6.33±0.26	0.72	0.41	0.07	1.08	1.19	0.71

Note: Significance level: p□0.05, p□0.01**, p□0.001****

Fig. 1: The dynamic of erythrocytes on the groups with mercury.



The concentration of erythrocytes (RBC) in the groups treated with mercury ranges from the minimal value $2.02.10^6$ to maximal value 2, 19.106 erythrocytes. As presented in Table no.3, this oscillation is not ascertained statistically compared with the control group (first group) and among experimental groups themselves. The value of t-statistic oscillates from 1.3 to 0.27.

The level of HGB (in g%) oscillates from 8.7 g% to 9.43 g%. The level at the third group decreases in comparison with the second group and further decreases in the third group and increases in the fourth group. But these differences are not ascertained statistically (P> 0.05). Other blood indicators, connected with the level of RBC and HGB (MCV, MCH, MHCH, RDW) suffer oscillations depending from the dose but their difference is not ascertained statistically (P> 0.05).

Fig. 2: The dynamic of hemoglobin on the groups with mercury.

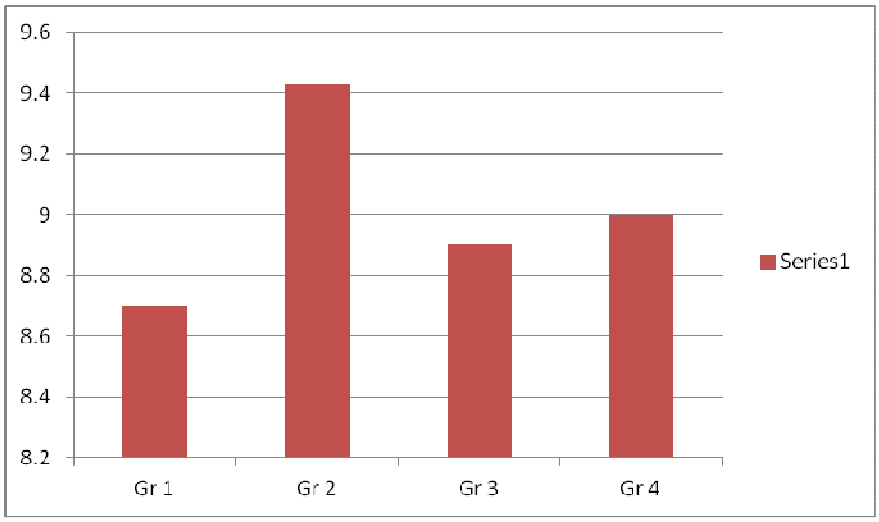


Fig. 3: The dynamic of hematocrit on the groups with mercury.

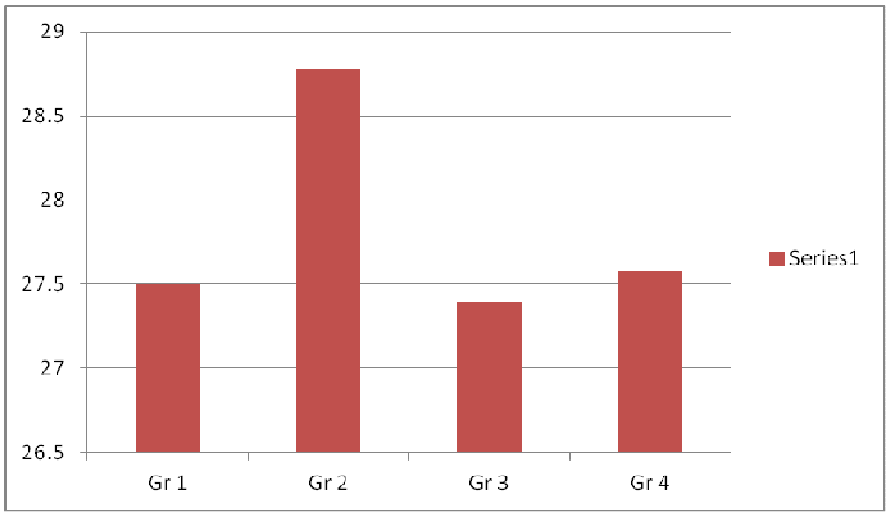
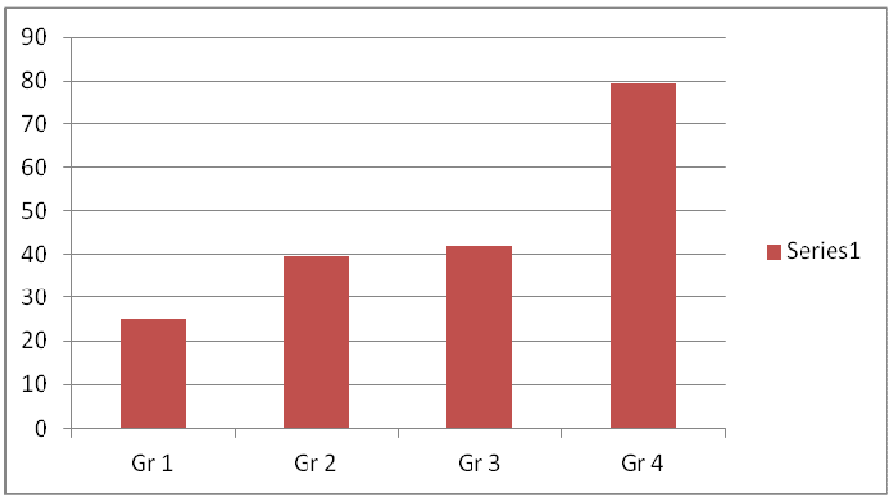


