CONCENTRATION OF CHROMIUM IN EGG YOLK AND MEAT OF JAPANESE QUAILS IN RESPONSE TO DIETARY CHROMIUM SUPPLEMENTATION

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An experiment was conducted to study the concentration of chromium in egg yolk and meat of Japanese quails. A total of 700 day old Japanese quail chicks were randomly divided into seven treatment groups with four replicates consisting of 25 chicks in each replicate. The feed supplemented with inorganic chromium, organic chromium (chromium with azolla and chromium with yeast) at 500 and 1000 ppb levels and a control diet without chromium supplement fed to quails from day old to fourteen weeks of age. At six week of age, twelve birds from each replicate were selected randomly and slaughtered. Meat samples were collected for chromium analysis. Totally eight eggs from each treatment were collected during 14 weeks of age for analyzing the chromium content. Significantly higher chromium content was noticed in egg yolk (17.63 ± 0.65 ppb) and meat (6.37 ± 0.69 ppb) of Japanese quails fed with 1000 ppb of chromium enriched yeast diet. A very less chromium concentration was observed in inorganic chromium supplemented group.

Key words: Egg yolk, Inorganic chromium, Meat, Organic chromium, Quails

Japanese quail is a domestic economic species for commercial egg and meat production. Nutrition is one of the most important factors required to maintain quails in good physical condition and to obtain normal growth and egg production. The popularity of quail eggs has increased in India due to some belief in its medicinal

value (Punya Kumari *et al.*, 2008). Chromium is an essential nutrient for animals. 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

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stresses. Chromium is an essential element required for carbohydrate, lipid, protein and nucleic acid metabolisms, activating certain enzymes and stabilizing proteins and nucleic acids (Khan *et al.*, 2014). The beneficial effect of chromium in human health is well documented for its role as an integral component of the glucose tolerance factor (GTF) which participates in glucose metabolism by enhancing the effects of insulin (Kroliczewska *et al.*, 2004). Supplemental dietary chromium is recommended by NRC (1997) for animals under environmental stress. Intake of 50-200 ppb of trivalent chromium is recommended for adult humans (NRC, 1989).

A total of 700, day old Japanese quail chicks were randomly divided into seven treatments with four replicates consisting of 25 quail chicks in each replicate. They were fed with different levels of chromium supplemented feed from day old to six weeks of age. The experimental treatment groups as follows:

- T₁ (Control group) -No chromium supplementation in Japanese quail feed
- T₂ Group - Japanese quail feed with chromium enriched azolla (500ppb chromium)
- T₃ Group - Japanese quail feed with chromium enriched azolla (1000ppb chromium)
- T₄ Group - Japanese quail feed with chromium enriched yeast (500ppb

chromium)

- T₅ Group - Japanese quail feed with chromium enriched yeast (1000ppb chromium)

- T₆ Group - Japanese quail feed with inorganic chromium (500ppb chromium)

- T₇ Group - Japanese quail feed with inorganic chromium (1000ppb chromium)

Japanese quails were fed with pre-weighed feed during the experimental period as per different treatment groups. The iso-nitrogenous and iso-caloric experimental diets were prepared at Central Feed Technology Unit, Kattupakkam, Tamilnadu and fed to the birds. 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. The chromium level in the azolla and yeast were analysed using Atomic Absorption Spectrophotometry (PerkinElmer – PinAAcle 900H) and the inclusion level was fixed based on their chromium content.

The meat samples for analyzing the

chromium content were collected during slaughter study at six weeks of age and analysed by using AAS. Total eight eggs from each treatment were collected during 14 weeks of age for analysing the chromium content of eggs. 750 mg of fresh meat/ egg samples were weighed in a 75 mL digestion vessel of PerkinElmer Titan MPS. 10 mL of concentrated nitric acid (70%) was added. The contents were mixed and kept in a microwave for digestion after ten minutes. The temperature program used for digestion includes 170°C for five minutes followed by 200°C for 20 minutes and 50°C for ten minutes at 30 pound pressure. The digestion vessel was opened after 20 minutes. The standard chromium solutions were prepared in different concentrations

and analysed their chromium content by using Atomic Absorption Spectrophotometry (PerkinElmer – Pin AAcle 900H). Then the digested meat and egg samples were estimated for chromium content at 425.4 nm.

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).

The mean values of chromium concentration in egg yolk and meat of Japanese quails as influenced by different sources and different levels of chromium are presented in Table 1.

Table 1. Chromium concentration (ppb) in egg yolk and meat of Japanese quails

Treatments	Egg yolk	Meat
T1	0.00 ^d	0.00 ^e
T2	11.00 ^b ±0.74	1.75 ^d ±0.32
T3	12.38 ^b ±0.24	3.00 ^c ±0.46
T4	16.25 ^a ±0.32	4.75 ^b ±0.74
T5	17.63 ^a ±0.65	6.37 ^a ±0.69
T6	1.13 ^{cd} ±0.31	0.00 ^e
T7	2.25 ^c ±0.66	0.00 ^e
P- value	224.760 ^{**}	43.325 ^{**}

Mean values bearing same superscript in columns did not differ significantly

^{**}p<0.01

The results revealed significantly higher incorporation of chromium in egg yolk and meat in organic chromium with yeast supplemented group at 500 and 1000 ppb levels followed by organic chromium with azolla supplemented group. Significantly ($p < 0.01$) higher chromium content was noticed in egg yolk (17.63 ± 0.65 ppb) and meat (6.37 ± 0.69 ppb) of Japanese quails fed with 1000 ppb of chromium enriched yeast diet. Chromium content was very low in inorganic chromium supplemented group compared to organic chromium supplemented group. Among organic chromium supplemented groups quails fed with organic chromium with yeast had higher chromium content in egg yolk and meat and it was in accordance with Eseceli *et al.* (2008) who reported 37.6 to 44.6 μg of chromium content in egg yolk of laying hens. When the level of chromium increased in the diet the transfer rate of chromium in the egg and meat also linearly increased. Chromium content of egg and meat of chromium with azolla treatment group was found to be lower than chromium with yeast supplemented group. However, ten times higher retention of chromium in the egg was noticed in chromium with azolla supplemented group than inorganic chromium supplemented group. No chromium was found in the meat of Japanese quails supplemented with

inorganic chromium in the diet.

Meluzzi *et al.* (1996) reported that very high doses of inorganic chromium resulted in low transfer rate of chromium in the hens. Similarly, Piva *et al.* (2003) and Rajendran *et al.* (2012) also reported that when the hens were supplemented with chromium chloride in the diet it did not influence the chromium content of egg.

Chromium content in egg yolk and meat of Japanese quail was higher in organic chromium supplemented group than inorganic chromium supplemented group as observed in this study. This might be due to the fact that, organic chromium is absorbed more efficiently than inorganic chromium chloride. Trivalent chromium is added as dietary supplement as it is an essential nutrient for most food producing animals and assumed to be safe and non toxic. However, Olufemi and Bosede (2011) reported that human consumption of birds fed with chromium chloride supplemented diets up to 0.25 mg/Kg was safe. Extensive research works may be carried out for studying the chromium enriched poultry products on the beneficial effects of health conscious consumers.

Better efficiency is observed in organic chromium supplementation.

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