ОШ МАМЛЕКЕТТИК УНИВЕРСИТЕТИНИН ЖАРЧЫСЫ. АЙЫЛ ЧАРБА: АГРОНОМИЯ, ВЕТЕРИНАРИЯ ЖАНА ЗООТЕХНИЯ

ВЕСТНИК ОШСКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА. СЕЛЬСКОЕ ХОЗЯЙСТВО: АГРОНОМИЯ, ВЕТЕРИНАРИЯ И ЗООТЕХНИЯ

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EFFECTIVENESS OF DICTYOCAULOSIS TREATMENT

КОЙЛОРДУН ДИКТИОКАУЛОЗУН ДАРЫЛООСУНУН НАТЫЙЖАЛУУЛУГУ

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EFFECTIVENESS OF DICTYOCAULOSIS TREATMENT

Abstract

Dictyocaulosis remained one of the most prevalent helminthic infections in global sheep farming, inflicting substantial economic losses on the industry. The aim of the research was to study the efficacy of treatment methods for dictyocaulosis in sheep. The article presented the results of research on the efficacy of various antihelminthic drugs in the treatment of sheep dictyocaulosis caused by the nematode Dictyocaulus filaria. Diagnosis was carried out comprehensively, including epizootological data, clinical signs (coughing, emaciation, digestive disorders) and laboratory methods (helmintholarvoscopy according to Berman-Orlov). Three groups of sheep receiving Nilverm 20%, Santomectin and Ivermec were formed. The efficacy was evaluated according to the intensity and extensiveness of invasion, as well as extensiveness and intensiveness. Results showed that Nilverm 20% and Santomectin completely eliminated infestation by the 30th, whereas Ivermec provided 85-86% efficacy. Economic analysis revealed the highest profitability of Nilverm 20% application (91.2 RUB per 1 RUB of costs), followed by Santomectin (87.9 RUB) and Ivermec (83.2 RUB). The study demonstrated that timely and appropriate selection of antihelminthic drugs can significantly reduce the prevalence of dictyocaulosis in sheep herds. The study results confirmed the high efficacy of Nilverm 20% and Santomectin in controlling dictyocaulosis and emphasized the importance of proper selection of antihelminthic drugs to maintain animal health and improve flock productivity. The findings provided evidence-based guidance for veterinarians and sheep farmers in selecting the most effective and economically advantageous antihelminthic treatment for dictyocaulosis, ultimately improving animal health, productivity, and farm profitability

Keywords: Dictyocaulus filaria; Nilverm; Santomectin; Ivermec; treatment efficacy; helminthic diseases

Койлордун диктиокаулозун дарылоосунун натыйжалуулугу

Аннотация

Диктиокаулез дүйнөлүк кой чарбачылыгында эң кеңири таралган гельминттик оорулардан бири болуп кала берүүдө жана өнөр жайга олуттуу экономикалык чыгымдарды алып келет. Изилдөөнүн максаты – койлордо диктиокаулезди дарылоонун ыкмаларынын эффективдүүлүгүн изилдөө болгон. Макалада Dictyocaulus filaria нематодасы менен козголгон кой диктиокаулезин дарылоодо ар кандай антигельминттик препараттардын натыйжалуулугуна байланыштуу изилдөөнүн жыйынтыктары келтирилген. Диагностика комплекстүү жүргүзүлгөн, эпизоотологиялык маалыматтар, клиникалык белгилер (жөтөл, арыктоо, сиңирүү бузулуусу) жана лабораториялык ыкмалар (Берман-Орлов боюнча гельминтлорвоскопия) колдонулган. Nilverm 20 %, Santomectin жана Ivermec алган үч топ кой түзүлгөн. Эффективдүүлүк инвазиянын интенсивдүүлүгү жана таралышына жараша бааланган. Жыйынтыктар көрсөттү, Nilverm 20 % жана Santomectin 30-күнгө чейин инвазияны толугу менен жок кылган, ал эми Ivermec 85-86 % натыйжа берген. Экономикалык анализ Nilverm 20 % колдонуунун эң жогорку кирешелүүлүгүн (1 рубль чыгымга 91,2 рубль) көрсөткөн, андан кийин Santomectin (87,9 рубль) жана Ivermec (83,2 рубль) турган. Изилдөө антигельминттик препараттарды убакытында жана туура тандоо койлордо диктиокаулездин таралышын олуттуу төмөндөтө аларын көрсөткөн. Изилдөө натыйжалары Nilverm 20 % жана Santomectin

