

## A COMPARATIVE STUDY REGARDING THE EFFICACY OF ANTHELMINTIC TREATMENT FOR GASTROINTESTINAL PARASITISM IN SHEEP

### STUDIUL COMPARATIV PRIVIND EFICACITATEA UNOR ANTIHELMINTICE ÎN PARAZITISMUL GASTROINTESTINAL LA OVINE

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#### ABSTRACT | REZUMAT

The therapeutic efficacy of two medicinal products was tested on two batches of sheep, 20 each. Ivermectin (Evomec plus<sup>®</sup>) was administered subcutaneously (0.2 mg/kg) and albendazole (Vermidan<sup>®</sup> 10%), orally (7.5 mg/kg). The degree of infestation was determined using the McMaster quantitative coproscopic method, before administration and on the 7th, 14th and 21st day of the experiment. Anthelmintic efficacy (E%) and possible presence of product chemoresistance was calculated using the faecal egg count reduction test (FECRT). *Eimeria* spp. oocysts, larvated eggs of *Strongyloides* spp., morulated eggs of gastrointestinal strongyls and *Dicrocoelium lanceolatum* eggs were observed following coproscopic examinations. The therapeutic efficacy of Evomec Plus<sup>®</sup> was: 90.99% (in eimeriosis), 99% (in strongyloidiasis), 99.73% (in gastrointestinal strongyle infestation) and 96.31% (in dicrocoeliasis). Vermidan<sup>®</sup> 10% had a variable efficacy depending on parasites: 45.8% (in eimeriosis), 99.16% (in strongyloidiasis), 99.84% (in gastrointestinal strongyle infestation) and 94.3% (in dicrocoeliasis).

**Keywords:** gastrointestinal parasites, sheep, anthelmintic, chemoresistance

Eficacitatea terapeutică a două produse medicamentoase a fost testată pe două loturi a câte 20 de ovine. Ivermectina (Evomec plus<sup>®</sup>) s-a administrat subcutanat, 0,2 mg / kg, iar albendazolul (Vermidan<sup>®</sup> 10%), oral, 7,5 mg/kg. Gradul de infestare al ovinelor s-a determinat cu ajutorul metodei coproscopice cantitative McMaster, în zilele 0, 7, 14 și 21 ale experimentului. Eficacitatea antihelmintică (E%) și eventuala prezență a chimiorezistenței produselor utilizate în deparazitarea ovinelor s-a calculat prin testul reducerii ouălor din faecale (FECRT). În urma examenelor coproscopice la cele două loturi s-au identificat oochisturi de *Eimeria* spp., ouă larvate de *Strongyloides* spp., ouă morulate de strongili gastrointestinali și ouă de *Dicrocoelium lanceolatum*. Eficacitatea terapeutică a antihelminticului Evomec Plus<sup>®</sup> a fost de: 90,99% în cazul eimeriozei, 99% în strongiloidoză, 99,73% în strongilidozele gastrointestinale și 96,31% în dicrocelioză. Vermidanul<sup>®</sup> 10% a avut o eficacitate variabilă în funcție de specia parazită: 45,8% în eimerioză, 99,16% în strongiloidoză, 99,84% în strongilidozelor gastrointestinale și 94,3% în cazul dicroceliozei.

**Cuvinte cheie:** paraziți gastrointestinali, ovine, antihelmintice, chimiorezistență

Gastrointestinal parasitism is one of the most important causes of economic losses in sheep and goats.

Currently, although there are many antiparasitic products, the chemoresistance remains a big problem that affects the efficacy.

Gastrointestinal strongyle infestations have the largest distribution in western Romania, causing significant economic damage, such as: production decreases (meat, milk, wool), growth delays, mortality, or increase in prophylactic expenses (4, 8).

In the Western part of Romania, albendazole and avermectin-based products are the most used anthel-

mintics. It is known that anthelmintic resistance is inevitable but it can be delayed.

The epidemiological situation, according to the antiparasitic methods implemented, varies from one herd to another, one farm to another and one area to another. Starting from this premise and from the fact that, since 1997 increased chemoresistance has been reported in western Romania for albendazole and fenbendazole (7), the present study aims to establish the possible presence of chemoresistance for albendazole and ivermectin, in case of gastrointestinal nematodes, in sheep.

