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## Sensitivity of the initiators of acute catarrhal bronchopneumonia in calves to antibiotics and phytobiotics

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**Abstract.** Antimicrobial activity of antibacterial agents (benzylpenicillin, methicillin, amoxicillin, cefazolin, ceftriaxone, cefquinome, cefepime, gentamicin, tylosin, lincomycin, enrofloxacin, marbofloxacin) and herbal medicines (extracts of *Eleutherococcus*, *Echinacea purpurea* and *Hypericum perforatum*) was studied. The purpose of the research was to determine sensitivity to antibiotics and phytobiotics in microorganisms isolated from bronchoalveolar lavage fluid collected from calves with acute catarrhal bronchopneumonia. Calves with acute catarrhal bronchopneumonia ( $n = 37$ ) aged 1–3 months were studied in the research. Bronchoalveolar lavage was collected into sterile test tubes from sick calves using silicone sterile catheter. Bacteriological studies were carried out in LLC “Vettest”, using generally accepted methods. Determining the sensitivity of isolated opportunistic microorganisms to antibacterial drugs showed that the vast majority of them have rather low efficiency. It was found that all 115 isolated microorganisms were sensitive only to three antibacterial drugs: fourth-generation cephalosporin antibiotics — cefquinome and cephepime, and third-generation fluoroquinolone antibiotic — marbofloxacin. Of the phytobiotics studied, *Hypericum perforatum* extract had the most pronounced antimicrobial properties against the main initiators of acute catarrhal bronchopneumonia in the calves. Moreover, it showed a more powerful antimicrobial effect against gram-positive bacteria. This makes it possible to use it widely in complex therapy in calves.

**Keywords:** lungs, inflammation, bronchoalveolar lavage, microflora, therapy, antibacterial activity, *Hypericum perforatum*

**Conflict of interests.** The authors declare that they have no conflict of interests.

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## Introduction

In livestock farms, respiratory diseases are widespread among highly productive animals, which are most often diagnosed in young animals. These diseases lead to significant economic losses for the industry: death of animals, loss of production from sick or recovered animals, slowdown in their growth and development, costs for treatment and prevention [1–4]. Bronchopneumonia in calves is registered in almost all regions of Russia and ranks second after gastrointestinal diseases, reaching 20...30% among all pathologies on farms. The etiological factor of nonspecific bronchopneumonia in calves is a complex of reasons: crowded housing, reduced resistance, and immunological reactivity of the body of newborn animals, exposure to unfavorable environmental factors, stress, unbalanced feeding, and opportunistic microbiota of the upper respiratory tract, which under unfavorable conditions can acquire pathogenic properties [5–9].

In production conditions against factor infections, including bronchopneumonia of calves, antibiotics are widely used as antimicrobial drugs, which are most often prescribed empirically. However, in recent years, there has been an increase in bacterial resistance to antibiotics all over the world [10, 11]. In this regard, in many countries there is a consistent trend towards complete or partial abandonment of antibacterial drugs in animal husbandry. The search for natural alternatives to antibiotics has been the most popular scientific direction in recent years [3, 12, 13].

Plants and their extracts, known as phytobiotics, have been widely used in veterinary medicine since ancient times to treat various pathologies in animals and as health promoters. Phytobiotics are classified based on the medicinal properties of plants, their essential oil extracts and bioactive compounds. Most biologically active compounds in plants are secondary metabolites, such as terpenoids, phenols, glycosides and alkaloids [14–17].

Therefore, determination of antimicrobial activity of antibiotics (benzylpenicillin, methicillin, amoxicillin, cefazolin, ceftriaxone, cefquinome, cefepime, gentamicin, tylosin, lincomycin, enrofloxacin, marbofloxacin) and herbal medicines (extracts of

*Eleutherococcus*, *Echinacea purpurea* and *Hypericum perforatum*) widely used in veterinary medicine against microorganisms isolated from calves with acute catarrhal bronchopneumonia is a relevant direction for research.

