

Anticoccidial Activity of *Curcuma longa* L. in Broilers

Rao Zahid Abbas^{1*}, Zafar Iqbal¹, Muhammad Nisar Khan¹, Muhammad Arif Zafar² and Muhammad Anjum Zia³

¹Department of Parasitology; University of Agriculture; Faisalabad-38040; Pakistan. ²Department of Clinical Medicine & Surgery; University of Agriculture; Faisalabad-38040 - Pakistan. ³Department of Chemistry; University of Agriculture; Faisalabad-38040 - Pakistan

ABSTRACT

Comparative efficacy of turmeric (*Curcuma longa* L.) crude powder and salinomycin sodium on the occurrence of coccidiosis and growth performance of broiler was evaluated. A total of 90, day-old chicks were randomly divided into six groups. From first day onward, ration was supplemented with 1, 2 and 3 % turmeric powder in groups 2, 3 and 4, respectively, group 1 received salinomycin sodium @ 12 g 50 kg⁻¹ feed while groups 5 and 6 were kept as infected un-medicated and uninfected un-medicated controls. First five groups were infected with *Eimeria tenella* sporulated oocysts @ 1,00,000/chick at the age of 20 days. Body weight gain, feed consumption, feed conversion ratio were investigated throughout the experimental period, and bloody diarrhea and oocysts excretions were investigated at the first and the second week after infection. Maximum coccidiostatic effect was observed with turmeric (3%) showing mild bloody diarrhea as compared to other infected groups receiving turmeric containing rations. This effect was comparable with a standard coccidiostat i.e., salinomycin sodium. Similarly, the weight gain in the groups treated with salinomycin sodium (2280g) and 3% turmeric (2293g) were also significantly higher ($p \leq 0.05$) than that of infected control group (1955g). In the groups treated with ration supplemented with 3% turmeric powder and salinomycin sodium, the peak excretion of oocysts was delayed about 1 or 2 days relative to the control infected group. Concentration-dependent coccidiostatic effect of turmeric suggested that further studies should be carried out to determine the possible maximum safe levels of turmeric with least toxic effects to be used as coccidiostat.

Key words: *Curcuma longa*; Coccidiostat; *Eimeria tenella*

INTRODUCTION

Coccidiosis is one of the most detrimental and lethal managemental disease of poultry. It causes high mortality in affected flocks. Many anticoccidial drugs have been developed and introduced in the poultry industry all over the world. Since Levine (1939) discovered that sulfanilamide cured coccidiosis in chickens, various anticoccidial feed additives, predominantly polyether ionophorous antibiotics, have been

developed and used (Matsuda et al., 1989). While effective for avian coccidiosis, the continuous use and misuse of anticoccidial drugs have led to the emergence of drug-resistant strains (Long, 1982; Ruff and Danforth, 1996).

To prevent the emergence of drug resistant strains, new drugs have been developed and administered on a rotational basis with existing drugs. However, this has resulted in the increased cost of poultry products. Furthermore, drug- or antibiotic-residue in the poultry product is potentially annoyance to

* Author for correspondence: raouaf@hotmail.com

consumer. Therefore, it is sought that the regulations for anticoccidial drugs should be strengthened gradually. Halofuginone was derived from an extract of the *Dichroa febrifuga*. The original extract, febrifugine, was known for antimalarial and anticoccidial activity, but was never marketed because of a very narrow safety margin at the dose of 3 ppm. Other extracts of herbs were known to be effective against parasites, such as malaria, amoeba, trichomonad, arthropods and helminths (Foure and Bennejean, 1974; Klayman et al., 1984; Akhtar and Rifaat, 1985; Jiang et al., 1985; Klayman, 1985; Cooke et al., 1987; Lin et al., 1987; Dutta et al., 1989, 1990; He and Zhang, 1989; Matsuda et al., 1989, 1991; Shuhua and Catto, 1989; Ou-Yang et al., 1990; Quan, 1990).

