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EFFECT OF DIFFERENT LEVELS OF INORGANIC CHROMIUM IN THE DIET ON SOME PHYSIOLOGICAL TRAITS OF THE BLOOD PLASMA OF LAYER HENS

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ABSTRACT

The study was conducted at the poultry field, the Agricultural Research and Experiments Station, College of Agriculture, Al-Muthanna University, from 12/6/2019 to 2/28/2020 (12 weeks period), divided into six durations, each period of 14 days. A total of 84 layer hen (ISA Brown), 21 weeks of age, distributed randomly into four treatments, were distributed into four pens (3 x 3 m) and each was divided into three equal parts, each section contains 7 laying hens (21 laying hens per treatment). The treatments were as follows: T1 (control treatment): given the basal diet without any additives. T2: $CrCI_3$ was added at a concentration of 10 ppm / kg feed. T3: $CrCI_3$ was added at a concentration of 15 ppm / kg feed. T4: $CrCI_3$ was added at a concentration of 20 ppm / kg of feed. The results of the study indicated that the added levels of inorganic chromium decreased significantly ($P \leq 0.05$) in the cholesterol concentration, with a significant increase ($P \leq 0.05$) in albumin, globulin, and total protein in blood plasma in the inorganic chromium treatments compared to the control treatment.

Keywords: Inorganic chromium, physiological traits, blood plasma, laying hens.

Introduction

Chicken eggs were one of the most important sources of animal protein because of digest easy, the sources of health because contains important amino acids, as well as the unsaturated fatty acids, which reduce the proportion of cholesterol in the blood (Al-Kassar, 2012). The demand for chicken eggs increases because they contain essential elements for human nutrition such as protein, which contains many essential amino acids necessary for human growth, as well contains many vitamins such as vitamins A, B, D, E, and K, a good source of salts such as iron and phosphorous. in view of the large costs involved in the production process of the poultry sector, researchers have since resorted to reducing the cost of feeding, represented by adding the mineral elements necessary for the growth of laying hens, these elements were divided into two parts according to the bird's need, the first was the elements that the bird needs in simple or medium quantities, and therefore they were added in percentages when forming feeds, according to the requirements for sustainability and egg production, such as calcium, phosphorous and potassium (Underwood, 1981). The second were the elements were needed in very small quantities, it is measured as a part per million, called the trace elements, were considered the basic components in the formation of the diet, such as chromium, iron, copper and others (NRC, 1994). Despite low percentage in the components of the diet, the effect of its deficiency on the productive and physiological performance of poultry cannot be ignored (Hamidi, 2017). The important trade elements was the chromium, which exists in two forms: the organic and inorganic form, chromium was one of the most important basic elements that a bird needs, to maintain a normal level of glucose, as well as lowering effect on the concentration of cholesterol and fatty acids in the blood (Chen *et al*., 2006). It has a major role in increasing the entry of nutrients, especially glucose and amino acids, into cells (Althuis *et al.,* 2002). Chromium was considered an anti-stress agent for the body, Chromium has an important role in improving the production and reproductive performance of field animals, including poultry (Abdallah *et al*., 2013).

The present study aims to determine add different levels of inorganic chromium ($CrCl_3$) to the laying hens' diet on some blood traits of the layer hens.

Materials and Methods

The study was conducted at the poultry field, the Agricultural Research and Experiments Station, College of Agriculture, Al-Muthanna University, from 12/6/2019 to 2/28/2020 (12 weeks period), divided into six durations, each period of 14 days. A total of 84 layer hen (ISA Brown), 21 weeks of age, distributed randomly into four treatments, were distributed into four pens (3 x 3 m) and each was divided into three equal parts, each section contains 7 laying hens (21 laying hens per treatment). The treatments were as follows: T1 (control treatment): given the basal diet without any additives. T2: $CrCI_3$ was added at a concentration of 10 ppm / kg feed. T3: $CrCI_3$ was added at a concentration of 15 ppm / kg feed. T4: $CrCI_3$ was added at a concentration of 20 ppm / kg of feed.

