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Original Article

Strongyloides and *Eimeria* Infection and Its Treatment Way in Sheep

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Abstract

Parasitic infections are one of the main problems in sheep breeding farms. For this reason, in order to control the damage caused by parasitic infections, a wide range of antiparasitic drugs with different forms are used. A particular area is important due to contamination with radioactive substances and its effect on the immune system of livestock in the area. Therefore, the aim of the present study was the effectiveness of antiparasitic drugs in sheep farms in Kazakhstan. In the current study, 3 groups of lambs were evaluated; each one included 30 infected lambs of 5 to 6 months with *Strongyloides* and *Eimeria spp.* and treated with antiparasitic compounds in two forms of tablets (Albendazole, Pyrantel, Ivermectin, Phenasal) and mineral-salt cube (Albenvet, Trimeratinvet). The result of the study showed that began 10, 20, and 30 days after experimentation, the mineral-salt cube significantly reduced the number of helminths and *Eimeria spp*. in sheep (92.18%) ($P \leq 0.05$). Ant antiparasitic drugs in livestock diet are essential in reducing contamination and its effects on the herd.

Keywords: *Eimeria spp*., *Strongyloides*, Kazakhstan, Sheep, Treatment

1. Introduction

Sheep farming is one of the largest agricultural branches in the Republic of Kazakhstan and is highly economically important. Among farm animals, sheep occupy the top place in the variety of products manufactured. Muldasheva, Toxanbayeva (1), (2) have noted that sheep breeding provides the national economy with a sufficient amount of wool, sheepskin, and leather and supplies the population with food products: milk, meat, cheese, and feta cheese. Parasitic infections such as protozoa and worms can significantly damage animal breeding; this pathogenesis of these infections causes a significant reduction in productivity and the immunity of young animals, which often causes more loss than mortality (3, 4).

Knowing the types of parasitic pathogens and their epizootological characteristics in specific climatic and production conditions is necessary to control various infections. Moreover, treatment plans based on these principles have a synergistic effect (5, 6). Melikyan (7) reported that sheep mortality due to parasitic diseases could vary from 13.3 to 50%. Sariev, Kereev (8) announced that the loss due to mortality is a smaller part of the economic damage caused by parasitic contamination, and a large amount of loss to livestock farmers is caused by the latent effects of contamination on the productivity of livestock products. It should be noted that sheep health is related to immune protection, which is weakened in conditions of parasitic infection (3, 4). Kazakhstan has a Semipalatinsk nuclear test site, which was used for 40 years (1949-1989). It had

suffered more than 450 aboveground and underground explosions. Radiometric control shows a high level of radiological pollution at all control points: the exposure dose rate ranged from 0.08 to 032 μSv/h. The Semipalatinsk test site still has a harmful impact on human and animal health. For example, the rural spontaneous pastures organized at landfill lands near the test site affected the immune, bone, and reproductive systems changing metabolism processes (3, 9).

So far, many researches have shown that susceptibility to Eimeria infection increases if the immunity of ruminants is reduced. Kozhabaev, Suleimanov (10), (11) have noted that lambs are more susceptible to infection compared to older sheep. The prevalence of infection in sheep flocks has a pattern that its level increases in spring and autumn and decreases in winter. Examination of the infection shows that the infection is often observed in a mixed form of two to five species of Eimeriaspp. in sheep. More mixed invasions by different helminths (gastrointestinal tract helminths and Eimeria spp.) were found in lambs aged 3–4 months in East Kazakhstan. Gastrointestinal parasites in lambs often include *Strongylusspp, Strongyloidspp.* And *Eimeria* species (12-14). Therefore, the prevention and treatment of parasitic diseases in farm animals have a significant place in the system of veterinary practices (9). Due to the contamination of radioactive radiation in this region and the adverse effect on the immune system of livestock in the region, parasitic diseases are common. Antiparasitic drugs are necessary cures to preserve healthy livestock in the conditions of radioactive pollution, but this cannot be done without a detailed study of the regional parasites' epizootiology. For this purpose, in the present study, different treatment methods using antiparasitic drugs were evaluated in the control of *Strongyloides spp.* and *Eimeria spp.* infection.