Эффективность лечения диктиокаулёза овец

Аннотация

Диктиокаулез остается одним из наиболее распространенных гельминтозных заболеваний в овцеводстве во всем мире, нанося значительные экономические убытки отрасли. Целью исследования было изучение эффективности методов лечения диктиокаулеза у овец. В статье представлены результаты исследования эффективности различных антигельминтных препаратов при лечении овечьего диктиокаулеза, вызванного нематодой Dictyocaulus filaria. Диагностика проводилась комплексно, включая эпизоотологические данные, клинические признаки (кашель, истощение, нарушения пищеварения) и лабораторные методы (гельминтоларвоскопия по Берману-Орлову). Были сформированы три группы овец, получавших Nilverm 20 %, Santomectin и Ivermec. Эффективность оценивалась по интенсивности и распространенности инвазии. Результаты показали, что Nilverm 20 % и Santomectin полностью устранили инвазию к 30-му дню, тогда как Ivermec обеспечил эффективность 85-86 %. Экономический анализ показал наибольшую рентабельность применения Nilverm 20 % (91,2 руб. на 1 руб. затрат), за ним следовали Santomectin (87,9 руб.) и Ivermec (83,2 руб.). Исследование продемонстрировало, что своевременный и правильный выбор антигельминтных препаратов может существенно снизить распространенность диктиокаулеза в овцеводческих стадах. Полученные данные исследования подтвердили высокую

препараттарынын диктиокаулезди көзөмөлдөштөгү жогорку эффективдүүлүгүн тастыктап, малдын ден соолугун сактоо жана стаддардын продуктивдүүлүгүн жогорулатуу үчүн антигельминттик препараттарды туура тандоонун маанилүүлүгүн баса белгиледи. Алынган натыйжалар ветеринарлар жана койчулар үчүн эң эффективдүү жана экономикалык жактан пайдалуу дарылоо ыкмасын тандоого далилденген негиз түзүп, малдардын ден соолугу, продуктивдүүлүгү жана чарбанын кирешелүүлүгүн жакшыртууга салым кошот

Ачкыч сөздөр: Dictyocaulus filaria; Nilverm; Santomectin; Ivermec; гельминттик оорулар

эффективность Nilverm 20 % и Santomectin в контроле диктиокаулеза и подчеркнули необходимость правильного выбора антигельминтных препаратов для сохранения здоровья животных и повышения продуктивности стад. Полученные результаты предоставляют ветеринарам и овцеводам доказательную основу для выбора наиболее эффективного и экономически выгодного лечения, что способствует улучшению здоровья животных, их продуктивности и рентабельности хозяйства

Ключевые слова: Dictyocaulus filaria; Nilverm; Santomectin; Ivermec; гельминтозные заболевания

Introduction

Dictyocaulosis, caused by nematodes of the genus Dictyocaulus and particularly by D. filaria, continues to be one of the most prevalent and economically devastating helminthic infections in global and Russian sheep farming. This chronic or acute disease, characterised by lesions in the bronchi, bronchioles, and lung parenchyma, inflicts multi-million-dollar losses on the industry, manifested in direct and in-direct costs. The resistance of this infestation to traditional control methods, exacerbated by climate change and the intensification of production processes, demands new, comprehensive scientific approaches, which underscores the high relevance of its comprehensive study.

