

Short communication

Kaempferol improved growth performance in broiler chickens challenged with *Eimeria tenella*

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Abstract

The study investigated the effects of kaempferol on growth performance in two weeks old broilers challenged with *Eimeria tenella*. Sixty, one-day old broiler chicks were randomly allotted into six groups (I-VI) of ten broiler chicks each and brooded for two weeks with commercial broiler feed (vital feed®) and provided water ad libitum. At two weeks of age, broilers in group I were neither infected nor treated. Broilers in groups II- VI were infected with *Eimeria tenella* sporulated oocyst (10^4 /mL) via oral inoculation. After infection was established, broilers in groups II-IV were treated Per os with 1 mg/kg, 1.5 mg/kg and 2 mg/kg of kaempferol respectively. Broilers in group V were treated for five days with amprolium, 1.25 g/L in drinking water and those in group VI were administered normal saline, 5 mL/kg per os for five days. The experimental birds were examined daily for feed intake (FI), weight gain (WG) and feed conversion ratio (FCR). Data obtained were analyzed using pad prism version 5.0. There was a statistically significant ($p < 0.05$) increase in the mean values of WG, FI and FCR in groups II, III and IV in a dose dependent fashion when compared to VI. There was also statistically significant ($p < 0.05$) reduction in the mean values of WG in Group II and III than in Groups IV and V. Mean WG of Groups IV and V did not differ statistically, but there were statistically higher WG in Group V than in group IV. There were consequent high FCR values of 7.3, 5.71, 5.67, 6.19 and 7.08 for groups I, II, III, IV and V respectively compared to 4.9 for Group VI. Thus, the treatment with kaempferol in two weeks old broilers had ameliorated the effects of *Eimeria tenella* on WG, FI and FCR in this study.

Keywords: Amprolium, *Eimeria tenella*, feed conversion ratio, kaempferol, weight gain,

Introduction

Avian coccidiosis caused by an enteric protozoan parasite from genus *Eimeria*. The major outbreak in most farms is due to *Eimeria tenella* being the most pathogenic species of all *Eimeria* affecting birds (Shirley *et al.*, 2005). The disease is associated with serious economic losses all over the world, and it was estimated to be in excess of \$3 billion dollars annually (Williams, 2006). Ingestion of sporulated oocyst from the environment remains the only means of transmission of the *Eimeria* parasite (Shirley *et al.*, 2005). Following

ingestion, the parasite multiplies in the bird's intestinal tract leading to considerable tissue damage and consequently impaired nutrient absorption, hemorrhagic diarrhea, dehydration, weight loss and oxidative stress (Shirley *et al.*, 2005). The affected birds become more susceptible to other diseases such as necrotic enteritis and colibacillosis, and in severe case of coccidiosis, variable level of mortality could be recorded (Jatau *et al.*, 2017). The drugs and live vaccines against coccidiosis are the two main control measures (Blakes and Tomley, 2014) but

because of increasing rates of drug residue in animal products and widespread of drug resistance as well as high cost of vaccines, the alternative means of control are needed (Jatau *et al.*, 2017). Varieties of dietary supplements are known to enhance host immunity against enteric pathogen (Jatau *et al.*, 2017), as well as reports on *In vivo* efficiency of natural products like flavonoids in the treatment of coccidiosis (Wael *et al.*, 2014) prompted us to conduct this study with aim of determining the effects of kaempferol on growth performance in broilers challenged with *Eimeria tenella*.

Materials and methods

Study area

This research was conducted in the Departments of Animal Health and Production, Binyaminu Usman Polytechnic, Hadejia, Jigawa State, Nigeria (10°02' 28.14" E Longitude and 12°27' 12.49 N Latitude)

Drugs, sources and preparations

Kaempferol was sourced from whitehead scientific (pty) limited, South Africa, it came along with the following details; CAS number (520-18-3), Catalog number (3603), EC number (208-287-6) and batch number (3). Amprolium was purchased from pharmacy unit of the Departments of Animal Health and Production Binyaminu Usman Polytechnic, Hadejia, Jigawa State. The drugs (kaempferol and amprolium) were dissolved in normal saline and administered to each bird according to the body weight.

