

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

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This paper deals with the effect of supplementation with the three different preparations of organic chromium complexes: the ethylenediaminetetraacetic acid complex with chromium; chromium (III)-lysine and chromium picolinate, on broilers meat quality. In every preparation supplementing broilers diet chromium was present at the three different levels: 0.2; 0.4 and 0.6 mg/kg. The meat quality was monitored with respect to the following parameters: the contents of fat, protein, minerals and water.

It was observed that the fat content in broilers white meat was significantly lower if their diet was supplemented with 0.4 mg/kg chromium in the form of chromium(III)-lysine. In addition, different kinds of preparations influenced the protein, fat and water content in the white meat. Water content in white and red meat was lower in all experimental groups if compared to the control. However, the protein content in white and red meat was higher in experimental groups than in the control one.

KEYWORDS: Organic chromium; broilers; meat quality

INTRODUCTION

Chromium is an essential trace element required for normal carbohydrate and lipid metabolism in humans and animals (1). Previous research pointed to the beneficial effects of organic chromium supplementation in poultry diet on meat quality, in terms of fat reduction and increase in protein content (2-5). Chromium picolinate, chromium proteinase and chromium-enriched yeast are the most used forms of chromium as supplementation. The

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purpose of this research was to examine the effects of the two organic chromium preparations, ethylenediaminetetraacetic acid complex with chromium and chromium(III)-lysine, which have not been applied so far, on broilers meat quality, as estimated according to the fat, protein, minerals and water content. Chromium picolinate, which has already been used as a diet supplement, was introduced for the purpose of comparison.

EXPERIMENTAL

Preparation Hela I, the ethylenediaminetetraacetic acid complex with chromium(III), was synthesized according to the instructions (6). Hela II, the complex of chromium(III) with lysine, was synthesized according to the procedures for production of metal lysine complexes (7). Hela III, chromium picolinate, was prepared following the method of Anderson et al. (8).

The experiment has been conducted in accordance with the technical and technological standards for fattening chicken broilers. The one-day old, male and female chicken broilers of Arbor Acres × Ross 308 hybrids were used in the experiment. The total number of 150 broilers was divided into 10 groups of 15 chickens, which were fattened for 42 days. The control group had a controlled diet, whereas the remaining nine had a diet supplemented with the preparations made with the three different levels of chromium: 0.2; 0.4 and 0.6 mg/kg (experimental groups). The chickens were slaughtered six weeks later and from the six chickens, randomly chosen from each group, samples of white and red meat were taken for the analysis. Samples were stored at -20°C until before they were analyzed.

Contents of fat, protein, minerals and water content were determined according to the JUS ISO methods. The water content was measured according to JUS ISO 1442: 1997, and minerals according to JUS ISO 936:1997. Protein content in white and red meat was determined according to the Kejldahl method. For the purpose of defining the protein for the samples solubility, use was made of the instrument Turbotherm, Gerhardt, Germany and for distillation, the instrument Vapodest 30, Gerhardt, Germany. Fat content in meat samples was determined according to the method JUS ISO 1444:1996, using the continual Soxhlet extraction apparatus, RA FA TEC EXTRA UNIT, Tecator, Colorado. The values were determined by the six repeated analyses, and results were statistically processed by means of variance analysis.

RESULTS AND DISCUSSION

The protein content in white meat was higher in all experimental groups than in the control one (Table 1). It reached 23.30% in the control group and the highest value of this parameter was 24.17%, found in the group whose diet was supplemented with Hela I preparation containing 0.4 mg/kg chromium. Moreover, the protein content in red meat was also higher in all experimental groups as compared to the control. It was 19.30% in the control group and the highest value of 20.69% was found in the group whose diet was supplemented with Hela I preparation, as was the case with the white meat (Table 2.).