The epizootic situation for dictyocaulosis of sheep in the Russian Federation and countries with developed sheep breeding remains tense and tends to aggravate in certain regions. This is facilitated by a complex of interconnected factors, among which global climate change plays a dominant role. The warming observed in recent decades, characterised by milder and shorter winters, early spring, increased humidity and unstable precipitation, radically changes the conditions for the existence of free-living stages of the pathogen. Warm and humid weather creates ideal conditions for the rapid development of eggs and larvae in the environment, significantly lengthening their survival time in pastures. Studies conducted by S. Shestakova et al. (2021), V. Domatsky & E. Sivkova (2024), in key sheep-breeding regions of the Russian Federation, including the North Caucasus region, Altai Territory, Vologda region, record a shift in the beginning of the pasture season to earlier timing and, accordingly, earlier onset of sheep infection. In addition, as noted by M. Gulden & I. Makhova (2023), the frequent abnormally hot and dry periods, although negatively affecting the survival of larvae on the soil surface, contribute to their migration to wetter micro-zones (basal part of plants, litter), where they maintain viability, creating hidden foci of invasion.

In parallel with climatic, anthropogenic and economic factors have a powerful impact on the spread of invasion. However, as noted by A. Ataev et al. (2020), M. Zubairova et al. (2021), the most significant link in the epizootic chain is the pasture system. Long-term, haphazard, and often year-round grasing in the same areas leads to their catastrophic leafiness. The absence of scientifically substantiated pasture turnover, in which different areas would be used with a certain interval that would allow larvae to die under the influence of adverse environmental factors, is the main reason for the formation of persistent natural foci of dictyocaulosis. The widespread, often uncontrolled and haphazard use of chemical anthelmintics for decades has created a powerful selection press, which has led to the appearance and fixation in D. filaria populations of genes responsible for resistance to the main classes of drugs. Thus, study conducted by D. Hamel et al. (2021), demonstrates an alarming situation with a decrease in the effectiveness of drugs based on macrocyclic lactones (ivermectin, moxidectin) and benzimidazoles (albendazole, fenbendazole).

Studies conducted by N. Gasanaliev (2022), S. Aki-mova & S. Fomenko (2023) show that the economic damage from dictyocaulosis is complex and multi-level, which makes it not just a veterinary, but also an acute economic problem. Direct losses are most obvious and easy to account for. First of all, this is the death of animals. During enzootic outbreaks of dictyocaulesis in disadvantaged farms, mortality among lambs can reach 30-50%, causing irreparable damage to herd re-production. The pathogenic impact of dictyocaulosis on the sheep body is complex and multifaceted, which determines the severity of the clinical course and the severity of the

consequences According to A. Cârstolovean et al. (2024), the pathogenesis begins with the penetration of invasive larvae into the animal's body when eating contaminated food or water. Migrating from the intestines through lymphogenic and circulatory pathways to the lungs, the larvae make a difficult journey, injuring the tissues. In lambs, the disease often proceeds in an acute or super-acute form, leading to mass death from asphyxia due to complete obstruction of the respiratory tract by tangles of parasites or from acute pulmonary insufficiency.

In the light of the above, the failure of an isolated, one-component approach to the fight against dictyocaulesis, based solely on chemotherapy, becomes absolutely obvious. As noted by M. Vanhecke et al. (2022), Z.-Q. Gao & J. Xing (2025), modern realities require the development, testing and widespread implementation of comprehensive control of dictyocaulesis. It should include not only regular scatological studies with cultivation of larvae according to Berman-Orlov to identify the species and determine the intensity of invasion, but also the use of modern serological methods (for example, enzyme-linked immunosorbent assay, which allow the detection of specific antibodies. Based on the above, the search for new highly effective drugs for the treatment of sheep dictyocaulosis is an urgent problem of veterinary science and practice.

The aim of the study was to evaluate the efficacy of different treatment methods for sheep dictyocaulosis.

