



## Praziver® and Ivermek® effectiveness for horse helminthiase prevention

E. G. Kalughina <sup>1\*</sup>, O. A. Stolbova <sup>1,2</sup>

<sup>1</sup> Institute of Biotechnology and Veterinary Medicine, Federal State Budget Educational Institution of Higher Education "Northern Trans-Ural State Agricultural University", RUSSIA

<sup>2</sup> All-Russian Scientific Research Institute of Veterinary Entomology and Arachnology - branch of the Federal State Budgetary Institution of Science of the Federal Research Center of Tyumen Scientific Center of the Siberian Branch of the Russian Academy of Sciences, Tyumen, RUSSIA

\*Corresponding author: [notgsa@mail.ru](mailto:notgsa@mail.ru)

### Abstract

After the examination of horses in various horse breeding farms, including the hippodrome, schools, clubs, private stables and the horses of various ages, sex, and breeds, a wide spread of parasitic diseases was found, most often manifested in the form of helminthic infections and causing horse discomfort, preventing the development of young animals, reducing the working capacity and productivity of the adult population, as well as a number of different deviations. In order to protect animals from the harm caused by mixtinvasions, a hematological and biochemical study of horse blood was carried out. 32 animals infested with helminths were selected for the experiment. Blood was taken from experimental animals and examined in the laboratory. Studies have shown that invasions negatively affect the functional state of animals, while reducing the number of red blood cells, hemoglobin, basophils, platelets, total protein, urea, glucose, micro and macro elements, and increasing white blood cells, eosinophils, neutrophils, monocytes, lymphocytes, alkaline phosphatase, alanaminotransferase, aspartate aminotransferase, and bilirubin. They studied the effectiveness of the drugs Praziver® and Ivermek® for horse helminthiasis. The drug "Praziver®" showed 100% therapeutic efficacy, used by the dose of 0.04 ml/kg against mixtinvasion of horses.

**Keywords:** horse, parasites, infestations, helminths, strongylatosis, oxyurosis, parascaridosis, deworming, praziquantel, ivermectin, blood, biochemistry

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### INTRODUCTION

The Tyumen region is a unique region of Russia, ranging from the Arctic Ocean in the north to the state border with Kazakhstan in the south, and it also borders the Komi Republic, Krasnoyarsk Territory, Omsk, Tomsk and Arkhangelsk Regions (Lozhkina and Ganieva 2016, Veterinary pharmacy Horsevet, Emelyanova 2015).

Geographically, the region located in the meridional direction across Russia, covering natural zones and zoogeographic regions, thereby determines faunal diversity, and also has the whole range of parasitic fauna (Emelyanova 2015, Lozhkina and Ganieva 2016, Vatsaev et al. 2018).

At present, horse breeding is in great demand. There are equestrian schools, complexes, clubs, tourist centers, private stables, which continue to develop to this day. Because of livestock increase, the most urgent problem is the treatment and prevention of infectious and non-infectious horse diseases (Emelyanova 2015, Kalugina and Stolbova 2017, 2019).

Among the diseases of parasitic etiology, helminthiases is very common one. It is known that helminths, settling in a horse body, feed on it, sucking out blood and tissue juices, partially absorb the nutrients needed to feed the host body, causing allergic reactions, and disrupt the gastrointestinal tract. Others secrete highly toxic substances that are absorbed into the blood and act on the nervous, hematopoietic, cardiovascular, immune, and respiratory systems, causing toxic effects (Emelyanova 2015, Panayotova-Pencheva et al. 2017, Vodyanov et al. 2009).

Inadequate deworming to achieve a therapeutic effect, a weak dose or an old recommendation to conduct it for the purpose of healing, reduces the immunity of animals and promotes the formation of chemotherapy-resistant parasites in horses (Arkhipov 1987, Kalugina and Stolbova 2019, Musaev et al. 2018).

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**Fig. 1.** Dock combing

In this regard, the study of this problem related to the spread, diagnosis, treatment, planned veterinary measures during horse helminthiasis, remains an urgent problem nowadays (Andreeva 1957, Cherepanov et al. 2001, Emelyanova 2015).