**The purpose of the study** was to determine sensitivity to antibiotics and phytobiotics in microorganisms isolated from bronchoalveolar lavage fluid collected from calves with acute catarrhal bronchopneumonia.

## Materials and methods

Calves with acute catarrhal bronchopneumonia ( $n = 37$ ) aged 1–3 months were studied in the research. The experiments were carried out in ‘Babaevo’ livestock farm (Sobinsky district, Vladimir region) and ‘Delta-F’ livestock farm (Sergiev Posad urban district, Moscow region). Total number of livestock was 3680 animals, including 1690 cows.

Animals that were treated within 14 days prior to sampling were excluded from the study.

In the morning, blood was taken from the jugular vein of sick animals into sterile tubes to exclude causative agents of chlamydia and mycoplasmosis. Serological studies using automatic ALISEI system for enzyme immunoassay were conducted.

Bronchoalveolar lavage fluid (BALF) was collected into sterile tubes from sick calves. Before sampling, the arms and both nostrils of the calves were treated with 70° ethyl alcohol. Sampling was carried out by the same veterinarian without sedation of sick animals using disposable silicone sterile catheters with diameter of 4 mm and length of 150 cm. After extending the head and neck of the sick calf, a nasogastric catheter was inserted transnasally until slight resistance occurred, allowing the catheter to pass into the trachea during the inspiratory phase of the respiratory cycle. The repeated cough reflex served as an indicator of reaching the tracheal bifurcation area. Upon reaching the carina region, the nasogastric tube was moved back 1–2 cm and 30 ml of sterile isotonic saline solution (0.9% NaCl solution, 37 °C) was injected into the trachea using a syringe, followed by immediate aspiration of up to 10 ml of BAL fluid. The BAL sample collected in the described manner was delivered to the laboratory within three hours for bacteriological analysis.

Bacteriological studies were carried out in LLC “Vettest”, using generally accepted methods.

The sensitivity of microorganisms to antibacterial drugs was determined using disk diffusion method. 12 antimicrobial drugs were used as test drugs: benzylpenicillin, methicillin, amoxicillin, cefazolin, ceftriaxone, cefquinome, cefepime, gentamicin, tylosin, lincomycin, enrofloxacin, marbofloxacin. When assessing the results obtained, bacteria strains were considered sensitive if their growth was inhibited in presence of antibiotic by more than 18 mm (+++); slightly sensitive — if their growth was inhibited by 11...18 mm (++) , and insensitive — if their growth was inhibited by less than 10 mm (+).

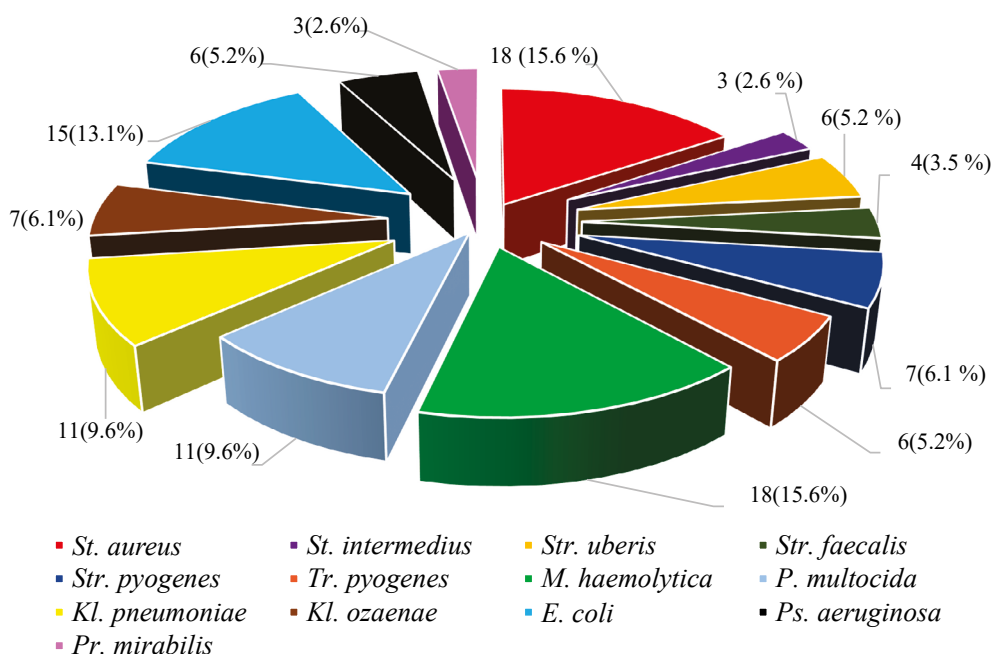
The study of antimicrobial activity of *Eleutherococcus*, *Echinacea purpurea* and *Hypericum perforatum* extracts against the main causative agents of acute catarrhal