Materials and Methods

The study was conducted in 2024. The subjects of the research were Romanov sheep infected with dictyocaulosis. The following substances were used in the study: Nilverm 20%. One gram of the preparation contains 200 mg of tetramisole hydrochloride as the active ingredient. Nilverm 20% is a fine white powder, poorly soluble in water, supplied in 750 g cardboard canisters. Tetramisole, the active component of Nilverm, possessed a broad spectrum of anthelmintic activity. It is effective against Haemonchus spp., Ostertagia spp., Trichostrongylus spp., Cooperia spp., Nematodirus spp., Bunostomum spp., Oesophagostomum spp., Dictyocaulus viviparus, Chabertia ovina, Ascaris suum, Hyostrongylus rubidus, and Metastrongylus spp. When administered orally, tetramisole is absorbed and exerts its effect not only in the gastrointestinal tract but also in internal organs and tissues. Nilverm 20% powder is administered once to cattle, sheep, goats, and pigs, mixed with feed at a dose of 75 mg/kg of body weight. For fattening pigs, the dose is 3.5 kg of the preparation per 1 ton of feed. Administration to sheep is also possible with the drug dissolved in water.

Santomektin. A combined antiparasitic drug. Closantel, a component of the preparation, belongs to the salicylanilide class and has a broad spectrum of antiparasitic action, being effective against trematodes, certain nematodes, and botfly larvae. Closantel acts on mitochondrial membranes, disrupting electron transfer involved in the phosphorylation process, which deprives the parasite's cells of their energy source, leading to its death. Ivermectin, another component of the preparation, belongs to the macrocyclic lactone class and has a pronounced antiparasitic effect against larval and adult stages of gastrointestinal and pulmonary nematodes, as well as against larvae of subcutaneous, nasopharyngeal, and gastric botflies, lice, keds, and sarcoptid mites. Ivermectin enhances the release of the inhibitory neurotransmitter gamma-aminobutyric acid, disrupting nerve impulse transmission in parasites, leading to their paralysis and death. Santomektin is administered to animals once, subcutaneously or intramuscularly, following aseptic techniques, at a dose of 1 mL per 50 kg of animal body weight. This corresponded to 0.1 mg of ivermectin and 2.5 mg of closantel per 1 kg of bodyweight.

Ivermek. An injectable solution for the treatment and prevention of parasitic diseases in cattle, sheep, goats, deer, camels, and pigs. Ivermek contains as active ingredients ivermectin (obtained by fermentation of the fungus Streptomyces avermitilis) – 10 mg/cm³, and tocopherol acetate – 40 mg/cm³, along with excipients. The drug is administered once intramuscularly to animals following aseptic techniques: to pigs in the neck and inner thigh region, and to other species in the croup or neck region at the following doses: for cattle and small ruminants, deer, and camels – 1.0 cm³ of Ivermek per 50 kg of body weight (200 mcg ivermectin per 1 kg of body weight).

The diagnosis of dictyocaulosis was made comprehensively, taking into account the following: epizootiological data; clinical signs of the disease – nasal dis-charge, cough, general depression, anemia, rapid weight loss; results of laboratory tests – helminth larvoscopic examination of animals was performed using the Berman-Orlov method. Ten grams of feces were placed on a metal sieve, which was then lowered into a funnel (20 cm in diameter at the top) filled with clean water at a temperature of up to 38°C. A 15 cm long rubber tube, clamped with a Mohr's clip (Germany), was attached to the lower end of the funnel. The water completely covered the feces on the sieve, and the end of the rubber tube was immersed in a warm test tube. After placing the funnels in a stand, they were left at room temperature for 8 hours. Subsequently, the lower portion of the liquid from the rubber tube was drained into centrifuge tubes, which were centrifuged for 2 minutes. The sediment was then examined under a microscope at low magnification for the presence of larvae. When examining feces from the rectum, D. filaria was found. This type of pathogen is twice as large in size; in males, sac-shaped spicules, freshly isolated larvae on the head end are equipped with a button-shaped formation. Over the study period, a total of 84 sheep aged from one month to 3 years were examined. A diagnosis of dictyocaulosis was confirmed in 31 animals.