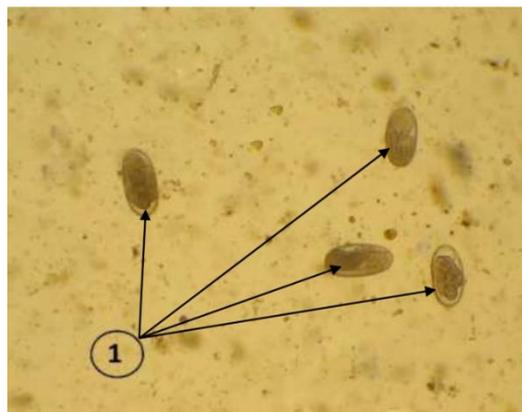
#### Study Purpose

The aim of our research is to study the effectiveness of the antiparasitic drugs Praziver® and Ivermek® for horse helminthiasis prevention in the Tyumen Region. (Gholami et al 2019).

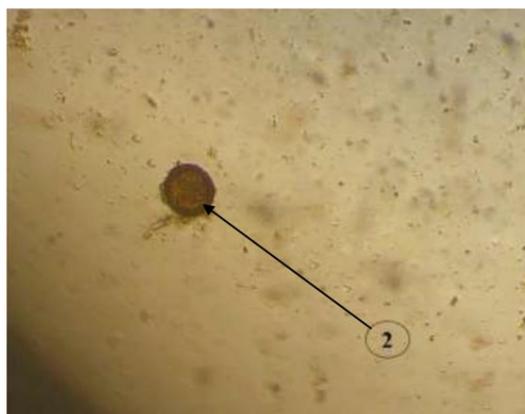
#### STUDY MATERIALS AND METHODS

The study was carried out during 2017 - 2019 on the basis of the Federal State Budgetary Educational Establishment of Higher Education "State Agricultural University of the Northern Trans-Urals", the Institute of Biotechnology and Veterinary Medicine, the Department of Non-communicable Diseases of Farm Animals and Infectious and Invasive Diseases of Farm Animals, and the Clinical and Diagnostic Laboratory, VNIIVEA - the branch of the Tyumen Scientific Center SB RAS, the Equestrian Sports School "GAU of Northern Trans-Urals" and other horse breeding farms of the Tyumen region. We examined 32 horses of sports, breeding and work breeds, and of different age categories.

To establish a diagnosis, a clinical examination of the animals was carried out, while paying attention to the presence of scratches on tail skin (**Fig. 1**), itching in the anus, severe anxiety, the presence of nervous reactions in the form of tooth grinding, refusal to feed, emaciation, impaired function of gastrointestinal tract, colic, short-



**Fig. 2.** The eggs of Strongylidae equinus (1)



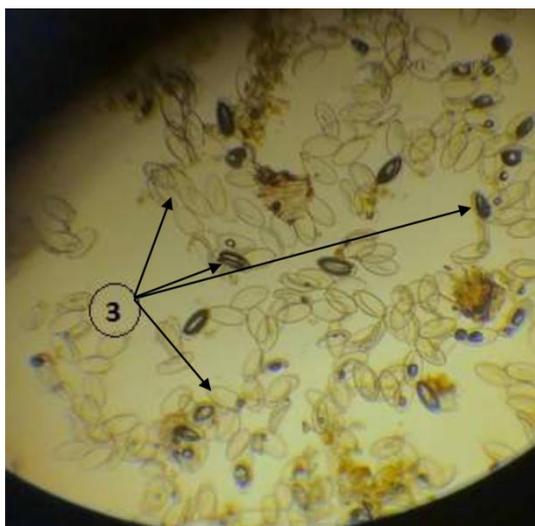
**Fig. 3.** The egg of Parascaris equorum (2)

term increase of body temperature, and growth and development retardation. The diagnosis was confirmed by conventional coproscopic examination of the samples using the method of helminthoscopy and helminthovoscopy according to Fulleborn, hematological and biochemical blood tests were performed among the animals prior to deworming and 30 days after it.

To obtain samples, feces were taken in the morning on an empty stomach before and after deworming, then 5 grams of fresh samples were placed in a glass beaker, poured with flotation liquid in an amount of 50 milliliters, thoroughly mixed and filtered through one layer of gauze in a dry, clean beaker, and settled for thirty minutes and the surface film was removed with a careful touch of the loop, then it was transferred to a glass slide and examined under a microscope.

Blood samples were taken from the jugular vein on an empty stomach in the morning for examination before and after deworming on the thirtieth day to determine hematological and biochemical parameters performed on a semi-automatic analyzer "Medonic Ca 620", "Clima MC15", using the reagents "Deacon", and "Vital Diagnostics SPb".