The faecal egg count reduction test (FECRT) was used, knowing its efficiency in detecting chemoresistance and choosing the most effective anthelmintic treatment (13).

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## MATERIALS AND METHODS

### Animals

To test the efficacy of some anthelmintics, two groups of 20 sheep were randomly chosen from a herd, in western Romania. Each batch was treated with a different anthelmintic. The sheep were adult females of the Turcana breed. Each animal was individualized so that it could be easily tracked during the experiment.

### Coproscopic technique

The faecal samples were collected transrectally from each sheep, using individual containers. The parasites were identified using flotation (the Willis method) and sedimentation methods. The degree of infestation for each sheep was determined using the McMaster quantitative coproscopic method, before treatment and on the 7th, 14th and 21st day of experiment.

### Treatment

One batch of 20 sheep was treated with 0.2 mg/kg ivermectin (Evomec plus®, Farmavet, Romania), injectable, subcutaneously and the other batch of 20 sheep was treated with 7.5 mg/kg albendazole (Vermitan® 10%, Maravet), oral administration. The therapy was administered after the first samples were collected. The anthelmintic efficacy (E%) and the possible presence of product chemoresistance were calculated according to FECRT formula:

$$E\% = \frac{\text{E.P.G. before treatment (day 0)} - \text{E.P.G. day 14}}{\text{E.P.G. day 0}} \times 100$$

### FECRT

The FECRT was utilized following the guidelines of the World Association for the Advancement of Veterinary Parasitology (WAAVP) and AAEP Parasite Control Guidelines methods for the detection of anthelmintic resistance in nematodes with veterinary importance (6).

### Statistics

Statistical interpretation was performed using Mann Whitney test (GraphPad Prism 9.0.1.).

## RESULTS AND DISCUSSIONS

Following coproscopic examination, *Eimeria* spp. oocysts, eggs of *Strongyloides* spp. and *Dicrocoelium lanceolatum*, along with gastrointestinal strongyles were identified in the two groups.

The evolution of parasitic elements in faeces after Evomec Plus® treatment is shown in Table 1.

Following Evomec Plus® administration, there was a significant reduction of oocyst elimination after 7 days. The decrease in parasitic egg elimination was also present at 21 days after treatment.

However, during the whole study, the oocyst elimination process was maintained.

The *Strongyloides* spp. egg elimination was significantly reduced and stopped, except for three samples at 7 days posttreatment (p.t.), two samples at 14 days p.t. and one sample at 21 days p.t.

The gastrointestinal nematode eggs were significantly reduced, especially at 14 days, with a few eggs being eliminated by five out of the 20 sheep tested. At 21 days, egg elimination was recorded in seven sheep.

Regarding *D. lanceolatum*, a significant reduction of egg elimination was found, probably due to clorsulon, contained in Evomec Plus®, without sample negatvation, except one, at 14 days p.t.

The efficacy of Evomec Plus® antiparasitic treatment, in sheep polyparasitism, according to FECRT formula was: 90.99% (in eimeriosis), 99% (in strongyloidiasis), 99.73% (in gastrointestinal strongyle infestation) and 96.31% (in dicrocoeliasis).

Table 2 shows the results of albendazole therapy.

**Table 1**

**The EPG evolution following Evomec Plus® treatment**

Explanatory note	<i>Eimeria</i> spp.				<i>Strongyloides</i> spp.				GI*** strongyls				<i>D. lanceolatum</i>			
	D**0	D 7	D 14	D 21	D 0	D 7	D 14	D 21	D 0	D 7	D 14	D 21	D 0	D 7	D 14	D 21
N=20																
E.P.G. mean	4551.2	960	410	785	502.5	7.5	5	2.5	5762.5	35	15	30	5375	473	198	332
SD*	± 266.22	± 79.93	± 49.68	± 76.44	± 32.63	± 3.8	± 3.7	± 2.3	± 223.27	± 8.9	± 6.3	± 11.1	± 163.7	± 39.1	± 25.7	± 45.3

