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Effective measures to control eimeriosis in poultry in the Republic of Dagestan

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ABSTRACT
The most common disease of young poultry in commercial farms of the Russian Caspian region is eimeriosis. In most cases, after convalescence from coccidiosis caused by one of *Eimeria* species poultry remains susceptible to other species. This parasite has a very short life cycle and immense reproductive capacity that is why it can cause large-scale outbreaks of the disease in commercial poultry houses. To control avian eimeriosis, various coccidiostats are used in combination with probiotics and vitamins. Frequent and long-term use of the same drugs against this infection can potentially result in the emergence of resistant *Eimeria* populations. This suggests that this coccidiosis control requires rotation of eimeriocidal drugs. Studies on eimeriosis prevalence were performed in the laboratory of the Caspian Regional Research Veterinary Institute and in different poultry farms of the Republic of Dagestan. Swabs of the floor, litter, equipment, droppings, feedstuffs, cecum smears from dead poultry were used for testing. High infection rate with eimerias was established in floor-housed poultry in the plain and piedmont zones of the Republic (Khasavyurtovsky and Karabudakhkentsky raions), where the infection rates were 81.6 and 82.4%, respectively. In batter-cage system poultry farms of the mountain and mountain valley zones (Khunzakhsky and Gergebilsky raions) the infection rates were significantly lower – 61.2 and 58.0%, respectively. The comparative efficacy study of two eimeriocidal drugs showed that "Robenidine", used daily from the first day of life during the entire rearing period at a dose of 33 g per 1 ton of feedstuffs controls coccidiosis in poultry. At the same time, the survival rate of the experimental young poultry during the observation period was 98.0% compared with "Sarucoxum 12%" group (96.7%).

Keywords: broilers, eimeriosis, oocysts, eimerias, eimeriocidal drugs, "Robenidine", "Sarucoxum 12%", efficacy, infection rate, ceca, droppings

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Эффективные меры борьбы с эймериозами птиц в условиях Республики Дагестан

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РЕЗЮМЕ
Самым распространенным заболеванием молодняка на птицефабриках промышленного типа в Прикаспийском регионе России является эймериоз (кокцидиоз). В большинстве случаев птица, которая переболела кокцидиозом, вызванным одним видом эймерий, остается восприимчива и к другим видам возбудителя. У данного паразита очень короткий жизненный цикл и огромная репродуктивная способность, вследствие чего в птичниках промышленного типа случаются массовые вспышки заболевания. Для борьбы с эймериозами птиц применяют различные кокцидиоцидные препараты в сочетании с пробиотиками и витаминами. Частое и долгосрочное использование одних и тех же средств лечения данной инвазии приводит к возникновению устойчивых популяций эймерий. Это говорит о том, что при борьбе с этим паразитозом важно чередовать эймериоцидные препараты. Исследования по изучению распространения эймериоза проводили на базе лаборатории Прикаспийского зонального научно-исследовательского ветеринарного института и в птицеводческих хозяйствах Республики Дагестан различного типа. Материалом для исследований служили соскобы с пола, подстилки, инвентаря; помет; корма; мазки-отпечатки слепых отростков кишечника павшей птицы. Выявлена высокая зараженность эймериями птиц, выращиваемых в условиях напольного содержания в равнинной и предгорной зонах республики (Хасавюртовский и Карабудахкентский районы), где уровень инвазирования составил 81,6 и 82,4% соответственно. В птицеводческих хозяйствах горной зоны и зоны горных долин (Хунзахский и Гергебильский

районы) при клеточном выращивании степень поражения птиц была значительно ниже – 61,2 и 58,0% соответственно. При сравнительном изучении эффективности двух эймериоцидных препаратов установлено, что «Робенидин» ежедневно с первого дня жизни в течение всего периода выращивания в дозе 33 г на 1 тонну корма санирует организм птицы от паразитов. При этом выживаемость подопытного молодняка птицы за период наблюдения составила 98,0% по сравнению с группой, где применяли «Сарукокс 12%» (96,7%).

