



ISSN: 2230-9926

Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research

Vol. 11, Issue, 01, pp. 44019-44021, January, 2021

<https://doi.org/10.37118/ijdr.20951.01.2021>



RESEARCH ARTICLE

OPEN ACCESS

EFFECTIVENESS OF ANTI-HELMINTHIC IN SHEEP CREATED IN THE AMAZON REGION

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ARTICLE INFO

Article History:

Received 14th October, 2020
Received in revised form
11th November, 2020
Accepted 06th December, 2020
Published online 30th January, 2021

Key Words:

Monepantel; Gastrointestinal nematodes;
Resistance; Sheep Raising; Ivermectin.

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ABSTRACT

The aim of this paper was to evaluate the efficiency of anthelmintics about the reduction of gastrointestinal nematodes of the sheep raised in amazon region in different times of the year. The experiment was developed At the Federal Institute of Rondônia, Colorado do Oeste Campus, using 40 sheep and performed effectiveness tests and evaluation of the effectiveness of the anthelmintics monepantel, ivermectin, levamisole, and albendazole. For each treatment, it was used 15 animals. From these, it was collected feces to do the eggs counting by feces grams before the anthelmintics injection, and 14 days after application. After that, It was performed the percentage of the effectiveness and evaluation of the effectiveness and efficiency of the anthelmintics used, being done all procedures in two different seasons of the year, characterizing the rainy season (September to April) and dry season (May to August). The results showed that the monepantel ($p < 0,01$) anthelmintic was the most effective and efficient treatment in the gastrointestinal nematodes controlling, it did not matter the season of the year and the albendazole anthelmintic was the worst effectiveness, being considered non-efficient its use in the amazon region.

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Citation: Alan A. Mesquita, Victor H. de Souza, Daniele J. Venturim, Maria H. Ferrari, Lucien B. Freiria, Fagton M. Negrão, Flávio H. B. Caldeira, Túlio O. J. D. Lins, Abílio P. Ciríaco, Raphael H. P. Reis, Fabiano G. Souza and Eduardo M. B. Reis, 2021. "Effectiveness of anti-helminthic in sheep created in the amazon region" *International Journal of Development Research*, 11, (01), 44019-44021

INTRODUCTION

Sheep raising has grown significantly in the amazon region, that from the 80th century on, with the wholes sheep importing such as Morada Nova and Santa Inês, by farmers initiative, and also by governmental programs through joint actions, especially from Brazilian Livestock and Farming Research Corporation (EMBRAPA) and Association of Technical Assistance and Rural Extension (ATER) (Oliveira *et al.*, 2017). With this boom of the sheep farming, came out a troublesome in terms of the welfare of the animals raised in the amazon region, region with weather characteristics very different from the other Brazilian countries where the animals were imported. Those characteristics are favorable to parasites development in sheep, mainly the parasitism by gastrointestinal nematodes, in what is the main welfare problem faced throughout the world (Vieira, 2007). The parasitism by gastrointestinal nematodes causes meat and milk production decrease, besides the high number of the herd mortality, these make that gastrointestinal worm represents the highest

economic impact in the small ruminant's exploration (Pinheiro *et al.*, 2000). Worm resistance has caused a great impact in the sheep husbandry, such as many sheep farmers are disabling their creation facilities due to the shortage of alternatives to fight against the worm infection and the low productivity of the herd (Ramos *et al.*, 2002; Sczesny-Moraes *et al.*, 2010). Some researchers have been developed trying the effective control of these worms in an alternative way, aiming the reduction of chemical composts uses, effective measures but they are very little used. It's important to highlight that the nowadays controlling methods still depend on anthelmintics (Araújo *et al.*, 1999; Araújo *et al.*, 2004). It's known that the selection of resistant worms after their exposure to chemical products is unavoidable and besides that, the development and commercialization of new drugs are slow and excessively expensive, with a troublesome, because the chemical control of the gastrointestinal helminths is practiced with medicines which contain high concentration or even combined with many anthelmintics together, without production rules and/or indications to its wide use (Molento *et al.*, 2011). In this context, a new anthelmintic class based on monepantel has been used in the national market as a new alternative in the gastrointestinal

nematodes control (Kaminsky *et al.*, 2008). But all these anti worms were tested in very distinct environments from animals raised in the amazon region, researches have already shown the sheep difficulty to adapt to this region (Costa *et al.*, 2010). Consequently, sheep become more exposed to diseases and need effective treatments. With the lack of reliable data, the aim of this research is to evaluate the effectiveness of the anthelmintic by the reduction of sheep gastrointestinal nematodes raised in the amazon region in different seasons of the year.