To determine the therapeutic efficacy of the anthelmintic preparations against ovine dictyocaulosis, three groups of sheep, with seven animals each, were formed based on the principle of pair analogues. Sheep were kept under the conditions of the accepted technology of housing and feeding (Table 1). Comparative efficacy of antihelminthic preparations in dictyocaulosis of sheep was studied using four indices: AI (intensity of invasion) – number of parasites detected in the examined animal, expressed in copies; EI (infestation extensiveness) – the ratio of the number of infected animals to the total number of examined animals, expressed in per cent; EE (extensiveness) – the percentage of animals (from the number of treated animals) free of helminths; EE (intensiveness) – percentage of helminths released after the drug administration to the number of helminths before helminthisation.

Table.1 Schematic of the research experience

Animal group (n = 7)	**Preparations used**
1	Nilverm 20% powder – once in mixture with feed at a dose of 75 mg/kg body weight. It is possible to use the drug dissolved in water to sheep
2	Santomectin – once with observance of aseptic rules subcutaneously or intramuscularly in a dose of 1 mL per 50 kg of animal weight, which corresponds to 0.1 mg ivermectin and 2.5 mg clozantel per 1 kg of animal weight
3	Ivermec – intramuscularly in the croup or neck area 1.0 cm^3 per 50 kg of animal weight (200 μg ivermectin per 1 kg of weight)

Source: developed by the authors based on Galen (n.d.)

All sick animals were clinically monitored. The general clinical condition of animals (temperature, pulse, respiration, appetite) was monitored during treatment. Therapeutic efficacy of antihelminthic treatment in groups was considered according to the results of coproscopic examination of fresh faecal samples on the 5th, 15th and 30th days after application of antihelminthics. Statistical processing of experimental data was carried out using the statistical analysis package for Microsoft Excel. The study was conducted in accordance with the ethical standards of the Code of Practice for the Housing and Care of Animals Bred, Supplied or Used for Scientific Purposes (2014).

Results and Discussion

During the study period, a total of 84 sheep aged from one month to three years were thoroughly examined. Among them, 31 animals were diagnosed with dictyocaulosis. Clinical signs in affected sheep were generally non-specific but indicative of respiratory and gastrointestinal involvement (Table 2). The majority of animals exhibited marked lethargy and noticeable emaciation, while body temperature remained within physiological norms. A persistent, wet cough accompanied by dis-comfort was frequently observed. Respiratory distress was evident, with animals breathing through the open mouth, protruding the tongue, and producing excessive thick oral mucus. Gastrointestinal disturbances were also pronounced: appetite was significantly reduced, diarrhea was common, and feces often contained streaks of blood and mucus. Additionally, some sheep displayed mucous nasal discharge, reflecting concomitant upper respiratory tract involvement. According to R. Akbaev (2024), sheep kept in private household conditions are infected with nematodes belonging to the species Dictyocaulus filaria. However, clinical signs of the disease in animals, such as coughing and leakage from the nasal openings, did not appear. E. Timofeeva (2024) in her study notes that the bottom of the frequent parasitic diseases of small cattle is dictyocaulosis. Due to the disease, the growth and development of young animals slow down, there is a massive death, and adult animals lose productivity, become weak and emaciated, and are also carriers of parasites, which poses a danger to young animals (Jolborsov et al., 2024). During experimental dictyocaulosis in young sheep and following complex treatment, eosinophil reactions in the blood are observed. Significant eosinophilia occurs in the blood of lambs during dictyocaulosis. Deworming animals with albene does not fully restore eosinophil levels (Tihaya & Ponamarev, 2024). Complete recovery of eosinophil content in the blood of invasive lambs occurs after complex treatment with albene in combination with T and Bactivin. The clinical signs of dictyocaulesis are still not specific enough even when the pathological process has reached full development, parasites have developed and are located in large and medium bronchi.

