The Pharma Innovation Journal 2022; SP-11(12): 879-881

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(12): 879-881

www.thepharmajournal.com
Received: 16-09-2022
Accepted: 17-10-2022

T Sathyabama
Assistant Professor, Dept. of Veterinary Physiology, VC & RI, Namakkal, Tamil Nadu, India

A Kirubakaran
VUTRC, Erode, Dept. of Veterinary Pharmacology & Toxicology, VC & RI, Namakkal, Tamil Nadu, India

A Jagadeeswaran
Dept. of Veterinary Pharmacology & Toxicology, VC & RI, Namakkal, Tamil Nadu, India

Corresponding Author:
T Sathyabama
Assistant Professor, Dept. of Veterinary Physiology, VC & RI, Namakkal, Tamil Nadu, India

Influence of nano chromium on egg shell and yolk mineral content in egg type chickens

T Sathyabama, A Kirubakaran and A Jagadeeswaran

Abstract
In the present study, the influence of dietary Nano chromium (Nano Cr) on egg mineral contents of egg type chicken was studied. A total of 240, twenty two weeks old layer chickens (Babcock) were divided into 5 treatment groups (T_1, T_2, T_3, T_4 and T_5) with four replicates of twelve chicks in each. The birds were reared under standard management conditions for 12 weeks. T_1 did not receive Cr and acted as control. T_2 and T_3 groups were fed dietary inorganic chromium chloride, while T_4 and T_5 fed Nano Cr at 200 µg and 400 µg per kg feed, respectively. Eggs collected at the end of the study period were used for egg yolk and shell mineral content analysis. Based on the data obtained, it was concluded that Nano Cr supplementation at 400 µg per kg layer diet, improved the zinc content in egg yolk and shell, and chromium and calcium content in egg shell alone.

Keywords: Nano chromium, chromium chloride, mineral content, egg shell, egg yolk, egg type chickens

Introduction
Chromium (Cr) is one of the trace mineral elements and its supplementation brings about a new interest in trace mineral nutrition, because it improves nutritional quality of poultry meat and egg. As the intake of Cr is usually low through feed ingredients and diets, attention of researchers is being focused for exploring the possible beneficial aspects of Cr supplementation on biological activities, body composition and health of animals including birds and humans. The National Research Council (NRC 1997) [3] has not given any recommended level for Cr supplementation in chicken diet. The market demand for poultry products has been increasing at an alarming pace and so is the pressure on the industry to increase production. Various mineral supplements have been tested successfully as feed additives and water medications, but with little-to-high unwanted actions on the human body. Many evidences have supported that Cr supplemented diets have many beneficial effects viz., improving nutrient digestion and consumption, enhancing food metabolism, immune responses, positive effects on egg quality, potent antioxidant, cholesterol lowering activity and helping retention of other essential elements in the body (Shabana *et al*., 2014) [6].
The present work was designed to study the influence of dietary Nano chromium on egg mineral content in egg type chickens.

Materials and Methods
Two hundred and forty, twenty two weeks old layer chickens (Babcock) raised in well ventilated elevated two-tier cage system were divided into 5 treatment groups (T_1, T_2, T3, T^4 and T5) under uniform standard management practices for 12 weeks. The layers were randomly allotted to five experimental groups each with four replicates and twelve chicks in each replicate. Feed (110 g/day) and *ad libitum* water was provided in the biological trial. The inorganic chromium and Nano Cr - 99 per cent Chromium Nanoparticles of 35-50 nm size (TEM) were purchased from Sigma Aldrich, USA. A completely randomized design was followed as shown below.

Egg collection and Mineral content Analysis
Egg were collected at the final period were used for egg yolk and shell mineral content analysis. The concentration of chromium, zinc, copper, iron, calcium and phosphorus were estimated in the basal feed, egg yolk and egg shell samples of the experimental birds. For analysis of chromium and zinc, the methodology suggested by Perkin Elmer Inc. (Germany) was followed in the atomic absorption spectrophotometer using graphite and flame technique with slight modifications.

Standard methods of AOAC (2005) [1] were used to determine copper (method 947.03), iron (method 944.02), calcium (method 927.02) and phosphorous (method 964.06) in the samples. The experimental data were analysed as randomised complete block design (Snedecor and Cochran, 1994) [8]. Statistical significance was determined at 5% probability level.