Table 1. Protein, fat, minerals and water contents in white meat of broilers whose diet was supplemented with three different forms and levels of organic chromium. Results are expressed as %, and represent mean value \pm standard deviation

Treatment	Protein	Fat	Minerals	Water
Hela I 0.2 mg/kg	24.13 \pm 0.31	0.55 \pm 0.14	1.38 \pm 0.12	74.12 \pm 0.12
Hela I 0.4 mg/kg	24.17 \pm 0.16	1.23 \pm 0.40	1.38 \pm 0.27	73.98 \pm 1.21
Hela I 0.6 mg/kg	23.80 \pm 0.51	1.34 \pm 0.22	1.34 \pm 0.22	74.28 \pm 0.59
Hela II 0.2 mg/kg	23.34 \pm 0.30	0.62 \pm 0.41	1.44 \pm 0.32	74.48 \pm 0.04
Hela II 0.4 mg/kg	23.93 \pm 0.49	0.43 \pm 0.24	1.81 \pm 0.11	74.37 \pm 0.27
Hela II 0.6 mg/kg	23.73 \pm 0.58	0.52 \pm 0.34	1.14 \pm 0.04	74.45 \pm 0.96
Hela III 0.2 mg/kg	23.67 \pm 0.60	0.89 \pm 0.14	1.27 \pm 0.16	74.42 \pm 0.28
Hela III 0.4 mg/kg	23.91 \pm 0.86	0.91 \pm 0.55	1.49 \pm 0.31	74.36 \pm 0.78
Hela III 0.6 mg/kg	23.74 \pm 0.48	0.45 \pm 0.19	1.70 \pm 0.35	74.74 \pm 0.47
Control	23.30 \pm 0.70	1.04 \pm 0.15	1.39 \pm 0.05	75.07 \pm 0.32

The fat content in white meat ranged between 0.43% and 1.34%. The lowest, but also statistically significant value was observed in the group whose diet was supplemented with Hela II preparation, with 0.4 mg/kg chromium. It was found that the linear increase in the fat content was in correlation with increase in chromium content in Hela I supplemented diet. However, the preparation Hela II demonstrated approximately equal and lowest values for all chromium levels compared to the other two preparations and the control diet group. The diet with Hela III preparation resulted in the values approximately equal to those of the control group for 0.2 and 0.4 mg/kg chromium levels. The fat content in white meat with the highest chromium level was significantly lower. The fat content in red meat ranged between 1.01 and 2.60%. The lowest value was found in the broilers whose diet was supplemented with Hela II with 0.6 mg/kg chromium, and the highest one in the group whose diet was supplemented with Hela I with 0.6 mg/kg chromium. Therefore, the preparation Hela II resulted in approximately equal and lowest fat content values for different chromium levels both in white and red meat.

Table 2. Protein, fat, minerals and water contents in red meat of broilers whose diet was supplemented with three different forms and levels of organic chromium. Results are expressed as %, and represent mean value \pm standard deviation

Treatment	Protein	Fat	Minerals	Water
Hela I 0.2 mg/kg	20.03 \pm 1.13	1.49 \pm 0.45	1.64 \pm 0.12	76.26 \pm 1.03
Hela I 0.4 mg/kg	20.69 \pm 0.22	2.21 \pm 0.35	1.55 \pm 0.15	76.03 \pm 0.27
Hela I 0.6 mg/kg	19.71 \pm 0.90	2.60 \pm 0.30	1.23 \pm 0.18	75.74 \pm 0.74
Hela II 0.2 mg/kg	19.45 \pm 0.67	1.10 \pm 0.32	1.53 \pm 0.32	75.74 \pm 0.65
Hela II 0.4 mg/kg	19.81 \pm 1.11	1.11 \pm 0.33	1.59 \pm 0.27	76.19 \pm 0.47
Hela II 0.6 mg/kg	19.51 \pm 0.71	1.01 \pm 0.17	1.36 \pm 0.10	75.59 \pm 0.37

Table 2. Continued

Hela III 0.2 mg/kg	20.24±0.67	1.27±0.12	1.31±0.22	75.30±0.37
Hela III 0.4 mg/kg	19.81±1.20	1.96±0.18	1.14±0.04	75.91±0.28
Hela III 0.6 mg/kg	19.47±1.05	1.27±0.14	1.38±0.07	75.54±0.27
Control	19.30±1.13	1.65±0.48	1.51±0.18	76.33±0.13

The water content in both white and red meat were lower in all experimental groups compared to the control. It was 75.07% in white meat of the control group, the lowest value of this parameter (73.98%), was found in the broilers whose diet was supplemented with Hela I with 0.4 mg/kg chromium. The highest water content in red meat was 76.33% and the lowest one 75.30% in the broilers group whose diet was supplemented with Hela III with 0.2 mg/kg chromium. These differences bear no statistical significance.