The horses with mixtinvation (*Strongylus equinus* (**Fig. 2**), *Parascaris equorum* (**Fig. 3**) *Oxyuris equi* (**Fig.**



**Fig. 4.** The eggs of *Oxyuris equi* with and without larvae (3)

4), selected according to the principle of analogues, were divided into three groups (two experimental and one control). The examinations were performed before and after deworming on the third, seventh, fourteenth and twenty first day. Among the animals of the first experimental group (n = 11), the suspension was administered orally with the therapeutic dose of 0.4 ml per 10 kg of animal body weight. The second group (n = 11): the animals took the drug intramuscularly with the therapeutic dose of 1 ml per 50 kilograms of animal body weight. The horses of the third group (n = 10) did not receive anthelmintic and served as a control.

Praziver® is an anthelmintic drug, 1 ml of which contains the following active ingredients: 25 mg of praziquantel and 5 mg of ivermectin, as well as the following auxiliary components: 10 mg of knotweed extract, 1.5 mg of microcrystalline cellulose, 50 mg of glycerol, 6 mg of tween-80 and up to 1 ml of distilled water by the manufacturer LLC NPF “Api-San”, Russia (Veterinary pharmacy Horsevet).

Ivermek® is an antiparasitic drug that contains the active substance in 1 ml - ivermectin 10 mg, auxiliary component - vitamin E (40 mg), preservative and aqueous-organic base by the manufacturer NITA-PHARM, Russia (Veterinary pharmacy Horsevet).

The results were processed statistically in accordance with the methods of biometry, with the

calculation of arithmetic mean and root mean square errors ( $M \pm m$ ), using Microsoft Excel and BioStat.

### RESEARCH RESULTS AND DISCUSSION

Analyzing the results of the studies, we can conclude that mixed-invasion of one-hoofed animals are common among the stock of horse farms of the Tyumen region. It was established that after examination of the feces sample the eggs of *Oxyuris equi*, *Parascaris equorum*, Strongylidae equinus were found at different stages of development. The intensity of invasions (II) among experimental animals with strongilates, parascaris, and oxiuri made on the average  $97.32 \pm 1.85$  eggs in one gram of feces before deworming.

The degree of horse infection with helminth infections during the administration of anthelmintic drugs was different. The effectiveness of the applied drugs Ivermek® and Praziver® was taken into account according to the results of fecal sample studies before and three, seven, fourteen, twenty-one days after deworming (Table 1).

As can be seen from the data in Table 1, the indicators of invasion intensity before deworming range from  $94.95 \pm 2.10$  to  $98.87 \pm 1.69$  eggs in one gram of feces within the experimental groups.

After the horses of the first experimental group took Praziver®, the invasiveness amounted to 25.07 eggs per gram on the third day, this makes 26% of the invasion rate, 9.12 eggs per gram (9%) on the seventh day and there was 100% elimination of helminths on the fourteenth day.

In the second experimental group, the deworming performed by the Ivermek® drug did not lead to 100% effect, on the third day the extensiveness of the drug was 57%, 77% on the seventh day, and 90% on the twenty-first day. The intensity of invasion gradually decreased, but there was no complete release of the animal organism from helminths. Side effects on the animal organism were not noted during anthelmintic drug use.

The next stage of our work was the laboratory study of blood samples of horses infected with mixtinvasions, according to two analyzes before and after the use of the anthelmintic drugs Praziver® and Ivermek®. The results are shown in Table 2.

The table shows that the horses infected with mixt invasions, demonstrated erythrocyte concentration

**Table 1.** Indicators of horse invasion with helminthiases before and after deworming ( $M \pm m$ )

Group of horses, drug	Animal invasion rates								
	Prior to deworming	after deworming, days							
		II, eggs/g	EI, %				II, eggs/g		
		3	7	14	21	3	7	14	21
First Praziver® (n = 11)	$94.95 \pm 2.10$	26	9	0	0	$25.07 \pm 1.42$	$9.12 \pm 1.21$	0	0
Second Ivermek® (n = 11)	$98.87 \pm 1.69$	43	23	13	10	$42.61 \pm 1.63$	$22.75 \pm 3.21$	$13.09 \pm 1.42$	$10.61 \pm 2.08$
Control (n = 10)	$98.15 \pm 1.75$	100	96	99	100	$98.16 \pm 2.08$	$95.12 \pm 2.92$	$98.21 \pm 2.25$	$96.78 \pm 2.92$