Results

The Mean (±SE) mineral (µg/g dry mater) content in egg yolk and shell of egg type chicken (34 weeks) were shown in Table1.

Treatment	Replicates	Birds/ replicate	Birds/ treatment	Duration
T_1 (Basal diet)	4	12	48	22-34 weeks of age (12 weeks)
T_2 (Basal diet +inorganic Cr chloride 200 µg /kg)	4	12	48	
T_3 (Basal diet + inorganic Cr chloride 400 µg /kg)	4	12	48	
T_4 (Basal diet + Nano Cr 200 µg /kg)	4	12	48	
T_5 (Basal diet + Nano Cr 400 µg/kg)	4	12	48	

Table 1: Mean (±SE) minerals (µg/g dry mater) content in egg yolk and shell of egg type chickens (22-34 weeks) fed inorganic and Nano chromium

Treatment	Chromium		Copper		Zinc		Iron		Calcium		Phosphorus	
	Yolk	Shell	Yolk	Shell	Yolk	Shell	Yolk	Shell	Yolk	Shell	Yolk	Shell
T1-Basal diet	0.151±0.031	0.157^{a}±0.072	0.912±0.67	3.20±0.41	18.39 ^{a} ±1.30	3.89^{a}±0.69	29.34±1.54	50.34± 1.37	0.153± 0.51	28.23^{a}± 1.15	0.514± 0.60	0.048± 0.51
T2- Basal diet+200 µg inorganic Cr / kg	0.154±0.010	0.169^{a}±0.091	0.907±0.58	2.95±0.35	18.26 ^{a}±1.27	4.19^{a}±1.87	28.70±1.48	50.11± 1.24	0.151± 0.31	28.50^{a}± 0.44	0.481± 0.24	0.048± 0.42
T3- Basal diet+400 µg inorganic Cr / kg	0.153±0.018	0.180^{a}±0.084	0.912±0.53	3.29±0.55	18.81 ^{a}±0.89	4.21^{a}± 0.64	28.80±1.31	51.16± 1.80	0.146± 0.42	28.67^{a}± 0.27	0.504± 0.43	0.052± 0.83
T4- Basal diet+200 µg Nano Cr / kg	0.164±0.022	0.212^{b}±0.081	0.911±0.53	3.22±0.65	20.82^{ab}±0.87	5.18^{b}± 1.96	30.57±0.98	52.14± 0.89	0.147± 0.57	29.67^{b}± 0.82	0.521± 0.25	0.051± 0.95
T5- Basal diet+400 µg Nano Cr / kg	0.170±0.008	0.254^{c}±0.112	0.909±0.91	3.30±1.02	22.31 ^{b}±0.90	5.81^{c}± 1.27	32.73±1.73	53.91± 1.53	0.153± 0.26	30.63^{b}± 0.37	0.526± 0.60	0.053 ± 0.64

*Means with similar superscripts within each column do not differ significantly; (N = 12)

Mineral content in basal and experimental feed

The estimated concentration of chromium(Cr), zinc(Zn), copper (Cu) and iron (Fe) in the basal layer diet (T1) were 0.509 µg, 100 mg, 20 mg and 110 mg per kg feed respectively. The analysed calcium (Ca) and phosphorus (P) were 4.14 and 0.43 per cent DM basis.

The supplemented chromium level in the experimental groups was 0.639 µg, 0.931 µg, 0.845 µg and 1.241 µg per kg feed in T2, T3, T4 and T5 respectively.

Mineral content in egg shell

In the present study, dietary supplementation of Cr did not influence copper, iron and phosphorus mineral levels in egg shell.

The chromium content in egg shell was significantly ($p \leq 0.05$) increased by Nano Cr at 400 µg followed by Nano Cr at 200 µg, while the calcium content in egg shell were significantly ($p \leq 0.05$) increased by Nano Cr at both the levels used than inorganic Cr. There was no significant difference between inorganic Cr and control groups in chromium and calcium analysis.

The analysis of zinc content in egg shell was higher in Nano Cr at 400 µg than Nano Cr at 200 µg and inorganic Cr supplements.

Mineral content in egg yolk

In the present study, the egg yolk mineral content *viz.*, chromium, copper, calcium, phosphorous and iron were not influenced ($p \leq 0.05$) by dietary supplementation of Cr as revealed by the analysis of variance.

The zinc content in yolk was significantly ($p \leq 0.05$) higher by Nano Cr at 400 µg followed by Nano Cr at 200 µg than inorganic Cr compared to control group.

