

THE EFFECT OF DIETARY SUPPLEMENTATION WITH DIFFERENT FORMS AND LEVELS OF ORGANIC CHROMIUM ON BROILERS MEAT QUALITY

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Abstract: This paper deals with the effect of supplementation with three different preparations of organic chromium complex: the ethylene diamine tetra acetic acid complex with chromium, chromium (III)-lysine and chromium (III) - picolinate on three different levels of chromium in broiler food: 0.2, 0.4 and 0.6mg/kg with respect to the mass of particular body parts and the level of triglycerides in blood. Statistically significant breast enlargement in broilers was obtained by feeding them with supplementation of chromium (III) - picolinate with chromium content of 0.4mg/kg. Supplementation of 0.6mg/kg of chromium (III) - picolinate resulted in the significantly lower amount of abdominal fat in the carcass. Lower level of serum triglycerides was also noticed with the use of 0.4mg/kg chromium in broiler food in all three examined preparations but it was not statistically significant.

Keywords: Organic chromium, broilers, carcass features, triglycerides

Introduction

Chromium is essential trace element required for normal carbohydrate and lipid metabolism in human and animals, (Mertz *et al.*, 1974). Beneficial effects of organic chromium supplementation in chicken diet on meat quality, as for reduction fat and enhance protein content, have been shown in many studies, (Kim *et al.*, 1995; Debski *et al.*, 2004; Sahin *et al.*, 2003; Hossain *et al.*, 1998).

The purpose of this research was the investigation of the effects of two organic chromium preparations, which have not been studied yet: the ethylene diamine tetra acetic acid complex with chromium and chromium (III)-lysine on parts of carcass and the level of triglycerides in blood. Chromium picolinate, which has been in use as a supplementation, was included in the research for comparison.

Materials and Methods

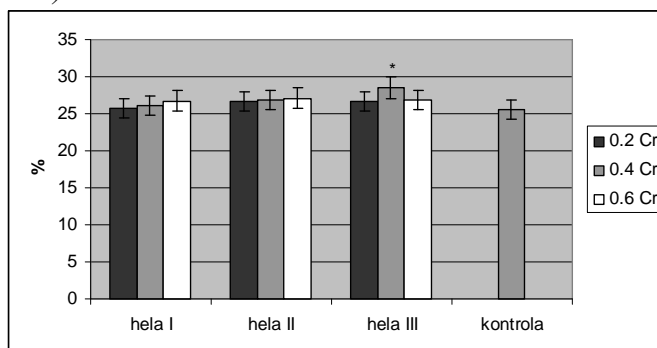
Preparations of organic chromium complex were synthesized: hela I, the ethylenediaminetetraacetic acid complex with chromium (III), (*Randal et al., 1953*); hela II, complex of chromium (III) with lysine, (*Leu et al., 1991*); and hela III, chromium picolinate, (*Anderson et al., 1996*).

Experiment was conducted under technical and technological normative fattening chicken broilers. Experimental animals were both male and female broilers of Arbor Acres × Ross 308. Total number of 150 broilers were divided into 10 groups of 15 chickens and fed 42 days. One group was given diet without chromium (control). The remaining nine groups of broilers received supplemented three preparation of organic chromium within three levels of chromium: 0.2; 0.4 and 0.6 mg/kg (experimental). Six chickens from each group were randomly chosen (3 male and 3 female) and after the slaughter their carcasses were kept cooled for 24 hours at temperatures between 0 and 4°C. After cooling, the mass of cooled carcasses was measured first and then the carcasses were cut into anatomic parts (head, neck, legs, wings, breasts, back and edible intestines) which were separately measured. After the fattening period, blood samples were taken and the level of triglycerides was determined according to standard GPO-PAP method, (*Buccolo et al., 1973*). The obtained figures were statistically processed by multi-factorial variance analysis and the significance of difference between certain treatments was examined using multiple interval test, (*Duncan, 1955*). The level of significance in all statistical researches was 0.05, (*Hadživuković, 1991*).