**Table 2.** Hematological blood counts of horses before and after deworming

Indicators	First (n=11)		Second (n=11)	
	before deworming	After deworming by "Praziver®" on the 30th day	before deworming	After deworming by "Ivermek®" on the 30th day
Red blood cells, 10 <sup>2</sup> /l	5.11 ± 0.35	8.95 ± 0.35	4.61 ± 0.15	5.71 ± 1.04
White blood cells, 10 <sup>9</sup> /l	13.90 ± 0.66	9.01 ± 0.46	14.08 ± 0.21	12.86 ± 0.22
Hemoglobin, g/l	82.90 ± 1.87	123.50 ± 2.41	80.13 ± 0.22	92.14 ± 0.30
Basophils, %	0.10 ± 0.05	1.08 ± 0.03	0.10 ± 0.02	0.23 ± 0.05
Eosinophils, %	8.71 ± 0.52	4.61 ± 0.09	7.12 ± 0.11	6.70 ± 0.17
Rod nuclear neutrophils, %	9.21 ± 0.23	5.35 ± 0.17	8.24 ± 1.03	6.38 ± 0.66
Segmented neutrophils, %	76.6 ± 1.69	49.75 ± 1.59	78.22 ± 1.19	67.11 ± 0.09
Lymphocytes, %	52.16 ± 0.13	34.90 ± 0.88	51.03 ± 0.51	46.08 ± 0.13
Monocytes, %	6.40 ± 0.02	2.54 ± 0.29	5.50 ± 0.11	4.06 ± 0.21
Platelets, %	127.20 ± 0.33	415.30 ± 0.15	133.16 ± 0.29	178.15 ± 0.54

decrease in the first experimental group which made  $5.11 \pm 0.35$  10<sup>2</sup>/l, after deworming the indicator increased by 75.1%, in the second experimental group -  $4.61 \pm 0.15$  10<sup>2</sup>/l, after treatment it was increased by 23.9%, but also remains below normal. It entails hemoglobin level decrease, in the first experimental group the indicator before deworming was  $82.90 \pm 1.87$  g/l, after treatment it became higher by 49%, in the second experimental group it increased by 15% before treatment and amounted to  $92.14 \pm 0.30$  g/l, below normal.

There is leukocyte concentration increase before horse treatment in both experimental groups, there is a noticeable decrease by 35.1% in the first one after treatment, and it decreased insignificantly in the second one - by 8.7%.

When they analyzed the results of the study, they noted a low content of basophils in the blood of horses of the experimental groups before deworming, after it was carried out, the indicator increased by 98% on the thirtieth day in the first group, and did not reach the norm in the second, increasing by 13% ( $0.23 \pm 0.05$  %).

The number of eosinophils in horse blood of both experimental groups before treatment is above the normal range,  $8.71 \pm 0.52\%$  and  $7.12 \pm 0.11\%$ , on the thirtieth day after treatment with anthelmintics, the indicators become lower: by 47,1% in the first group, and by 5.9% in the second one.

During the blood test, the rod nuclear neutrophil number was increased in the first experimental group before treatment and made  $9.21 \pm 0.23\%$ , after it was significantly reduced by 41.9% and segmented neutrophils -  $76.6 \pm 1.69\%$  were decreased by 35.1% after treatment. The results were also improved in the second experimental group: segmented -  $78.22 \pm 1.69\%$ , rod nuclear -  $8.24 \pm 1.03\%$ , the former were slightly decreased by 14.2% after deworming, the latter were decreased by 22.6% in the position slightly above normal.

Analyzing the results of the studies, they observe the increase of lymphocyte and monocyte number in the first group before deworming which makes the following:  $52.16 \pm 0.13\%$  and  $6.40 \pm 0.02\%$ , decreased by 33.1% and 60.3% after deworming corresponding to the norm, and in the second group before treatment -  $51.03 \pm$

$0.51\%$  and  $5.50 \pm 0.11\%$ , and on the thirtieth day after treatment the indicators decreased by 9.7% and 26.2%, and are above normal.

The platelet count was reduced to  $127.20 \pm 0.33\%$  in the first group before deworming, after the use of the drug "Praziver®" the indicators increased by 69.4%. In the second group, it was lowered to  $133.16 \pm 0.29\%$ ; after deworming, Ivermek® indicators became higher by 33.80%.

Analyzing the data on a biochemical blood test, one can note the decrease of total protein amount in blood serum of horses before deworming, in the first group it made  $38.14 \pm 0.06$  g/l, and  $41.25 \pm 0.27$  g/l in the second, thirty days after deworming, the indicators became higher among the horses treated with Praziver® by 91.5%, and by 7.4% for those treated with Ivermek® (**Table 3**).

The urea content of horses before deworming is lower than normal in both groups, in the first one -  $1.79 \pm 0.37$  mmol/l, in the second -  $1.68 \pm 0.06$  mmol/l. After application of anthelmintics, the indices increased by 59.9% in the first group, and by 20.8% in the second.