The feed was provided to the chickens according to the company's proven needs, Table 1 shows the components of the production diet used during the experiment. As for the lighting program, it was 16 hours a day (from six in the morning until ten in the evening). Water was provided to birds continuously. The temperature ranged between 22-26

°C during the experiment. No vaccinations were performed on the herd during the trial period, except for administration of the herd with vitamin AD3E at a rate of 1 ml / 2 liter once a week. CrCI3 available in the local market in Baghdad was used.

Table 1 : Basal diet used in the experiment (20-32) weeks.

Items	(%)
Maize	38.50
Wheat	10.00
Barley	6.50
Soybean meal	23.00
Wheat bran	8.00
Premix	2.50
Plant oil	2.00
Limestone	8.00
Salt	0.50
Vitamins	1.00
Chemical analysis	
Crude protein (%)	17.09
Metabolizable energy (kilo calorie/ kg diet)	2784.71
Lysine (%)	0.82
Methionine (%)	0.39
Methionine + Cysteine (%)	0.75
Calcium (%)	3.59
Available phosphorus (%)	0.48

*The chemical composition values of the diet were calculated according NRC (1994).

Blood samples were collected in two stages, the first at the beginning of the experiment (21 weeks), and the second at the end of the experiment (32 weeks), from the brachial vein from 6 birds for each treatment, the blood was collected in 10 ml glass tubes that do not contain anticoagulants, placed horizontally to get rid of the thrombus (fibrinogen proteins), the blood was placed in the central centrifuge at 3000 rpm for 15 minutes, serum was stored in other sterile tubes at -18 °C for the purpose of conducting laboratory analyzes and according to the instructions attached to the ready-made kits, for the purpose of estimating cholesterol, triglycerides, glucose, albumin, globulin and total protein.

A Complete Random Design (CRD) was used to study the effect of different levels of chromium chloride to layer hens' diets on blood traits, significant differences between the means were compared with the Duncan (1955) multiple range test under 0.05 and 0.01 significance levels, the program SPSS (2012) was used for statistical analysis.

Results and Discussion

Table 2 show that no significant differences between treatments on the glucose during the first period at the age of 21 weeks, however, at the second period of the experiment, a significant difference (P≤0.05) between the treatments, the chromium treatments were significantly superior to the control treatment, not significant differences between chromium treatments. As for cholesterol, no significant differences among the treatments during the first period at the age of 21 weeks, at the second period, was a significant difference (P≤0.05) between the treatments, a significant decrease (P≤0.05) in the fourth and third treatments in cholesterol concentration compared to the control treatment, the first, second, third and fourth treatments recorded 240.65, 237.25, 240.02 and 233.57 mg/ 100 ml blood plasma, respectively. The use of chromium has an important role in the rise of high-density proteins (H.D.L) and decrease in low-density proteins (LD.L) (Bandr, 2011).

No significant differences among the treatments on triglycerides during the 21-week and 32-week periods, chromium had no effect on glucose, cholesterol and triglycerides at the beginning of the experiment, however, at the end of the experiment, at the age of 32, a significant effect on these characteristics was obtained in favor of chromium treatments in blood plasma.

Table 2 : Effect of inorganic chromium on glucose, cholesterol and triglycerides in blood plasma of laying hens of 21 and 32 weeks (mean ± standard error).

Treatments	Glucose (mg/ 100 ml blood)		Cholesterol (mg/ 100 ml blood)		Triglycerides (mg/ 100 ml blood)	
	21 weeks	31 weeks	21 weeks	31 weeks	21 weeks	31 weeks
T1	1.12±151.50	1.39±171.28b	1.21±227.96	2.70±240.65a	0.68±115.38	1.26±118.92
T2	1.12±151.06	0.80±176.92a	1.85±227.65	1.01±240.02a	0.70±115.40	0.58±121.03
T3	0.62±151.38	0.56±177.37a	0.60±227.78	0.39±237.25b	0.52±115.53	0.52±121.58
T4	0.35±151.48	0.60±176.45a	0.76±227.82	0.75±233.57c	0.82±115.42	0.50±120.64
Sig.	N.S	0.05	N.S	0.05	N.S	N.S