Results and Discussion

The values of mass share of particular parts of carcass were determined and statistically significant change in mass of breast parts and abdominal fat was recorded in comparison to the control test. The average values of mass share of head, neck, legs, wings and back showed no statistical difference in experimental groups in comparison to the control group. The average value of the breast mass in the whole amount of the carcass for all experimental groups is larger than in the control group (Figure 1). The highest value of this parameter, 28.52% was in the group which had hela III supplemented diet with 0.4 mg/kg chromium and the lowest value 25.51% was in the control group. This difference (3.1%) is statistically important. The value of the back mass in all experimental groups is lower in comparison to the control group but it is less statistically significant. The increase in the breast mass and the decrease in the back mass in a corpse is the desirable effect in broiler breeding. Similar results were obtained when the breast mass in broilers was increased after they received chromium supplemented diet in

the form of chromium supplemented yeast with 0.2mg/kg of chromium in the diet. (Debski *et al.*, 2004).



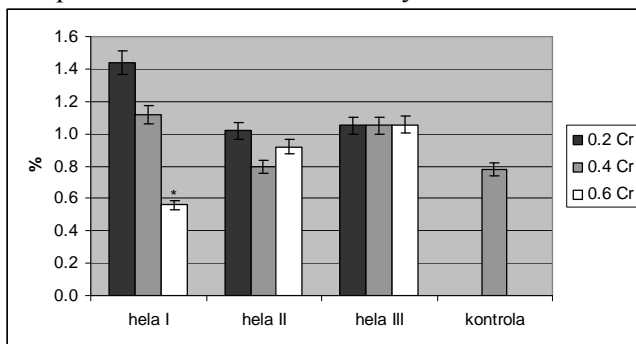
* Significant at the level $P < 0.05$

Figure 1. Effects of different forms and levels of organic chromium on breast mass in the whole carcass mass

The highest value of the abdominal fat share, 1.44% was recorded in the group with chromium content of 0.2mg/kg used as hela I preparation, and the lowest value of this parameter 0.56% was recorded in the same preparation but with 0.6mg/kg chromium content (Figure 2). The difference between these two values is statistically significant. Tangtaweewipat and associates managed to reduce abdominal fat in the broilers which consumed diet with chromium supplemented yeast. The chromium content in their diet was 0.2mg/kg and 0.4mg/kg (www.agri.cmu.ac.th).

Decrease of abdominal fat caused by diet supplemented with hela I preparation with 0.6mg/kg chromium content shows the influence of trivalent organic chromium on metabolism lipids which is also proved by the decrease of serum triglycerides. The average values of the triglyceride content in blood are between 0.34 mmol/l and 0.75 mmol/l (Figure 3). From the chart we can see that the chromium content of 0.4 mg/kg for each preparation shows the lowest level of triglyceride content in blood. The lowest value of this parameter was recorded in hela II preparation with 0.4mg/kg chromium content in food. For each preparation, it was only the level of 0.4 mg/kg chromium in diet that showed lower values of serum triglycerides in comparison to the control group. The past research obtained different results. In diet supplemented with organic trivalent chromium no changes in serum triglycerides were detected (Kim *et al.*, 1996, Sands *et al.*, 2002) while (Kim *et al.*, 1995) notice significant decrease in the serum triglyceride level as a result of organic trivalent chromium supplemented diet. The result similar to ours was obtained in the experiment, (de Souza da Silva, 2007). Since we carried out the experiment with small number of repetition it is difficult to determine the best value of chromium content in a diet which would lead to the lowest and statistically

significant values of the serum triglyceride levels and other lipids. The past observation emphasizes the need for further research in this area by means of greater number of experiments and control of many exterior conditions.



