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Influence of dietary organic and inorganic chromium on meat characteristics of Japanese quails

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Abstract
An experiment was conducted to study the influence of dietary organic and inorganic chromium on meat characteristics of Japanese quails for a period of six weeks with seven hundred day-old quail chicks. These quail chicks were randomly grouped into seven treatment groups with four replicates consisting of 25 quail chicks in each replicate. They were provided with feed supplemented with inorganic chromium and organic chromium in the form of chromium with azolla and chromium with yeast at 500 and 1000 ppb levels and a control diet without chromium supplement from day old to six weeks of age. Quails which received organic chromium at 1000 ppb level had increased New York dressed weight (215.25±3.60g) and eviscerated weight (171.19±3.50g). The difference in weight of heart, gizzard, giblet, back and breast muscles were not significant between treatment groups. Whereas, combined weight of thigh and drumstick (49.84±1.11g) was higher in 1000 ppb of chromium with yeast supplemented group than control. Organic chromium supplementation showed an improvement in the carcass yield in Japanese quails without much affecting the relative weights of visceral organs.

Keywords: Japanese quails, organic and inorganic chromium, carcass characters

1. Introduction
Poultry meat is the main quality of protein provides to meet the ever growing demand of the human population in India and it is one of the cheapest good quality animal protein to reduce protein hunger even in rural areas. Even though the broiler meat is available easily in all parts of country, the consumer preference towards diversified poultry meat is increasing steadily because of increasing health conscious consumers. Among the diversified poultry, Japanese quails are the main contributors and its meat being a "gourmet's delight" due to its good quality animal protein. Japanese quails are hardy birds that thrive in small cages and low on maintenance. Moreover, the higher economical benefit attracted most of the farmers towards quail farming.

In recent years, there has been considerable research interest in the utilization of chromium (Cr) in livestock and poultry feeds. The beneficial effects of chromium can be observed more efficiently under environmental, dietary and hormonal stresses. Chromium is an essential element required for carbohydrate, lipid, protein, and nucleic acid metabolisms, activating certain enzymes and stabilizing proteins and nucleic acids. The primary role of chromium in metabolism is to potentiate the action of insulin as a component of Glucose Tolerance Factor (GTF). Supplemental dietary chromium is recommended by (NRC, 1997) [6] for animals undergoing environmental stress. Intake of 50-200 ppb of trivalent chromium is recommended for adult humans (NRC, 1989) [5].

2. Materials and Methods
The Saccharomyces cerevisiae culture was grown in the laboratory and enriched with chromium. Chromium chloride was used in the culture medium for enriching chromium content in the Saccharomyces cerevisiae culture. The harvested culture was washed thoroughly to remove inorganic chromium and the presence of organic chromium was estimated. The chromium incorporation is directly proportional to the incubation time. Organic chromium content in yeast culture varied from 154 to 226 mg /kg of yeast. At six week of age, twelve birds from each replicate were selected randomly. Feed and water were withdrawn 12 hours prior to slaughter. Birds were slaughtered manually using a conventional unilateral neck cut to serve the carotid artery and jugular vein.

After defeathering, head, shanks and feet were removed. The carcass was eviscerated manually by cutting around the vent to remove all of the viscera including the kidneys, abdominal fat, which consisted of fat surrounding the gizzard, proventriculus from the abdominal cavity was removed. The weight of heart, liver and gizzard were recorded. Eviscerated carcass with giblet was weighed to determine ready to cook yield. Each carcass was cut into its component parts namely breast, thighs, drumsticks, wings, back and neck. All the cut up parts were weighed and recorded. Data collected on various parameters were statistically analysed by one way ANOVA by using SPSS.20. The significance was tested using Duncan multiple range test (Duncan, 1955) [3].

3. Results

The mean values of carcass characteristics of Japanese quails as influenced by different sources and different levels of chromium are presented in Table 1.

Significantly ($p<0.01$) the best New York dressed weight and eviscerated weight was observed in T3 (1000 ppb of organic chromium with azolla) and T5 (1000 ppb of organic chromium with yeast) and this was comparable with groups T4 (500 ppb of organic chromium with yeast) and T7 (1000 ppb of inorganic chromium). The results revealed that live weight was significantly increased in 1000 ppb of organic chromium supplemented groups. Similarly increased New York dressed weight and eviscerated weight was observed in the same groups than other treatment groups. On comparing the cut up parts there was no significant difference in the back and breast muscles between treatment groups, whereas significantly ($p<0.01$) higher weight of thigh and drumstick (49.84±1.11) was observed in 1000 ppb of organic chromium with yeast supplemented groups than the control. With regard to weight of visceral organs no significance was observed for heart, gizzard and giblets while significantly ($p<0.01$) higher liver weight (6.13±0.18) was noticed in 1000 ppb of organic chromium with yeast group (T5). Similarly the weight of ready-to-cook yield meat was higher in 1000 ppb of chromium supplemented groups than control.

