COMPARATIVE INVESTIGATION OF EFFICACY OF TWO SULFONAMIDES ON BROILER COCCIDIOSIS INFECTED BY IRANIAN EIMERIA SPP IN IRAN

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Abstract

The objective of this experimental study was comparative investigation of efficacy of two Sulfonamides (sulfaclozine 30% and Sulfaquinoxaline+Diaverdine) on broiler coccidiosis experimentally infected by Iranian *Eimeria spp* based on oocyst per gram (OPG), lesion scoring (LS) and breeding performances. Sixty four one-day old male chicks, Ross 308 strain, were divided equally and randomly into 4 groups (16 chicks /group) and reared in cages up to 28 days of age. Groups were designed as follows: Group 1 as negative control: non-treated and non-infected. Group 2 infected and then received sulfaclozin 30%. Group 3 infected and then received Sulfaquinoxaline+Diaverdine and group 4 as positive control: infected but non- treated. Groups 2,3 and 4 were infected at 12 day old by 100,000 oocystes (an oocyst mixture of 25% *E. tenella*, 15% *E. necatrix*, 20% *E. acervulina* and 40% *E. maxima* as pathogenic species of Iranian *Eimeria* isolates). Groups 2 and 3 treated at 17 days of age. OPG test was done on 11st, 15th, 17th, 21st, 23rd and 25th and LS on15th, 18th and 25th days of rearing period. Also weekly mortality, weight gain, feed conversion rate (FCR) and European Efficacy Factor (EEF) were recorded. Results indicated that treatment by sulfonamides could improve body weight, FCR and EEF after infection, compared to untreated group (positive control). Also, they could completely inhibit the oocyst shedding and repaired lesions of intestine in infected groups' one week after treatment. Based on this experiment, the efficacy of two drugs (Sulfaclozine30% and Sulfaquinoxaline+Diaverdine) on treatment of broiler coccidiosis induced by Iranian *Eimeria spp* seemed to be the same.

Keywords: Coccidiosis, Eimeria, Broiler, Sulfaclozine 30%, Sulfaquinoxaline+Diaverdine.

Introduction

Coccidiosis is a disease almost universal importance in poultry production. The protozoan parasites of the genus Eimeria multiply in the intestinal tract and cause tissue damage, with resulting interruption of feeding and digestive processes or nutrient absorption, dehydration, blood loss, and increased susceptibility to other disease agents (McDougald, 2008). Sulfonamides have a good coccidiostatic effects on control and treatment of chicken coccidiosis in experimental and natural infection (Levin, 1945 and McDougald, 2008).

Materials and Methods

Chicken and grouping: Sixty four one-day old Ross 308 male broiler chicks were randomly assigned to 4 groups (16 chicks /group) and reared in cages up to 28 days of age in separated pens in similar condition that was equal for all groups. Groups were designed as follows: Group 1 as negative control: non-treated and non-infected. Group 2 infected and received sulfaclozin 30%. Group 3 infected and received Sulfaquinoxaline+Diaverdine and group 4 as positive control: infected but non- treated. During the experiment, chickens were fed with a diet based on corn and soybean meal. Ingredient amounts of feedstuff and calculated analysis of it are given in Tables 1 and 2. Food and water were provided ad libitum.

Oocyst preparation and inoculation: The oocysts were obtained from department of parasitilogy collection, faculty of veterinary medicine, Islamic Azad University, Karaj branch. A mixture of 100,000 oocysts of four incident Iranian *Eimeria* species including: *E. tenella*: 25%, *E.maxima*: 40%, *E. acervulina*: 20% and *E. necatrix*: 15% were prepared in 100 µl potassium bichoromate solutions and stored in 4^{oC}. Chickens in all groups except negative control were inoculated orally by 0.5 ml of oocyst mixture containing 100,000 sporulated oocysts as mentioned above at 12 days of age.

Drug administration: Chickens in group 2 received Sulfaclozine: 1 gr /1 lit in drinking water, at 17, 18 and 19 days of age. Chickens in group 3 received Sulfaquinoxaline + Diaverdine: 3 ml / l lit in drinking water at 17, 18, 19 and 22, 23, 24 days of age based on manufacture's recommendation.

