The Theraupetic Efficiency of a Drug Based on the Siberian Fir Essential Oil the Complex Therapy of Calf Respiratory Diseases

Y. G. Popov, N. N. Gorb, A. V. Lyakhova, D. V. Altayeva

Novosibirsk State Agrarian University,Dobrolyubova street, 160, Novosibirsk, Russia, 630039

Abstract

Currently, one of the promising areas in the development of preparations used to prevent and treat respiratory diseases of calves is the development of preparations based on fir essential oil. A natural preparation of Aerosan-P has been developed in Rosvetfarm Co., Ltd (Krasnoobsk, Novosibirsk region), the main active ingredient of which is the Siberian fir essential oil (Abies sibirica L.). Because of the active substance, the drug has a beneficial effect on the mucociliary apparatus of the respiratory system, and has a mucolytic action, promotes energy metabolism and improves appetite. In the present paper, the results of the study of the therapeutic efficacy of the treatment of respiratory diseases of young cattle, when Aerosan-P is included in the treatment, are shown. It was found that the inclusion of the preparation in the treatment regimen at a dose of 2 ml per animal once a day, for 7 days, showed 95 % efficiency and promoted acceleration of the animals' recovery in the experimental group by 2.46 days relative to the control group. Recovering of animals was characterized by an improvement in the general condition, decrease of rectal body temperature, normalization of respiratory activity and heart rate, disappearance of rales, dyspnea and cough. At the same time, the content of leukocytes, erythrocytes, hemoglobin and ESR was normalized to the level of a healthy animal. The economic efficiency of the experimental scheme with the inclusion of the Aerosan-P preparation was 2.02 rubles for 1 ruble of costs, which was 1.91 rubles more than the treatment of the control scheme.

In the result, the scheme including Aerosan-P preparation has high therapeutic and economic efficiency and contributes to faster normalization of clinical and hematological parameters.

Keywords: Siberian fir essential oil, Aerosan-P, respiratory diseases, calf, the therapeutic efficiency, blood, serum.

INTRODUCTION

The respiratory diseases of young cattle are among the most serious ones in terms of economic losses. At present, they lead to a decrease in the economic efficiency of the dairy and beef cattle industry by 20-30 per cent [1-5]. The forecast is also not consoling, with veterinary experts predicting that by 2020 the three leading indicators of death will include respiratory diseases, which will further affect the profitability of the industry [6].

A good organization in cattle-breeding of medical and preventive measures is the best strategy, which allows the reduction of losses caused by respiratory diseases of young cattle. Traditional pharmacological methods, which also include the use of antimicrobial drugs, decrease in effectiveness over time due to the emergence of resistant and superresistant microorganisms [4, 7, 8, 9]. In addition, the use of antimicrobial agents entails their accumulation in products of animal origin, in particular in meat, and the use of such products leads to immunodepression, allergic reactions, dysbacteriosis, and a decrease in the effectiveness of antimicrobial agents used in humanitarian medicine [6-8, 10].

To ensure the release of environmentally safe products, it is necessary to develop and introduce into veterinary practice highly effective, environmentally friendly animal treatment products, including those for respiratory diseases [9, 11-12].

Currently, one of the promising areas in the development of preparations used to prevent and treat respiratory diseases of young cattle is the development of preparations based on fir essential oil [4, 11, 13].

Aerosan-P natural preparation has been developed in Rosvetfarm Co., Ltd (Krasnoobsk, Novosibirsk region), its main active ingredient is the Siberian fir essential oil (*Abies sibirica L.*). Because of the active substance, the drug has a beneficial effect on the mucociliary apparatus of the respiratory system, and has a mucolytic action, promotes energy metabolism and improves appetite.

The purpose of this research was to study the efficacy of treatment of young cattle respiratory diseases when Aerosan-P was included in the treatment.

MATERIALS AND METHODS

The research was carried out in LLC "Siberian Niva" in the Maslyaninsky district of the Novosibirsk Region at the Department of Obstetrics, Anatomy and Histology of the Faculty of Veterinary Medicine of Novosibirsk State Agricultural University in 2016-2017. Some separate research studies were carried out on the basis of Federal State Budgetary Institution of Science "Siberian Federal Scientific Center of Agrobiotechnologies of the RAS" and Rosvetfarm Co., Ltd.