SD - standard deviation; \*\*D - day, \*\*\*GI - gastrointestinal

Table 2

## Evolution of parasitism after Vermitan® 10% treatment

Explanatory note	<i>Eimeria</i> spp.				<i>Strongyloides</i> spp.				GI*** strongyls				<i>D. lanceolatum</i>			
	D**0	D 7	D 14	D 21	D 0	D 7	D 14	D 21	D 0	D 7	D 14	D 21	D 0	D 7	D 14	D 21
N=20																
E.P.G. mean	2265	1206.5	1227.5	945	1195	12.5	5	5	6407.5	57.5	10	17.5	2852.5	252.5	162.5	260
SD*	± 108.3	± 127.7	± 136.4	± 75.5	± 58.64	± 4.7	± 3.2	± 3.2	± 162.9	± 15.1	± 4.3	± 5.2	± 90.64	± 33.9	± 25.3	± 29.3

SD - standard deviation; \*\*D - day, \*\*\*GI - gastrointestinal

Following albendazole treatment, *Eimeria* spp. oocyst elimination was significantly reduced ( $P < 0.0001$ ), especially at 14 days p.t., then counting a new increase at 21 days p.t. None of the samples were negative.

The use of albendazole also determined a significant *Strongyloides* spp. egg reduction ( $P < 0.0001$ ) and sample negativation, except for two.

A good effect was also observed against gastrointestinal nematodes, the egg elimination being significantly reduced ( $P < 0.0001$ ) after 14 days, in most of the samples, except for 4 of them, that were negative.

Albendazole also had a significant effect against *D. lanceolatum* ( $P < 0.0001$ ), sample negativation being observed, but only in two cases, at 14 days p.t.

Vermitan® 10%, according to FECRT formula, had a variable efficacy depending on parasite species: 45.8% (in eimeriosis), 99.16% (in strongyloidiasis), 99.84% (in gastrointestinal strongyle infestation) and 94.3% (in dicrocoeliasis).

Some studies conducted in Western Romania by Indre et al. (2011) and Hora et al. (2013) reported 97.03% (10) and 98.46% (11) efficacy of albendazole used against sheep gastrointestinal nematodes.

In a similar study, Godara et al. (2011), after analysing the activity of anthelmintics against gastrointestinal nematodes in Jamnapari goats, counted 23% efficacy for fenbendazole, 63% for levamisole and 98.11% for ivermectin (9). Eprinomectin was also ineffective against *H. contortus*, in goats (1).

Borges et al. (2019) tested the efficacy of ivermectin administered in combination with quercetin and observed a chemoresistance of *H. contortus* larvae and adults (2).

In India, a group of researchers led by Rialch (2013), following the investigation of 14 herds of goats and sheep, detected a benzimidazole resistance in eight out of the 14 herds examined, with a FECRT ranging between 54.95% and 90.86% (12).

Benzimidazoles chemoresistance was also observed in Belgium, in a study conducted by Claerebout et al. (2020). The gastrointestinal nematode species with the highest chemoresistance were *Haemonchus contortus* and *Teladorsagia circumcincta*. Benzimidazoles identified as ineffective were albendazole, fenbendazole and mebendazole (5).

In another study, in Scotland, the efficacy of albendazole in lamb dicrocoeliasis was 72.9% (14).

In Uganda, a study conducted by Byaruhanga et al. (2011) showed an efficacy of 28.5% for albendazole, 91% for levamisole and 98% for ivermectin, used against gastrointestinal nematodes (3).

The E.P.G. evolution, from 0 to the 21<sup>st</sup> day p.t., places the Evomec Plus® and Vermitan® 10% products in the "safety group". Although these are the most used anthelmintics in Western Romania, it seems, based on FECRT, that we are not dealing with a chemoresistance phenomenon. However, the fact that, after treatment, not all the samples were negative, shows that there is a small parasitic population with the potential to develop resistance to these anthelmintics. Using these products irrationally, without a proper rotation plan, can lead to chemoresistance.

The reduction in *Eimeria* spp. oocyst elimination, following therapy, is yet to be explained properly without further studies, although there was no negativation.

## CONCLUSIONS

Chemoresistance of albendazole and ivermectin was not reported. The therapeutic efficacy of Evomec Plus® was: 90.99% (in eimeriosis), 99% (in strongyloidiasis), 99.73% (in gastrointestinal strongyle infestation), and 96.31% (in dicrocoeliasis). Regarding Vermitan® 10%, the efficacy was: 45.8% (in eimeriosis), 99.16% (in strongyloidiasis), 99.84% (in gastrointestinal strongyle infestation) and 94.3% (in dicrocoelia-

sis). The FECRT can be used in current practice to choose the most effective anthelmintic.

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