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COMPARATIVE STUDY ON THERAPEUTIC EFFICACY OF SULFAQUINOXALINE SODIUM AND AMPROLIUM AGAINST COCCIDIOSIS IN RABBITS

STUDIU COMPARATIV ASUPRA EFICACITĂȚII TERAPEUTICE A SULFAQUINOXALINEI SODICE ȘI A AMPROLIUMULUI ÎMPOTRIVA COCCIDIOZEI LA IEPURI

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ABSTRACT | REZUMAT

Coccidiosis is a parasitic disease caused by species of the genus Eimeria, clinically manifested through weight loss, diarrhoea with bloody faeces, dehydration, and death, leading to important economic losses. Coccidiosis in rabbits has two forms: hepatic and intestinal. The aim of this study was to compare two drugs involved in the parasitological control of coccidiosis under conditions of natural infection. Belgian Giant rabbits taken into study were randomly divided into three groups of 20 rabbits each. One group was the untreated control group. The other two groups were treated with sulfaquinoxaline sodium and amprolium. Sulfaquinoxaline sodium was administered in water at a dose of 45 ml in 22 litres of water for 3 days, followed by a 3-day break, then 15 ml in 11 litres of water for 2 days, followed by a 2-day break. Amprolium was administered in water at a dose of 5 grammes in 4 litres of water for 14 days. Faeces were collected from each rabbit on days 0, 7, and 14 and examined using the McMaster method. The efficacy of sulfaquinoxaline sodium and amprolium was 99.05% and 96.48%, respectively.

Keywords: rabbits, coccidiosis, EPG, anticoccidial drugs

Coccidioza este o boală parazitară produsă de specii ale genului *Eimeria*, manifestată clinic prin scăderea în greutate, diaree cu fecale sanguinolente, deshidratare și moarte, ducând astfel la pierderi economice mari. Coccidioza la iepuri evoluează sub două forme: hepatică și intestinală. Scopul acestui studiu a fost acela de a compara două substanțe medicamentoase în controlul parazitologic al coccidiozei în condițiile infecției naturale. Iepurii luați în studiu au fost împărțiți randomic în trei loturi a câte 20 de iepuri aparținând rasei Uriaș Belgian. Unul dintre loturi a fost reprezentat de martorul netratat. Celelalte două loturi au fost tratate cu sulfaquinoxalină sodică și amprolium. Sulfaquinoxalina sodică a fost administrată în apă, în doză de 45 ml în 22 litri de apă timp de 3 zile, urmat de o pauză de 3 zile, apoi timp de 2 zile se administrează 15 ml în 11 litri de apă, urmat de o pauză de 2 zile. Amprolium a fost administrat în apă, în doză de 5 grame în 4 litri de apă timp de 14 zile. De la fiecare iepure s-au recoltat fecale în zilele 0, 7 și 14, examinarea făcându-se prin metoda McMaster. Eficacitatea sulfaquinoxalinei sodice și a amproliumului a fost de 99,05%, respectiv 96,48%.

Cuvinte cheie: iepuri, coccidioza, OPG, anticoccidice

Coccidiosis is the most important parasitic disease, causing massive economic losses in rabbit breeding (2, 9). Coccidiosis causes high mortality and morbidity, especially in weaned rabbits (2, 5). Twelve species of *Eimeria* of varying pathogenicity are known to cause coccidiosis in rabbits: *Eimeria coecicola*, *Eimeria exigua*, *Eimeria flavescens*, *Eimeria intestinalis*, *Eimeria irresidua*, *Eimeria magna*, *Eimeria media*, *Eimeria perforans*, *Eimeria piriformis*, *Eimeria roobroucki*, *Eimeria vejdovskyi,* and *Eimeria stiedae* (9). Rabbits have two forms of coccidiosis: intestinal coccidiosis and hepatic coccidiosis. Rabbits with intestinal coccidiosis may show diarrhoea, dehydration, inappetence, weight loss, coarse hair, and congested mucous membranes, leading to low productivity (18), while hepatic coccidiosis is manifested through polydipsia, jaundiced membranes, and enlarged abdomen (1, 15). The occurrence of coccidiosis in rabbit farms is exacerbated by poor hygiene and high livestock density, which encourage the dispersal of parasites (7). Eimeria oocysts have a remarkable ability to survive outdoors, making it difficult to control them using common disinfectants (3). Currently, several control strategies are used to treat and prevent coccidiosis. Proper hygiene and strict biosecurity have been shown in previous studies to play a significant role in preventing the occurrence and spread of coccidiosis in a rabbit farm (9). A study by Peeters et al, (1982) demonstrated the efficacy of narasin against liver and intestinal coccidiosis. On the other hand, robenidine, salinomycin, and lerbek have

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been widely used in Europe with varying efficacy against liver coccidiosis (9-11). The prophylactic and therapeutic use of diclazuril against coccidiosis in rabbits has shown remarkable results in Italy, France, and Spain (9, 19). Studies have also reported varied efficacy following prophylactic and curative use of sulfonamides against coccidia (8, 12, 14, 16).