Oocyst per gram: Oocyst per gram (OPG) was measured at 11, 15, 17, 21, 23 and 25 days of age using Mc Master counting chamber.

Lesion scoring: lesion scoring (LS) was done on two chickens selected randomly from all groups at 15, 18 and 25 days of age based on Johanson and Reid's method (1970). A score of 0-4 is assigned to a bird where 0=normal and 4=most severe case. Four separate sections of intestine which scored were: duodenum, jujenum, ileum and ceca.

Breeding performance and data analysis: Body weight (BW), mortality, feed conversion rate (FCR), and European efficacy factor (EEF) were determined in all groups. All data were analyzed by Kruskal-Wallis test. Differences between means were considered significant at $p<0.05$.

Results

Mortality: Based on table 3, negative control and treated group didn't show any mortality (zero) during 28 days of rearing, but positive control had 6.25 % and 12.5 % mortality one week and 2 weeks after infection respectively. It can be concluded that administration of two sulfonamides could inhibit mortality in treated groups.

Body weight: Weight of four groups were not different before infection significantly ($p>0.05$). However, after infection, weight of positive control was significantly lower than negative and treated groups ($p<0.05$) (table 4).

Feed conversion rate: Although FCR in positive group were higher than other groups, FCR were not different significantly between all groups ($p>0.05$). It can be interpreted that because the positive group had lower body weight and lower feed intake (data wasn't shown) than the other groups, FCR was not significantly higher than the others (Table 5).

European efficacy factor: EEF were not different significantly between all groups ($p>0.05$). However, positive control showed lower EEF than the other groups especially after infection and in the end of rearing period.

OPG: Frequency of OPG during 1 day before infection and 3 and 5 days after infection and 3, 6 and 7 days after treatment in 4 groups were shown in table 7. Based on data, two sulfonamides could decrease OPG shedding in treated groups compared to positive control. OPG in negative control remained zero during rearing period. OPG were zero one week after treatment in treated groups.

Lesion scoring: The results of LS are given in tables 8 which showed LS in positive control is higher than LS in treated groups. LS in treated groups were Zero one week after treatment and LS in negative control remained zero until end of rearing period.

Discussion

Coccidiosis is one of the most relevant diseases concerning economic losses on livestock production. The world losses attributable to avian coccidiosis were estimated in 1.5 billion dollar per year (Duquette, 2005). Despite the introduction of live vaccines, in most countries chemotherapy is still the preferred method for the control of coccidiosis. Significant improvements in the performance of commercially reared poultry have been made during the last half of the twentieth century. It has often been assumed that these improvements would not have been possible without the introduction of a succession of ever more effective anticoccidial agents to control coccidiosis (Chapman, 2005). Without anticoccidial drugs and vaccines, the growth of the broiler industry would have been impossible, as coccidia are ubiquitous and extremely deleterious to the growth and survival of broilers. Fortunately, introduction of the sulfonamide drugs in the 1930s started an era of treating and preventing coccidiosis. Sulfonamides have a broad spectrum of activity against *Eimeria spp.* of the anterior and lower part of the intestine in chickens. Feeding of sulfonamides may prevent clinical signs and reduce oocyst production thereby allowing development of protective immunity. Based on the results of this study, treatment by sulfonamides could improve body weight, FCR and EEF after infection, compared to untreated group (positive control). Also, they could completely inhibit the oocyst shedding and repaired lesions of intestine in infected groups' one week after treatment. It seems that the highest oocyst outputs were in 10 days post inoculation and then decreased because the immunity against oocyst developed and increased and so decreased the oocyst shedding. This experiment indicated that the treatment effects of two drugs (Sulfaclozine 30% and Sulfaquinoxaline+Diaverdine) on broiler coccidiosis induced by Iranian *Eimeria spp* are significant and these effects seem to be the same when two drugs were compared.

