The effect of administration of anti-coccidial drugs on oocyst shedding and performance in experimental coccidiosis in broiler chickens

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Abstract: **Coccidiosis is one of the major parasitic diseases of poultry. In this study, to compare the effects of coccidiostatic drugs on fecal oocyst shedding and body weight gain of coccidi-infected broiler chickens, 180 one day old Ross 308 broiler chicks were randomly assigned to four treatments. Each treatment contained 3 replicates of 15 chickens. Treatments 1 and 2 were fed diets supplemented with 200ppm Diclazuril and 500ppm Salinomycin, respectively. Treatments 3 and 4 were designated as positive and negative control, received no coccidiostate. Chickens in treatment 1, 2 and 3 were inoculated with a suspension containing four *Eimeria* species. Frequency of excreted oocyst obtained from feces samples during 7-13 days post - challenged was carried out. Body weight, body weight gain, feed conversion ratio and mortality rate were evaluated weekly. The results revealed that coccidiostatic drugs decreased oocyst per gram of feces significantly in 7-13 days post inoculation ($p<0.05$). The highest mean of body weight was related to negative control followed by chickens treated with Diclazuril. The lowest FCR was belonged to negative control followed by chickens treated with Diclazuril. It could be concluded that coccidiostate -supplemented diets in *Eimeria* infected groups shed less ($P<0.05$) oocyst than control-infected chickens and improved production performance in coccidian-infected broiler chicks.**

Key words: coccidiosis, coccidiostates, broilers, performance.

Introduction

Avian coccidiosis is one of the most economically important diseases of the poultry industry (Lillehoj and Lillehoj, 2000). It is caused by *Eimeria* and is an important disease in intensive poultry production, leading to reduce growth and sometimes death in broiler chickens with significant economic losses of up to $3 billion annually worldwide (Williams, 1999; Dalloul *et al*., 2006). These estimates include the costs of prophylactic in-feed medication for broilers and broiler breeders, alternative treatments if medication fails and losses due to mortality, morbidity, impaired growth rate, temporary reduction of egg production in layers and poor feed conversion of chickens that survive outbreaks (Williams, 1999). For many years, prophylactic use of anticoccidial drugs has been the primary means of controlling chicken coccidiosis in broiler industry

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Table1: Feedstuffs and amount of starter and grower diets for experimental coccidiosis.

Diets		Primal substances
Growth diet days 22-49(%)	Starter diet d1-21 (%)	
59.5	57.5	Corn
36.0	38.0	Soya
1.2	1.2	Carbonate calcium powder
1.8	1.8	Di-calcium phosphate
Vitamin /Mineral 0.5	Vitamin /Mineral 0.5	Vit+ Min.Promix
0.1	0.1	Vit-A
0.1	0.1	Vit-B
0.1	0.1	Vit-D3
0.1	0.1	Vit-E
0.05	0.05	Vit-K
0.18	0.16	Methionine
0.08	0.07	Lysine
0.28	0.29	Salt
0.02	0.03	Multi Enzyme
100%	100%	Total

Table1(continued): The compositions of Vitamins and mineral supplements.

Vitamin + Mineral supplements			
Vit A	5000000 IU	Carrier	1000gr
Vit D3	5000 IU	Vit H2	2 gr/kg
Vit K	5000mg/kg	Antioxidant	0/4gr/kg
Vit E	5500mg/kg	Cuso4	16gr/kg
B1	4 gr/kg	CaI2	0/6/kg
B2	3/3gr/kg	Premix Selenium	8gr/kg
B3	4 gr/kg	Carrier	1000gr
B5	12gr/kg	Mn o	64gr/kg
B6	1.2gr/kg	Feso4	100g/kg
B9	0/5gr/kg	Zno	44gr/kg
B12	0/6gr/kg	Colin chlorides	400gr/kg

and has played a major role in the growth of this industry. Modern intensive poultry production is largely dependent upon chemoprophylaxis for the control of coccidiosis (Chapman, 1999; Allen and Fetterer, 2002). The effective use of anticoccidial drugs over the past 50 years has played a major role in the growth of poultry industry and has allowed the increased availability of high quality, affordable poultry products to the consumer. Medication current by anticoccidial drugs in chicken had been started about 30 years ago in Iran and numerous products were introduced, many of which are available and used today (Rahbari *et al*., 1995). The recent anticoccidial drugs for control of coccidiosis are Diclazuril, and Salinomycin. Chapman (1999) and McDougald *et al* (1990a,b) reported that Diclazuril has a potent, broad-spectrum anticoccidial activity against *Eimeria* species and it was noted to be highly effective against the six major pathogenic species of *Eimeria*. The aim of this study was to determine the effects of administration of anti-coccidial drugs (Salinomycin and Diclazuril) on oocyst shedding, body weight and feed efficiency of broiler chickens in experimental coccidiosis in north districts of Iran.