Since most anticoccidials are recommended for both prophylactic and therapeutic use, the aim of this study was to determine the comparative therapeutic efficacy of sulfaquinoxaline sodium and amprolium against coccidiosis in rabbits.

MATERIALS AND METHODS

The study was carried out on 60 rabbits in Timis County from March to June 2023. Rabbits were kept in a semi-intensive system, in cages individualised on 2 to 3 levels. The rabbits ranged in age from 2 to 4 months and belonged to the Belgian Giant breed.

Faecal samples were freshly collected, immediately after their elimination by the leporids, placed in stool sample containers, and labelled accordingly. Samples were then kept in a chilled box at a temperature of 4°C, transported, and examined at the Clinic of Parasitology and Parasitic Diseases of the Faculty of Veterinary Medicine Timisoara (Fig. 4).

Both qualitative (Willis method) and quantitative (McMaster method) coproparasitological methods were carried out to detect parasite eggs (4). The faecal egg count reduction test (FECRT), was performed according to the Presidente's (%) relationship (13).

To assess the efficacy of the antiparasitic substances, measurements were made on days 0, 7, and 14 post treatment. On day 0, when these measurements were taken, the antiparasitic substance was also administered. On days 7 and 14, faecal samples were taken to observe the evolution of the parasite elements.

The efficacy of the antiparasitic substances administered to the leporids in the study was determined per batch by calculating the arithmetic mean of the EPGs. Rabbits in the study that were naturally infested with *Eimeria* spp. were randomly divided into three groups of 20 rabbits. One group was the untreated control. The other two groups were treated with sulfaquinoxaline sodium (Coccistop S®, oral solution, 45 ml in 22 litres of water for 3 days, followed by a 3-day break, then 15 ml in 11 litres of water for 2 days, followed by a 2-day break) and amprolium 20% (Amprolrom 20%®, water-soluble powder, 5 g in 4 litres of water, for 14 days).

RESULTS AND DISCUSSIONS

Coproscopic assays performed before treatment on the 60 studied leporids revealed monoparasitism with *Eimeria* spp. with a prevalence of 100%. The OPG values recorded on day 0, day 7 and day 14 are shown in Figs. 1 - 3, respectively, Tables 1 - 3.

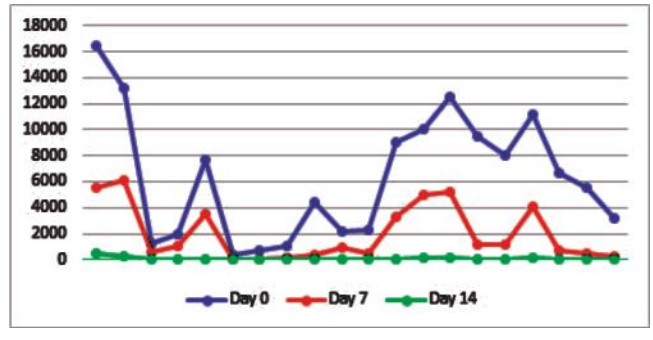

Fig. 1. Graphical representation of EPG evolution in rabbits treated with sulfaquinoxaline sodium

The group treated with sulfaquinoxaline sodium on day 0 of treatment obtained a mean EPG value of 6365, with a minimum EPG of 350 and a maximum of 16400. On day 7 and day 14 of treatment the mean value was 2000 EPG on day 7 and 60 on day 14 respectively. On day 7 and day 14 the minimum EPG value was 0 and the maximum EPG value on day 7 was 6050,

Table 1

Descriptive statistics of data obtained by McMaster coproscopic examination in rabbits treated with sulfaquinoxaline sodium

Day 0		*Day 7*		*Day 14*	
Mean	6365	**Mean**	1932.7	**Mean**	60
Standard Deviation	4778.848683	**Standard Deviation**	2162.972129	**Standard Deviation**	120.9610638
Sample Variance	22837394.74	**Sample Variance**	4678448.432	**Sample Variance**	14631.57895
Minimum	350	**Minimum**	0	**Minimum**	0
Maximum	16400	**Maximum**	6050	**Maximum**	450
Confidence Level (95.0%)	2236.57003	**Confidence Level (95.0%)**	1012.302117	**Confidence Level (95.0%)**	56.61152046