Minerals content in white meat ranged between 1.14 and 1.81%. The highest value was found in the broilers group whose diet was supplemented with Hela II with 0.4 mg/kg chromium, and the lowest one in the group whose diet was supplemented with Hela II with 0.6 mg/kg chromium. Concerning red meat, the highest mineral content of 1.64% was found in the broilers group whose diet was supplemented with Hela I with 0.2 mg/kg chromium, and the lowest one (1.14%) was found in the broilers group whose diet was supplemented with Hela III with 0.4 mg/kg chromium. However, the differences in mineral content in white and red meat bear no statistical significance.

CONCLUSION

Chromium(III)-lysine supplemented diet with 0.4 mg/kg chromium resulted in statistically significant fat content reduction in white meat from 1.04 to 0.43%. The fat contents in white meat were lower in all broilers groups whose diet was supplemented with chromium (III)-lysine and chromium tripicolinate compared to the ones which had usual diet. The fat content reduction in red meat for all chromium levels was found only in chromium(III)-lysine supplemented diet.

Water content in white and red meat were lower in all experimental groups than in the control one. However, the protein content in white and red meat was higher in all experimental groups as compared to the control one. However, these data bear no statistical significance.

In conclusion, the presented results show that supplementation with organic chromium in broilers diet enhances the meat quality, especially of white meat, due to the fat content reduction. Best results in all examined preparations were obtained with chromium(III)-lysine, since its supplementation resulted in the highest reduction of fat content in white and red meat.

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ЕФЕКАТ ДОДАТКА РАЗЛИЧИТИХ ОБЛИКА И НИВОА ОРГАНСКИ ВЕЗАНОГ ХРОМА У ИСХРАНИ БРОЈЛЕРА НА КВАЛИТЕТ МЕСА

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Хром је есенцијални микроелемент неопходан за метаболизам угљених хидрата и липида. Циљ овога рада био је испитивање ефекта два препарата органски везаног хрома: хром (III)-етиленидиаминтетрасирћетна киселина и хром(III)-лизин, која до сада нису примењивана, на квалитет меса бројлера праћеног преко садржаја протеина, масти, минералних материја и воде. Хром (III)-пиколинат, који је већ познат као додаток у исхрани бројлера, укључен је у истраживање ради поређења. Укупно 150 бројлера подељено је у 10 група по 15 пилића у свакој групи. Једна група је добијала храну без додатка хрома (контрола), а преосталих девет храну са додатком три различита препарата у три нивоа: 0,2; 0,4 и 0,6 mg/kg. Након тога пилићи су заклани и од шест насумце одабраних пилића из сваке групе узети су узорци белог и црвеног меса за анализе.

Хром(III)-лизин додат у храну бројлера довео је до статистички значајног снижења садржаја масти у белом месу са 1,04 на 0,43%. Вредности садржаја масти у

белом месу за хром(III)-лизин и хром-трипиколинат имају ниже вредности при свим нивоима у односу на контролну групу. Снижење садржаја масти у црвеном месу за све нивое хрома примећено је само код хром(III)-лизина. Вредности удела воде у белом и црвеном месу су ниже у свим експерименталним групама у односу на контролну, а удео протеина у белом и црвеном месу има веће вредности за све експерименталне групе у односу на контролу. Међутим, ове вредности нису статистички значајне. Можемо закључити да присуство органски везаног хрома у исхрани бројлера побољшава квалитет њиховог меса, што је нарочито изражено код белог меса, које карактерише нижи садржај масти. Од испитиваних препарата најбољи резултат је показао хром(III)-лизин, јер доводи до највећег снижења садржаја масти у белом и црвеном месу.

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