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Original Article

EFFECT OF DIETARY CHROMIUM SUPPLEMENTATION IN BROILER DIET ON SERUM LIPID PROFILE AND ABDOMINAL FAT PERCENTAGE

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Abstract: ***The present study was conducted to compare the serum lipid profile and abdominal fat percentage in 360 numbers of day old broiler chicks divided as six groups fed three sources of chromium. T1 group serve as control fed standard diet without chromium (Cr) supplementation. Inorganic chromium chloride was fed to group 2, organic chromium in two forms - Chromium propionate CrProp (T3), organic Chromium picolinate CrPic (T4), at 200 µg and nano chromium (nanoCr) source at two dosage levels of 100 and 200 µg chromium per kg broiler diet was given to T5 and T6 groups respectively. The serum lipid profile and abdominal fat weight at the end of sixth week of the trail was recorded. The observed per cent decrease in Low density lipoprotein cholesterol (LDL-C), triglycerides, abdominal fat and increase in High density lipoprotein cholesterol (HDL-C) levels were 35.724, 24.033, 28.261 and 22.154 respectively in nanoCr 200 µg/kg fed T6 group. The results indicated that dietary nanoCr followed by organic CrPic supplementation had significantly ($p \leq 0.05$) decreased the LDL-C, triglycerides and abdominal fat and HDL-C level was increased at 200 µg of nanoCr/kg without any significant change in total cholesterol level when compared to other groups. Chromium could improve lipoprotein lipase and lecithin cholesterol acyltransferase activity which in turn accelerated cholesterol esterification and excretion, promoting the synthesis of HDL-C thereby increasing LDL-C uptake by hepatocytes and reducing the blood LDL-C content.***

Keywords: Inorganic chromium, Lipid profile, Abdominal fat, Broiler.

INTRODUCTION

Chromium, being a known cofactor in normal lipid and carbohydrate metabolism, recently included as a feed additive in animal nutrition. Earlier published research reports of Cr supplementation to poultry diet is limited, however many evaluated the inorganic Cr effects on poultry and only few on organic Cr source

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Treatment	Total Cholesterol (mg/dl)	% decrease	HDL Cholesterol (mg/dl)	% increase	LDL Cholesterol (mg/dl)	% decrease	Triglycerides (mg/dl)	% decrease	Abdominal fat	% decrease
T1-Standard diet	120.96 ± 3.96	-	68.43^{a} ± 1.46	-	44.48^{c} ± 3.71	-	40.32^{c} ± 0.65	-	0.92^{b} ± 0.06	-
T2-Standard diet + 200µg inorganic Cr/kg	118.78 ± 4.05	1.802	69.84^{a} ± 2.29	2.06	41.42^{c} ± 4.44	6.879	37.61^{b} ± 0.49	6.721	0.89^{b} ± 0.03	3.261
T3- Standard diet+200µg organic CrProp /kg	117.28 ± 2.73	3.042	74.07^{a} ± 2.92	8.242	35.61^{b} ± 4.53	19.942	37.94^{b} ± 1.47	5.903	0.76^{ab} ± 0.04	17.391
T4- Standard diet+200µg organic CrPic /kg	115.72 ± 3.57	4.332	73.36^{a} ± 3.01	7.204	35.06^{b} ± 4.19	21.178	37.45^{b} ± 0.94	7.118	0.66^{a} ± 0.04	28.261
T5- Standard diet+100µg nanoCr/kg	115.71 ± 1.32	4.34	71.95^{a} ± 1.49	5.144	36.95^{b} ± 3.11	16.929	36.23^{b} ± 3.11	10.144	0.74^{ab} ± 0.02	19.565
T6- Standard diet+200µg nanoCr/kg	112.06 ± 0.73	7.35	83.59^{b} ± 3.26	22.154	28.59^{a} ± 3.26	35.724	30.63^{a} ± 3.21	24.033	0.66^{a} ± 0.02	28.261

Table 1: Mean (± SE) serum lipid profile and abdominal fat of broilers fed inorganic, organic and nanochromium. * Means for each trait, within each category, bearing different superscripts, differ significantly (P < 0.05)

(Pechova [1]). Poultry feed being low in Cr, inclusion of Cr in poultry diet is essentially beneficial for better performance. A deficiency of chromium results from feed low in biologically available chromium. Several studies on pig, rat reported the beneficial effect of chromium on serum lipids. Considering this, a study was designed in an attempt to evaluate the effects of various sources of Cr as inorganic Cr chloride, two organic as Chromium picolinate (CrPic) and Chromium propionate (CrProp) and Nanochromium (nanoCr) on the blood lipid profile in broiler chickens.