Fig. 4: The dynamic of platelets on the groups with mercury.



The level of platelets increases from the control group to the fourth group. This increase is ascertained statistically between the control group and the experimental group (P< 0.05) and it is not ascertained statistically only between the second and third group (P> 0.05). The values of platelets in control group are within the normal average limits [7].

Indicators dependant on platelets (MPV, PDW) suffer changes but these changes are not ascertained statistically (P> 0.05).

The level of PCT increases from the control group to the fourth group. This increase is ascertained statistically between the control group and experimental group (P< 0.05) and between the experimental group (P< 0.05) and it is not ascertained statistically only between second and third group (P> 0.05).

Fig.1 proves that mercury ions in the first experimental group influences on the increase of the level of RBC in reaction with the control group. In the second experimental group it is concluded that the mercury ions influences in the increase of the level of RBC. Same legality is observed also in the third experimental group in comparison with the second experimental group. This proves that mercury ions in small doses influence sin the incitement of the erythropoietin [8].

The role of mercury ions in small doses and for relatively short timeframe in increase of erythrocytes is concluded also [9]. Incitement of the synthesis of metal-thiamine in the level leads to lowering of the free ions of mercury this result in the consequences noticed in the second and third group. Data of the fig.2 proves that the level of hemoglobin under the activity of mercury ions in the lowest dose suffers increase (first experimental group). In the second it is noticed the decrease of hemoglobin level under the activity of mercury ions. In the third group with a highest level of mercury, it is noticed that the level of hemoglobin increases.

The data presented in the fig.3 proves the dynamic of the in the birds taken for study, under the activity of mercury. In the first experimental group we notice the increase of the level of hematocrit in the group treated with mercury ions. In the second experimental group we found that the hematocrit level decreases during the treatment with mercury. In the third group level of hematocrit increases a bit in comparison with the second group when treated with mercury. Mercury ions in the first group influences in the increase of the erythrocyte's level. Impact of mercury ions on the level of platelets (figure no.4) is sensitive. Thus, in the first group it is noticed the increase of platelets but this increase is from the activity of mercury ions. In the third experimental group we notice moderate growth of the platelets level under the activity of mercury ions. Same dynamics of platelets is concluded, during the use of various doses of mercury in fish [5].

CONCLUSION

Relying on the achieved results through experimental way in birds *Isa brown*, under the effects of mercury ions on the hematological indicators, we may conclude that mercury ions have displayed effect on the level of erythrocytes and other hematological parameters liked with erythrocytes and hemoglobin in the blood, but observed effects are not ascertained statistically. Hematocrit level in the bird's blood has oscillations between the control group and experimental groups but differences are not ascertained statistically. Platelets level suffers changes statistically ascertained between the control group and experimental groups and between second and fourth group. Hematological indicators dependant of plates (MPV, PCT) generally has differences ascertained statistically between the control group and experimental groups and within experimental group during the use of mercury whereas the level of PDW does not present differences statistically ascertained.

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