bronchopneumonia in calves was carried out by the method of sequential two-fold serial dilutions (stock, 2 times, 4 times, 8 times, 16 times, 32 times, 64 times and 128 times) in dense nutrient medium — Meat Peptone Agar (MPA). For this purpose, the flask with meat-peptone agar was heated in microwave and cooled to 45...50 °C, after which it was poured into cups. Dilutions of medicinal herbal extracts were pipetted into sterile Petri dishes in sterile box, observing the rules of asepsis and antiseptics. After solidification of the nutrient medium with diluted phytopreparations, the surface of the plates was divided into sectors using a marker. Each sector was inoculated with test strains of microorganisms using a streak method with a bacteriological loop. The dishes with meat peptone agar were incubated in a thermostat at 37 °C for 24 hours, after which the results of the study were recorded.

The obtained results were subjected to statistical analysis and presented in figures and tables.

## Results and discussion

Making a final diagnosis when dealing with any infectious disease is impossible without determining the entire spectrum of its causative agents. The results of studying the microbial community composition isolated from BAL samples of calves with bronchopneumonia are shown in the figure.



Microbial community composition for bronchopneumonia in calves

Source: created by Rudenko P.A. using Microsoft Word

The presented data indicate that the occurrence of bronchopneumonia in calves is caused by a fairly wide range of opportunistic microflora. Thus, from BAL samples during microbiological research, we isolated 115 bacteria of thirteen species referred to nine genera. Moreover, most of it, namely 71 cultures (61.7%), were assigned to gram-negative pathogens. The following bacteria were more often isolated from bronchoalveolar fluid samples from calves: *St. aureus* — 18 cultures (15.6%), *M. haemolytica* — 18 strains (15.6%), *E. coli* — 15 isolates (13.1%), *P. multocida* — 11 cultures (9.6%) and *Kl. pneumoniae* — 11 strains (9.6%). The least frequently isolated cultures were *St. intermedius* and *Pr. mirabilis* — three (2.6%) cases for each, respectively.

The main goal of analyzing the sensitivity of microorganisms that initiate any infectious process to antibiotics is to predict the effectiveness of antibacterial drugs when developing a strategy to combat the disease. Therefore, antibiotic susceptibility was subsequently determined for the isolated microflora (Table 1).

Table 1

The sensitivity of isolated microflora (n = 115) to antibacterial drugs

Antibiotics	Antibiogram results					
	+++		++		+	
	Abs. number	%	Abs. number	%	Abs. number	%
Benzylpenicillin	36	31.3	13	11.3	66	57.4
Methicillin	19	16.6	15	13.0	81	70.4
Amoxicillin	62	53.9	26	22.6	27	23.5
Cefazolin	73	63.5	26	22.6	16	13.9
Ceftriaxone	102	88.7	9	7.8	4	3.5
Cefquinome	115	100.0	–	–	–	–
Cefepime	115	100.0	–	–	–	–
Gentamicin	74	64.3	30	26.1	11	9.6
Tylosin	62	53.9	17	14.8	36	31.3
Lincomycin	80	69.6	20	17.4	15	13.0
Enrofloxacin	103	89.6	7	6.1	5	4.3
Marbofloxacin	115	100.0	–	–	–	–

It was found that all 115 (100.0%) isolated strains of microorganisms were sensitive to only three antibacterial drugs: fourth-generation cephalosporin antibiotics — cefquinome and cefepime, and third-generation fluoroquinolone antibiotic — marbofloxacin. Isolated cultures of microorganisms showed good sensitivity to enrofloxacin and ceftriaxone — 103 (89.6%) and 102 (88.7%) isolates, respectively.