2. Materials and Methods

2.1. Sampling and Design of the Study

The experiment lasted from 2017 to 2019 at East Kazakhstan farm manufacturers "Zhartas" (Tarbagatai district), "Әzbergen" (Abai district), "Altai" (Semey city), "Nurzhan" (Beskaragai district), "Aydar" (Ayagoz region). In the current experiment, 3 groups of lambs were evaluated, including 30 lambs of 5 to 6 months. After determining the degree of contamination of the lambs based on the coprological test based on Fulborn's method, the infected lambs were divided into 3 groups considering the body weight and degree of contamination. The first was the control (without any treatment), and the other two were treated with different designs.

2.2. Experimental Treatment Design

The treatment groups in this research were divided into two groups that were treated with 2 broad-spectrum antiparasitic compounds in the form of tablets and a mineral-salt cube .Treatment schemes were provided according to the patents of Akhmetsadykov, Nur (15), (16). Pills of the anti-helmintic drug (Table 1) were tested on the first experimental animal group spontaneously infested with Strongyloides spp. and Eimeria spp. So, the oral free-feeding antiparasite drug (pill dosage of 4 pills per 20 kg of weight) was introduced to the first group. The second experimental group got the mineral-salt cube with the antiparasite effect created by was added to the diet of the sheep according to Akhmetzhanova, Shabdarbaeva (16), (17, 18). It not only had disinfestation action but also served as mineral feeding and improved meal absorption (Table 2). The experimental and control lambs were kept together in a stall and fed green mass and compound feed. The results of the treatment and prevention actions were examined on the 7th day after anti-wormed treatment was conducted on the animals in the experiment with the control group's data.

Table 1. The composition of the antiparasite veterinary formula (the first version)

Component	wt.%
Albendazole	0-30.0
Pyrantel	20.0-30.0
Ivermectin	0.5-5.0
Phenasal (niclosamide)	5.0-20.0
Horse sorrel fruit powder	5.0-20.0
The powder of the aerial part of the lubaznica vulgaris	5.0-20.0
Sucrose	5.0-15.0
Starch	20.0-50.0
Polyvinylpyrrolidone	1.0-5.0

Table 2. The mineral-salt cube composition

Component	wt.%
Albenvet 360	0.8-1.0
Trimeratinvet 270	1.2-1.3
Starch	3.8-5.9
Feed salt	72.0-74.0

2.3. Evaluation of Treatment Effectiveness

In order to evaluate the efficiency and effectiveness of the treatment methods used in the investigated groups, the spectrum of parasitic infection was examined using complete and incomplete worm dissection methods and intra-vital studies. Matrices of a complete helminthological autopsy were preserved with Barbagallo liquid (the 3% formalin solution in the isotonic sodium chloride solution) and labeled in a glass jar.

Coprological studies were done based on the Fuller Bon method. Stool samples (3 grams) are kept in a 2.5% potassium dichromate solution. Each stool sample was ground in a porcelain cup with 15-20 ml of water, and after filtering, it was centrifuged (5 minutes; 1000-1500 rpm). The supernatant was drained, and zinc chloride or lead nitrate solutions with a specific gravity of 1598 and 1500 were added. The pellet was thoroughly mixed and centrifuged for 1 min at 1000 rpm. The upper layer was removed from the liquid with a wire loop, transferred to a slide plate, a drop of distilled water was added, covered with a cover slip, and then a microscopic examination was done.

The infection intensity was determined by the formula (1):

$$\text{Prevalence} = \frac{A}{B} \times 100$$

A – The number of infected animals;

B – The number of examined animals.

2.4. Statistical Analysis

The SPSS20.0 was used to compare the effectiveness of treatment methods. The t-test and one-way analysis of variance was performed to test the difference between the methods used and the level of parasitic infection ($P \leq 0.05$).

3. Results and Discussion

The Semipalatinsk side of the experiment is still a radioactive wasteland. The protective immune response is reduced due to radiation; therefore, invasive diseases can cause significant damage, as Ilyazov (3) noted. Melnychuk and Antipov (19) emphasized that radioactive incursions cause great economic damage to animal husbandry worldwide. In this case, our goal was to investigate the treatment methods and the effectiveness of the drugs used in this area in sheep infected with parasites. Millions of animals are annually treated and prevented to limit invasion, reduce economic losses, and gradually recover process. 9 species of *Strongyloides* and 5 species of eimeria were found in sheep in the omasum, abomasum, small and large intestines: in omasum-*Haemonchuscontortus*, *Ostertagiacircumcincta*, in abomasum and duodenum — *Nematodirusspathiger*, in small intestine-*Bunostomumtrigonocephalum*, *Trichostrongyluscolumbriformis*, *T. axei*, *Oesophagostomumvenulosum*, *Strongyloidespapillosus*, in the large intestine – *Chabertiaovina* and 5 types of eimeria (*E. arloingi*, *E. ninaekohljakimovae*, *E. Parva*, *E. faurei, E. ahsata)* were found (19, 20).