Materials and Methods

Oocyst preparation: The oocyst were collected from department of parasitology collection, faculty of veterinary medicine, University of Tehran, Iran,

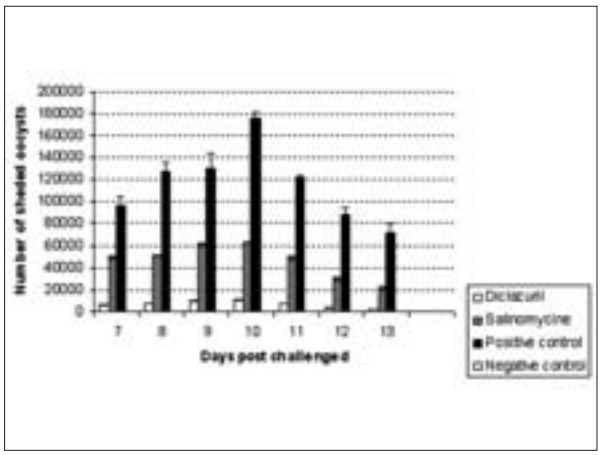

Fig. 1- Effect of administration of anti-coccidial drugs on oocyst shedding after challenged of 180 broiler chickens with pathogenic species of *Eimeria* in experimental coccidiosis.

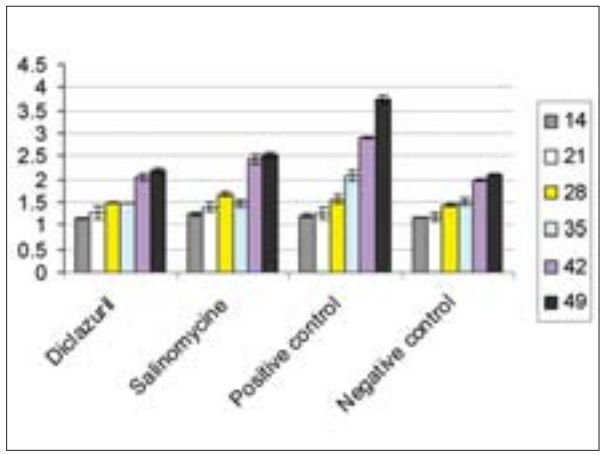

Fig. 2- Effect of administration of anti-coccidian drugs on feed conversion ratio (FCR) in 180 broiler chickens in 2-7 weeks post - Inoculation.

containing a mixture of four incident Iranian *Eimeria* species (*Eimeria tenella*, 3×10^4, *Eimeria necatrix*, 3×10^4 *Eimeria maxima*, 4×10^4 and *Eimeria acervulina*, 10^5). For this study one hundred and eighty one - day old Ross 308 broiler chicks were randomly assigned to 4 groups, containing 45 chicks in each treatment. Each group contained three replicates of 15 chicks. Each replicate allocated in separated pen in similar condition that was equal for all groups. During the experiment (49 d) the chickens were fed with a diet based on corn and soybean meal (table 1) and food and water were provided ad libitum. Treatments 3 and 4 (as positive and negative control, respectively) received no coccidiostates and treatments 1 and 2 were fed diets supplemented with Diclazuril 0.02 % (200 ppm) and Salinomycin 0.05 % (500 ppm) (Kimiaphaam.CO.Ltd.), during the experiment, respectively. Chickens in all groups except negative control were inoculated orally by 0.5 ml of mixture of sporulated oocyst of four mentioned pathogenic species of *Eimeria* at the end of fourth week (26 d) of age (Chapman, 1989).