Discussion

Mineral content in basal and experimental feed

The mineral analysis of both the basal and experimental feed, revealed that the concentration of Cr from both inorganic and Nano Cr sources were adequately included as per the required supplemented level of 100 and 200 µg per kg.

Literature on the influence of Cr supplementation on egg mineral content in egg type chicken is scanty.

Mineral content in egg shell

The findings of our study concur with Yenice *et al.* (2015) [9], who reported that Cr and Zn concentrations were increased by the addition of organic than inorganic Cr source and on the contrary, Sirirat, *et al*. (2013) [7] recorded only Ca accumulation in shell of laying hens that received trace mineral mixture and NanoCr respectively.

Mineral content in egg yolk

The observed effect of Cr supplementation on yolk minerals content concurred with those of Mabe *et al.* (2003) [2] who reported that hen diets containing trace minerals, namely Cr, Zn, and Cu and the source (organic or inorganic) of trace mineral supplementation did not affect the yolk minerals content.

The increased zinc concentration observed in the present work agreed with Sahin *et al*. (2004) [6] who reported that Zn together with Fe and Cr increased in yolk of quails that received organic chromium picolinate at 8 mg/kg diet.

The present study revealed that the nanoCr supplementation retained the minerals to a higher level which might be due to higher absorption efficiency of nanoCr than Cr chloride (Zha *et al*. 2007) [10].

It has also been reported that in stressed mice, loss of Zn and Fe was reduced by organic chromium picolinate supplementation (Schrauzer *et al*. 1986) [5]. The present result corroborated with the earlier finding and also indicated that Cr supplementation might help in reducing the level of supplementation of Zn, Fe, Ca and P in diet which might lead to better economic returns.

Conclusions

Based on these results, it was concluded that Nano Cr at 400 µg per kg feed improved the retention of Cr, Ca and Zn in egg shell, and Zn in egg yolk of egg type chicken.

Acknowledgement

The authors sincerely acknowledge the support and facilities provided by Tamil Nadu Veterinary and Animal Sciences University for the conduct of this study.

References

1. Association of Official Agricultural Chemists, AOAC. Horwitz, W. Official methods of analysis. Washington, DC: Association of Official Analytical Chemists; c1975. p. 222.
2. Mabe I, Rapp C, Bain, MM, Nys Y. Supplementation of a corn-soybean meal diet with manganese, copper, and zinc from organic or inorganic sources improves eggshell quality in aged laying hens. Poultry Science. 2003;82(12):1903-1913.
3. National Research Council. NRC. The Role of Chromium in Animal Nutrition; c1997.
4. Sahin K, Onderci M, Sahin N, Gursu MF, Vijaya J, Kucuk O. Effects of dietary combination of chromium and biotin on egg production, serum metabolites, and egg yolk mineral and cholesterol concentrations in heat-distressed laying quails. Biological trace element research. 2004 Nov;101(2):181-192.
5. Schrauzer GN, Shrestha KP, Molenaar TB, Mead S. Effects of chromium supplementation on food energy utilization and the trace-element composition in the liver and heart of glucose-exposed young mice. Biological Trace Element Research. 1986 Mar;9(2):79-87.
6. Shabana N, Kuldeep D, Mani S, Ruchi T, Jeon G, Laudadio V, *et al*. Modes of action and beneficial applications of chromium in poultry nutrition, production and health: A review. International Journal of Pharmacology. 2014;10(7):357-367.
7. Sirirat N, Lu JJ, Hung ATY, Chen SY. Lien TF. Effects different levels of nanoparticles chromium picolinate supplementation on growth performance, mineral retention, and immune responses in broiler chickens. Journal of Agricultural Science. 2012 Dec 1;4(12):48-51.
8. Snedecor GW, Cochran WG. Statistical methods. Edn; c1994. p. 8.
9. Yenice E, Mizrak C, Gültekin M, Atik Z, Tunca M. Effects of organic and inorganic forms of manganese, zinc, copper, and chromium on bioavailability of these minerals and calcium in late-phase laying hens. Biological trace element research. 2015 Oct;167(2):300-307.
10. Zha LY, Wang MQ, Xu ZR, Gu, LY. Efficacy of chromium (III) supplementation on growth, body composition, serum parameters and tissue chromium in rats. Biological Trace Element Research. 2007;119(1):42–50.