It should be noted that most of the presented antimicrobial drugs showed rather low effectiveness against isolated bacterial cultures. Thus, 8 (44.4%) strains of *St. aureus* and 58 (81.6%) representatives of gram-negative microflora were resistant to benzylpenicillin from the penicillin group. Ten (55.5%) isolates of *St. aureus* and 71 (100.0%) representatives of the gram-negative bacteria showed resistance to

methicillin — a  $\beta$ -lactam antibiotic from the penicillin class. All representatives of isolated *Ps. aeruginosa*, *Pr. mirabilis* and *M. haemolytica* showed resistance to amoxicillin from the penicillin group. All strains of *Ps. aeruginosa* and *Pr. mirabilis*, as well as 7 (38.8%) cultures of *M. haemolytica*, showed resistance to cefazolin, a first-generation cephalosporin antibiotic. Four (66.7%) strains of *Ps. aeruginosa* showed resistance to the third-generation cephalosporin antibiotic — ceftriaxone. All 6 (100.0%) cultures of *Str. uberis*, 3 (42.9%) isolates of *Str. pyogenes* and 2 (33.3%) strains of *Tr. pyogenes* were resistant to aminoglycoside antibiotic — gentamicin. All *Klebsiella* isolates (11 strains of *Kl. pneumoniae* and 7 strains of *Kl. ozaenae*), as well as strains of *M. haemolytica*, showed resistance to the macrolide antibiotic — tylosin. Six (33.3%) cultures of *St. aureus*, 4 (66.7%) strains of *Str. uberis* and 5 (27.8%) isolates of *M. haemolytica* showed resistance to lincomycin, an antibiotic from the lincosamide group. It should be noted that 5 (27.8%) cultures of *St. aureus* showed resistance to an antibacterial drug from the third-generation fluoroquinolone group — enrofloxacin. Thus, the empirical prescription of antibiotics is associated with high risks of choosing an antimicrobial agent with low antimicrobial activity.

The search for alternative agents to antibiotics to combat factor infections is the most popular area of research. Among the alternative groups, probiotics, prebiotics, bacteriolytic enzymes, phytobiotics, and various feed additives are primarily considered [12, 18, 19]. Plants and their extracts, known as phytobiotics, have been widely used since ancient times to treat various pathologies in animals, as well as health promoters. Worldwide, the use of herbal medicines in animal husbandry is increasing due to side effects of modern medicines, high costs of raw materials, toxic residues in food products, and increasing antibiotic resistance to microorganisms [20]. Therefore, in continuation of the research, we determined the antimicrobial activity of herbal remedies widely used in veterinary medicine — extracts of *Eleutherococcus*, *Echinacea purpurea* and *Hypericum perforatum* against microorganisms isolated from calves with acute catarrhal bronchopneumonia (Tables 2–4).

Table 2

### Antibacterial activity of *Eleutherococcus* extract against clinical isolates causing bronchopneumonia in calves

Microorganism	Two-fold dilution of <i>Eleutherococcus</i> extract							
	Stock	2	4	8	16	32	64	128
<i>S. aureus</i>	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18
<i>S. intermedius</i>	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
<i>Str. uberis</i>	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6
<i>Str. faecalis</i>	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
<i>Str. pyogenes</i>	7/7	7/7	7/7	7/7	7/7	7/7	7/7	7/7
<i>Tr. pyogenes</i>	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6
<i>M. haemolytica</i>	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18

End of the table 2

Microorganism	Two-fold dilution of <i>Eleutherococcus</i> extract							
	Stock	2	4	8	16	32	64	128
<i>P. multocida</i>	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11
<i>Kl. pneumoniae</i>	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11
<i>Kl. ozaenae</i>	7/7	7/7	7/7	7/7	7/7	7/7	7/7	7/7
<i>E. coli</i>	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15
<i>Ps. aeruginosa</i>	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6
<i>Pr. mirabilis</i>	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3

Note. Numerator – the number of strains capable of growth; denominator – the total number of tested isolates.