4. Discussion

Increased live weight of chromium treated groups at the level of 1000 ppb of chromium than the control observed in this study was in accordance with earlier findings of Hossain *et al*. (1998) [4], Debski *et al*. (2004) [2] and Samanta *et al*. (2008) [8]. The significant increase in New York dressed weight in the treatment groups supplemented with chromium than control obtained in this study was in contrary to the findings of Anandhi *et al*. (2006) [1], who reported no influence of dietary inclusion of organic chromium with regards to new York dressed weight and eviscerated weight in case of broilers.

The non significant difference noticed in this study for back and breast muscle yield was also contrary to the findings of Hossain *et al*. (1998) [4] who reported higher breast muscle yield when chromium yeast supplemented in broiler diet.

The results revealed that chromium supplementation by different sources and levels did not significantly influence the relative weights of visceral organs such as heart, gizzard and giblets which are in accordance with the findings of Rajalekshmi *et al*. (2014) [7]. However, significantly higher ready-to-cook yield was observed in this study was in contrary to the findings of Rajalekshmi *et al*. (2014) [7], who reported chromium propionate supplementation at different levels did not influence the ready-to-cook yield in broilers.

Significantly increased New York dressed weight, eviscerated weight and ready-to-cook yield of quails supplemented with chromium than the control group might be attributed to the significantly higher body weight recorded in the chromium supplemented groups during the study period. The supplementation of chromium in the form of chromium yeast and azolla might offer a non nitrogenous method of improving the quantity and quality of meat and also carcass leanness (Hossain *et al*., 1998) [4]. The relative increase in the weight of cut up parts might be attributed to organic chromium supplementation, however further studies are required to probe the effect of yeast and azolla in increasing the carcass weight.

Quails which received organic chromium at 1000 ppb level had increased New York dressed weight and eviscerated weight. The difference in weight of heart, gizzard, giblet, back and breast muscles were not significant between treatment groups. Whereas, highest weight of thigh and drumstick (49.84±1.11) was observed in chromium 1000 ppb of chromium with yeast supplemented group than control.

Table 1: Carcass characteristics of Japanese quails as influenced by different sources and different levels of chromium (Mean±S.E) at six weeks of age

Carcass traits (g)	Inclusion of dietary chromium (Cr) levels in feed							F-value
	T1 (control)	T2 (500 ppb of Cr with Azolla)	T3 (1000 ppb of Cr with Azolla)	T4 (500 ppb of Cr with Yeast)	T5 (1000 ppb of Cr with Yeast)	T6 (500 ppb of Inorganic Cr)	T7 (1000 ppb of Inorganic Cr)	
Live weight	197.25^{c}±5.73	206.28^{bc}±6.12	226.06^{a}±7.34	221.37^{ab}±4.15	228.37^{a}±3.78	193.87^{c}±6.51	220.31^{ab}±5.39	6.098^{**}
New york dressed weight	182.34^{c}±5.46	191.34^{bc}±5.90	211.75^{a}±7.37	204.63^{ab}±3.95	215.25^{a}±3.60	176.28^{c}±5.39	205.53^{ab}±4.99	7.796^{**}
Eviscerated weight	152.56^{bc}±3.82	153.87^{bc}±5.62	171.12^{a}±5.79	163.50^{ab}±3.48	171.19^{a}±3.50	148.53^{c}±5.29	170.62^{a}±4.97	4.315^{**}
Back &Breast	71.30±1.87	65.94±2.78	72.59±2.91	70.72±1.77	72.69±1.55	66.94±2.10	70.31±2.90	1.294^{NS}
Thigh &Drumstick	45.81^{ab}±1.23	43.44^{bc}±1.37	46.97^{ab}±1.51	47.44^{ab}±0.91	49.84^{a}±1.11	40.94^{c}±1.03	48.81^{a}±1.83	5.514^{**}
Wings	8.22±0.45	8.25±0.46	7.97±0.42	8.34±0.42	8.28±0.36	7.41±0.38	8.22±0.34	0.633^{NS}
Heart	1.81±0.11	1.75±0.07	1.59±0.08	1.75±0.10	1.78±0.09	1.59±0.09	1.62±0.09	0.954^{NS}
Liver	5.31^{bc}±0.21	5.19^{bc}±0.15	5.66^{ab}±0.28	5.22^{bc}±0.20	6.13^{a}±0.18	4.66^{c}±0.24	5.59^{ab}±0.25	4.278^{**}
Gizzard	4.69±0.23	4.78±0.17	5.28±0.17	4.97±0.19	5.25±0.20	4.66±0.22	5.09±0.19	1.660^{NS}
Giblet	11.81±0.33	11.69±0.32	12.53±0.45	11.81±0.36	13.16±0.32	10.90±0.48	12.31±0.42	3.410^{NS}
Neck	4.44^{ab}±0.24	5.53^{a}±0.28	6.13^{a}±0.30	5.84^{a}±0.22	6.28^{a}±0.21	4.38^{ab}±0.32	6.06^{a}±0.22	9.125^{**}
Ready to cook yield	164.38^{bc}±3.86	165.56^{bc}±5.72	183.66^{a}±5.92	175.31^{ab}±3.38	184.34^{a}±3.41	159.44^{c}±5.60	182.94^{a}±5.17	4.676^{**}

Mean values bearing same superscript in rows did not differ significantly; NS-Non Significant; ** Highly significant ($p<0.01$)

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