

Therapeutic Effectiveness of Enterosorbent Based on Modified Polysaccharides



Petr Albinovich Krasochko, Irina Aleksandrovna Krasochko, Gennady Efimovich Tolyaronok, Oleg Yurevich Chernykh, Andrey Georgievich Koshchaev, Alexander Anatolyevich Lysenko, Sergey Viktorovich Shabunin

Abstract: *The authors present the results of the study of the therapeutic effectiveness of the “Enteropolysorb” enterosorbent based on modified polysaccharides in the livestock farms of the Republic of Belarus. It was found that the therapeutic effectiveness of the enterosorbent in the treatment of calves up to four months of age with signs of diseases of the gastrointestinal tract was 93.3-97.5%. The use of the newly developed drug can reduce the duration of the disease by 2.6-3.8 days and improve calves’ livability by 3.0-11.1%.*

Keywords: *cattle, enterosorbent, polysaccharides, calves, gastrointestinal tract, therapeutic effectiveness, infectious process, diarrhea.*

I. INTRODUCTION

Mass diseases of newborn calves, accompanied by diarrhea, are some of the most important infectious diseases of cattle and pose one of the most complex and intractable problems of modern veterinary medicine. In the etiological structure of pathogens of gastrointestinal infections, the leading place belongs to the diarrhea virus, rota- and coronaviruses, as well as several bacterial pathogens – Klebsiella, Escherichia coli, Proteus, Pseudomonas, i.e. causative agents of opportunistic infections [1]-[4]. One of the most effective means of combating the abovementioned infections is specific prophylaxis [5], [6]. The challenges of vaccine design and its maximum effectiveness are inextricably connected with the selection of both inactivating agents and the adjuvant with the maximum

sorption effect and immunostimulation effect [7]-[9].

In recent years, adjuvants based on various mineral oils, using which a stable oil-water emulsion can be obtained – Emulsigen (“Laboratories”, USA), Montanide ISA (“Seppic”, France), Freund's incomplete adjuvant, etc. – have become widely used in veterinary medicine [10]-[13]. The mechanism of action of the adjuvant is mainly the deposition of antigen at the administration site and, accordingly, its slower delivery to immunocompetent cells, which enhances the effect of the vaccine [14]-[17]. Based on this, we conducted research on the selection and modification of natural polymers in order to increase their sorption properties.

Plant polysaccharides are widely used as enterosorbents for the prevention of poisoning and elimination of various endogenous and exogenous toxins from the body [18], [19]. Among the most common natural sorbents, cellulose (in particular, its microcrystalline modification), pectins and alginates are the most important [20-22]. Microcrystalline cellulose is used widely in the pharmaceutical industry as an additive functioning as a filler and thickening agent for tablets, capsules, ointments, various medicinal products and other special formulations [23]-[26]. However, microcrystalline cellulose does not contain functional groups and, therefore, has a non-selective and relatively low sorption activity. In contrast, natural polymers, such as alginates and pectins, are polyelectrolytes. They have carboxyl groups in their composition and thus they are relatively effective sorbents [27]-[30]. Modification of cellulose in order to give it polyelectrolyte properties will increase the sorption activity and the selectivity of the natural polymer. Another material that is suitable for the creation of enterosorbent for animals is pectin-containing crops, in particular, beet [31]-[34]. Beet pulp that remains after processing of sugar beet, as a by-product of sugar beet production, is currently used as feed for farm animals [35], [36]. In our opinion, the use of beet pulp as a raw material source for the creation of enterosorbent for animals is very promising.

Therefore, we consider the application of modified polysaccharides (cellulose) for use as adjuvants in the design of vaccines and for the treatment of enteritis ehnterosorbentov calves infectious etiology reasonable.

The aim of this study was to investigate the therapeutic effectiveness of the “Enteropolysorb” enterosorbent based on modified polysaccharides.

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* Correspondence Author

Petr Albinovich Krasochko, Institute of Experimental Veterinary Medicine, Minsk, Belarus.

Irina Aleksandrovna Krasochko, Institute of Experimental Veterinary Medicine S.N. Vyshesleskogo, Minsk, Belarus.

Gennady Efimovich Tolyaronok, Vitebsk Order "Badge of Honor" State Academy of Veterinary Medicine, Vitebsk, Belarus.

Oleg Yurevich Chernykh, Kuban State Agrarian University, Krasnodar, Russia.

Andrey Georgievich Koshchaev, Kuban State Agrarian University, Krasnodar, Russia.

Alexander Anatolyevich Lysenko, Kuban State Agrarian University, Krasnodar, Russia.

Sergey Viktorovich Shabunin, Russian Research Veterinary Institute of Pathology, Pharmacology and Therapy, Voronezh, Russia.

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II. MATERIALS AND METHODS

The studies were conducted in the department of viral infections of the Vyshelesky Institute of Experimental Veterinary Medicine and at the livestock farms of the Republic of Belarus. For the experiment, we used “Enteropolysorb” – an enterosorbent based on modified polysaccharides developed in the department of viral infections of the Vyshelesky Institute of Experimental Veterinary Medicine.

The drug is intended for the treatment of toxic dyspepsia, enteritis of infectious etiology in calves, food intoxication (poisoning), poisoning with salts of heavy metals, etc.

To study the therapeutic effectiveness of the enterosorbent, studies were carried out at four livestock farms in the Republic of Belarus: “Budslavskoye” OJSC (Myadelsky district of the Minsk region), “Gniezno” SE (Volkovyssk district of the Grodno region), “Volkovysskoye” DACUE (Volkovyssk district of the Grodno region) and “Khanchitsy” agricultural branch of Grodno Tobacco Factory “Neman”

OJSC (Svisloch district of the Grodno region).