Table 2

Descriptive statistics of data obtained by McMaster coproscopic examination in rabbits treated with amprolium 20%

Day 0		*Day 7*		*Day 14*	
Mean	3270	**Mean**	1130	**Mean**	115
Standard Deviation	4529.505608	**Standard Deviation**	2431.882528	**Standard Deviation**	254.4860662
Sample Variance	20516421.05	**Sample Variance**	5914052.632	**Sample Variance**	64763.15789
Minimum	50	**Minimum**	0	**Minimum**	0
Maximum	15000	**Maximum**	8650	**Maximum**	950
Confidence Level (95.0%)	2119.873878	**Confidence Level (95.0%)**	1138.156058	**Confidence Level (95.0%)**	119.1031452

and on day 14 the maximum EPG value was 450.

The group treated with 20% amprolium on day 0 of treatment obtained an average EPG value of 3270, with a minimum EPG of 50 and a maximum of 15000. On day 7 and day 14 of treatment, the mean EPG values were 1130 on day 7 and 125 on day 14, respectively. On day 7 and day 14 the minimum EPG value was 0 and the maximum EPG value on day 7 was 8650 and on day 14 the maximum EPG value was 950.

As for the EPG obtained in the untreated control group on day 0 an average value of 8415 was obtained, with a minimum EPG of 4400 and a maximum of 15100. On day 7 an average EPG of 8540 was obtained, with a minimum EPG of 4550 and a maximum of 15250, while on day 14, an average EPG of 8605 was obtained, with a minimum EPG of 4600 and a maximum of 15300. A slight increase in the EPG value can be observed from day 0 of the study to day 14.

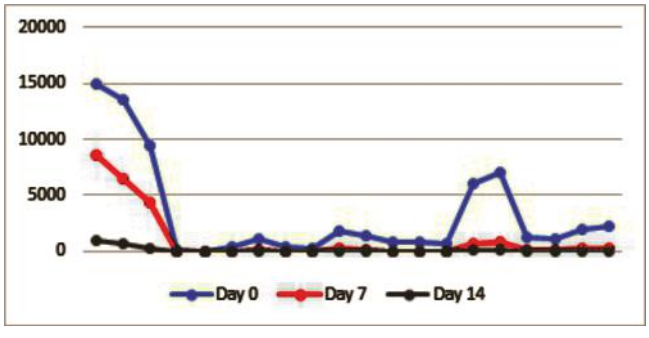

Fig. 2. Graphical representation of EPG evolution in rabbits treated with amprolium 20%

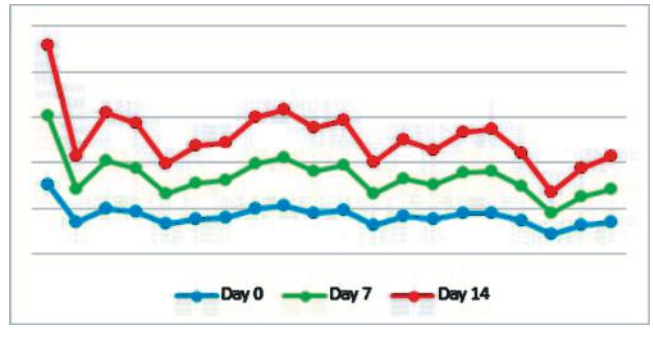

Fig. 3. Graphical representation of EPG evolution in untreated rabbits

Table 3

Descriptive statistics of data obtained by McMaster coproscopic examination in untreated rabbits

Day 0		*Day 7*		*Day 14*	
Mean	8415	**Mean**	8540	**Mean**	8605
Standard Deviation	2190.956292	**Standard Deviation**	2206.247111	**Standard Deviation**	2207.576666
Sample Variance	4800289.474	**Sample Variance**	4867526.316	**Sample Variance**	4873394.737
Minimum	4400	**Minimum**	4550	**Minimum**	4600
Maximum	15100	**Maximum**	15250	**Maximum**	15300
Confidence Level (95.0%)	1025.399109	**Confidence Level (95.0%)**	1032.555432	**Confidence Level (95.0%)**	1033.177683

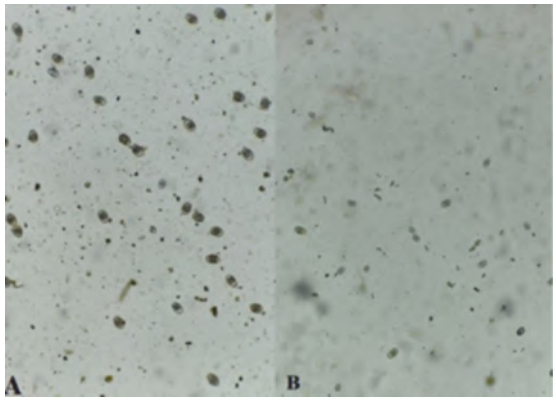

Fig. 4. Examination of faecal samples by the McMaster method before (A) and after drug administration (B), ob x 10

The efficacy of the antiparasitic substances was evaluated per group, resulting in both tested substances, sulfaquinoxaline sodium (99.05%) and amprolium (96.48%) showing efficacy in the treatment of coccidiosis in rabbits (Table 4).