***Eimeria tenella* isolate**

The *Eimeria tenella* isolate used in this study was obtained from the parasite bank of the Department of Veterinary Parasitology and Entomology, Ahmadu Bello University, Zaria. The oocysts were propagated in two week-old coccidian-free chickens before use. The unsporulated

oocysts collected from the caecal content on the seventh day post-infection was purified and preserved in 2.5% potassium dichromate solution to induce sporulation at 28°C. The sporulated oocysts were kept at 4°C until use.

Experimental birds and grouping

Sixty, one-day old broiler chicks obtained from a reputable hatchery were used in this study. The chicks were randomly allotted into six groups (I-VI) of 10 birds and brooded for 2 weeks on concrete floor (using wood shaven as litter material) under strict biosecurity measures and as routine were adequately vaccinated against Newcastle disease and infectious bursal disease. They were fed with commercial broiler feed (Vital feed®) and water which were provided *ad libitum*.

Experimental infection and treatments

At exactly two weeks of age, birds in Groups II-VI were orally inoculated with 10⁴ sporulated oocysts of the *E. tenella* isolate, and then treated as follows:

Group I: Birds in this group served as non-infected control.

Group II: Birds in this group were treated with 1 mg/kg *Per os* of kaempferol for 5 consecutive days.

Group III: Birds in this group were treated with 1.5 mg/kg *Per os* of kaempferol for 5 consecutive days.

Group IV: Birds in this group were treated with 2 mg/kg *Per os* of kaempferol for 5 consecutive days.

Group V: Birds in this group were treated with 1.25 g/L of amprolium in drinking water for 5 consecutive days.

Group VI: Birds in this group served as infected untreated control.

Determination of feed intake, weight gain and feed conversion ratio

The birds were tagged for identification and weighed individually prior to experimental infection with the *E. tenella* sporulated oocysts. The daily feed given to each group

of birds was weighed and the amount left in the feeders was also weighed at the following day to determine the daily feed intake. At the end of the experiment (5 days post infection), the birds were re-weighed individually. Mean weight gain and feed conversion ratio for each group were determined as described by Holdsworth *et al.* (2004).

Statistical analysis

Data obtained from the study were summarized as means $\pm$ standard error of mean and differences between the means determined at 5% level of significance using the one-way analysis of variance (ANOVA), complimented with post hoc analysis using the Tukey's multiple comparison test.

Results

Table 1: Effects of treatment with kaempferol on growth performance in two weeks old broilers experimentally infected with *E. tenella*

Group	Treatment	Total WG (kg)	Total	
			FI(kg)	FCR
I	untreated control	0.3945 $\pm$ 0.003 ^a	2.91 ^a	7.38 ^a
II	kaempferol 1 mg/kg	0.3484 $\pm$ 0.023 ^b	1.99 ^b	5.71 ^b
III	kaempferol 1.5 mg/kg	0.3733 $\pm$ 0.024 ^b	2.12 ^b	5.67 ^b
IV	kaempferol 2 mg/kg	0.3765 $\pm$ 0.031 ^b	2.33 ^b	6.19 ^b
V	Amprolium 1 g/L	0.3622 $\pm$ 0.032 ^b	2.56 ^a	7.08 ^a
VI	NS 5 ml/kg	0.2341 $\pm$.035 ^c	1.16 ^c	4.96 ^c

Superscripts with different letters differ significantly

Discussion

In the present study, a significant increase in the mean weight gain in kaempferol treated birds (groups II-V) when compared to negative control (group VI, this was possibly due to the inhibition of inflammation in the intestinal mucosa which is suggestive of an increased nutrient absorption across the intestinal wall and enhanced feed conversion ratio (in kaempferol treated birds) (Joyner and Norton, 1983). Nwosu *et al.* (2006) and Biu *et al.* (2012) reported an increased weight gain and feed conversion ratio in birds treated with plant extract rich in flavonoids. Similarly, the general weight loss observed in the infected untreated birds (group VI) when compared to the infected and treated birds (groups II-V) may be due to the gut morphology and truncation of the intestinal villi as a result of injury caused by the invasion and replication of the parasite (Joyner and Norton, 1983) thereby affecting the normal absorption of the

nutrients. Thus, administration of kaempferol had ameliorated the effects of *Eimeria tenella* on weight gain, feed intake and feed conversion ratio in the infected and treated broiler chickens.

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