MATERIALS AND METHODS

Three hundred and sixty, day-old broiler chicks were wing banded, weighed and randomly allotted to six experimental groups with three replicates of twenty chicks each per replicate. By using commercial kits (Span Diagnostics Ltd., India), lipid profile was estimated in UV-VIS double beam spectrophotometer (Systronics, Model 2202, India). The broiler chickens (nine birds per group) were slaughter by halal method and abdominal fat weight as gram per cent was recorded.

The completely randomized design was followed as per procedures Snedecor [2] and the data collected were statistically analyzed using Duncan's multiple range significance difference test Duncan, [3].

RESULTS

The effect of dietary treatments on the serum lipid profile and abdominal fat percentage of broilers fed inorganic, organic and nano chromium is shown in Tables 1. Significant (P<0.05) variations were

noticed in nanoCr 200 µg/kg fed T6 group when compared with other treatment groups.

DISCUSSION

The mean total cholesterol levels did not differ significantly in all treatment groups irrespective of the dosage and sources of dietary Cr when compared with control. LDL level was significantly decreased in T6 when compared to other groups. The groups T3 to T5 showed significant ($p<0.05$) decrease in LDL-C level when compared to control and inorganic Cr supplemented groups between which there was no significant difference. The triglycerides levels decreased and HDL-C level increased significantly ($p<0.05$) in nanoCr supplemented T6 group than inorganic, organic Cr supplemented and control groups. However, both levels did not show any significant difference among inorganic, organic and nanoCr (100 µg/kg) supplemented birds.

The observed per cent non significant decrease in total cholesterol, and significant decrease LDL-C, triglycerides, abdominal fat and increase in HDL levels were 7.350, 35.724, 24.033, 28.261and 22.154 respectively in nanoCr 200 µg/kg fed T6 group. The present findings concurs with Uyanik [4] who observed that supplementation of Cr chloride at 20-80 mg/kg to broilers did not affect serum cholesterol whereas, decreased cholesterol level without affecting other serum lipid profile (Al-Bandr [5]), were reported earlier. Previous reports of significant reduction by Cr chloride in serum LDL-C and increased HDL-C concentration (Al-Bandr [5]) in broilers and in rats fed nanoCrPic (Lien [6]) were also agreed with the current results. Similarly Cr nanocomposite in the diet at 300 ppb level decreased serum triglycerides in rats (Zha [7]), both serum total cholesterol and triglycerides in finishing pigs (Wang [8]) and in broilers (Raut [9] and Habibian [10]) whereas at 200 ppb level, cholesterol and triglycerides were not affected but HDL were increased in pigs (Wang [11]). Increased the serum HDL concentration and decreased cholesterol, triglycerides and LDL concentrations (Aslanian [12], Moeini [13], Toghyani [14]) in serum of broilers fed Cr as Cr yeast, methionine and nicotinate at the levels of 200, 400, 800 and 1200 ppb in the diet. Abdominal fat followed the similar pattern of reduction as that of LDL cholesterol and triglycerides concentration which was in agreement with the earlier reports of Suksombat [15], Zha [7] and. Ebrahimzadeh [16]. On the contrary, Ramarao [17] observed organic Cr amino acid chelates did not influence abdominal fat content in broilers. The nanoCr and organic CrPic at 200 µg significantly ($p<0.05$) reduced the serum LDL cholesterol, triglycerides, abdominal fat (%) levels but increased the HDL cholesterol, than nanoCr at 100 µg as that of CrProp and inorganic Cr supplementation µg without any significant change in total cholesterol level when compared to control.

Chromium could improve lipoprotein lipase and lecithin cholesterol acyltransferase activity which in turn accelerated cholesterol esterification and excretion, promoting the synthesis of HDL. Insulin increases liver LDL receptors thereby increasing LDL uptake by hepatocytes and reducing the blood LDL content and concomitantly the HDL proportion increased Brindley [18]. The present study indicated that nanoCr (T6) and organic CrPic (T4) fed broilers had significantly ($p<0.05$) lowered serum LDL cholesterol, triglycerides and increased HDL cholesterol than inorganic Cr supplemented and unsupplemented groups. The cholesterol lowering effect of Cr significantly reduced the abdominal fat deposition (g %) in Cr treated groups. Dietary Cr supplementation had significantly decreased the LDL, triglycerides and abdominal fat with higher reduction in nanoCr (200 µg/kg) and HDL level was increased without any significant change in total cholesterol level.

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