MATERIAL AND METHODS

The experiment was developed at the Federal Institute of Rondônia (IFRO) Colorado do Oeste Campus, in Colorado do Oeste County, state of Rondônia from September, 2018 to August, 2019. According to Köppen classification, the predominant weather of Rondônia is AW – Rainy tropical weather (hot and wet). Because of the AW weather influence, the annual rainfall average changes between 1.400 mm/year and 2.600 mm/year, while the annual temperature average varies between 23°C e 26°C (Sedam, 2007). The animals used were 60 male and female sheep whose age was superior to six months old and lower than 48 months old from the experimental herd from IFRO – Colorado do Oeste Campus. The animals were put in the paddock in the morning fed with *Panicum maximum* cv. Massai, with water and salt “*ad libitum*”, and they were arrested by the end of the afternoon to sheepfold where they were fed with corn silage and a balanced diet. Tests of effectiveness of the anthelmintics monepantel, ivermectin, levamisole, and albendazole were performed. To each treatment, 15 animals picked randomly were used, allocated in randomized blocks, with 4 treatments and 15 repetitions. All procedures were developed in two different seasons of the year characterized by the rainy which is from September to April and the dry season from May to August. To perform the tests, the animals stayed 45 days without any kind of treatment against the gastrointestinal nematodes before the anthelmintics application. The fecal grab samples were obtained directly from the rectum of the animals’ feces collection from all animals was done straightly from the animals’ rectal vial with the surgical gloves placed in 50ml sterile bottles to be analyzed afterward. After the feces collection, it was done a fecal egg count (FEC), by the McMaster modified technique using 4g of feces and salt-saturated solution, resulting in number of eggs per feces grams (Ueno & Gonçalves 1994).

After performing the FEC it was done the monepantel, ivermectin, levamisole and albendazole anthelmintic applications in the animals as recommends the leaflet according to the treatment chosen. The application was done right to the animal’s mouth by a dosifier pistol, placing the cannula of the pistol in the mouth lateral and above the backside of the tongue. So, it was injected the anthelmintics in cases of medicines based on monepantel, levamisole and albendazole. The application of ivermectin basis was performed in a subcutaneous way, under the soften skin, in front of the shoulder clod also using a dosifier pistol with a 15x18 needle. The feces were collected again after 14 days of the application to perform the FEC examination whose procedures were the same as the ones described before. The aim is to check the efficiency in the reduction of the animals’ contamination by the gastrointestinal helminths (Coles *et al.* 2006). Afterwards, analyses were done by comparing FEC medium before and after the anthelmintic application.

The effectiveness percentage was obtained by the following formula:

$$\% \text{ Effectiveness} = 1 - \left[\frac{\text{FEC post-treatment}}{\text{FEC before do treatment}} \right] \times 100$$

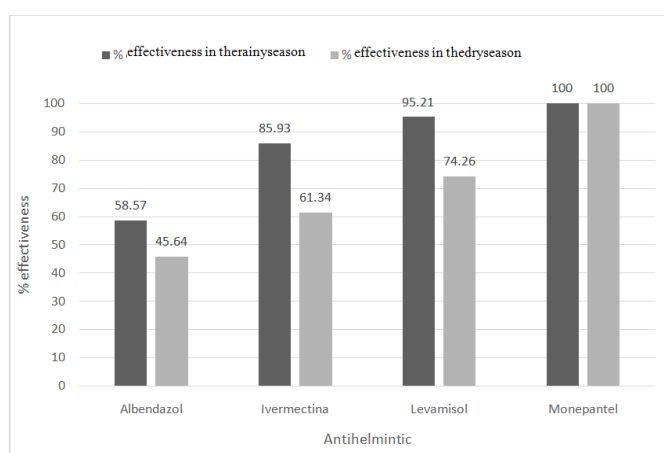
The evaluation of the anthelmintic effectiveness used was determined according to the average obtained in each treatment of its effectiveness. It was considered efficient when its effectiveness was higher than 90% when its effectiveness was between the interval of 80% to 90%, it was considered low efficiency or suspect and effectiveness below 80%, inefficient (Zajac & Conboy 2006).

After that, data were statistically analyzed by the variance analyses procedures and comparison of the effectiveness percentage average by the Tukey test to 1% of probability, using SAS (2006).

Ethical and Legal Issues: This project was approved by the Ethical Committee of use of animal of the College of Biomedicine Science of Cacoal – FACIMED, whose protocol number is 014/18, September 5th, 2018.

RESULTS AND DISCUSSION

It was observed reduction in the FEC counting of animals fed in relation to FEC before the anthelmintics application in all treatments in all seasons of the year. The results showed that monepantel anthelmintic ($p < 0,01$) was the most effective in the gastrointestinal nematodes no matter the season of the year (Table 1; Table 2). However, ivermectin and levamisole anthelmintics did not differ from the effectiveness of the product based on monepantel in the rainy season. Only albendazole anthelmintic had its effectiveness differed, being considered the less effective among the treatments.