Curcuma longa L. (Zingiberaceae), commonly known as turmeric, is a medicinal plant widely used and cultivated in the tropical regions. Traditionally, it has been used to treat various diseases/disorders e.g., liver obstruction, jaundice, ulcers, inflammation, dysentery, diabetes, stomach disorders, fresh wounds, insect stings and viral infections including chickenpox and smallpox (Nadkarni, 1976). Plant extracts have been found to have antioxidative (Osawa et al., 1995), antimutagenic (Soni et al., 1997) and immunomodulatory (Antony et al., 1999). A number of pharmacological activities of *Curcuma longa* have been reported which include nematocidal (Kiuchi et al., 1993), anti-inflammatory (Ammon et al., 1993), internal and external injuries (Lans and Brown, 1998) and food additives on aflatoxin-induced mutagenicity and hepatocarcinogenicity (Soni et al., 1997). Information regarding anticoccidial activity of turmeric is very limited. Therefore, the present study was carried out to evaluate the prophylactic effect of turmeric in comparison with salinomycin sodium against avian coccidiosis in broilers.

MATERIALS AND METHODS

Chicken and feed composition

Ninety, 1-day-old broiler chicks were purchased from a local hatchery. The chicks were reared in groups of 15 per cage. In order to prevent the outbreak of newcastle disease (ND), they were

vaccinated at 2-weeks of age with ND oil-emulsion vaccine. Experimental feed manufactured for starters without anticoccidial feed additives was obtained from Nashat Feed Mills Pvt. Ltd. Pakistan. Its composition followed the commercial chicken production manual (North, 1984). Feed and water were offered ad libitum.

Parasite and dose

The strain of *Eimeria tenella* used was developed from the field strain obtained from commercial poultry shops in and around Faisalabad, Pakistan, and was purified by single oocysts infections. The oocysts were preserved in 2.5% potassium dichromate solution to induce sporulation and kept in a refrigerator (2–5°C) until use. Each bird was challenged with 1,00,000 oocysts/chicken of *E. tenella* at the age of 20th day.

Experimental groups

There were six experimental groups and each was having 15 chicks. Different groups of chicks were assigned to various rations with different supplementations from day 1 till end of experiment.

Group 1: Salinomycin sodium (Sacox) @12g per 50 kg feed;

Group 2: Turmeric (*Curcuma longa*) crude powder @ 1%;

Group 3: Turmeric (*Curcuma longa*) crude powder @ 2%;

Group 4: Turmeric (*Curcuma longa*) crude powder @ 3%;

Group 5: Infected unmedicated control;

Group 6: Uninfected unmedicated control.

Evaluation parameters

Efficacy of turmeric powder and salinomycin sodium was evaluated on the basis of body weight gain, feed consumption, feed conversion rates, bloody diarrhea and oocyst counts. The body weight gain of the chicken in each group was determined on weekly basis up to the end of experiment (six weeks). The feed conversion rate of each group was also analyzed on weekly basis. Bloody diarrhea was investigated from 4th to 6th day after the challenge.

The extent of bloody diarrheal score was assigned one of the four degrees, from 0(-) to 3(+++). Zero

was the normal status, whereas 1, 2, and 3 corresponded to 33, 33-66, 66-99% blood in total feces, respectively. Excreted oocysts were counted from 6 to 13 days after infection with *E. tenella*. All the items were investigated according to the method suggested by the previous report (Youn et al., 1993).

Statistical analysis

The results of body weight gain, feed conversion rates and feed intake were analyzed statistically (Steel and Torrie, 1982).

RESULTS

Bloody diarrhea of almost all experimental groups, with the exception of the uninfected control group, was observed from the 4th to 6th day after challenge with *E. tenella*. In the groups treated with rations supplemented with salinomycin sodium, and 2 and 3% turmeric powder, the extent of bloody diarrhea was milder than that observed in other groups (Table 1). The mean values of body weight gain, feed consumption and feed conversion ratio in various groups at different weeks after the treatment are shown in Table 2.

Table 1 - Bloody diarrhea of chickens treated with turmeric and challenged with *Eimeria tenella*.

Groups	Blood in feces (days after infection)				
	3	4	5	6	7
Salinomycin sodium	-	+	+	-	-
1% Turmeric	-	+	++	+	-
2% Turmeric	-	+	++	-	-
3% Turmeric	-	+	+	-	-
Infected control	-	+	+++	+	-
Uninfected control	-	-	-	-	-

Table 2 - Broiler production performance (0-6 weeks).

