



Anticoccidial efficacy of diclazuril on experimentally *Eimeria tenella* infected broiler chickens.

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ABSTRACT

This study was carried out to evaluate the efficacy of diclazuril in control of experimental *Eimeria tenella* infection in broiler chickens. The trial was carried out on 75, day-old broiler chicks as they were divided into 3 main equal separate groups (25 chicks; each). Group (1) was non infected non treated (control positive), group (2) was infected non treated (control negative) and group (3) was infected and treated with diclazuril. Groups (2 & 3) were orally received 1ml of an inoculum containing 100.000 sporulated oocysts of *Eimeria tenella* chick at 14 days of age. Chickens of group (3) were infected and rations were supplemented with diclazuril from 1st day of experiment till the end of experiment (42nd day). This study was assessed by effect of diclazuril on the performance parameters including feed intake, body weight (BW), body weight gain (BWG), feed conversion ratio, feed efficiency ratio and also mortalities in infected and treated chickens. Also, oocyst count (shedding) in the dropping and lesion score was also recorded. The results revealed that group treated with diclazuril showed great and significant improvement in (BW), (BWG) and (RGR) and also revealed the highest reduction in mortalities, lowered number of oocysts and the lesion score, indicating that diclazuril is an effective anticoccidial drug in treatment of *E. tenella* infection in chickens. Group provided with diclazuril gave significant and satisfactory improvement in the assessment criteria when compared with infected non treated group.

Key words: Diclazuril, Coccidia, Efficacy, Broiler chickens.

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1. INTRODUCTION

Coccidiosis is one of the most important parasitic diseases of poultry causing death and impaired development rate in poultry industry (Lee et al., 2007). Conventional control of this problem depends mainly on anticoccidial drugs that are a significant cost to the industry. Moreover, development of resistance in most of the poultry parasites has endangered the economics of the poultry industry (Abbas et al., 2014). Evaluation of any anticoccidial drug is based upon estimation of bird's performance criteria such as growth rate and feed conversion, and parasitological criteria including oocyst shedding and the

presence of pathognomonic intestinal lesions (Champan, 1997). Anticoccidial compounds should be highly effective against all developmental stages of *Eimeria* species, don't effect on the host immune response as well as have no residues in the tissues. In this respect, diclazuril is one of a series of benzenacetone derivatives. The prophylactic anticoccidial efficacy of diclazuril in feed was studied in chickens (Awaad et al., 2003), turkeys (McDougald et al., 1991 and Chapman et al., 2004), pigeons (Vercruyssen, 1990), pheasants (Vanparijs et al., 1990), partridges (Vanparijs et al., 1991) and rabbits (Vanparijs et al., 1989a, d).

The objective of this trial was to investigate the efficacy of anticoccidial drug (diclazuril) on *E. tenella* experimentally infected broiler chickens.

2. MATERIALS AND METHODS

2.1. Chickens:

A total of 75 one-day old unsexed Hubbard chicks with an average body weight of 45-50 gm were obtained from a private farm in Benha, Egypt. The rations were obtained from Cairo Company for poultry and rations, Egypt.

2.2. Drug: Diclazuril (Zox®)

It is a powder product administered through feeding ration. Manufactured by Marcyrl Pharmaceutical industries, for Delta Vet Center, Egypt. Each 1 gm contains 5 mg diclazuril. The recommended dosage: 200 gm/ton feed (Company instructions).

2.3. Experimental design:

The used 75, day-old Hubbard broiler chicks were kept on wire floor cages with daily examination of their dropping till the 14th day of life, where birds were randomly collected and divided into three equal separate groups (25 chicks each). Chicks of group (1) were kept as non-infected and non-treated control negative group. Chicks of group (2) were infected and non-treated group. Chicks of group (3) were infected and rations were supplemented with diclazuril from 1st day of experiment till the end of experiment (42nd day).

2.4. Preparation of *E. tenella* sporulated oocysts:

Oocysts of *E. tenella* were obtained from the parasitological laboratory of poultry diseases department, Faculty of Veterinary Medicine, Cairo University. The caeci of naturally infected chickens were separated by sieving and sedimentation techniques (Soulsby, 1978). The two caeci were emulsified in 2.5% potassium dichromate solution (in a ratio of one part of fecal sample to two parts of the solution), then

filtrated and the filtrate was left for sedimentation. The sediment was taken and washed with distilled water several times. Finally, the washed oocysts were kept in 2.5% potassium dichromate solution at room temperature for sporulation.