Graphic 1. Effectiveness average of the anthelmintics in dry and rainy seasons in the control of nematodes gastrointestinal of the treatments

Table 1. Effectiveness average in the rainy season (September to April) in percentage in the gastrointestinal nematodes control of the treatments with reference the average of the counting eggs per grams of feces before anthelmintics application (FEC before) and after the anthelmintics application the average of counting eggs per gram of feces (FEC after)

Anthelmintics	Average FEC Before	Average FEC after	% effectiveness
Albendazole	1352	125	58,57b
Ivermectina	1421	47	85,93a
Levamisole	1523	50	95,21a
Monepantel	2033	0	100a

Averages followed by different letters are different ($P \leq 0,01$), by Tukey test. Variance Coefficient (VC) 8.09%.

Table 2. Effectiveness average in the Dry season (May to August) percentage in the nematodes gastrointestinal control of treatments with reference the average of the eggs per gram counting of the feces before anthelmintics application (FEC before) and after the anthelmintics application the average of counting eggs per gram of feces (FEC after)

Anthelmintics	Average FEC Before	Average FEC After	% effectiveness
Albendazole	1965	456	45,64b
Ivermectina	1443	234	61,34b
Levamisole	1878	70	74,26ab
Monepantel	1610	0	100a

Average followed by different letters is different ($P \leq 0,01$), by the Tukey test. Variance Coefficient (VC) of 12.86%.

According to the efficiency of the treatments during the rainy seasons using albendazole active ingredient was considered inefficient. The ivermectin was classified with low efficiency or suspect efficiency, and only levamisole and monepantel anthelmintics were considered efficient because they were able to achieve 95% of effectiveness in the gastrointestinal worms' control. During the dry season, it was observed that only the monepantel anthelmintic keep its effectiveness in 100%, but the treatment with levamisole did not differ to monepantel treatment ($p < 0,01$), and also, it is not seen an effectiveness higher from levamisole to treatments based on ivermectin and albendazole (Table 2). In the dry season, only monepantel was classified as efficient in the gastrointestinal worms, even though the albendazole, ivermectin, and levamisole active ingredient were classified as inefficient. These results support results reached by Duarte *et al.* (2012), in which its effectiveness percentage varied from 90 to 100% to animals treated with levamisole, and from 56,3-100% to lambs wormed with albendazole, also observing that albendazole showed up lower effectiveness. It can be seen in the results that the animals can already be created a multi-resistance to albendazole and ivermectin active ingredients (Table 2), these results were also observed by Ramos *et al.* (2002), in which it was evaluated 65 sheep herd in Santa Catarina observing the multi-resistance. 77% showed resistance to ivermectin and 74% resistance to albendazole. The results pointed out to an efficiency to monepantel active ingredient in any season of the year with 100% effectiveness. This supports what other studies have also pointed out to a great efficiency at around 98,99%, indicating the effectiveness of gastrointestinal strongylides worm's active ingredient on *Haemonchus* spp. e *Trichostrongylus* spp., the most involved genders in speeches of anthelmintic resistance in (Ciuffa *et al.* 2017). As it can be observed in the results (Graphic 1), there was a difference in the effectiveness in different seasons of the year. This can be occurred because of the phenomena of the increase of eggs elimination in the periparturient, as many ewes were in the reproductive period. According to Stear *et al.* (1997), there is an increase in the number of gastrointestinal worm eggs eliminated by the ewes in the periparturient caused by the weakened immunity of these animals in this period. So, it is allowed the development of larvae in hypobiosis and a higher establishment of new ones. It is important to highlight that between the data observed is the possible resistance of albendazole, levamisole and ivermectin anthelmintics because the effectiveness was lower 90% in the dry season, as well as albendazole and ivermectin in the rainy season is considered insufficiently active (GMC, 1996), and according to Coles *et al.* (1992), it is present when the effectiveness is low than 95%. So, the three active ingredients are classified as inefficient. The results pointed that it must be done management practices to minimize resistance effects that according to Costa *et al.* (2011), it can be strategic and selective plans to treatments making the worming of the animals based on data of the helminths biological, weather conditions and selective form based on the treatment needs and anthelmintics effectiveness, always looking for alternatives to chemical principles like herbal or homeopathic medicines.

CONCLUSION

It can be concluded that among the treatments used in sheep raising in amazon region the Monepantel was the most efficient and effective in the control of gastrointestinal nematodes, it does not matter the season of the year. The anthelmintic based on albendazole had the worse effectiveness being considered unsatisfactory to its use in the amazon region.

Acknowledgment: To the Research Department of IFRO Colorado do Oeste by the research financial support.

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