Flock was monitored for signs of disease and mortality. Oocyst shedding was assessed as described by Min *et al*., 2001. Briefly, fecal droppings from each group (4 treatments) were collected for 7 days, starting on the7th d p-I, fecal material ground and homogenized. Then two 35 ml samples were taken and diluted and the oocysts were counted microscopically using a Mc Master counting chamber. The total number of oocyst was calculated using the formula:

Total oocyst = oocyst count × dilution factor× (fecal sample volume / counting Chamber volume).

Body weights (BW), body weight gains (BWG), feed intake (FI) and feed conversion ratio (FCR) were determined on weekly basis in all groups and replicates. FCR was calculated using the formula: FCR = total feed intake / weight of alive + dead chickens. The dead chickens in each group were weighed with an analytical scale on daily basis and were down a necropsy for diagnosis reason of mortality during experiment.

All data were subjected to ANOVA, significant differences in the ANOVA were compared using Tukey's test. Differences between means were considered significant at $p< 0.05$. (Steel and Torrie, 1989).

Results

Oocyst shedding: Frequency of excreted coccidian oocyst obtained from feces samples during 7-13 days post -challenged showed that the most excreted oocyst was related to positive control and shed maximum 1.75×10^5 .The lowest oocyst per gram of feces was for negative control which was maximum 50 oocysts per gram of feces (Fig.1). The birds infected with *Eimeria* and fed diets supplemented with Diclazuril and Salinomycin shed 1.1×10^4 and 6.3×10^4 oocysts, respectively 10 days

Table2: Effect of administration of anti-coccidian drugs on mean body weight (g) in broiler chicks in experimental coccidiosis. *Different letters (a-c) in column indicate significant differences between treatments (based on Tukey test, at 0.05 levels).

Age (day) / Treatments	14	21	28	35	42	49
Diclazuril	386.67±3.33	706.67±6.67	1193±39^{ba}	1675.66±57.85^{a}	1975.66±21.30^{a}	2482±80.80^{a}
Salinomycin	370.67±14.62	673.33±18.56	1125.33±54.84^{b}	1624±70.29^{a}	1643±58.70^{b}	2033.33±92.79^{b}
Positive control	360±10	685±22.55	1042±29.96^{b}	1086±5.29^{b}	1026±38.07^{c}	1261.33±51.65^{c}
Negative control	380±1	723.67±13.17	1130±23.02^{b}	1623.33±56.08^{a}	2065±49.07^{a}	2503.33±74.4a

Table3: Effect of administration of anti-coccidian drugs on weight gain in broiler chickens in experimental coccidiosis (g). Different letters (a-c) in columns indicate significant differences between treatments (based on Tukey test, at 0.05 levels).

Age (day) / Treatments	15 - 21	22 -28	2 9-35	36 -42	43 -49
Diclazuril	320±5.77	486.33±36.22	482.66±18.94^{a}	300±38.30^{a}	506.66±62.05^{a}
Salinomycin	302.66±33.17	452±67.58	498.66±47.01^{a}	19±107.70^{b}	390.33±40.91^{ab}
Positive control	325 ±18.93	357±22.86	44±35.23^{b}	-60±33.24^{c}	235.33±39.93^{b}
Negative control	343.66±12.72	406.33±9.87	493.33±43.65^{a}	442±76.79^{a}	438±26^{a}

Table 4: Effect of administration of anti-coccidian drugs on feed intake (g) in broiler chickens in experimental coccidiosis. Different letters (a-c) in column indicate significant differences between treatments (based on Tukey test, at 0.05 levels).

Age (day) / Treatments	14	21	28	35	42	49
Diclazuril	445±5.77	893.55±101.61	1762.77±57.100^{ba}	2455.33±77.89	4051.11±228.17^{a}	5412.45±44.87^{a}
Salinomycin	458.33±12.93	936.66±39.64	1884.66±44.98^{b}	2384.25±52.93	4019.55±311. 85^{a}	5157.96±120.98^{ab}
Positive control	435±2.88	854.58±80.46	1625.51±56.34^{a}	2246.66±140.30	2973.33 ±72.77^{b}	4713.33±134.83^{b}
Negative control	446.84±6.84	858.42±68.59	1626±28.41^{a}	2436.98±91.17	4098.17±114.560^{a}	5303.33±125.27^{ab}

Table 5: Effect administration of anti-coccidian drugs on mortality rate% in broiler chickens in experimental coccidiosis. Different letters (a-c) in columns indicate significant differences between treatments (based on Tukey test, at 0.05 levels).