2.5. Experimental infection:

Each chick in the infected groups was orally inoculated at 14th day of age with 1 ml solution containing about 100.000 sporulated *E. tenella* oocysts in the crop using a wide mouthed 1 ml pipette (Dalloul et al., 2003).

Birds of all groups were observed daily and mortalities were recorded as it occurred. Severe clinical signs (bloody dropping) were appeared at the 5th day post infection (19th day of age).

2.6. Growth performance parameters evaluation:

2.6.1. Relative growth rate:

Relative growth Rate (RGR) was calculated according to the following equation: (Tawfik, 1991):

$$\text{Relative growth Rate (RGR)} = \frac{100 \times W_2 - W_1}{W_2 + W_1} \text{ (weight gain)}$$

$$W_2 + W_1 / 2$$

Where W1 = Mean initial weight of birds in each group just before infection (14th day of age). W2 = Mean final weight at the end of the experiment (45th day of age).

2.6.2. Oocysts per gram of faeces (OPG)

Feces were collected from five chicks in each group on days 5, 6, 7, 8, 9 and 10 after inoculation of sporulated oocysts for oocyst counts, which were expressed as oocyst/g feces.

2.6.3. Lesion scoring

Three birds / group were sacrificed daily from 1st, 3rd, 4th, 5th, 7th and 14th day post infection (dpi) for detection of macroscopic caecal lesions score and scored on a scale of 0 to 4 by Lesion Scoring Technique (Johnson and Reid, 1970) as follows. 0: No

gross lesions. +1: Very few scattered petechiae on the caecal wall; no thickening of the caecal walls; normal caecal contents present. +2: Lesions more numerous with noticeable blood in the caecal contents; caecal wall is somewhat thickened; normal caecal contents present. +3: Large amounts of blood or caecal cores present; caecal walls greatly thickened; little, if any, fecal contents in the caeca. +4: Caecal wall greatly distended with blood or large caseous cores; faecal debris lacking or included in cores. Dead chicks were scored as +4.

2.6.4. Mortality percentage

Mortality percentage was recorded for each group of chickens.

Table (1): Efficacy on body weight (BW), body weight gain (BWG), relative growth rate (RGR) and mortalities in control, infected non treated and infected and treated with diclazuril groups.

Group	Non infected non treated	Infected non treated	Infected + Diclazuril
Mean W ₁ (gm)	320.56±25.36 ^a	321.71±24.87 ^a	321.54±27.18 ^a
Mean W ₂ (gm)	1876.73±71.38 ^a	1197.48±71.48 ^c	1612.45±69.45 ^b
W ₂ -W ₁ (Weight gain)	1556.17 ^a	875.77 ^c	1290.91 ^b
$\frac{W_2+W_1}{2}$	1098.64 ^a	759.59 ^c	966.99 ^b
RGR	141.64 ^a	115.29 ^b	133.49 ^a
No of dead birds/group	0/25 ^c	19/25 ^a	4/25 ^b

^{a, b, c} Mean values having different letters in row differ significantly ($P<0.05$).

Table (2) Effect of treatment with diclazuril on oocyst count ($\times 10^3$ gm feces) from 5th to 10th day post infection in broiler chickens experimentally infected with *Eimeria tenella*.

Time	Control	Infected	Infected + diclazuril
5 th pi	0	24	11
6 th pi	0	132	87
7 th pi	0	451	228
8 th pi	0	142	92
9 th pi	0	113	71
10 th pi	0	64	34
Total oocyst count	0.0±0.0 ^c	154.33 ± 62.04 ^a	87.17±30.94 ^b

^{a, b, c, d} Mean values having different letters in row differ significantly ($P<0.05$).

2.7. Statistical analysis

Analysis of variance (ANOVA) using Duncan's multiple range test for variables was computed for different parameters. Differences between group means were considered significant at $P< 0.05$ (Duncan, 1955).

