EFFECT OF FEEDING DIFFERENT LEVEL OF ZINC ON THE GROWTH PERFORMANCE OF BROILERS

STENCLOVA HANA, KARASEK FILIP, STASTNIK ONDREJ, DOLEZALOVA EVA, ZEMAN LADISLAV
Department of Animal Nutrition and Forage Production
Mendel University in Brno
Zemedelska 1, 613 00 Brno
CZECH REPUBLIC

xstenclo@mendelu.cz

Abstract: The experiment was carried out to investigate the effects of feeding different level of zinc (Zn) on feed consumption, weight gain and slaughter weight of broilers. Total of 140 male broiler chicks (Ross 308) were divided into four groups and raised up to 35 days of age. During the trial, control group (control) of birds were given basal diet containing 28 mg · kg^{-1} of total Zn without zinc supplement and other groups were given the diets modified by adding either 20 (Zn20), 40 (Zn40) or 120 (Zn120) mg · kg^{-1} of Zn supplied as zinc oxide. The results show that maximum feed consumption, weight gain and slaughter weight of broilers occurred at a zinc supplement of 20 mg · kg^{-1} (corresponding to about 49 mg total zinc) and this parameters decreased by adding 40 and 120 mg · kg^{-1} of Zn to the basal diet. Differences between these groups were not significant (P>0.05). Chicks fed a non-supplemented basal diet (control) had lower weight gain and slaughter weight than other treatment groups. There was significant difference (P<0.05) between control group and group with zinc supplement of 20 mg · kg^{-1}. Feed conversion ratio was the lowest by added 40 mg · kg^{-1} of zinc and the highest by added 20 and 120 mg · kg^{-1} of zinc.

Key Words: zinc, zinc oxide, broiler, feed consumption, weight gain

INTRODUCTION

Zinc (Zn) is an essential trace mineral, it is a cofactor of more than 200 enzymes and plays a very important role in chick growth, feathering, and immune system and disease resistance. Zinc affects all cellular functions, especially growth and development of organisms (Ao et al. 2011). For broiler chickens, the values for zinc requirements/allowances vary between 35 and 70 mg · kg^{-1} diet and for recommendations between 70 and 140 mg · kg^{-1} diet (EFSA 2014). The NRC (1994) estimates the zinc requirement for broilers at 40 mg · kg^{-1} diet. The technological instructions of Ross 306 recommend to add 110 mg · kg^{-1} of Zn to basal diet. Zinc is added to the diets in inorganic sources (usually zinc oxide, zinc sulphate, zinc chloride) or in organic forms complexed to amino acids, proteins, or carbohydrates. The nutritional value of mineral sources depends on the composition of the diet, concentration in the feed, interactions with other mineral elements, and the bioavailability of the element to the chicks (Star et al. 2012). The inorganic zinc sources are preferred rather than organic ones due to their lower prices. Inorganic mineral sources have been over-formulated to ensure adequate concentration but these high doses may cause antagonism between minerals and present an environmental burden (Ao et al. 2011).

MATERIAL AND METHODS

The experiment was conducted with 140 male chicks of hybrid Ross 308. Chicks were marked by wing tags and housed in the balance cages, each cage had feeders and drinkers. The lighting regime was 18 hours light and 6 hours dark. The room temperature and humidity were managed according to Management Handbook for broilers Ross 308. Temperature and relative humidity was recorded every day. Chicks were given ad libitum access to feed and tap water. The experiment started at 11 days of broiler age and chicks were fattened up to 35 days of age. A basal diet was formulated to be adequate in all nutrients except zinc. Composition of the basal diet is given in Table 1. The feed consumption was

noticed every day. Body weight of each chicks was measured at the start, then twice a week and at the end of the experiment.

Chicks were divided into 4 dietary treatments. Dietary treatments included:
(1) control diet without supplementation of Zn (control);
(2) control + 20 mg · kg^{-1} of zinc (Zn 20);
(3) control + 40 mg · kg^{-1} of zinc (Zn 40);
(4) control + 120 mg · kg^{-1} of zinc (Zn 120).