Table.2 Main clinical signs in sheep dictyocaulosis

Indicators	Number of animals, heads
Total number of animals	31
Increase in body temperature by 0.5-1.00C	4 (12.9%)
Coughing	31 (100%)
Apathy	31 (100%)
Nasal serous discharge	10 (32%)
Swelling of the head, lips	-
Digestive disorders, diarrhoea	20 (64.5%)

Source: developed by the authors

Studies of anthelmintic efficacy in sheep dictyocaulesis showed that the invasion intensity in sheep ranged from 56.8 ± 2.2 to 62.5 ± 3.5 specimens (Table 3). After deworming with Nilverm

20% in the animals of the first group, it is noted a significant decrease in the intensity and extensiveness of the invasion. So, after 5 days, the intensity and extensiveness of the invasion decreased, respectively, by 1.2 times; on the 15th day – 2.2 and 3.6 times; on the 30th day of studies, Dictyocaulus larvae did not stand out. After deworming with Santomectin in animals of the second group, the decrease in the intensity and extensiveness of the invasion was more significant. So, after 5 days, the intensity and extensiveness of the invasion decreased, respectively, by 1.5 and 1.2 times; on the 15th day – 2.8 and 3.6 times; on the 30th day of studies, Dictyocaulus larvae did not stand out.

Table.3 Intensity and extensiveness of infestation with the use of antihelminthic drugs in sheep dictyocaulosis

Animal group (n = 7)	The drug	Infestation							
		Intensity of invasion. ex.				Infestation extensiveness. %			
		Von	Day 5	Day 15	Day 30	Day 5	Day 15	Day 30	Day 5
1	Nilverm 20% powder	56.8 ± 5.2	46.8 ± 2.2*	26.8 ± 2.2*	0	100	86*	28*	0
2	Santomectin	62.5 ± 6.5	42.5 ± 3.5*	22.5 ± 3.5*	0	100	86*	28*	0
3	Ivermec	57.6 ± 4.3	50.6 ± 2.3*	37.6 ± 2.3*	7.6 ± 2.3	100	86*	42*	14*

Note: * – $p < 0.05$

Source: developed by the authors

With the use of Ivermec, after 5 days, the intensity and extent of invasion decreased, respectively, by 1.13 and 1.2 times; on the 15th day – 1,5 and 2,3 times; on study day 30, the number of larvae was 7.6 ± 2.3 with an invasion extensiveness of 14%. The efficacy of anti-helminthic therapy using Nilverm 20% and injectable Santomectin was 100%, whereas Ivermek treatment was 86% (Table 4).

Table.4 Effectiveness of antihelminthic therapy in sheep dictyocaulosis

Animal group (n = 7)	The drug	Efficiency, %	
		Extensiveness	Intensiveness
1	Nilverm 20% powder	100	100
2	Santomectin	100	100
3	Ivermec	85	86

Source: developed by the authors

Study was consistent with the conclusions of a number of authors on the study of the effectiveness of anthelmintic drugs in dictyocaulosis of sheep. So, A. Kryazhev & V. Nikitin (2018) note that the invasive-ness of dictyocaul in various climatic and geographical zones of the Vologda region is not the same. The highest infection was noted in the northwestern zone, and the lowest in the southwestern zone. Parasitization of the species Dictyocaulus viviparus has been established. Infection of animals occurs in the summer pasture period. Invasion extensiveness peaks in September (82.4%) with invasion intensities averaging 150.7 ± 8.8 copies per animal. Dictyocaul larvae were first found in feces in the second decade of June. Animals aged 1-2 years are most infected. The most effective drugs for deworming against dictyocaul are helmicide and fesol. P. Magomedbegova et al. (2024) note the high anthelmintic efficacy of gatolin, which was used once

at a dose of 20 to 40 mg per kilogram of body weight. In studies conducted by M. Kryukova & R. Radjabov (2024), the effectiveness of Alvet and Eprimek in the treatment of sheep dicroceliosis was studied. In the first group, the drug Alvet was used, in the second – Eprimec. After administration of the drugs, the number of helminth eggs in animal feces decreased to 10 and 3, respectively. The efficacy of the drugs was 90% for Alvet and 97% for Eprimec. The study showed high efficacy of the drug Eprimec compared to the analogue. Both drugs were well tolerated by animals, no painful events or side effects were detected. Also, V. Chetvertnov & V. Kolesnikov (2023) found that a suspension of praziquantel 2.5% and ivermectin 0.5% at a dose of 0.4 mL/10 kg animal weight showed 100% efficacy in sheep dictyocaulesis.