To study the effectiveness of the newly developed drug, in each farm, using the principle of analogues, we formed two groups of calves up to four months of age (45-100 animals in each) with signs of diseases of the gastrointestinal tract. 50 ml of the drug was administered orally to the calves of the experimental group 1-2 times a day 3-4 days in a row until the signs of pathology disappeared. The calves of the control group were treated according to the regimen used at the farms.

We determined the effectiveness of treatment regimens according to the results of clinical examinations, periods of treatment and periods of recovery and the number of recovered, dead and compulsorily slaughtered animals.

III. RESULTS AND DISCUSSION

The results of the use of the drug for the treatment of calves up to four months of age with signs of diseases of the gastrointestinal tract are presented in Tables 1-4.

Table 1: Therapeutic effectiveness of the use of the “Enteropolysorb” enterosorbent based on modified polysaccharides at the “Budslavskoye” OJSC (Myadelsky district of the Minsk region).

Parameter	Units	Group	
		Experiment	Control
Number of animals in the group	animals	45	45
Recovered	animals	43	33
	percent	95.6	73.3
Duration of treatment	days	3.3	7.1
Relapsed	animals	2	10
	percentage	4.4	22.2
Dead and compulsorily slaughtered	animals	-	5
	percentage	-	11.1

The study of the therapeutic effectiveness of enterosorbent in calves showed that 43 out of 45 experimental calves recovered and the treatment duration was 3.3 days. At the same time, the treatment of calves according to the regimen used in the farm led to the recovery of 33 animals and the treatment duration was 7.1 days. The number of animals with relapse was 17.8% lower and the number of dead and compulsorily slaughtered animals was 11.1% lower in the experimental group compared to the control. Thus, the

therapeutic effectiveness of “Enteropolisorb” was 95.6% and the effectiveness of the treatment regimen used at the farm was 73.3%.

The results of the performance tests of the “Enteropolisorb” enterosorbent based on modified polysaccharides at the “Gniezno” state enterprise in the Volkovyssk district of the Grodno region are presented in Table 2.

Table 2: Therapeutic effectiveness of the use of the “Enteropolysorb” enterosorbent based on modified polysaccharides at the “Gniezno” state enterprise (Volkovyssk district of the Grodno region).

Parameter	Units	Group	
		Experiment	Control
Number of animals in the group	animals	100	100
Recovered	animals	96	65
	percent	96	65
Duration of treatment	days	3.2	5.8
Relapsed	animals	4	32
	percentage	4	32
Dead and compulsorily slaughtered	animals	-	3
	percentage	-	3

The results shown in Table 2 indicate that the therapeutic effectiveness of the newly developed drug “Enteropolisorb” was 31% higher in comparison with the regimen used at the farm. In addition, the use of the enterosorbent based on modified polysaccharides made it possible to reduce the duration of the disease by 2.6 days, the number of relapses by 28% and the number of dead and compulsorily slaughtered

animals by 3% in comparison with the control group.



Table 3 presents the results of the evaluation of the therapeutic effectiveness of the use of “Enteropolysorb” at the “Volkovysskoye” DACUE in the Volkovyssk district of the Grodno region.

Table 3: Therapeutic effectiveness of the use of the “Enteropolysorb” enterosorbent based on modified polysaccharides at the “Volkovysskoye” DACUE (Volkovyssk district of the Grodno region).

Parameter	Units	Group	
		Experiment	Control
Number of animals in the group	animals	80	80
Recovered	animals	78	61
	percent	97.5	76.2
Duration of treatment	days	3.1	5.9
Relapsed	animals	2	19
	percentage	2.5	23.8
Dead and compulsorily slaughtered	animals	0	0
	percentage	0	0

The results of the performance tests of the newly developed drug at the “Volkovysskoye” DACUE showed that its therapeutic effectiveness was 21.3% higher in comparison with the treatment regimen used at the farm. The use of the enterosorbent made it possible to reduce the duration of the disease by 2.8 days and the number of relapses by 21.3% in comparison with the control group.

The results of the evaluation of the therapeutic

effectiveness of the enterosorbent at the “Khanchitsy” agricultural branch of Grodno Tobacco Factory “Neman” OJSC in the Svisloch district of the Grodno region are presented in Table 4.

Table 4: Therapeutic effectiveness of the use of the “Enteropolysorb” enterosorbent based on modified polysaccharides at the “Khanchitsy” agricultural branch of Grodno Tobacco Factory “Neman” OJSC (Svisloch district of the Grodno region).

Parameter	Units	Group	
		Experiment	Control
Number of animals in the group	animals	45	45
Recovered	animals	42	31
	percent	93.3	68.8
Duration of treatment	days	3	6.1
Relapsed	animals	3	12
	percentage	6.7	26.6
Dead and compulsorily slaughtered	animals	0	2
	percentage	0	4.4

These results indicate that the use of the newly developed “Enteropolysorb” enterosorbent based on modified polysaccharides led to the recovery of 93.3% of calves, which was 24.5% higher than in the control group of animals. The duration of treatment with the use of the newly developed drug was 3.1 days shorter, the number of relapses was 19.9% lower and the number of dead and compulsorily slaughtered animals was 4.4% lower.

IV. CONCLUSION

“Enteropolysorb” enterosorbent based on modified polysaccharides, intended for the treatment of enteritis of infectious etiology in calves, demonstrated high therapeutic effectiveness (93.3-97.5%) in treatment of calves up to four months of age with signs of diseases of the gastrointestinal tract. The use of this drug reduced the duration of the disease by 2.6-3.8 days and increased the livability of calves by 3.0-11.1%, which allows us to recommend the newly developed drug for the use in veterinary practice.

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Therapeutic Effectiveness of Enterosorbent Based on Modified Polysaccharides

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