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International Journal of Current Research
Vol. 7, Issue, 05, pp.16536-16539, May, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

EFFICIENCY OF COPPER SULPHATE VERSUS FLAVOMYCIN AS A GROWTH PROMOTER IN BROILER CHICKENS

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ARTICLE INFO

Article History:
Received 05th February, 2015
Received in revised form
02nd March, 2015
Accepted 05th April, 2015
Published online 31st May, 2015

Key words:
Copper, Flavomycin, Protein efficiency ratio, energy efficiency ratio, production efficiency factor and Broiler chicken.

ABSTRACT

An experimental study was carried over a period of 42 days using 160 day-old commercial broiler chicks (Ven Cobb) to study the effect of copper and flavomycin as feed additives on growth promotion in broiler chicken. The birds were divided into four groups with four replicates of ten chicks in each replicate. The treatment (T_1) was control with standard broiler ration and Cu as $CuSO_4$ at 100 ppm, 200 ppm and flavomycin at 10 ppm were supplemented in the basal diet to form treatment 2 (T_2), treatment 3 (T_3) and treatment 4 (T_4) respectively. The chemical composition of T_1, T_2, T_3 and T_4 rations contained 15.43, 106.49, 212.54 and 18.69 ppm of Cu in broiler starter and 12.67, 101.13, 202.72 and 20.20 ppm of Cu in broiler finisher, respectively. The results of the present study revealed that the supplementation of Cu as $CuSO_4$ (100 and 200 ppm) or flavomycin (10 ppm) showed no significant difference among the treatment groups with regard to the feed consumption, body weight gain and feed conversion ratio up to six weeks of age. It was concluded that dietary supplementation of broiler chicken with Cu up to 200 ppm and flavomycin at 10 ppm did not have any adverse effect on protein efficiency ratio (PER), energy efficiency ratio (EER) and production efficiency factor (PEF) in broiler chicken.

***Citation*:** Vasanth, S., Dipu, M.T. Mercy, A.D and Shyama, K., 2015. "Efficiency of copper Sulphate versus Flavomycin as a growth promoter in broiler chickens", *International Journal of Current Research,* 7, (5), 16536-16539.

INTRODUCTION

In the world poultry market, India ranks ninth. Poultry farming in India is a culmination of many years of innovation and ingenuity, in the face of tough circumstances. Moreover, today the industry as a whole, with its enabling of low cost model with increased productivity, is a showcase of success to poultry farmers, breeding companies, integrators like few, across the world. In the event, Animal health nutritionist can see the progress of their peers and review the usefulness of such procedures and practices for their national and international poultry productions. Thus, reduction in feed cost by improving the bird performance is the need of the day for making profit in poultry production. Hence, growth promoters are used in poultry diets by nutritionists to increase the nutrient availability and to decrease the cost of production. Copper is a useful growth promoting agent in broiler chicken between 125 to 250 ppm feedingstuff (Pesti and Bakalli, 1996; Ewing *et al*., 1998; Skrivan *et al*., 2002). Copper is an essential trace element, which plays a vital role in haemoglobin synthesis, connective tissue maturation, nerve function and bone development.

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Antibiotics have been used in livestock and poultry diets ever since its discovery not only as an antibacterial agent, but also as a growth promoter. Flavomycin is a glycolipid antibiotic produced by *Streptomyces* species and is used as a growth promoter in livestock and poultry diets. However, this situation requires seeking of alternatives and Cu has received considerable attention due to its antimicrobial action similar to that of feed antibiotics. The systematic studies comparing the effects of copper and antibiotics are scanty in literature. Hence, this research work was carried out to study growth promotion in broiler chicken and thereby efficiency of feed additive Copper sulphate compared to antibiotic flavomycin.

MATERIALS AND METHODS

An experiment was carried out for a period of six weeks using one hundred and sixty, day-old commercial broiler chicks (Ven Cobb). The chicks were wing banded, weighed individually and randomly allotted to four dietary treatments viz., T_1, T_2, T_3 and T_4. Each group comprised of four replicates of ten birds each. The group T_1 was fed a control ration as per the BIS (1992) and this diet was supplemented with Cu as $CuSO_4$ at 100 ppm, 200 ppm and flavomycin at 10 ppm level in T_2, T_3 and T_4 respectively. The birds were fed with standard broiler starter ration up to 4 weeks of age and finisher ration up to 6

weeks of age. All the rations were made isocaloric and isonitrogenous. Proximate analysis of the broiler starter and finisher rations were done according to the procedures described by AOAC (1990). Standard managemental practices were followed throughout the experimental period. Feed and water were provided *ad libitum*. The production performance of broilers was evaluated for a period of six weeks. The weekly body weight was recorded individually. The feed consumption was recorded weekly, replicate wise. Protein intake (g) of the birds was calculated at weekly intervals based on the data on feed intake and protein content of feed. The Protein Efficiency Ratio (PER) was calculated as grams of weight gain per gram of protein intake. (Osborne *et al.,* 1919).

