EFFECTS OF CHROMIUM YEAST SUPPLEMENTATION ON HAEMATOLOGICAL PARAMETERS IN CHICKEN

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ABSTRACT

A biological trial was conducted to study the effect of supplementing chromium yeast in chicken on haematological parameters. 400 chicks were allocated into four groups with 100 chicks in each treatment. Group I was fed with basal diet and groups 2, 3 and 4 were fed with basal diet added with 200, 400 and 600 ppb Cr yeast. Blood analysis revealed that supplementation of Cr yeast significantly increased Hb%, Total cell counts, lymphocytes and reduced heterophils and heterophil to lymphocyte ratio. Other haematological parameters viz., TEC, PCV, MCV, MCH, MCHC and platelet counts were unaffected by Cr yeast supplementation. These results indicate that Cr yeast is beneficial in improving immune response and also increasing Hb and TC, thereby alleviating stress in chicken.

KEY WORDS : Chicken, Haematology, Haemoglobin, Immunity, Lymphocyte

INTRODUCTION

In recent years, there are considerable research interests in the utilization of chromium in animal feeds. The beneficial effect of Cr in human health is well documented for its role as an integral component of the glucose tolerance factor (GTF), which potentiates the action of insulin, one of the most important anabolic hormones. Insulin regulates energy production, muscle tissue deposition, fat metabolism and cholesterol utilisation. Poultry diets are basically composed of ingredients from plant origin, which are usually low in Cr (Giri *et al.,* 1990). Cr in poultry has been shown to be effective during stress and improves production, immunity and carcass quality (Malathi *et al*., 2015). The objectives of the study was to assess the effects of dietary Cr from Cr yeast on haematological parameters in chicken.

MATERIALS AND METHODS

Experimental design and diets

A total of 400 day old straight run Giriraja chicks were wing banded, weighed and randomly assigned to four treatment groups with five replicates in each group and having 20 chicks in each replicate (100 chicks per treatment). The chicks were reared in deep litter system with all standard managemental practices till eight weeks of age. Standard vaccination schedule were followed for immunizing the chicks. Birds were fed with broiler pre starter diet (0-3 weeks), starter diet (3-6 weeks) and finisher diet (6-8 weeks of age) with one of the experimental diets. Birds of group 1 were fed with the basal diet, which was formulated as per NRC (1994) specifications. To formulate groups 2, 3 and 4 diets, Chromium yeast was added to the basal diet to contain 200 ppb, 400 ppb and 600 ppb levels of chromium respectively. Chromium yeast sample required for the trial was procured from Zeus Biotech Private Limited, Mysore. The Cr yeast sample was analyzed for chromium content before using in the feed by Inductively Coupled Plasma – Optical Emission Spectrophotometer(ICP-OES; Perkin Elmer Optima 8000) using argon gas as fuel and nitrogen gas for purging at 267.716 nm wave length.

Haematological parameters :

On 56th day of the trial, blood samples were collected from the brachial vein into the EDTA coated tubes and hematological parameters *viz*., Haemoglobin (Hb %), Packed cell volume (PCV %), Erythrocyte sedimentation rate (ESR, mm/hr), Total erythrocyte count (TEC, m/mm^3), Mean corpuscular volume (MCV, fl), Mean corpuscular haemoglobin (MCH, Pg), Mean corpuscular haemoglobin concentration (MCHC, %), Total count (1000/mm^3), Platelets (10^3/mm^3) and differential leukocyte count (heterophils, lymphocyte, monocyte, basophil and eosinophil %)were performed immediately using automated haematology analyser.

Statistical analysis :

The data were subjected to ANOVA using SPSS software version 20.0 . Means were compared by Duncan's multiple-range test and a P-value of less than 0.05 was considered statistically significant (Duncan, 1995).

RESULTS AND DISCUSSION

The results pertaining to the haematological parameters as affected by the supplementation of Cr yeast are presented in Tables 1 and 2. The Haemoglobin (Hb %) significantly increased in Cr yeast at 600 ppb level when compared to the control, while the Hb per cent in other Cr supplemented groups was comparable with the control. however, the PCV, ESR, TEC, MCV, MCH and MCHC values remained statistically similar among different treatment groups. Increased Hb per cent as observed in this study is in accordance with reports of Toghyani *et al.* (2006), who noticed that hemoglobin, MCH and MCHC were increased by 1000 ppb chromium picolinate supplementation at 42 days age, whereas WBC, RBC, PCV, MCV and thrombocyte counts did not differ significantly from that of control.

