Effects of zinc supplementation on laying performance of hens

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ABSTRACT: The effect of different supplemental sources of Zinc (Zinc Oxide (ZnO), Zinc Sulphate ($ZnSO_4$), Zinc Carbonate ($ZnCO_3$) and Zinc Proteinate (ZnP)) was investigated in laying hensl. Diets were formulated to include in which Zn in each diet was supplied at 140mgKg^{-1} diet. Significant (P<0.05) differences were recorded among the treatment means in final body weight, feed intake, egg production and feed conversion ratio. Birds on the control diet significantly (P<0.05) consume more than the birds on ZnP and other inorganic Zn sources. Birds on ZnP supplemented diet recorded significantly (P<0.05) higher egg production, this was however similar to the group fed $ZnSO_4$ supplemented diet. For better laying performance, 140 ppm of Zn in bioplex form (Zn protenieate) was recommended for laying chickens.

INTRODUCTION

Zinc is a trace element that is necessary for normal growth, maintenance, bone development, feathering, enzyme structure and function, and appetite regulation for all avian species (Batal *et al*., 2001). NRC(1994) recommended between 29-44mgZn/kg for laying strains of leghorn type chickens, which appeared to be based on the results that considered laying performance as the only criterion. Higher Zn supplementation was found to be beneficial (Bartlett and Smith, 2003). Currently there are two inorganic feed-grade zinc sources commercially used by the poultry feed industry: zinc oxide (ZnO: 72% Zn) and zinc sulfate monohydrate (ZnSO4·H2O: 36% Zn). Therefore, the present study was undertaken to study the effect of different source of higher Zn supplementation on laying performance and egg quality of laying hens at early laying age without inducing molting.

MATERIALS AND METHODS

Experimental Diets and Design

A total 360 (Point of lay) Brown Yaffa strain hens were allotted to 6 dietary treatment groups replicated thrice. The control group was fed basal diet without Zn supplement. Basal diet (control) was formulated to meet NRC (1994) requirements and was supplemented with Zinc oxide, Zinc sulphate, Zinc carbonate, Zinc chloride (Sigma Chemical, St! Louis, M.O.) and Zinc proteinate (Bioplex Copper, Alltech, Nicholasville, KY) respectively to supply 140mgZn/kg of diets. Each of the six dietary treatments was fed to triplicate groups of chickens for ten weeks. The composition of the basal diet in percentage are: Maize 49.00,Soyabean11.00,Wheat offal 12.00, Groundnut cake 9.64, Palm kernel cake 5.00, Fish meal 1.50 ,Bone meal 2.50,oyster shell 8.5, Salt 0.30, Lysine 0.15, Methionine, 0.16 and Vitamin/mineral premix without zinc 2.5 respectively. The basal diet supplied 2598kcal ME per kg, 17.5% crude protein, 7.5% fibre, 3.8% Ca, 0.9% P and 35mg Zn per kg of diet. Experimental birds were kept in a standard battery cage with automatic nipple drinkers and standard feeding trough. All recommended health and management practices were strictly observed. Statistical analyses (ANOVA) were performed using General Linear Model (GLM) procedure of SAS (1985). Significant differences between treatment means were determined at P<0.05 using Duncan's new multiple range tests.

RESULTS AND DISCUSSION

No significant difference was noticed in the initial body weight and the feed per dozen egg laid (Table 1). Zn supplementation significantly influenced the values of final body weight, feed intake,