In this study, lambs infected with parasites in eastern Kazakhstan were tested. Significant infection of lambs, especially in the conditions of the former Semipalatinsk polygon, we noted: the infection of sheep at the age of 5-6 months with different intensity of infection varied from 70 to 100%. Clinical signs such as depression and loss of appetite were recorded in lambs, body temperature change in infected sheep was not significant, but in some cases, it increased to 41-40.5ºC, and the feces contained mucus and blood streaks.

According to the study, the minimum infestation was fixed at the "Zhartas" farm of the Tarbagatai district and the "Aydar" farm of the Ayagoz district. Furthermore, the maximum infestation points were

detected at the "Nurzhan" farm in the Beskaragai district. In total, 1200 sheep (80%) had Strongyloides-eimeriotic invasion. Strongyloides-eimeriotic infestation of sheep at the zone of minimal radiation risk amounted to 66.7% (19).

The efficacy of these measures largely depends on the quality of antiparasite drugs and the perfection of the methods of their use. Therefore, developing new antiparasite drugs with high efficacy as a treatment drug and economic action is an urgent task of veterinary science (19-21). In this regard, several antiparasitic drugs with a broad spectrum were used in two forms to make antiparasitic drugs more effective and easier to use.

The supervision was carried out at all stages of the drug preparation. Next, the developed drug was studied for anti-helmintic activity. The veterinary composition was administered orally once with the dosage: of 4 pills (2.0 g of granulate) per 20 kg of live weight of sheep. The autopsy and parasite egg counting results showed that all the lambs in the control group were infected with helminths and *Eimeria spp*. Nematodes, Strongyloides, and *Eimeria spp*. Predominated among nematodes. In the experimental groups, a 100% effect was obtained.

The developed mineral-salt cube showed its efficacy with simultaneously anti-helminth and anti-eimeria action. Using a mineral-salt cube showed its effective action against mixed invasions caused by helminths and *Eimeria*spp. It was used for preventive measures. Studies that began 10, 20, and 30 days after this part of the experiment showed that the mineral-salt cube significantly reduces the number of helminths and *Eimeria* spp. in sheep ($P \leq 0.05$). It must be noted that the control group's animals demonstrated a total (92.18%) infestation of both *Eimeriaspp* and *Strongyloides* (Table 3).

Table 3. The efficacy of tablets and mineral-salt cube antiparasite in infected sheep

Sheep farms	Mean EPG value before/after treatment	Efficacy (%)
Mineral-salt cube	1580/124	92.18%
Tablets	1648/235	85.74%

In treating sheep parasites, ivermectin, levamisole, albendazole, closantel, and monopantel are available. IVM (macrocyclic lactone) and ABZ (benzimidazole) are more commonly used and have a more appropriate effect (22). Although extensive studies have shown that Trichostrongylidae infestations have shown resistance to IVM and ABZ, research on antiparasitic resistance is underway worldwide (23). Infestation of sheep with *Eimeria spp*. and *Strongyloides spp.* in the conditions of the ex-Semipalatinsk test-side region is enormous. The highest levels of prevalence and infection intensity in animals were recorded under 6 months. The developed treatment drug schemes have such advantages as a broad spectrum of action and synergism action of the drug components on the helminths infestations.

Authors' Contribution

Study concept and design: O. A.
Acquisition of data: S. D.
Analysis and interpretation of data: A. A.
Drafting of the manuscript: S. T.
Critical revision of the manuscript for important intellectual content: A. A.
Statistical analysis: S. D.
Administrative, technical, and material support: A. Y.

Ethics

All experiments were conducted according to the Ethical Protocol approved by the Shakarim State University of Semey Ethics Committee.

Conflict of Interest

The authors declare that they have no conflict of interest.

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