All 115 strains of microorganisms isolated from bronchoalveolar fluid taken from calves with acute catarrhal bronchopneumonia showed high resistance to *Eleutherococcus* extract. Thus, in Petri dishes with the initial stock dilution of the tested herbal medicine, all strains of *S. aureus*, *S. intermedius*, *Str. uberis*, *Str. faecalis*, *Str. pyogenes*, *Tr. pyogenes*, *M. haemolytica*, *P. multocida*, *Kl. pneumoniae*, *Kl. ozaenae*, *E. coli*, *Ps. aeruginosa* and *Pr. mirabilis* showed abundant growth.

Table 3

**Antibacterial activity of *Echinacea purpurea* extract against clinical isolates causing bronchopneumonia in calves**

Microorganism	Two-fold dilution of <i>Echinacea purpurea</i> extract							
	Stock	2	4	8	16	32	64	128
<i>S. aureus</i>	0/18	0/18	0/18	7/18	12/18	18/18	18/18	18/18
<i>S. intermedius</i>	0/3	0/3	0/3	1/3	3/3	3/3	3/3	3/3
<i>Str. uberis</i>	0/6	0/6	1/6	5/6	6/6	6/6	6/6	6/6
<i>Str. faecalis</i>	0/4	0/4	2/4	4/4	4/4	4/4	4/4	4/4
<i>Str. pyogenes</i>	0/7	0/7	2/7	4/7	7/7	7/7	7/7	7/7
<i>Tr. pyogenes</i>	0/6	1/6	5/6	6/6	6/6	6/6	6/6	6/6
<i>M. haemolytica</i>	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18
<i>P. multocida</i>	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11
<i>Kl. pneumoniae</i>	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11
<i>Kl. ozaenae</i>	7/7	7/7	7/7	7/7	7/7	7/7	7/7	7/7
<i>E. coli</i>	0/15	0/15	11/15	15/15	15/15	15/15	15/15	15/15
<i>Ps. aeruginosa</i>	0/6	0/6	0/6	2/6	6/6	6/6	6/6	6/6
<i>Pr. mirabilis</i>	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3

Note. Numerator – the number of strains capable of growth; denominator – the total number of tested isolates.

The data presented (see Table 3) indicate that *Echinacea purpurea* extract does not have antibacterial activity against the following gram-negative microflora: *M. haemolytica*, *P. multocida*, *Kl. pneumoniae*, *Kl. ozaenae* and *Pr. mirabilis*.

It should be noted that *Echinacea purpurea* showed quite high antimicrobial activity against all gram-positive microorganisms — the initiators of bronchopneumonia in calves. In particular, the herbal medicine showed 100% activity against all strains of *S. aureus* and *S. intermedius* in 2-fold and 4-fold dilutions. A four-fold dilution of *Echinacea purpurea* extract inhibited growth of 83.3% of *Str. uberis*, 50.0% of *Str. faecalis*, 71.4% of *Str. pyogenes* and 16.7% of *Tr. pyogenes*. The tested herbal medicine showed high activity against *E. coli* and *Ps. aeruginosa* strains: *Echinacea purpurea* extract inhibited growth of 4 (26.7%) isolates of *E. coli* in 4-fold dilution, and it inhibited growth of 4 (66.7%) strains of *Ps. aeruginosa* in 8-fold dilution.