Ключевые слова: цыплята-бройлеры, эймериоз, ооцисты, эймерии, эймериоцидные препараты, «Робенидин», «Сарукокс 12%», эффективность, интенсивность инвазии, слепые отростки кишечника, помет

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INTRODUCTION

The most common disease of young poultry in commercial farms of the Russian Caspian region is eimeriosis (coccidiosis) [1].

The scientists point out that eimeriosis mainly affects young poultry (10 day – 3-month old) and attribute this to underdeveloped immunity [2, 3, 4, 5, 6].

In most cases, after convalescence from coccidiosis caused by one of *Eimeria* species poultry remains susceptible to other species. This parasite has a very short life cycle and immense reproductive capacity that is why it can cause large-scale outbreaks of the disease in commercial poultry houses [6, 7, 8, 9].

Many authors describe the enormous damage caused to poultry farming by poultry deaths, reduced weight gain and meat production [10, 11, 12, 13].

To control avian eimeriosis, various coccidiostats are used in combination with probiotics and vitamins [14, 15, 16, 17].

The peak incidence in poultry is most often observed during warm and humid periods of the year (spring and late autumn).

The scientists note that 4–10 *Eimeria* species can infect poultry at the same time, which significantly complicates this disease control [6, 9].

In recent years, co-infections with eimerias and cryptosporidias, salmonellas and colibacterias have been frequently reported [18].

Frequent and long-term use of the same drugs against this infection can potentially result in the emergence of resistant *Eimeria* populations. This suggests that control of this coccidiosis requires rotation of eimeriocidal drugs [19, 20, 21].

The aim of the research was to study eimeriosis prevalence in poultry farms of the Republic of Dagestan and the efficacy of "Robenidine" and "Sarucoxum 12%" by comparison.

MATERIALS AND METHODS

Commercial drugs "Robenidine" and "Sarucoxum 12%" were tested.

"Robenidine" has a coccidiostatic effect against the main species of avian coccidia (*Eimeria necatrix*, *Eimeria tenella*, *Eimeria acervulina*, *Eimeria brunetti*, *Eimeria maxima*, *Eimeria mivati*), at the stage of first and second generation schizonts. "Robenidine" affects energy metabolism of coccidia cells and adversely affects the process of nuclear division which leads to the death of parasites.

"Sarucoxum 12%" contains salinomycin sodium, a polyether ionophore antibiotic. The drug disrupts the transport of sodium and potassium ions in the oocyst and leads to the death of coccidia at the stage of schizogony. It has an anticoccidial effect against all coccidia species of poultry and other livestock.

The experiments were performed in the laboratory of the Caspian Regional Research Veterinary Institute and commercial poultry farm AO "Poultry farm "Makhachkalinskaya", as well as in other poultry farms of the region.

Swabs of the floor, litter, equipment, droppings, feedstuffs, cecum smears from dead poultry were used for testing.

Laboratory tests to establish the diagnosis and *Eimeria* infection rate in poultry were carried out in accordance with GOST 25383-82 (ST SEV 2547-80) "Domestic animals. Methods of laboratory diagnostics of coccidiosis"[1].

To conduct an experiment in a commercial poultry farm of AO "Poultry farm Makhachkalinskaya", 3 groups of chicks were formed: 2 test groups and 1 control group (150 chicks per group).

Test group 1 broilers received "Robenidine" daily from the first day of life during the entire rearing period at a dose of 33 g per 1 ton of feedstuffs. The drug was removed from

[1] https://docs.cntd.ru/document/1200025474?ysclid=lwmb1ge0n7566471140 (in Russ.)