References

CHAPMAN, H. D. (September 19-23, 2005). Perspectives for the control of coccidiosis in poultry by chemotherapy and vaccination, *Proceedings of the IXth International Coccidiosis Conference*, Foz de Iguassu, Parana, Brazil, pp: 99-104

DUQUETTE, P. (September 19-23, 2005). A US perspective on the current and future regulation of anticoccidial drugs and vaccines, *Proceedings of the IXth International Coccidiosis Conference*, Foz de Iguassu, Parana, Brazil, pp: 117-124

JOHANSON, J. and REID, W. M. (1970). Anticoccidial drugs: Lesion scoring techniques in battery and floor-pen experiments with chickens. *Exp Parasitol* 28:30-36

LEVIN (1945): Sulfamerazine therapy in experimental cecal coccidiosis of chicken, *The journal of parasitology,* 31: 6

McDOUGALD, L. R. and FITZ-COY, S. H. (2008). Coccidiosis. In: SAIF, Y.M., BARNES, H.J., GLISSON, J.R., FADLY, A.M., McDOUGALD, L.R., & SWAYNE, D.E. (Eds) *Diseases of Poultry*. 12th Ed. pp: 1068-1085 (Ames, Iowa State University Press)

Table 1. Ingredient amounts of feedstuff (0-28 days)

Feedstuff	Amount (%)
Corn	58.65
Soy bean meal	37
Vitamins & minerals supplements	0.6
Di-calcium phosphate	1.6
Shell	1.5
Methionine	0.2
Lysine	0.1
Salt	0.3
Multienzyme	0.05
Total	100

Table 2. Calculated analysis of feedstuff

ME (Kcal/ Kg)	Crude Protein (%)	Calcium (%)	Available Phosphorus (%)	Methionine (%)	Lysine (%)
2820	21.5	0.99	0.47	0.53	1.26

Table 3. Effect of administration of two sulfonamides on mortality of broiler chickens in experimental coccidiosis

Group / week	Positive control	Negative control	Sulfaclozine 30%	Sulfaquinoxaline +Diaverdine
1	0	0	0	0
2	0	0	0	0
3	6.25	0	0	0
4	12.5	0	0	0

Table 4. Effect of administration of two sulfonamides on weight of broiler chickens in experimental coccidiosis

Group / Week	Positive control	Negative control	Sulfaclozine30%	Sulfaquinoxaline +Diaverdine
1	113.5 [a]	114.57 [a]	113.62 [a]	115.94 [a]
2	326.2 [a]	325.12 [a]	324.31 [a]	328.75 [a]
3	418.15 [a]	627.85 [b]	555.15 [b]	602.43 [b]
4	722.8 [a]	987.25 [b]	967.27 [b]	1054.75 [b]

Different letters (a-b) in rows indicates significant differences between treatments ($p<0.05$).

Table 5. Effect of administration of two sulfonamides on FCR of broiler chickens in experimental coccidiosis

Group / Week	Positive control	Negative control	Sulfaclozine30%	Sulfaquinoxaline +Diaverdine
1	0.77	0.91	0.93	0.89
2	1.55	1.46	1.28	1.41
3	2.35	1.76	1.85	1.91
4	2.77	2.17	2.07	2.06

Table 6. Effect of administration of two sulfonamides on EEF of broiler chickens in experimental coccidiosis

Group / Week	Positive control	Negative control	Sulfaclozine30%	Sulfaquinoxaline +Diaverdine
1	170.11	179.84	174.53	186.1
2	124.1	159.1	180.98	166.54
3	79.43	169.86	142.89	150.19
4	81.22	162.47	166.88	182.86

Table 7. Oocyst shedding in experimental coccidiosis of broiler chickens

Group / Day		Positive control	Negative control	Sulfaclozine30%	Sulfaquinoxaline + Diaverdine
11	B.I.	0	0	0	0
15	3 days P.I.	0	0	0	0
17	5 days P.I.	26700	0	35000	28100
21	3 days P.T.	37000	0	700	300
23	6 days P.T.	17500	0	150	80
25	7 days P.T.	3600	0	0	0

B.I. = before infection, P.I. = post infection, P.T. = post treatment

Table 8. Lesion scoring of intestine of broiler chickens in experimental coccidiosis

Groups / Days	Positive control	Negative control	Sulfaclozine 30%	Sulfaquinoxaline +Diaverdine
15	1	0	1	1
18	3	0	3	3
25	2	0	0	0