The experimental part was carried out in accordance with the requirements for medical and biological research [14]. The animals were selected according to the principle of para-analogues. They were provided with the same conditions for feeding, keeping and recording the results during the entire experimental control period.

The experience in studying the efficiency of the Aerosan-P preparation in the complex therapy of young cattle for respiratory diseases was performed in 80 clinically ill calves 1-3 months old. The animals were divided into 2 groups: experimental and control calves. Treatment of experimental calves was carried out according to the scheme adopted at the farm: Baytril 10% - 2 ml SC once a day for 5 days; Flunex - 2 ml IM once. Calves from the experimental group were additionally fed with milk or a substitute for whole milk of Aerosan-P according to the scheme developed by us: 2 ml orally once a day for 7 days. The animals were daily monitored for 30 days, paying attention to the general condition of the experimental animals, measuring body temperature, respiratory rate and heart rate, observing the time of disappearance of a symptom of the disease and the outcome of the disease.

Before starting the experiment and also on the 30th day of the study in order to observe body weight change of calves in the process of treatment young cattle for respiratory diseases, 20 animal analogues including those from the experimental and control groups in each of the experiments were weighted; the gross increment, the average daily weight gain, and the growth rate according to Brody's formula, were calculated [14].

To study hematological, biochemical and immunobiological indices, blood was taken from the jugular vein by a conventional technique three times: immediately before starting the experiment and every 10 days afterwards.

Haematological indices were assessed using unified methods of haematological examination [15], the content of leukocytes, hemoglobin, erythrocytes and ESR was measured.

Changes of body weight and hematological parameters of sick animals were evaluated in a comparative sense with the indicators of healthy animals. To this end, a healthy group of animals of 1-3 months of age was established; the conditions for its maintenance and feeding were similar to sick animals.

The indicators of economic efficiency were calculated in accordance with the "Methodology for determining the economic efficiency of veterinary activities", approved by the Veterinary Department of the Ministry of Agriculture and Food of the Russian Federation (1997) [16].

The digital indices obtained during the experiment were statistically processed by the methods adopted in biometrics. The Microsoft Office Excel 2010 was used for statistical analysis.

RESULTS AND DISCUSSION

The rectal body temperature of 39.3-40.1 °C was recorded in animals with respiratory illnesses, along with the heart rate of 100-127 beats/min, the pulmonary insufficiency ratio was above 1.6, animals had dyspnea, wheezing in the lungs and stiffening noises, recurrent coughing (spontaneous or provoked), discharge from the nasal cavity, hyperemia of the nasal mucosa, lacrimation and cloudy discharge from the eyes; some calves had one or both drooping ears, and periodic shaking of the head.

Recovering of animals after treatment was characterized by an improvement in the general condition, decrease of rectal body temperature, normalization of respiratory activity and heart rate, disappearance of rales, dyspnea and cough.

The calves of the experimental group recovered within 8.71 ± 2.2 days, the calves of the control group recovered within 11.17 ± 2.4 days (Table 1). The therapeutic efficacy was 95% at day 14 of the study in the experimental group, and 90% - in the control group. In the control group, one calf at the age of 9 weeks was forced to die. Other animals became chronically affected for the disease.

The inclusion of Aerosan-P in the treatment regimen of respiratory diseases of young cattle promoted acceleration of the animals' recovery in the experimental group by 2.46 days relative to the control group.

Table 1. The therapeutic efficiency.

Indices	Group	
	experimental	control
Number of animals in the group	40	40
Recovered	38	36
Forced to be killed	–	1
The length of the disease, days	8.71±2.2	11.17±2.4
The therapeutic efficiency, %	95	90

To study the dynamics of changes in body weight of calves before the beginning of the study and on the 30th day of the experiment, they were weighed; and the gross increment, as well as the average daily weight gain, and the growth rate according to Brody's formula were calculated. The results are shown in Table 2.