The total count (TC) increased significantly in birds supplemented with 600 ppb Cr yeast when compared to the unsupplemented control group. Among the differential leukocyte counts, heterophils reduced significantly in Cr yeast, 400 and 600 ppb supplemented groups than control. The lymphocyte counts significantly increased in 400 and 600 ppb Cr yeast groups than the control. Correspondingly the heterophil to lymphocyte ratio (H/L) reduced significantly in Cr yeast, 400 and 600 ppb supplemented groups. The monocyte, basophil and eosinophil counts were not influenced by Cr supplementation. Similar results were recorded by Sirirat *et al*. (2012), wherein supplementation of nanoparticles of chromium picolinate significantly increased lymphocytes and decreased both heterophils and H/L ratio. Uyanik *et al.* (2002), also found that supplementation of broiler chicks with 20, 40, or 80 mg/kg Cr as CrCl3 increased lymphocyte counts and reduced Heterophil and heterophil/lymphocyte ratio. Similar results were also recorded by other researchers wherein the heterophil to lymphocyte ratios decreased significantly with supplementation of Cr (Bahrami *et al*., 2012; Ebrahimzadeh *et al.*, 2012; Ghazi *et al.*, 2012 and Rajalekshmi *et al.*, 2014)

The exact mechanism by which Cr enhances the immune system is not known. However, one of the consistent results of the studies was that Cr reduced plasma cortisol levels. Cortisol, the most important glucocorticoid, has been found to be immunosuppressive, inhibiting the production and actions of antibodies, lymphocyte function, and leucocyte population (Munck *et al*., 1984). The number of heterophils increased in the blood of corticosterone (stress) fed chicks and hence the H:L ratio is reported to be a reliable index of stress response in broiler birds. Reduction in H:L ratio observed during this study could be indicative of reduced corticosteroid levels. Hence, the results of this study indicated that Cr in the form of Cr yeast exhibits an anti-stress and immune modulation function.

Table 1. Effect of supplementing chromium yeast on some haematological parameters in chicken

Cr yeast Level (ppb)	Hb(%)	PCV (%)	ESR (mm/hr)	TEC (m/mm3)	MCV (fl)	MCH (Pg)	MCHC (%)
0	13.16 ± 0.21^{b}	38.94 ± 0.91	3.00 ± 0.55	2.77 ± 0.06	140.94 ± 0.73	51.06 ± 0.27	36.26 ± 0.35
200	13.52 ± 0.35^{ab}	36.30 ± 0.81	3.80 ± 0.37	2.56 ± 0.05	141.74 ± 1.00	51.36 ± 0.53	36.24 ± 0.29
400	13.58 ± 0.51^{ab}	33.64 ± 4.31	3.80 ± 0.58	2.39 ± 0.27	139.44 ± 3.34	50.08 ± 1.60	35.98 ± 0.55
600	14.42 ± 0.09^{a}	39.56 ± 0.49	2.20 ± 0.73	2.74 ± 0.05	144.90 ± 1.74	52.64 ± 0.91	36.44 ± 0.58
P-value	0.036	0.266	0.192	0.248	0.294	0.348	0.915

Table 2. Effect of supplementing chromium yeast on Total cell counts, Platelets and Differential leukocyte counts in chicken

Cr yeast Level (ppb)	TC (1000/mm3)	Platelet (10^3/mm3)	Heterophil	Lymphocyte	Monocyte	Basophil	Eosinophil	H/L Ratio
0	15.22 ± 0.84^{b}	57.60 ± 4.65	34.00 ± 1.05^{a}	57.80 ± 1.02^{b}	0.60 ± 0.24	6.60 ± 0.51	1.00 ± 0.45	0.59 ± 0.03^{a}
200	11.28 ± 3.14^{b}	45.20 ± 2.71	33.20 ± 1.24^{a}	58.40 ± 1.21^{b}	1.20 ± 0.37	6.60 ± 0.51	0.60 ± 0.24	0.57 ± 0.03^{a}
400	14.30 ± 0.30^{b}	54.20 ± 7.47	27.80 ± 0.58^{b}	65.40 ± 1.12^{a}	1.00 ± 0.45	5.20 ± 1.20	0.60 ± 0.40	0.43 ± 0.01^{b}
600	33.44 ± 3.36^{a}	51.60 ± 1.63	24.80 ± 0.37^{c}	67.20 ± 1.11^{a}	1.40 ± 0.40	5.80 ± 0.86	0.80 ± 0.37	0.37 ± 0.01^{b}
P-value	0.000	0.322	0.000	0.000	0.495	0.573	0.852	0.000

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