Table 4

**Antibacterial activity of *Hypericum perforatum* extract against clinical isolates causing bronchopneumonia in calves**

Microorganism	Two-fold dilution of <i>Hypericum perforatum</i> extract							
	Stock	2	4	8	16	32	64	128
<i>S. aureus</i>	0/18	0/18	0/18	0/18	0/18	4/18	17/18	18/18
<i>S. intermedius</i>	0/3	0/3	0/3	0/3	1/3	3/3	3/3	3/3
<i>Str. uberis</i>	0/6	0/6	0/6	0/6	0/6	5/6	6/6	6/6
<i>Str. faecalis</i>	0/4	0/4	0/4	0/4	1/4	4/4	4/4	4/4
<i>Str. pyogenes</i>	0/7	0/7	0/7	0/7	0/7	3/7	7/7	7/7
<i>Tr. pyogenes</i>	0/6	0/6	0/6	0/6	1/6	4/6	6/6	6/6
<i>M. haemolytica</i>	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18
<i>P. multocida</i>	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11
<i>Kl. pneumoniae</i>	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11
<i>Kl. ozaenae</i>	7/7	7/7	7/7	7/7	7/7	7/7	7/7	7/7
<i>E. coli</i>	0/15	0/15	7/15	15/15	15/15	15/15	15/15	15/15
<i>Ps. aeruginosa</i>	0/6	0/6	0/6	2/6	6/6	6/6	6/6	6/6
<i>Pr. mirabilis</i>	0/3	0/3	0/3	1/3	1/3	3/3	3/3	3/3

Determining the antibacterial activity of *Hypericum perforatum* extract against clinical strains that initiate bronchopneumonia in calves showed complete resistance to the test drug in bacteria of the genera *Mannheimia sp. p.*, *Pasteurella sp. p* and *Klebsiella sp. p*. It was found that in the original form, 2-, 4- and 8-fold dilutions, *Hypericum perforatum* extract showed 100 % effectiveness against all gram-positive microflora. At the same time, in a 16-fold dilution, the tested phytopreparation inhibited growth of 2 (66.7%) strains of *S. intermedius*, 3 (75.5%) isolates of *Str. faecalis* and 5 (83.3%) isolates of *Tr. pyogenes*. It should be noted that even in a 32-fold dilution, *Hypericum perforatum* extract was active against 14 (77.8%) strains of *S. aureus*, 1 (16.7%) culture of *Str. uberis*,



4 (57.1%) strains of *Str. pyogenes* and 2 (33.3%) isolates of *Tr. pyogenes*. It is also worth noting that *Hypericum perforatum* extract showed quite high antimicrobial activity against individual representatives of gram-negative microflora: it inhibited growth of 8 (53.3%) strains of *E. coli* in 4-fold dilution, and 4 (66.7%) cultures of *Ps. aeruginosa* and 2 (66.7%) isolates of *Pr. mirabilis* in an 8-fold dilution.

Thus, *Hypericum perforatum* extract has the most pronounced antimicrobial properties against the initiators of acute catarrhal bronchopneumonia in calves. Moreover, this herbal medicine showed a more powerful antimicrobial effect against gram-positive bacteria than gram-negative ones. The obtained research results should be considered when choosing the most optimal strategy for combating respiratory tract diseases in calves on livestock farms.

