Efficiency evaluation of anticoccidials against the background of chickens infection with field coccidia isolate

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Abstract. The article gives a comparative efficiency evaluation of anticoccidials of different pharmacological groups at experimental infection of chickens with field coccidia isolate selected from the production sites of the poultry complex of the Belgorod region. The selected mixture of field strains of coccidia is partially resistant to eimicide, maksiban, esdot, decox (anticoccidial index is from 150.0 to 156.3). High sensitivity was noted to robenz, avatek and tsigro (anticoccidial index is from 160.4 to 177.1), in the absence of birds’ death in all groups that receive preparations. The use of preparations against the background of chickens’ infection reduced the loss of body weight gain. In groups receiving eimicide, maksiban and esdot it reduced by 2.3 and 4%, respectively; in groups receiving decox, robenz, avatec and zigro it reduced by 5.7, 11 and 15%. It should be taken into account that the partial resistance of coccidia to the preparations mentioned above can be increased and transmitted genetically. Therefore, there is a need for constant monitoring and rotation of preparations at this poultry complex.

1. Introduction

The prevention of eimeriosis (coccidiosis) of birds includes the obligatory implementation of several measures simultaneously. They are high-quality disinfection of premises with modern preparations; specific immunization; preventive feeding of anticoccidial preparations [1,2,3,4]. It has been established that the simultaneous use of vaccines and the use of preparations also has a qualitative preventive effect [5]. A special attention is paid to the prevention eimeriosis of birds with the help of anticoccidials in the system of treatment and prevention measures at all poultry enterprises. When growing broilers, this group of preparations is prescribed from the first days of life and excluded five to seven days before slaughter. The constant or repeated use of the same anticoccidial preparations for a long time, use of low doses, ineffective against eimeria, leads to the rapid resistance development to preparations for parasites.

Various programs for the preparations rotation have been developed in order to increase the efficiency and extend the period of use. The alternative use of chemical anticoccidial preparations, ionophore antibiotics, as well as their combinations have been developed [6,7,8]. The combined preparations are compound taking into account the synergism of the components included in their composition with the obligatory condition of reducing possible side effects.
The purpose of the study is to conduct a comparative efficiency evaluation of anticoccidials belonging to different pharmacological groups when experimental infection of chickens with field strains of coccidia selected from the production sites of the poultry complex.

2. Materials and methods
An average brood sample of broiler chickens from the production sites of the poultry complex of the Belgorod region was investigated. A culture of Eimeria was selected and identified from the brood. The species composition of eimeria was determined by morphological and biometric characteristics, as well as by the place of eimeria’s localization in the body of broiler chickens after infection.

The resistance of the volume of the isolated pathogens of the field eimeria isolate to anticoccidials was studied at the experiment on broiler chickens of 14 days of age. They were selected from a farm that was free from parasitic diseases and brooded under conditions excluding their spontaneous infection.

Chickens were divided into groups of 10 chickens each. The first group is an uninfected control group. Chickens of all experimental groups were infected via gavage with sporulated oocysts at a dose of 1.0 ml/head (multispecies mix of 3 million oocysts/head). The second group is an infected control group that did not receive treatment. A day before the infection and during 10 days after it, preparations were added to the compound feed in doses recommended in the instructions for use of the preparations (500 mg / kg) for chickens from the third to the ninth groups.

The third experimental group was given avatek with food; the fourth group was given Robenz; the fifth group was decox; the sixth fourth group was emiticide; the fifth group was escot; the sixth fourth group was emitecide; the seventh fourth group was tsigro; the ninth fourth group was a complex preparation Maxiban. The studied preparations belonged to different pharmacological groups and had different mechanisms of action:

- avatek is an ionophore antibiotic; an active ingredient is sodium lasalocide. It causes a disruption in the transport of Na and K ions through the membrane of the pathogen, causing extreme osmotic problems and its death (coccidiocidal effect). It belongs to preparations that do not cause the immunity development;
- robenz is an antiprotozoal preparation; an active ingredient is robenidide hydrochloride causing selective disturbance of energy metabolism, suppression of nuclear fission. It prevents the formation of mature schizonts and death of the parasite (coccidiocidal and coccidiostatic effect);
- decox is an antiprotozoal preparations; an active ingredient is decoquinate, which causes a coccidiostatic effect, acting at the stage of schizogony and gametogony before the formation of a zygote; it forms immunity (coccidiostatic effect);
- emiticide is an ionophore antibiotic, an active ingredient is sodium salinomycin, which causes death of immature forms of coccidia at the stage of schizogony (coccidiocidal effect);
- esdot is a coccidiostatic; an active ingredient is dinitolmide. It is capable of developing specific immunity. Therefore, it can be used when brooding a parent flock (coccidiostatic effect);
- zygro is an ionophore antibiotic; an active ingredient is maduramycin ammonium, which disrupts the transport of Na and K ions through the membrane of the pathogen, which leads to a violation of the osmotic balance and causes the death of the parasite (coccidiocidal effect);
- maksiban is a complex preparation containing narasine, an ionophore antibiotic and Nicarbazine, i.e., coccidiostatic. It causes united coccidiostatic and coccidiocidal effects.