Age (day) / Treatments	7	14	21	28	35	42	49
Diclazuril	0.33±0.33	0	0	1±0ab	1.33±0.33ac	1.33±0.33ab	0
Salinomycin	0.33±0.33	0	0	0.67±0.33a	2±0a	1±0a	0
Positive control	0	0	0	0	2±0b	6±0b	2±0 b
Negative control	1±0	0.33±0.33	0.33±0.33	0.33±0.33a	0.33±0.33c	0	0

post -inoculation (Fig.1). In this experiment, usage of anti-coccidian drugs caused considerable decrease in oocyst shedding through feces, whereas there were significant differences among treated groups and positive controls in 7-13 days post- inoculation ($p<0.05$). This way, in all of post- challenged days,

the number of OPG in positive control groups was significantly more than other groups ($p<0.05$). Diclazuril was more efficient in reducing oocyst output and birds of the Salinomycin group shed significantly ($p<0.05$) more oocysts (Fig.1). Also, there were significant differences among all groups except negative control and the group fed diet supplemented with Diclazuril.

Mean body weight: The obtained results from The BW of different treatments are shown in table 2. The lowest B.W was related to the chickens in positive control with significant differences in B.W among treatments. B.W in the anti-coccidial supplemented groups was significantly higher than positive control ($p<0.05$). Finally, significant differences for mean B.W among treatments were observed after 3rd week but significant differences among treatments were more pronounced after 4th week that chickens were challenged with pathogenic species of Eimera. However there was a considerable difference between groups fed diets supplemented with Diclazuril and Salinomycin at the end of experimental period.

Body weight gain (growth rate): Regarding increase in weekly body weight, the most mean growth rate during 3rd- 7th weeks was belonged to negative control and groups fed diets supplemented with Diclazuril and Salinomycin, respectively (Table3). The lowest weekly body weight gain was related to positive control. According to statistical analysis differences between body weight gains were significant especially between groups received diet supplemented with Diclazuril or salinomycin and the positive control. Between 36 to 42 and 43 to 49 dP-I, weight gains of birds on the Salinomycin and Diclazuril diets groups were higher than those of positive control.

4- Feed Intake and Feed Conversion Ratio: Amounts of food consumption in different treatments are presented in Table 4. According to the obtained results the lowest and the highest FI during the experiment were belonged to positive control and the chickens treated with Diclazuril, respectively (Table 4). Feed intake in groups received diet supplemented with Diclazuril was significantly higher than positive control ($p<0.05$) and no difference was observed between groups consumed anticoccidial drugs at the end of experiment. Amounts of FCR in different treatments have been indicated in (Fig. 2). According to the obtained results the negative control (non-challenged chickens) had the lowest FCR at the end of experiment. The highest FCR was related to positive control which was ≥3. Differences among FCR in treatments from post challenged day till the end of experiment were significant ($p<0.05$). FCR of the anti-coccidian supplemented groups was significantly lower than positive control group ($p<0.05$). Except week 7, in other week's post-inoculation there were no significant differences in feed conversion ratio between groups consumed anticoccidial drugs (Fig. 2).

Mortality: Although mortality occurred in all infected groups, but the highest mortality was observed in infected and unmedicated control (10 birds) followed by groups received Salinomycin and Diclazuril (3 and 4 birds), respectively. Mortality rate in negative control was less than other treatments and there were no significant differences among treatments before challenge (Table 5).

Discussion

There is no doubt that coccidiosis is a common and an important disease in the domestic fowl. It has been shown that the disease has brought about great economical losses in the poultry industry of Iran (Rahbari *et al*., 1995). In regard to oocyst shedding, all the groups fed Salinomycin and Diclazuril supplemented diets and infected with *Eimeria* shed less oocysts than non-coccidiostatic group (positive control). There was negative correlation between oocyst shedding and body weight gains in this study. Similar correlation between weight gain and the numbers of excreted oocysts has been previously reported in other study on coccidiosis (Sunghyen *et al*., 2007). Weight gain is usually used as a parameter following infection with *Eimeria* spp (Bahgat *et al*., 2005; Gil de los santos *et al*., 2005). During *Eimeria* infection, chickens fed 200 ppm Diclazuril apparently had more mean body weight and gained more weight than birds of other infected groups.