## Conclusion

The sensitivity to antibiotics and phytobiotics was determined in isolated microorganisms bronchoalveolar lavage samples collected from calves with acute catarrhal bronchopneumonia. It was found that all isolated microorganisms were sensitive to only three antibacterial drugs: cefquinome, cefepime and marbofloxacin. The vast majority of antibiotics showed low effectiveness: 8 (44.4%) strains of *St. aureus* and 58 (81.6%) representatives of gram-negative bacteria were resistant to benzylpenicillin; ten (55.5%) isolates of *St. aureus* and 71 (100.0%) representatives of gram-negative bacteria showed resistance to methicillin; *Ps. aeruginosa*, *Pr. mirabilis* and *M. haemolytica* showed resistance to amoxicillin; *Ps. aeruginosa* and *Pr. mirabilis* and 7 (38.8%) cultures of *M. haemolytica* were found to be resistant to cefazolin; 4 (66.7%) strains of *Ps. aeruginosa* showed resistance to ceftriaxone; *Str. uberis*, 3 (42.9%) isolates of *Str. pyogenes* and 2 (33.3%) strains of *Tr. pyogenes* were resistant to gentamicin; *Klebsiella* and *M. haemolytica* isolates showed resistance to tylosin; 6 (33.3%) cultures of *St. aureus*, 4 (66.7%) strains of *Str. uberis* and (27.8%) isolates of *M. haemolytica* were resistant to lincomycin; 5 (27.8%) cultures of *St. aureus* were resistant to enrofloxacin. It has been shown that *Hypericum perforatum* extract has the most pronounced antimicrobial properties against the initiators of acute catarrhal bronchopneumonia in calves among the tested herbal remedies. Thus, in its original form, in 2-, 4- and 8-fold dilutions, *Hypericum perforatum* extract showed 100% effectiveness against all gram-positive bacteria. At the same time, in 16-fold dilution, the tested herbal medicine inhibited growth of 2 (66.7%) strains of *S. intermedius*, 3 (75.5%) isolates of *Str. faecalis* and 5 (83.3%) isolates of *Tr. pyogenes*. Even in a 32-fold dilution, *Hypericum perforatum* extract was active against 14 (77.8%) strains of *S. aureus*, 1 (16.7%) culture of *Str. uberis*, 4 (57.1%) strains of *Str. pyogenes* and 2 (33.3%) isolates of *Tr. pyogenes*. *Hypericum perforatum* extract showed quite high antimicrobial activity against certain representatives of gram-negative microflora: it inhibited growth of 8 (53.3%) strains of *E. coli* in 4-fold dilution, and 4 (66.7%) cultures of *Ps. aeruginosa* and 2 (66.7%) isolates of *Pr. mirabilis* in 8-fold dilution.

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## Чувствительность к антибиотикам и фитобиотикам инициаторов острой катаральной бронхопневмонии у телят

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**Аннотация.** Приведены результаты изучения антимикробной активности антибиотиков (бензилпенициллин, метициллин, амоксициллин, цефазолин, цефтриаксон, цефкином, цефепим, гентамицин, тилозин, линкомицин, энрофлоксацин, марбофлоксацин) и фитобиотиков (экстракт элеутерококка, экстракт эхинацеи пурпурной, экстракт зверобоя продырявленного), широко используемых в ветеринарии, в отношении

микроорганизмов, изолированных от телят при острой катаральной бронхопневмонии. Материалом для исследования служили телята в возрасте 1–3 месяца, больные острой катаральной бронхопневмонией ( $n = 37$ ). От больных телят отбирали бронхоальвеолярный лаваж с помощью силиконовых стерильных катетеров в стерильные пробирки. Бактериологические исследования проводили на базе ООО «Вет-тест» общепринятыми методами. Определение чувствительности изолированных условно-патогенных микроорганизмов к антибактериальным препаратам показало, что подавляющее их большинство имеет достаточно низкую эффективность. Установлено, что все 115 изолированных микроорганизмов оказались чувствительны лишь к трем антибактериальным препаратам: цефалоспориновым антибиотикам IV поколения — цефкиному и цефепиму, а также к фторхинолоновому антибиотику III поколения — марбофлоксацину. Из исследованных фитобиотиков наиболее выраженными антимикробными свойствами по отношению к основным инициаторам острой катаральной бронхопневмонии у телят обладает зверобой продырявленный. При этом, он показал более мощное противомикробное действие по отношению к представителям грамположительных бактерий. Это дает возможность его широкого использования при проведении комплексной терапии у данного вида животных.

**Ключевые слова:** легкие, воспаление, бронхоальвеолярный лаваж, микрофлора, терапия, антибактериальная активность, зверобой продырявленный

**Заявление о конфликте интересов.** Авторы заявляют об отсутствии конфликта интересов.

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