Table 4

The efficacy of antiparasitic substances

Crt. no.	Groups	Efficacy	
		Day 7	**Day 14**
1.	Sulfaquinoxaline sodium	68.17%	99.05%
2.	Amprolium 20%	65.44%	96.48%

The P-value determined by TTEST after comparing groups before, on day 7, and at the end of therapy is shown in Table 5.

Following TTEST statistical analysis of EPG values in the studied groups, highly significant differences (p=0.0001) in infection were observed between day 0 of the SS group and day 7 of the SS group; between day 0 and day 14 of the SS group (p=0.0001), but also between day 7 and day 14 (p=0.0005) of the sulfaquinoxaline sodium treated group.

Highly significant differences were observed between day 0 and day 7 (p=0.0007) in the amprolium treated group. Highly significant differences were also observed between the sulfaquinoxaline sodium treated group and the untreated control group [day 7 SS - day 7 UC, day 14 SS - day 14 UC, respectively (p=0.0001)] and between the amprolium treated group and the untreated control group [day 0 A - day 0 UC, day 7 A - day 7 UC, day 14 A - day 14 UC, respectively (p=0.0001)].

Redrobe et al. (2010) conducted a study on rabbits naturally infected with intestinal coccidiosis. They were treated with toltrazuril at a dose of 5 mg/kg given once and sulfadimethoxine given consecutively for 9 days. The efficacy of these drugs was 99.6% for toltrazuril and 92.1% for sulfadimethoxine, respectively (16).

Table 5

P value by TTEST

Crt. no.	EXPERIMENTAL GROUPS			OBS.
1.	Day 0 - SS	vs	Day 7 - SS	0.0001*
2.	Day 0 - SS	vs	Day 14 - SS	0.0001*
3.	Day 7 - SS	vs	Day 14 - SS	0.0005*
4.	Day 0 - A	vs	Day 7 - A	0.0007*
5.	Day 0 - A	vs	Day 14 - A	0.0040
6.	Day 7 - A	vs	Day 14 - A	0.0519
7.	Day 0 - SS	vs	Day 0 - A	0.0422
8.	Day 7 - SS	vs	Day 7 - A	0.2345
9.	Day 14 - SS	vs	Day 14 - A	0.3882
10.	Day 0 - SS	vs	Day 0 - UC	0.0760
11.	Day 7 - SS	vs	Day 7 - UC	0.0001*
12.	Day 14 - SS	vs	Day 14 - UC	0.0001*
13.	Day 0 - A	vs	Day 0 - UC	0.0001*
14.	Day 7 - A	vs	Day 7 - UC	0.0001*
15.	Day 14 - A	vs	Day 14 - UC	0.0001*

Note: SS – sulfaquinoxaline sodium; A – amprolium 20%; UC – untreated control; $p < 0.05$*

A study by El-Ghoneimy et al. (2017) on rabbits naturally infected with intestinal coccidiosis were treated with amprolium at a dose of 50 mg/kg G.C. for 5 days, toltrazuril at a dose of 5 mg/kg G.C. for 2 days and simultaneously administered amprolium and toltrazuril at a dose of 50 mg/kg G.C., respectively, 5 mg/kg G.C. results indicated that both toltrazuril and amprolium administered individually as well as their concomitant use significantly reduced EPG rates ($p<0.05$) effectively controlled mortality and completely abolished clinical signs (6).

Another study by Qamar et al. compared different drugs in the control and treatment of coccidiosis in rabbits. The drugs involved were sulfadimidine sodium, toltrazuril, and amprolium. The efficacy of these drugs was 71%, 66.66% and 60%, respectively, thus sulfadimidine sodium and toltrazuril can be used as anticoccidials (14). According to Shameem (2010), the efficacy of sulfadimidine sodium is 99% (17).

CONCLUSIONS

The overall prevalence of Eimeria spp. infestation in the examined rabbits was 100%.

The results of antiparasitic therapy with sulfaquinoxaline sodium showed an efficacy of 99.05% and 96.48% for amprolium therapy.

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