Groups	Average feed Intake/bird (g)	Average wt Gained/bird (g)	FCR
Salinomycin sodium	4570 ^b	2280 ^b	2.02 ^a
1% Turmeric	4097 ^a	1988 ^a	2.25 ^b
2% Turmeric	4182 ^a	2023 ^a	2.23 ^b
3% Turmeric	4577 ^b	2293 ^b	2.00 ^a
Infected control	4085 ^a	1955 ^a	2.28 ^b
Uninfected control	4582 ^b	2298 ^b	1.99 ^a

Means in each row lacking common superscript differ significantly (p<0.05)

During first three weeks, before inoculation of infection, the body weight gain, feed consumption and feed conversion ratio were not significantly different among the groups. At the end of experiment, the body weight gain in the groups treated with rations supplemented with salinomycin sodium and 3% turmeric powder (2280g and 2293g, respectively) were significantly higher than that of infected group (1955g). The body weight gain in the groups treated with rations supplemented with 1 and 2% turmeric powder (4097g and 2023g, respectively) were relatively,

but not significantly higher than that of infected group. Excreted oocysts in the groups treated with ration supplemented with 1 and 2% turmeric powder (total 90,000 and 82,000/g of feces, respectively) were relatively lower than that of the infected control group (212,000/g of feces). In the groups treated with ration supplemented with 3% turmeric powder and salinomycin sodium, the peak excretion of oocysts was delayed about 1 or 2 days relative to the control infected group (Table 3).

Table 3 - Oocyst excretions from chickens treated with turmeric and challenged with *Eimeria tenella* (x1000).

Groups	Oocyst per gram of feces (days after infection)								
	5	6	7	8	9	10	11	13	Total
Salinomycin sodium	0	15	35	6	3	1	1	0	61
1%Turmeric	0	29	53	3	1	2	1	1	90
2%Turmeric	0	23	44	6	5	2	1	1	82
3%Turmeric	0	19	32	8	4	1	1	0	65
Infected control	0	120	60	25	3	2	1	1	212
Uninfected control	0	0	0	0	0	0	0	0	0

DISCUSSION

The body weight gain, feed consumption and feed conversion rate of all the groups were investigated from 1st to 6th week. After challenge with *E. tenella*, the bloody diarrhea and excreted oocysts of feces were investigated during two weeks. Bloody diarrhea of all the experimental groups, except the uninfected control group were seen during 4-6 days after infection with *E. tenella*. But the extent of bloody diarrhea in the groups treated with ration supplemented with salinomycin sodium and 3% turmeric powder was milder than that of other groups. The body weight gain and feed consumption of all the infected groups were lower than that of uninfected control group. But, the body weight gain and feed consumption of groups supplemented with the rations containing salinomycin sodium and 3% turmeric powder were significantly greater than that of all other infected groups. Also, the body weight gain and feed consumption of groups supplemented with the rations containing 1 and 2% turmeric powder were greater than that of infected group but that difference was not significant. It has been reported that the diets supplemented with the different concentrations of the turmeric were suppressive towards the development of coccidiosis in chickens (Allen et al., 1998). Furthermore, these diets were shown to increase the body weight gain, improve lesion scores and decrease oocysts out put. Oocyst counts were carried out on 5, 6, 7, 8, 9, 10, 11, 13 day after the introduction of infection. The counts were zero in uninfected groups. Large number of oocysts was produced in all the infected groups. However the oocysts count of birds given ration supplemented with salinomycin sodium and 3% turmeric powder was significantly lower than the other groups. The parasite was not completely suppressed by any of the treatments. Flocks given anticoccidial drug in diet remain susceptible to

infection and clinical disease can readily occur at any time (Chapman, 1993). The ionophorus anticoccidial did not work in this case. The reason for this observation could be the resistance caused by ionophorus anticoccidials (Butaye et al., 2000). Sluis (1998) also reported that severity of test exposure is important as resistant to ionophore was often effective with mild coccidiosis but ineffective at moderate or severe exposure. It could be concluded that plants could be a potential source of protection against coccidiosis.

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