Table 1
Prevalence of eimerioses in poultry in the raions and different attitudinal zones of the Republic of Dagestan

Raions and zones	Tested for eimeriosis				
	No. of samples	subjected to post-mortem examination	subjected to microscopy	positive samples detected	%
Khasavyurtovsky (plain zone)	364	104	364	297	81.6
Karabudakhkentsky (piedmont zone)	256	84	256	211	82.4
Khunzakhsky (mountain zone)	178	34	178	109	61.2
Gergebilsky (intermontane valley zone)	188	32	188	109	58.0
TOTAL	986	254	986	726	73.6

the diet 5 days before slaughter. Test group 2 was treated with "Sarucoxum 12%" at a dose of 7 mg/kg, which is equivalent to 1 mL per 1 liter of drinking water given within 48 hours. Control chicks were not treated.

Poultry were observed during the entire period of the experiment. Treated chicks were tested for oocysts on days 16, 26, 36, 48.

The experiments on animals were carried out in accordance with GOST 33215-2014, adopted by the Interstate Council for Standardization, Metrology and Certification, as well as in accordance with the requirements of the Helsinki Declaration (2000) and Directive 2010/63/EU of the European Parliament and of the Council of the European Union dated 09/22/2010 on the protection of animals used for scientific purposes.

The intensive efficacy (IE) of the drugs was determined by coproscopy for *Eimeria* oocysts in ceca and droppings.

The effect of the drugs on poultry performance was evaluated by clinical signs manifested; oocyst index and mortality rates caused by eimeriosis, as well as weight gains in control and test groups.

A McMaster or VIGIS counting chamber was used to count oocysts in 1 g of droppings.

The results were statistically processed using Biometrics software.

RESULTS AND DISCUSSION

The eimeriosis situation in different altitudinal zones of the region was studied at the poultry farms and small-scale farms practicing floor and battery cage system rearing, located in Khasavyurtovsky (plain zone), Karabudakhkentsky (piedmont zone), Khunzakhsky (mountain zone) and Gergebilsky (intermontane valley zone) raions of the Republic.

986 carcasses of dead and killed poultry were examined, including 254 birds subjected to post-mortem examination, and 986 birds subjected to microscopy. There were 726 positive results which is 73.6% (Table 1).

In the plain and piedmont zones of the Republic (Khasavyurtovsky and Karabudakhkentsy raions), a high *Eimeria* infection rate in floor-housed poultry was revealed. The prevalence was 81.6 and 82.4%, respectively.

A completely different picture is observed in the cage-housed poultry at the farms of the mountain zone and intermontane valley zone (Khunzakhsky and Gergebilsky raions) infection, where the prevalence of infection was 61.2 and 58.0%, respectively.

The laboratory tests revealed eimerias in ceca, duodena and droppings of broilers (Table 2).

According to the literature data the morphology of the eimerias detected in pathological samples (droppings, ceca and duodena) was consistent with *Eimeria tenella*, *Eimeria maxima*, *Eimeria mitis*, *Eimeria acervulina* species.

To control avian eimeriosis successfully, it is necessary to conduct constant research and development of modern highly effective eimeriocidal drugs, therefore, one of the stages of the study was a comparative efficacy study of "Robenidine" and "Sarucoxum 12%" against spontaneous eimeriosis in broilers in a commercial poultry farm (battery cage system) of AO "Poultry farm "Makhachkalinskaya" (Table 3 and 4).

Table 2
The results of testing of broiler intestines and droppings for eimerias

Raions and zones	No. of samples	*Eimeria* oocysts detected (No. seen in a single field of view)		
		in cecum	in droppings	in duodenum
Khasavyurtovsky (plain zone)	104	54–56	8–10	7–9
Karabudakhkentsky (piedmont zone)	84	24–26	4–5	4–6
Khunzakhsky (mountain zone)	34	11–12	2–3	1–2
Gergebilsky (intermontane valley zone)	32	6–8	2–3	1–2
TOTAL	254	–	–	–

Table 3
Design of testing in cage-housed ROSS 308 broilers

Groups	Drug	Number of chicks	Dose and course of treatment
Group 1	"Robenidine"	150	Daily from the first day of life during the entire rearing period at a dose of 33 g per 1 ton of feedstuffs. The drug was removed from the diet 5 days before slaughter
Group 2	"Sarucoxum 12%"	150	Given with water during 48 hours at a dose of 7 mg/kg, which is equivalent to 1 mL per 1 liter of drinking water
Control	–	150	–