As a result of the study, we noted lower rate of growth among sick animals relative to healthy animals. There were no significant differences in body weight change between the experimental and control groups of animals. The growth rate in the experimental group was 2.14% higher than in the control group.

To study the dynamics of changes in blood and serum, blood was taken according to the generally accepted method in 10 animals of each group. The measured indices were compared between groups of animals and with healthy animals.

The hematological indices including the content of leukocytes, erythrocytes, hemoglobin, and ESR were measured during the experiment (Table 3). Sick animals had significantly lower leukocytes count (p≤0.001); the ESR was higher than the healthy animals had. The number of erythrocytes and hemoglobin in sick calves was also lower than in the healthy ones, however, these indices had no significant differences. On the 10th day of the experiment only the difference in leukocyte count between sick and healthy animals was significant (p≤0.01). On the 20th day of the experiment there were no significant differences between the groups.

Table 2. Changes in body weight and the growth rate of animals.

Indices	Group		Healthy animals
	experimental	control	
Body weight of calves before the experiment, kg	38.10±1.40	39.00±1.52	36.30±1.60
Body weight of calves on the 30th of the experiment, kg	53.90±1.65	53.10±1.65	57.10±2.03
The average daily weight gain, kg	0.52±0.04	0.47±0.03	0.69±0.04
The gross increment, kg	15.6±0.79	14.1±0.89	20.8±1.21
The relative growth rate according to Brody,%	34.28	32.14	44.54

Table 3. The hematological indices.

Indices	Group		Healthy animal
	experimental	control	
Before setting up the experiment			
Leukocytes, x 10^9 / L	7.95±0.27***	7.83±0.31***	9.95±0.37
Erythrocytes, x 10^{12} / L	6.14±0.27	6.24±0.20	6.53±0.73
Hemoglobin, g / L	73.2±6.6	78.4±3.1	88.1±6.9
ESR, mm / h	2.03±0.09***	2.14±0.07***	1.24±0.03
On the 10th day of the experiment			
Leukocytes, x 10^9 / L	8.12±0.46**	8.09±0.56**	10.07±0.41
Erythrocytes, x 10^{12} / L	6.95±0.63	6.40±0.17	6.99±0.60
Hemoglobin, g / L	84.8±3.4	82.6±1.8	87.9±6.7
ESR, mm / h	1.47±0.02	1.52±0.06	1.29±0.09
On the 20th day of the experiment			
Leukocytes, x 10^9 / L	9.34±0.26	9.22±0.29	10.56±0.46
Erythrocytes, x 10^{12} / L	6.97±0.52	6.55±0.21	6.92±0.76
Hemoglobin, g / L	90.8±1.4	89.2±2.8	90.7±5.3
ESR, mm / h	1.29±0.05	1.34±0.03	1.23±0.01

Note: the reliability of differences with healthy animals ** P≤0.01; *** P≤0,001.

Recovering was accompanied by normalization of the hematological parameters studied in sick animals, while throughout the trial there were no significant differences in the experimental and control groups, but in the experimental group the normalization of hematological parameters was more pronounced.

The economic efficiency of the young cattle treatment for the respiratory diseases according to the experimental scheme with the inclusion of the Aerosan-P preparation was 2.02 rubles for 1 ruble of costs, which was 1.91 rubles more than the treatment regimen without Aerosan-P.

CONCLUSIONS

1. The inclusion of the Aerosan-P preparation in the treatment regimen of the respiratory diseases has showed 95 % efficiency and promoted acceleration of the animals' recovery in the experimental group by 2.46 days relative to the control group.

2. Recovering of animals was accompanied by normalization of the content of leukocytes, erythrocytes, hemoglobin and ESR to the level of a healthy animal. Throughout the experiment, the significant differences in the experimental and control groups were not detected, however, the normalization of the studied hematological parameters was more pronounced in the experimental group.

3. The economic efficiency of the young cattle treatment for the respiratory diseases according to the experimental scheme with the inclusion of the Aerosan-P preparation was 2.02 rubles for 1 ruble of costs, which was 1.91 rubles more than the treatment of the scheme adopted on the farm.

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