$$PER = \frac{\text{Weight gain, g}}{\text{Protein intake, g}}$$

The Energy Efficiency Ratio (EER) was calculated based on the data on weight gain and total ME intake (Cheng *et al*., 1997).

$$EER = \frac{\text{Weight gain, g}}{\text{Total ME intake}}$$

The Production Efficiency Factor or European Efficiency Factor (PEF or EEF) was calculated using the formula given below (Lemme *et al*., 2006).

$$PEF = \frac{\text{Final bird wt (kg)} \times \text{livability \%}}{\text{Age in days} \times \text{Feed conversion ratio}} \times 100$$

Data collected were statistically analyzed (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

Chemical composition of rations

The chemical composition of T_1, T_2, T_3 and T_4 rations contained (Table 1) 15.43, 106.49, 212.54 and 18.69 ppm of Cu in broiler starter and 12.67, 101.13, 202.72 and 20.20 ppm of Cu in broiler finisher, respectively.

The percentage of dry matter in starter rations varied between 89.23 and 90.23, ether extract between 1.39 and 1.72 per cent and crude fibre between 2.43 and 2.63 per cent. The total ash, NFE and acid insoluble ash fraction varied from 7.70 to 8.40, 64.40 to 65.37 and 1.40 to 1.80 per cent, respectively. In the finisher rations the percentage of dry matter varied from 90.05 to 90.23, ether extract from 2.32 to 2.56 and crude fibre from 2.46 to 2.55, respectively. The total ash, NFE and acid insoluble ash content varied from 8.05 to 8.40, 66.49 to 66.94 and 2.00 to 2.53 per cent, respectively in the finisher rations. The crude protein and the calculated ME (kcal/kg) of the broiler starter and finisher rations in the present study were in accordance with BIS (1992) recommendations.

Feed consumption

Cumulative feed consumption of birds maintained on different dietary treatments at weekly intervals (Table 2) indicates that there was no significant (P>0.05) difference among treatments. The observation on cumulative feed consumption is in agreement with Ledoux *et al.* (1991) in male Cobb chicks who observed no significant effect on average feed intake when Cu was supplemented at 150, 300 or 450 ppm. Similar results were also reported by Konjufca *et al.* (1997) in Ross male broilers. Similarly, the result obtained for flavomycin supplemented group was in close agreement with the findings of Gunal *et al.* (2006). On contrary, the result of the present study disagrees with the findings of Anjum *et al.* (1992) who observed an improvement in feed intake when broiler chicken were supplemented with Cu at 250 ppm levels.

Feed conversion ratio

The cumulative mean feed conversion ratio (FCR) of birds maintained on different dietary treatments were 1.67, 1.64, 1.64 and 1.64 for treatments T_1, T_2, T_3 and T_4 and the values (Table 2) were statistically similar (P>0.05). This is in agreement with the findings of Ledoux *et al.* (1991) who observed that supplemental dietary Cu at 150, 300 or 400 ppm did not improve FCR in broilers.

Table 1. The chemical composition of T_1, T_2, T_3 and T_4 of broiler starter and finisher rations

Components (% DM basis)	Broiler starter				Broiler finisher			
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
Dry matter	90.23	90.62	90.47	89.23	90.05	90.18	90.06	90.23
Crude protein	23.01	23.06	22.95	22.99	20.09	20.00	19.95	20.16
Ether extract	1.63	1.62	1.72	1.39	2.56	2.32	2.52	2.43
Crude fibre	2.63	2.52	2.62	2.43	2.53	2.46	2.55	2.52
Nitrogen free extract	65.03	64.40	64.64	65.37	66.78	66.94	66.72	66.49
Total ash	7.70	8.40	8.07	7.81	8.05	8.28	8.31	8.40
Acid insoluble ash	1.80	1.69	1.49	1.40	2.09	2.53	2.30	2.00
Calcium	1.28	1.31	1.33	1.25	1.28	1.35	1.29	1.17
Total Phosphorus	0.57	0.54	0.50	0.54	0.51	0.56	0.54	0.56
Copper, ppm	15.43	106.49	212.54	18.69	12.67	101.13	202.72	20.20
ME, kcal/kg*	2800	2800	2800	2800	2900	2900	2900	2900