T1 (control treatment): given the basal diet without any additives. **T2**: $CrCI_3$ was added at a concentration of 10 ppm / kg feed. **T3**: $CrCI_3$ was added at a concentration of 15 ppm / kg feed. **T4**: $CrCI_3$ was added at a concentration of 20 ppm / kg of feed. N.S: non- significant. * The different letters within column indicate the significant differences between the treatments on the level of probability (0.05).

Table 3 that there were no significant differences among treatments on the albumin during the first period (21 weeks), at the second period of the experiment (32 weeks), a significant difference (P≤0.05) between the treatments, where the chromium treatments (second, third and fourth) were significantly superior to the control treatment, there were no differences between chromium treatments. As for globulin, there were no significant differences between the treatments during the first period (21 weeks), but in the second period (32 weeks) were a significant difference (P≤0.05) between the treatments, where the second, third and fourth treatments significantly outperformed compare with control, there were no significant differences between chromium treatments. As for protein, there were no significant differences between the treatments during the first period (21 weeks), at the second period of the experiment (32 weeks), the chromium treatments recorded significant increases (P≤0.05) compare with the control treatment.

Protein and its components were the main source of stability in the body when abnormal changes to which a bird is exposed, in addition to its role as a transporter of many

minerals, vitamins, amino acids and thyroid hormones (Al-Daraji *et al*., 2012). The superiority of chromium treatments compare with control treatment indicates the positive effect of chromium (Cr^{+3}) on the stable physiological and health status of the bird, indicates the importance of chromium in improving protein synthesis, able to build a good muscular structure, the absorbed chromium moves into the bloodstream to the tissues by binding to the transferrin protein and creating the GTF complex (Glucose Tolerance Factor). Since the transferrin was to transport many metallic elements such as iron and copper, therefore, chromium competes with iron, copper and zinc in its association with transferrin, transfer to tissues and cells, an association of globulins has also been observed with chromium, co-occurring with the phosphorescent portion of proteins (Al-Kasar, 2012). The superior chromium treatments in the proportion of albumin indicates the positive effect of inorganic chromium, as the proportion of albumin and globulin can be used as genetic evidence for early selection, its increase indicates an improvement in the health and physiology of the bird, reflected on the high production performance of the bird (Al-Hadithi, 2020).

Table 3 : Effect of inorganic chromium on glucose, cholesterol and triglycerides in blood plasma of laying hens of 21 and 32 weeks (mean ± standard error).

Treatments	Albumin (g/ 100 ml blood)		Globulin (g/ 100 ml blood)		Total protein (g/ 100 ml blood)	
	21 weeks	31 weeks	21 weeks	31 weeks	21 weeks	31 weeks
T1	0.02±2.07	0.02±2.18b	0.01±2.20	0.01±2.38b	0.03±4.28	0.03±4.57b
T2	0.02±2.11	0.02±2.27a	0.03±2.21	0.02±2.44a	0.05±4.32	0.04±4.72a
T3	0.03±2.09	0.01±2.32a	0.01±2.20	0.01±2.48a	0.03±4.29	0.02±4.80a
T4	0.03±2.09	0.01±2.26a	0.03±2.21	0.01±2.44a	0.06±4.30	0.02±4.71a
Sig.	N.S	0.05	N.S	0.05	N.S	0.05

T1 (control treatment): given the basal diet without any additives. **T2**: $CrCI_3$ was added at a concentration of 10 ppm / kg feed. **T3**: $CrCI_3$ was added at a concentration of 15 ppm / kg feed. **T4**: $CrCI_3$ was added at a concentration of 20 ppm / kg of feed. N.S: non- significant. * The different letters within column indicate the significant differences between the treatments on the level of probability (0.05).

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