The indicators before deworming of aspartate aminotransferase (AsAT) prevail over alanine aminotransferase (AIAT), which causes the suspicion of the liver or gastrointestinal tract disease, in the first group AsAT -  $305.0 \pm 0.06$  UN/l, after treatment it decreases by 55.7%, and AIAT -  $29.14 \pm 0.31$  UN/l, it became 72.1% lower, in the second group before treatment AsAT made  $317.02 \pm 0.37$  UN/l, and AIAT -  $31.06 \pm 0.22$  UN/l, after treatment, the indicators increased by 5.0% and 16.6%.

Bilirubin was increased in the first group and amounted to  $31.12 \pm 1.16$  mmol/l, applying the treatment it became 36.1% lower, in the second group -  $35.87 \pm 0.13$  mmol/l, on the thirtieth day it decreased by 15 8% ( $30.22 \pm 0.41$  mmol/l).

The glucose value was  $1.47 \pm 1.20$  mmol/l before horse deworming from the first experimental group. Praziver® drug increased the indicator by 67%, the second experimental group -  $2.50 \pm 0.61$  mmol/l, after deworming it increased by 35.7% on the thirtieth day.

Alkaline phosphatase before treatment exceeds the norm in the first experimental group making  $415.0 \pm 0.32$  UN/l. Thirty days after treatment, the indicator was

**Table 3.** Biochemical blood counts of horses before and after deworming

Indicators	First (n=11)		Second (n=11)	
	before deworming	After deworming by "Praziver®" on the 30th day	before deworming	After deworming by "Ivermek®" on the 30th day
Total protein, g/l	38.14 ± 0.06	73.05 ± 0.64	41.25 ± 0.27	44.29 ± 1.21
Urea, mmol/l	1.79 ± 0.37	4.46 ± 1.54	1.68 ± 0.06	2.12 ± 0.26
AsAT, UN/l	305.0 ± 0.06	173.0 ± 0.23	317.02 ± 0.37	301.05 ± 0.11
AIAT, UN/l	29.14 ± 0.31	8.12 ± 0.06	31.06 ± 0.22	25.9 ± 1.16
Bilirubin, mmol/l	31.12 ± 1.16	19.9 ± 0.39	35.87 ± 0.13	30.22 ± 0.41
Glucose, mmol/l	1.47 ± 1.20	4.84 ± 0.12	2.50 ± 0.61	3.89 ± 0.33
Alkaline phosphatase, UN/l	415.0 ± 0.32	189.3 ± 0.42	378.12 ± 0.04	203.15 ± 0.34
Ca, mmol/l	1.87 ± 0.17	3.22 ± 0.49	1.67 ± 0.23	2.01 ± 0.20
P, mmol/l	0.30 ± 0.07	1.53 ± 0.41	0.54 ± 0.02	0.69 ± 0.45

reduced by 54.4%, in the second experimental group it made  $37.8 \pm 0.04$  UN/l, after treatment it decreases by 46.3% and corresponds to the norm.

At the same time, the increase of calcium was noted by 72.2% in the blood of treated animals from the first experimental group on the thirtieth day, in the second experimental group - by 20.4% as compared with the indices before treatment,  $1.87 \pm 0.17$  mmol/l in the first one,  $1.67 \pm 0.23$  mmol/l in the second.

Phosphorus is also increased among the animals of the first group by 41%, and by 27.8% in the second after treatment. The indicators in the first group were  $0.30 \pm 0.07$  mmol/l and  $0.54 \pm 0.02$  mmol/l in the second group.

At the end of thirty days after deworming, the indicators indicate the decrease of inflammatory and allergic processes and the normalization of the gastrointestinal tract, general condition, possibly caused by mixed infections. Consequently, deworming has a positive effect on the health and condition of horses, the means used have different indicators of treatment effectiveness, the drug Praziver® is most effective.

## SUMMARY

Thus, during mixed blood infections of horses, they observe the inhibition of erythropoiesis, neutrophilic leukocytosis, eosinophilia, monocytosis, lymphocytopenia, a significant decrease of hemoglobin, erythrocytes, total protein, urea, glucose, microelements and macrocells, the increase of leukocytes, eosinophils and bacilli. During deworming, using the Praziver® drug (the active ingredients are praziquantel and ivermectin), the studies proved 100% effectiveness in mixed invasions on horse farms of the Tyumen region. After this drug application, they observed complete release of animals from helminths, normalization of biochemical and hematological blood parameters to the physiological norm and general clinical condition of horses.

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