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Effect of Zinc Methionine Supplementation on the Growth Performance in Broilers

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A B S T R A C T

Effect of zinc methionine supplementation on the growth performance in Vencobb strain broilers were studied from day old to 42 days. A total 240 broiler chicks were randomly divided into 3 groups. The broilers fed with basal diet were kept as control group (C), T1 group consists of the broilers fed with zinc methionine @ 45mg/kg in basal diet; and T2 group consists of broilers fed with zinc methionine supplementation @ 90mg/kg of basal diet. Body weight was taken from day 1 to day 42 and feed intake, body weight gain and feed conversion ratio (FCR) were recorded from day 7 to 42 on weekly basis. All performance traits showed significantly ($P<0.05$) increasing trend with the advancing age. Zinc methionine supplementation in broilers significantly ($P<0.05$) enhanced body weight, feed intake, average body weight gain and improved FCR. From the present study, it can be concluded that zinc methionine can be used as a diet supplement for increasing the overall performance in broiler chicks during their growth period. Dietary supplementation of zinc methionine @ 45mg/kg is recommended in broilers for overall better performance.

Introduction

The poultry industry is one of the fast growing segments of Indian agricultural sector and therefore, plays a significant role in the Indian economy. From last three decades, poultry industry has made tremendous strides at the rate of 12-15% per annum in India. Today, India is the 18th largest producer of broilers (20th Livestock census, 2019). Among feed ingredients, trace minerals are highlighted, as they are essential for maintenance of physiological metabolism of poultry birds. Trace minerals generally act as a catalyst of wide variety of enzyme systems of the body and therefore, significantly affect growth performance and carcass characteristics. Among the trace minerals, zinc is present in

all cells and participates in a wide variety of metabolic processes. It must be supplemented to the most diets of poultry to meet its nutritional requirements, because of the poor availability of zinc in plant feed ingredients. Zinc is a component of more than 300 different enzymes, transcription factors and cell signaling proteins that maintain the body's normal immune function, cell regulation and differentiation (Saleh, 2017). It is essential for growth, skeletal development and immune competence. Zinc deficiency in poultry has been shown to causes low growth, shortened and thickened legs with an enlarged hock and frizzled feathers.

To negate these effects, poultry diets are routinely supplemented with additional zinc. Traditionally, zinc supplementation in poultry feed was from inorganic sources, in the form of zinc sulfate ($ZnSO_4$) and zinc oxide (ZnO), for reason of cost and availability. In recent years, organic zinc sources have been used progressively due to their potentially higher bioavailability (Salim *et al.,* 2010). It has been documented that organic forms of zinc such as zinc picolinate and zinc methionine are more readily absorbed and bioavailable as compared to inorganic form (Sahin *et al.,* 2005). Zinc methionine (ZnMet) is devoid of free divalent cations for chelation in the intestinal lumen with phytic acid. Therefore, it is metabolized in different methods which facilitate enhanced absorption of zinc (Burrel *et al.,* 2004). In this context, Zinc-methionine could be advantageously incorporated in broilers diet at lower levels as compared to inorganic zinc for apprehending higher zinc higher bioavailability and lower excretion of zinc to the environment (Sunder *et al.,* 2013). Available literature on the effect of zinc methionine on growth performance in broiler chicks is scant. Therefore, the present study was planned to observe the effect of zinc methionine at two different doses on the growth performance in broilers.

Materials and Methods

This study was designed to investigate the effect of various doses of zinc methionine as dietary supplement to assess growth performance in Cobb strain broilers. The investigation was conducted on 240 Cobb strain broilers in their growth phase from day old to 42 days. The experimental birds were divided in three groups. Control group (C): birds falling in this group were given the basal diet with no extra zinc supplementation.

Treatment-1 (T1): birds in this group were supplemented with zinc methionine @ 45 mg/kg of the feed during study period and Treatment-2 (T2): birds in this group were supplemented with zinc methionine @ 90 mg/kg of the feed during study period. The birds were provided formulated ration according to the feeding guidelines of NRC recommendations, 1994 (Table 1). Standard management practices were followed for proper maintenance of the broilers

Parameters studied

Body weight

All the broilers of each replicate group were weighed individually at the start of experiment and then at weekly intervals up to 42 days of age with the help of Mono pan balance and expressed in gram (g).

Feed Intake

Feed consumption of experimental birds under each treatment group was calculated on replicate basis at weekly intervals for six weeks. For the purpose, daily feed offered to different groups was noted. At the end of every week, feed residue and spillage were collected and weighed and their amount was deducted from total feed offered to calculate the net feed intake.

Feed conversion ratio (FCR)

Feed conversion ratio for a particular period was calculated from feed intake and body weight gain of that period by following formulae:

$$\text{Feed conversion ratio} = \frac{\text{Feed consumed (g)}}{\text{Weight gain (g)}}$$

Body weight gain

All the broilers of each replicate group were weighed individually at the start of experiment and then at weekly intervals up to 42 days of age with the help of Monopan balance and expressed in gram (g).Body weight gain was then calculated as difference between final body weight and initial body weight.

For all the observed data in the present experiment, the standard statistical procedures recommended by Snedecor and Cochran (2004) have been followed. The data were presented by showing mean and standard error. The significant differences of values for different parameters studied were assessed by two-way analysis of variance. The data were analyzed under polynomial contrast and Duncan's post hoc multiple comparison at the significance level of 0.05.