Although such differences were not significant. Rate of sheded oocyst was increased slowly and the highest oocysts outputs were in 10 days post inoculation, and then decreased (Fig. 1). This happened because at beginning of infection, chickens immunity system could not decrease oocyst output, after few weeks' immunity level went up and decreased the oocyst shedding (Mathis, 1999; Weppelman *et al*.,1997). Finally anti-coccidial drugs couldn't completely inhibit the oocyst shedding (Fig. 1). The result of the present study indicated that groups fed Diclazuril consumed more food when compared to other groups. All infected groups except groups supplemented diet with Diclazuril showed a depression in weight gain and impaired feed conversion as compared to un-infected control. The differences were more pronounced in groups Diclazuril and positive control. All treatments (especially positive control) caused impaired FCR (Fig. 2). The reason for this impairment is that the organism destroys the absorptive mucosal surface of the intestine (Logan *et al*., 1993). Comparing the anticoccidial effect of Salinomysin and Diclazuril indicated that Diclazuril was more effective on oocyst shedding significantly and was highly effective against combined infection with *Eimeria* Spp and improved production performance in coccidi- infected broiler chickens than Salinomysin.

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مجله بین المللی تحقیقات دامپزشکی، ۱۳۸۷، دوره ۲، شماره ۱، ۷۳-۶۷

مقایسه داروهای کوکسیدیواستات روی ااسیست‌های دفع شده از جوجه‌های گوشتی

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چکیده

کوکسیدیوز یکی از مهمترین بیماری‌های انگلی در پرندگان است. در این مطالعه جهت مقایسه داروهای کوکسیدیواستات روی ااسیست‌های دفع شده از مدفوع و وزن‌گیری جوجه‌های گوشتی آلوده با کوکسیدیوز تجربی، تعداد ۱۸۰ جوجه گوشتی نژاد راس ۳۰۸ به شکل تصادفی به چهار گروه درمانی ۴۵ تایی تقسیم شدند. هر گروه درمانی شمال سه گروه ۱۵ تایی در نظر گرفته شد. به ترتیب به جیره غذایی گروه ۱ و ۲ 200PPM دیکلازوریل و 500PPM سالینومایسین اضافه گردید و گروه‌های درمانی ۳ و ۴ به عنوان گروه‌های کنترل مثبت و منفی در نظر گرفته شدند و این گروه‌ها داروی کوکسیدیواستات دریافت ننمودند. جوجه‌های گروه ۱، ۲ و ۳ با مخلوطی از گونه‌های مختلف ایمریا تلقیح شدند. فراوانی ااسیست‌های دفع شده از مدفوع در طول ۱۳-۷ روز بعد از آگودگی انجام شد. میانگین وزن بدن، افزایش وزن، ضریب تبدیل غذایی و مرگ و میر به شکل هفتگی مورد ارزیابی قرار گرفت. نتایج حاصله نشان داد داروهای کوکسیدیواستات تعداد ااسیست در گرم مدفوع را به طور معنی‌داری طی ۱۳-۷ روز بعد از آلودگی کاهش دادند ($p<0/05$). بیشترین میانگین وزن بدن به ترتیب در ارتباط با گروه کنترل منفی و گروهی بود که دیکلازوریل دریافت کرده بودند ($p<0/05$). کمترین ضریب غذایی نیز به ترتیب مربوط به گروه کنترل منفی و گروهی بود که دیکلازوریل دریافت کرده بودند ($p<0/05$). بنابراین می‌توان نتیجه‌گیری کرد که گروه‌هایی که با ایمریاها آلوده شده و با جیره غذایی حاوی کوکسیدیواستات‌ها تغذیه شدند ااسیست کمتری در مقایسه با گروه کنترل مثبت دفع نمودند و بازدهی تولید در جوجه‌های گوشتی آلوده در استفاده از این داروها بهبود یافت.

واژه‌های کلیدی: کوکسیدیوز، کوکسیدیواستات، جوجه‌های گوشتی، بازدهی تولید.

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