* Significant at the level $P < 0.05$ /signifikantno na nivou $P < 0.05$

Figure 2. Effect of different forms and levels of organic chromium on the abdominal mass in the mass of the whole carcass

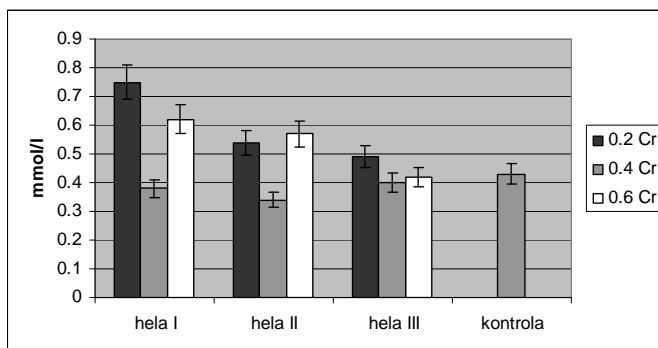


Figure 3. Effect of different forms and levels of organic chromium on the triglyceride content in blood of broilers at the end of the fattening period

Conclusion

Chromium (III)-picolinate supplementation in broiler diet with 0.4 mg/kg chromium resulted in statistically significant increase in the breast mass for 3.1%. Chromium (III)-EDTA with 0.6 mg/kg chromium content in diet with respect to the 0.2mg/kg content, resulted in statistically significant decrease in the abdominal fat from 1.44% to 0.56%. After analyzing triglyceride content in blood, it was noticed that the level of chromium in diet was important and that the kind of

preparation does not affect this parameter. The lowest values of the serum triglyceride levels were recorded in all preparations with medium chromium content in diet, 0.4mg/kg. Although these values are not statistically significant, they can help us assume the optimal value of the chromium content in broiler diet as well as that values which are either too high or too low do not give desirable results.

Efekat dodatka različitih oblika i nivoa organski vezanog hroma u ishrani brojlera na kvalitet trupa

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Rezime

Hrom je esencijalni mikroelement neophodan za metabolizam ugljenih hidrata i lipida. Cilj ovoga rada bio je ispitivanje efekta dva preparata organski vezanog hroma: hrom(III)-etilendiamintetrasirćetna kiselina i hrom(III)-lizin, koji do sad nisu primenjivani, na kvalitet trupa brojlera praćen preko udela pojedinih delova. Hrom(III)-pikolinat, koji je već poznat kao dodatak u ishrani brojlera uključen je u istraživanje radi poređenja. Ukupno 150 brojlera podeljeno je u 10 grupa po 15 pilića u svakoj grupi. Jedna grupa je dobijala hranu bez dodatka hroma (kontrola), a preostalih devet hranu sa dodatkom tri različita preparata u tri nivoa: 0.2, 0.4 i 0.6 mg/kg. Nakon tova pilići su zaklani i od šest nasumce odabranih pilića iz svake grupe određivan je udeo pojedinih partija trupa, a od četiri pileta iz svake grupe vršena je analiza sadržaja triglicerida u krvi.

Najveća vrednost udela mase grudi, 28.52% prisutna je u grupi koja je konzumirala hranu obogaćenu hela III preparatom sa sadržajem hroma 0.4 mg/kg, a najmanja vrednost, 25.51% u kontrolnoj grupi. Ova razlika (3.1%) je statistički značajna. Najveća vrednost udela abdominalne masti, 1.44% uočava se u grupi sa sadržajem hroma 0.2 mg/kg u obliku preparata hela I, a najmanja vrednost ovog parametra, 0.56% zapaža se kod istog preparata ali sa sadržajem hroma 0.6 mg/kg. Razlika između ove dve vrednosti je statistički značajna. Prosečne vrednosti sadržaja triglicerida u krvi bile su od 0.34 mmol/l do 0.75 mmol/l. Najniže vrednosti nivoa serumskih triglicerida zapažene su kod svih preparata sa srednjim nivoom sadržaja hroma u ishrani, 0.4 mg/kg. Ove vrednosti nisu statistički značajne.

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