Results and Discussion

In the study, it could be seen that weekly body weight and feed intake increased significantly ($P<0.05$) in all the experimental groups of Cobb broiler chicks with advancement of age (Table 2). Feed conversion ratio (FCR) increased significantly ($P< 0.05$) in control group from day 7 to 42; however, body weight gain increased significantly ($P< 0.05$) from day 7 to 28 and then declined on day 35 and then increase was observed on day 42. While in zinc methionine supplemented groups, the body weight gain of broiler chicks increased significantly ($P<0.05$) from day 7 to 21 and then declined on day 28 and again showed increasing trend up to day 42. This might be due to increase in the edible components of broiler chicks accompanied by increase in edible weight and decrease in inedible weight and higher content of muscle tissue which is directly proportionate to age related changes. These findings coincide with the findings of many authors (Ao *et al.*, 2006; Rehman *et al.*, 2008, Sunder *et al.*, 2008; Li *et al.*, 2010), who also observed a linear increase in body weight with advancement of age.

In the study (Table 2), it was found that feed intake and body weight gain of Cobb strain broiler chicks were significantly ($P<0.05$) higher in zinc methionine supplemented groups when values were compared with that of the control group during the entire experimental period. Zn is known to be highly important for correct ossification and mineralization of the bone tissue (Scrimgeour *et al.*, 2007). Depending on the dose, Zn affects bone metabolism and simulates bone-forming processes, it stimulates the synthesis of DNA in osteoblasts and increases bone weight and the concentration of Ca^{+2} ions (Ma and Yamaguchi, 2000). Higher body weight in zinc supplemented groups might be due to increased feed intake and supplementation of zinc methionine which increases the rate of digestion and absorption in small intestine which is attributed to increased intestinal villi and epithelial height which in turn increases the digestion. Karmouz *et al.*, (2011) and Sahoo *et al.*, (2014) found that zinc supplementation was responsible for more than 300 enzymes which increase the activity of main digestive enzymes to work efficiently, thereby increasing the digestive enzyme synthesis in small intestine, which in turn increases the absorption which leads to better performance traits. Zinc intake above

threshold induces intestinal metallothionein synthesis, is the zinc binding protein that is associated with increase zinc absorption. The study corroborated with the findings of Bun *et al.,* (2011) and Zhou *et al.,* (2010). A similar finding was also reported by Abas *et al.,* (2020), who showed that addition of zinc to the broiler chicks resulted in significant ($P<0.05$) improvement of growth performance. In an another finding reported by Tronina *et al.,* (2007) showed that at 21 day, the body weight of chicken receiving zinc oxide was lower by approximately 2% compared to chicken received zinc-glycine; while on 42 day, the birds receiving ZnO had significantly higher body weight than zinc-glycine fed group. Midilli *et al.,* (2014) found that the supplementation with organic and inorganic zinc alone or in combination significantly ($P<0.05$) increased the digestibility of Zn in the male broilers; supplementation of diet with zinc propionate @75mg/kg along with phosphorus or Zinc sulfate@75mg/kg of diet with phosphorus increased the body weight, body weight gain and enhanced the feed conversion ratio in broilers.

However, Iqbal *et al.,* (2011) reported that feed intake of broiler chickens were not significantly influenced by supplementation of zinc irrespective of their sources.

Similarly, Ezzati *et al.,* (2013) observed that 100 mg/kg of zinc in diet has no effect on feed consumption when compared to control. Midilli *et al.,* (2014) also reported same findings in regards to mean feed intake in broilers.

In the study (Table 2), FCR was found significantly ($P<0.05$) higher in control group when compared with zinc methionine supplemented groups. The positive of effect of zinc supplementation on feed conversion ratio may be attributed to the improvement in the nutrient digestibility and efficiency for better utilization of nutrients that enhances the feed conversion ratio.

Zinc has a protective role on the pancreatic tissue against oxidative damage, thus helping the pancreas to function properly including the proper secretion of digestive enzymes, thus improving the digestibility of nutrients and consequently the performance. The findings of Ahmadi *et al.,* (2013) also showed a decrease in FCR at 60 mg / kg supplementation of Zinc oxide nanoparticles.

When comparing between zinc supplemented broiler chicks @ 45mg/kg (T1) and 90 mg/kg of diet (T2), significantly ($P<0.05$) higher body weight was recorded in T2 on day 28 and 35 when compared to T1. Significant ($P<0.05$) difference was observed in feed intake between the group from 21 to 35 day.

While, no significant difference was found between T1 and T2 throughout the experimental period except day 14 in case of FCR and day 28 in case of body weight gain (Table 2).

Bun *et al.,* (2011) conducted a study to investigate growth performance and zinc utilization during the life cycle of broilers when diets were supplemented with various concentrations of zinc from two different sources and found that optimum body weight gain was achieved by 80 mg/kg zinc supplementation, which was in harmony with our results.

Norouzi *et al.,* (2013) investigated the effects of different dietary levels of zinc acetate (0, 30 and 60 mg/kg) on performance traits and blood antioxidant status of broilers under heat stress conditions and found the inclusion of 30 mg/kg zinc resulted in increase in performance traits (body weight gain and the average feed intake).

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