Table 1 Composition of the basal diet

Ingredient	g · kg^{-1}
Maize	340
Wheat	315
Soybean meal	260
Sunflower oil	40
Vitamin-mineral premix [1]	20
Experimental Zn-premix[2]	20
Chromium oxide	5

[1]Supplied per kilogram of premix: lysine 101.65 g, methionine 135.63 g, threonine 51.22 g, calcium 200 g, phosphorus 98.19 g, natrium 62.89 g, sulphur 0.39 g, chlorine 119.69 g, copper 752.5 mg, iron 3768.6 mg, zinc 44.73 mg, manganese 6046.07 mg, cobalt 11 mg, iodine 47.95 mg, selenium 8.96 mg, vitamin A 680000 IU, vitamin D 250000 IU, vitamin E 2250 mg, K_3 74.8 mg, B_1 206.44 mg, B_2 344 mg, B_6 300.44 mg, B_{12} 1999.2 mg, biotin 11 mg, niacinamid 1793.4 mg, calcium pantothenate 676.2 mg, folic acid 82.8 mg, cholinechlorid 9000 mg
[2] Content different levels of Zn according to the dietary treatments

Data has been processed by Microsoft Excel (USA) and Statistica version 12.0 (CZ). We used one-way analysis (ANOVA). Sheffe´s test was applied to defined statistical differences and differences were considered significant at $P<0.05$.

RESULTS AND DISCUSSION

The total zinc concentration was analysed in each of the experimental diets (Table 2). The basal diet without supplemental zinc contained 28 mg · kg^{-1} of zinc originated only from feedstuffs.

Table 2 Analytical concentration of Zn in dietary treatments

Treatment	Zn (mg · kg^{-1})
(1) Control	28
(2) Zn 20	49
(3) Zn 40	77
(4) Zn 120	164

The effects of different zinc level in this study on daily gain of broilers and total weight gain from 11 d to 35 d of age and slaughter weight are presented in Table 3.

Table 3 Effects of different Zn levels on daily body weight (bw) gain (g/d/broiler), total weight gain (g/broiler) and slaughter weight (g/broiler)

Group	n	Daily bw gain mean(g) ± sd	Total weight gain mean(g) ± sd	Slaughter weight mean(g) ± sd
(1) Control	35	62.47^{a} ± 8.03	1687.54^{a} ± 232.32	1975.66^{a} ± 247.21
(2) Zn 20	35	69.12^{b} ± 8.59	1832.34^{b} ± 268.42	2158.57^{b} ± 242.46
(3) Zn 40	35	67.47^{ab} ± 7.67	1800.66^{ab} ± 220.68	2074.09^{ab} ± 247.94
(4) Zn 120	35	64.21^{ab} ± 8.46	1737.37^{ab} ± 229.99	2040.34^{ab} ± 229.05

Different letters $^{a,b,\ ab}$ in the columns indicate significant differences at a level of $P<0.05$

Feed consumption and feed conversion ratio (FCR) is shown in Table 4.

Table 4 Effects of different levels of Zn on feed consumption of broilers and FCR during the trial

Experimental group	Feed consumption (g/broiler)	Feed conversion ratio
(1) Control	2744	1.63
(2) Zn 20	3000	1.64
(3) Zn 40	2902	1.61
(4) Zn 120	2844	1.64

The results show that maximum feed consumption, daily gain, total gain and slaughter weight of broilers occurred at a zinc supplement of 20 mg.kg^{-1} diet (49 mg · kg^{-1} of total Zn) and decreased by adding 40 and 120 mg · kg^{-1} of zinc to the basal diet (77 and 164 mg · kg^{-1} of total zinc). Differences between these groups were not significant (P>0.05). Huang et al. (2007) fed chickens for fattening diets containing zinc concentrations up to 170 mg for 21 days and observed that maximum feed consumption and weight gain occurred at about 50 mg · kg^{-1} of total zinc. Similarly, Jahanian et al. (2008) observed that in broiler chicks, increasing zinc concentrations from 105 to 145 mg · kg^{-1} diet (by supplementing zinc to a basal diet containing 25 mg · kg^{-1}) for 42 days significantly decreased average feed consumption (EFSA 2014). In the study reported by Ao et al. (2011) chicks were fed the basal diet containing 30 mg · kg^{-1} of zinc and those fed diet with zinc supplement of 12 mg · kg^{-1} had lower feed consumption and weight gain than chicks fed the diet with added 40 mg · kg^{-1} of zinc to the basal diet.

CONCLUSION

In this experiment, different zinc levels were evaluated for their effects on the growth performance of broiler chicks from 11 days up to 35 days of their age. The best results were achieved by a zinc supplement of 20 mg · kg^{-1} diet (49 mg · kg^{-1} of total Zn). There was significant difference (P<0.05) between this group (Zn 20) and control group. Weight gain and slaughter weight were not significantly affected by adding 40 and 120 mg · kg^{-1}of zinc (77 and 164 mg · kg^{-1}of total zinc) in comparison with other treatment groups.

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