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hen day egg production and feed per kilogram egg laid (Table1). The mean final body weight was significantly lower in the control and $ZnCl_2$ group than the rest of other treatment groups. However there was no weight loss but weight gain across treatment groups as body weight loss in hens has been directly associated with decreased muscle weight, decreased liver weight, decreased use of adipose tissue, involution of the reproductive tissue, and greater reproductive regression (Brake and Thaxton, 1979). The body weight loss has also been identified as a major factor contributing to the induced molting because body weight loss has influence on the successful results of an induced molting procedure. Hens fed the control diet had significantly ($P < 0.05$) greater feed intake (145.0 g/bird/day) than did hens fed diet supplemented with 140mg/kg zinc in the form of Zn proteanate or inorganic Zn salts. However, there was no significant ($P > 0.05$) difference in feed intake (129 to 139 g/bird/day) between hens fed Zn supplemented feeds (Table1). There were approximately 5 -11% reduction in feed intake of Zn supplemented fed hens when compared to the feed intake of hens fed non-supplemented control layer ration. Similar feed intake reduction was seen by Shippee *et al*. (1979). The reduced feed intake could be due to appetite depression or low palatibility of high levels of zinc (Fox, 1989). It has also been reported that the reduced feed intake could be due to the ability of zinc cation (Zn^{2+}) to induce follicular atresia and halt egg laying (Shippee *et al*., 1979). It is likely that the efficiency of dietary zinc treatments was directly related to the suppression of feed intake.

Hen day egg production was significantly highest in the Zn Proteinate group which was statistically similar with $ZnSO_4$ group. Lowest hen day production was noticed in the control group and was statistically the same with those obtained for ZnO, $ZnCl_2$, and $ZnCO_3$ groups. The result suggest that Zn from Proteinate group and $ZnSO_4$ have a different effect on reproduction organs that was distinct from that of ZnO, $ZnCl_2$, and $ZnCO_3$. Feed conversion efficiency in terms of feed per dozen egg laid was optimum in the ZnP treatment group. However Scott and Creger (1976) reported that the 20,000 ppm (2%) of zinc as zinc oxide stopped a egg production completely within 5 days. Shippee *et al*. (1979) found that the addition of 10,000 ppm (1%) zinc as either zinc oxide or zinc acetate to the layer ration for 14 days caused hen day egg production to decline form 60 to 0% in 6 days. Berry and Brake (1985) noticed cessation of ovulation when hens were fed high concentrations of zinc which was also linked to effectiveness of zinc at high concentrations to a depress feed intake. However, Breeding *et al*. (1992) reported that the moderate dietary concentrations of zinc (≤2,800 ppm) were sufficient to suppress hen reproduction systems.

Table 1. Effects of Zinc salts supplementation on the performance of commercial laying hens

	Level of Zinc (140mg/kg)					
Parameters	Control	ZnCl2	ZnSO4	ZnO	ZnCO	ZnP
Initial weight, kg/hen	1.76 ± 0.09	1.76 ± 0.09	1.73 ± 0.19	1.76 ± 0.12	1.87 ± 0.13	1.93 ± 0.07
Final weight, kg/hen	1.85 ± 0.07^{b}	1.90 ± 0.09^{a}	1.92 ± 0.19^{a}	1.85 ± 0.07^{b}	1.91 ± 0.14^{a}	1.95 ± 0.09^{a}
Feed intake, g/ day	145 ± 0.00^{a}	135 ± 0.00^{b}	130 ± 0.06^{b}	139 ± 0.05^{b}	137 ± 0.00^{b}	129 ± 0.00^{c}
Zn intake, mg/birc	355.25 ± 7.24^{b}	1653.75 ± 12.7^{a}	1592.50 ± 8.11^{a}	1702.55 ± 16.15^{a}	1677.45 ± 13.37^{a}	1580.05 ± 7.22^{a}
Hen day, %	66.29 ± 11.45^{b}	68.15 ± 4.07^{b}	71.59 ± 5.55^{a}	67.12 ± 4.96^{b}	66.49 ± 6.48^{b}	74.19 ± 9.97^{a}
Feed / kg Egg, kg	4.30 ± 0.99	4.21 ± 0.62	3.77 ± 0.421	4.11 ± 0.61	3.97 ± 0.45	3.31 ± 0.28
Feed / dozen egg, kg	3.45 ± 0.75^{a}	3.34 ± 0.23^{ab}	3.10 ± 0.35^{b}	3.20 ± 0.35^{b}	3.20 ± 0.36^{b}	3.00 ± 034^{c}

CONCLUSION

140 ppm of Zn in bioplex form (Zn protenieate) was more appropriate for better laying performance in hens.

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