3. RESULTS

The effect of diclazuril on the performance parameters including body weight gain (BWG) and the relative growth rate (RGR) and also mortalities in infected and treated chickens was recorded in table (1).

Table (3) Effect of treatment with diclazuril on lesion score (Mean \pm S.E.) in broiler chickens experimentally infected with *Eimeria tenella*.

Day	1 st dpi	3 rd dpi	4 th dpi	5 th dpi	7 th dpi	14 th dpi	X \pm SEdpi
Treatment							
Control	0.0 \pm 0.0 ^a	0.0 \pm 0.0 ^a	0.0 \pm 0.0 ^a	0.0 \pm 0.0 ^a	0.0 \pm 0.0 ^a	0.0 \pm 0.0 ^a	0.0 \pm 0.0 ^a
Infected	1.33 \pm 0.33	1.67 \pm 0.33 ^c	3.0 \pm 0.0 ^{ab}	3.33 \pm 0.33 ^a	3.67 \pm 0.33 ^a	2.67 \pm 0.33 ^b	2.61 \pm 0.54 ^b
Infected + diclazuril	0.67 \pm 0.33 ^c	1.0 \pm 0.0 ^{bc}	1.33 \pm 0.33 ^b	1.67 \pm 0.33 ^b	2.33 \pm 0.33 ^a	1.67 \pm 0.33 ^b	1.45 \pm 0.34 ^c

a, b, c, d Mean values having different letters in row differ significantly ($P < 0.05$).

Significant reduction in (BWG) and (RGR) was recorded in the infected non treated control positive chickens as compared with non-infected non treated control negative birds. Treated group showed significant increase in (BW), improvement in (BWG) and (RGR) and reduced mortalities than infected non treated group. Diclazuril induced significant reduction in the mean oocyst shedding and lesion score when compared with infected non treated control and this was recorded in table (2 & 3).

4. DISCUSSION

There were several successful trials had been done to study the effect of using diclazuril alone or in comparison with other anticoccidial drugs in the ration of chickens for the prevention of coccidial infection (Chapman, 1989; Vanparijs et al., 1989b,e,f; McDougald et al., 1990a,b; Vieira and Clemente, 1995; Chapman, 1998; Conway et al., 2001a,b and 2002a,b; Kiaei et al., 2001; Awaad et al., 2003) and the drug not only proved high efficacy, but also superceded the others in the prevention of the disease.

The effect of administration of diclazuril in the feed (the usual way), was proved to be effective. El-Banna et al., (2005) compared between using of diclazuril in the ration and administration of it as a solution as preventive medicament in the drinking water against mixed experimental infection with *E. tenella*, *E. acervulina*, *E. necatrix*,

E. maxima and *E. Brunetti* and the results revealed that the two methods were have the similar effect in elimination of infection as shown by increasing the body weight gain and the survival rate and reduction in the fecal shedding, dropping score and lesion score.

The drug was very effective as shown by significant ($P \leq 0.05$) decrease in the number of oocyst shedding and lesion scores as compared with control positive infected non medicated group. Also, diclazuril had the ability to reduce the mortality rate and prevent the reduction of body weight gain caused by coccidial infection. These results agree with those previously reported by El-Banna et al. (2005) and El-Dakhly et al., (2006) who reported that diclazuril in the drinking water was appropriate for use in the prevention and treatment of *Eimeria* infected chickens indicated by decrease the oocyst number and the lesion score in the treated groups than the control ones. In addition, Jiang-ZhongQi (1999) demonstrated that when diclazuril was given in the drinking water at concentrations (0.25, 0.5 or 1 mg / liter) for controlling of *E. tenella* infection in chickens, the body weight increased when compared with control and that improvement increased by increase the drug concentration, moreover, the losses caused by the infection were greater in the control than the treated group and the index of resistance to the infection increased with increasing rate of diclazuril.

The mode of action of diclazuril was studied by Brander *et al.*, (1991) and concluded that diclazuril breaks down all intracellular developmental stages of asexual and sexual cycles of *E. tenella*.

In conclusion, addition of diclazuril is very efficacious for the prevention and control of experimental infection with *Eimeria tenella*.

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