* Calculated value

Table 2. Performance of broilers supplemented with Cu and flavomycin in diets (0-6 weeks of age)

Parameter	Treatments			
	T_1 (Control)	T_2 (Cu - 100 ppm)	T_3 (Cu - 200 ppm)	T_4 (Flavomycin -10 ppm)
Live weight (g)	2028.83 ± 43.22	2082.55 ± 41.96	2013.43 ± 81.12	2135.35 ± 63.50
Body weight gain (g)	1980.98 ± 43.14	2034.70 ± 42.04	2015.78 ± 48.52	2087.40 ± 63.55
Feed consumption	3813.68 ± 33.50	3842.33 ± 44.65	3834.45 ± 47.33	3950.00 ± 66.76
FCR	1.67 ± 0.02	1.64 ± 0.01	1.64 ± 0.02	1.64 ± 0.04

Likewise, the results of present study do confirm with Wang *et al*. (2007) in broiler chicken. The flavomycin supplementation also did not improve the FCR in broilers which is in agreement with findings of Attia *et al.* (2011) in broiler chicken. On contrary to the present findings, Pesti and Bakalli (1996) and Samanta *et al*. (2011) observed an improved FCR in broilers supplemented with Cu as $CuSO_4$.

Table 3. Protein efficiency ratio, Energy efficiency ratio and Production efficiency factor of birds maintained on different dietary treatments

Parameter	Treatments†				SEM	P value
	T_1	T_2	T_3	T_4		
Protein efficiency ratio (PER)	2.59±0.03	2.65±0.04	2.57±0.08	2.62±0.04	0.05	0.70
Energy efficiency ratio (EER)	13.29±0.53	14.07±0.53	14.73±0.54	14.36±0.22	0.48	0.23
Production efficiency factor (PEF)	249.47±8.49	261.11±8.86	244.84±17.03	267.16±11.72	12.02	0.55

† Mean of forty values with SE

Livability percent

During the course of the experiment only one bird died out of 160, in the group T_3 at fifth week of age. The per cent livability was 100, 100, 97.5 and 100 for T_1, T_2, T_3 and T_4, respectively.

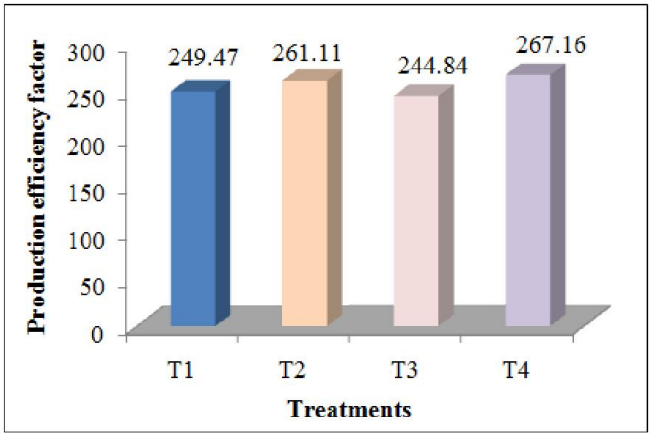

Figure 1. Production efficiency factor of birds maintained on different dietary treatments

Protein efficiency ratio (PER), Production efficiency factor (PEF) and Energy efficiency ratio (EER)

The protein efficiency ratio (PER), production efficiency factor (PEF) and energy efficiency ratio (EER) are presented in Table 3. The mean PER for birds belonging to T_1, T_2, T_3 and T_4 were 2.59, 2.65, 2.57 and 2.62, respectively. The PEF for T_1, T_2, T_3 and T_4 were 249.47, 261.11, 244.84 and 267.16, respectively. The PEF is graphically represented in Fig. 14. The mean EER was 13.29, 14.07, 14.73 and 14.36 for groups T_1, T_2, T_3 and T_4 respectively. From the data on protein efficiency ratio, energy efficiency ratio and production efficiency factor (Table 3 and Fig. 1), it can be seen that there was no significant differences among the four diets in any of parameters studied. As against the results of the present study Awad *et al.* (2008) reported that the addition of Cu as $CuSO_4$ at levels of 100, 300 and 500 ppm improved energy efficiency ratio (EER) in Pekin ducks. Similarly, Abaza *et al.* (2009) also reported higher protein efficiency ratio (PER) in laying Japanese quails when Cu was added to the diet at 100 and 200 ppm levels than that of birds fed control diet. Production efficiency factor (PEF) obtained in the present study for the control group was comparable to that reported by Nasr *et al.* (2011) in broiler chicken.

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