Prevention of dictyocaulosis of sheep consists in the implementation of planned preventive measures. Joint and replacement pasture of sheep dictations is also unacceptable. In the absence of the possibility of changing pasture lands, deworming of sick animals is carried out based on the results of diagnostic studies. Ewes flocks are processed first after lambing. If infected young sheep are detected in the summer, all flock of sheep is treated. So, V. Kolesnikov & S. Abakin (2023) recommend deworming against sheep dictyocaulesis in February, May, August and November. Under good conditions of keeping and optimal nutrition of sheep, animals best withstand dictyocaulesis, remaining tolerant to helminth invasions.

The economic damage caused by dictyocaulesis, manifested in a decrease in overall weight gain in sheep, is especially pronounced at the cost of therapeutic and preventive measures. Also, cases of mass death of animals are not excluded. So, according to M. Ibrahim et al. (2013) helminthiasis causes significant deviations in the chemical composition of sheep meat. The most noticeable deviations in the amount of water, protein and fat. Pulmonary nematodoses, fascioliasis and ovine echinococcosis contribute to higher water levels and reduce the amount of protein and fat in sheep meat. The economic effect on the ruble of costs when using Nilverm 20% amounted to 91.2 rubles, anthelmintics Santomectin – 8.9 rubles, Ivermec – 83.2 rubles.

In summary, dictyocaulosis remains one of the most significant parasitic diseases affecting sheep, with a wide range of non-specific clinical signs including respiratory distress, cough, lethargy, emaciation, and gastrointestinal disturbances. The disease impacts animals of all ages, leading to reduced growth and development in young sheep, decreased productivity in adults, and, in severe cases, mass mortality. Laboratory and clinical studies confirm that eosinophil levels in affected lambs increase during infection and are only fully restored following complex treatment. Anthelmintic therapy using Nilverm 20% and Santomectin demonstrated complete efficacy, while Ivermec showed slightly lower effectiveness, highlighting the importance of selecting appropriate treatment regimens. Preventive measures, including timely deworming and proper pasture management, are critical to minimiszing infection rates and economic losses. The disease not only reduces overall animal performance but also affects the quality of meat, altering protein, fat, and water content, thus emphasising its economic significance. Overall, the findings underscore the necessity of an integrated approach combining effective treatment, preventive measures, and proper animal husbandry practices to control dictyocaulosis, enhance flock health, and improve economic outcomes in sheep farming.

Conclusions

Sheep dictyocaulosis is widespread across Russia, with infection rates among young animals on certain farms reaching 60-80.4%. The disease is prevalent in many regions of Russia and leads to severe pathological changes, such as serous-catarrhal bronchitis and bronchopneumonia, often resulting in reduced productivity and mortality, particularly in animals during their first year of grasing. Clinical signs of dictyocaulosis are generally nonspecific, including lethargy, frequent moist cough with tenderness, mucous nasal discharge, and gastro-intestinal disturbances. Recent years have seen the use of various broad-spectrum antiparasitic agents for deworming. The application of Nilverm 20% and Santomectin resulted in a pronounced decrease in Dictyocaulus larvae: by the 5th day of treatment, invasion intensity declined by 1.2 and 1.5 times, respectively, and by the 15th day – 2.2 and 2.8 times, while invasion extensiveness decreased by 1.2 times on the 5th day and by 3.6 times on the 15th day; by the 30th day, larvae were completely absent. Treatment with Ivermec reduced invasion intensity to 7.6 ± 2.3 specimens with an extensiveness of 14% by the 30th day. Comparative assessment of anthelmintic efficacy demonstrated that Nilverm 20% and Santomectin achieved 100% effectiveness in both extensiveness and intensity, whereas Ivermec showed slightly lower results at 86% and 85%, respectively. The economic impact of dictyocaulosis is primarily due to reduced weight gain in sheep and significant expenditures on treatment and preventive measures, with the potential for mass mortality further exacerbating losses. Future research should focus on optimising treatment protocols, evaluating long-term effects of combined therapies, and developing preventive strategies to minimise infection and associated economic losses.

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