Table 4
The efficacy of eimeriocidal drugs against spontaneous eimeriosis in broilers

Indicator	Control	Test groups	
		"Robenidine"	"Sarucoxum 12%"
Before treatment			
No. of chicks per group	150	150	150
Age of chicks, days	15	15	15
The average weight of 1 chicken at the beginning of the study, g	426	432	443
The number of oocysts in the tested samples (mean value), No. in a single FoV			
In cecum	40.3 ± 5.3	36.7 ± 1.9	32.8 ± 2.3
In 20 samples of droppings	33.7 ± 1.9	29.3 ± 2.1	24.6 ± 2.3
After treatment			
Chickens died within 48 days (%)	59 (39.3%)	3 (2.0%)	5 (3.3%)
The number of oocysts in the tested samples (mean value), No. in a single FoV			
In cecum	43.6 ± 4.4	–	5.5 ± 1.4
In 20 samples of droppings	40.3 ± 3.8	–	4.9 ± 1.1
Intensive efficacy, %	–	98.0	96.7
Survival rate of chicks within 48 days, %	60.7	98.0	96.7
Average daily gain within 48 days, g	44	53	48
Feed consumption per 1 kg of weight gain within 48 days, kg	2.24	1.95	2.10
Live weight at slaughter, g	2,536	2,978	2,729

No. in a single FoV – number of oocysts in a single field of view.

It was found that in the test groups, after the use of "Robenidine" and "Sarucoxum 12%" in therapeutic doses, 3 and 5 chicks respectively died during the entire observation period (48 days). Thus, the survival rate of poultry in test groups was 98.0 and 96.7%, respectively. In the control group, the survival rate of broiler chicks was significantly lower – 60.7%.

The post-mortem examination of dead chicks of groups 1 and 2 revealed no lesions characteristic of eimeriosis in the internal organs and intestines.

Microscopy of cecum smears from dead birds of group 1 demonstrated no *Eimeria* oocysts, whereas single oocysts were found in group 2 broiler chicks (4–5 oocysts in a single field of view).

The intensive efficacy of "Robenidine" treatment was 98.0%, of "Sarucoxum 12%" – 96.7%. Thus, the therapeutic efficacy of "Robenidine" turned out to be higher than "Sarucoxum 12%".

The average daily gain in broiler chicks during the rearing period (48 days) in test groups 1 and 2 was 53 and 48 g, respectively, and feed consumption per 1 kg of live weight gain was 1.95 and 2.1 kg.

CONCLUSION

Monitoring tests performed in the plain and piedmont zones of the Republic (Khasavyurtovsky and Karabudakhkentsy raions) revealed a high *Eimeria* infection rate in floor-housed poultry. The prevalence was 81.6 and 82.4%, respectively.

The prevalence of infection in cage-housed poultry in the mountain zone and intermontane valley zone (Khunzakhsky and Gergebilsky raions) was 61.2 and 58.0%, respectively.

Morphology study of *Eimeria* detected in pathological samples (droppings, ceca and duodena) allowed

to identify them as *Eimeria tenella*, *Eimeria maxima*, *Eimeria mitis*, *Eimeria acervulina*.

As a result of a comparative assessment of eimeriocidal drugs in the setting of spontaneous eimeriosis in broiler chicks in the commercial poultry farm AO "Poultry farm "Makhachkalinskaya", 98.0% "Robenidine" effectiveness was established.

Daily treatment of chicks with "Robenidine" from the first day of life during the entire rearing period at a dose of 33 g per 1 ton of feedstuffs and removing the drug the diet 5 days before slaughter keeps the poultry free from the parasites. The survival rate of the young poultry under study during the observation period was 98.0%.

Thus, the therapeutic efficacy of "Robenidine" turned out to be higher than "Sarucoxum 12%". The commercial drug "Robenidine" can be used in poultry farms of the Republic of Dagestan for treating eimeriosis in broilers.

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