The observation of the chickens was carried out during 10 days; the safety was taken into account. At the beginning and at the end of the experiment, a bird was weighed, the percentage of weight gain was determined, and the ACI (anti-coccidial index) was calculated according to M.V. Krylov. [9].
3. Results of the research

*E. Acervulina, E. Maxima and E. Tenella* were selected from the average sample of broiler chickens broods. Sensitivity indicators of the field coccidia isolate to anticoccidial preparations (safety, weight gain, ACI) are presented in Table 1.

| №  | Name of preparations           | Preparation dose, mg/kg | Number of chickens, heads | Died, heads | Survived, % | Weight gain, % | ACI       |
|----|-------------------------------|-------------------------|---------------------------|-------------|-------------|----------------|-----------|
| 1  | Control uninfected            | -                       | 10                        | 0           | 100.0       | 48             | -         |
| 2  | Control infected              | -                       | 10                        | 2           | 80.0        | 22             | -         |
| 3  | Avatek (lasalocid 15%)        | 500                     | 10                        | 0           | 100.0       | 33             | 168.7     |
| 4  | Robenz (robenidin 6.6%)       | 500                     | 10                        | 0           | 100.0       | 29             | 160.4     |
| 5  | Декокс (decoquinate 6%)       | 500                     | 10                        | 0           | 100.0       | 27             | 156.3     |
| 6  | Amicide (salinomycin 12%)     | 500                     | 10                        | 0           | 100.0       | 24             | 150.0     |
| 7  | Esdot (dinitolmide 25%)       | 500                     | 10                        | 0           | 100.0       | 26             | 154.2     |
| 8  | Tsigro (maduramycin 1%)       | 500                     | 10                        | 0           | 100.0       | 37             | 177.1     |
| 9  | Maxiban (naraizine + nikarbazine) | 500                  | 10                        | 0           | 100.0       | 25             | 152.1     |

According to the information from the table, in the second group (infected control), the safety of chickens was 80%, while in all groups of infected chickens receiving anticoccidial preparations, it was 100%. This confirms the well-known fact that it is possible that the pathogenic effect on the body with a fatal outcome may increase with the simultaneous infection of chickens with several varieties of the pathogen at once. The anticoccidial indicator according to M.V. Krylov (ACI) of the studied preparations showed a partial resistance of the isolated amount of coccidiosis pathogens to eimicid, maksiban, esdot, decoxes (ACI from 150.0 to 156.3). When ACI is from 160 to 200, the sensitivity of pathogens to preparations is considered be high, this range of values includes robenz (160.4); avatek (168.7) and tsgiro (177.1). In the absence of chickens’ death in all groups receiving preparations, the body weight gain of the control and experimental chickens is shown in figure 1.

![Figure 1](image-url)
It can be seen from the data presented in the diagram, that the percentage of body weight gain in infected chickens that did not receive anticoccidial preparations was more than 2 times less than in the healthy group. The use of preparations against the background of infection of chickens reduced the loss of body weight gain to varying degrees. So, it reduced by only 2.3% and 4%, respectively in the groups receiving eimicide, maxiban and esdot. Those groups that received decox, robenz, avatek it reduced by 5.7% and 11%. The most effective studied preparation, which maximally retained the ability to increase body weight in chickens, was Tsigro. It increased body weight gain by 15% relative in the group of infected chickens.

The fact of the manifested resistance of field coccidia isolate to the complex preparation maxiban, which has in its composition parazine, an ionophore antibiotic with a coccidiocidal effect, and nikarbazine, that delays the maturation of coccidia (coccidiostatic effect), has caused our concern. Based on the logical assumptions that maxiban will give a more tangible preventive effect when artificially infecting chickens with a mixture of field strains, were not confirmed. It is explained by the fact that it has two components acting in different ways on the pathogen in its composition.

4. Conclusion
The mixture of field strains of coccidia isolate from the production sites of the poultry complex of the Belgorod region is partially resistant to eimicide, maksiban, esdot, decox (PKI from 150.0 to 156.3). High sensitivity was noted to robenz, avatek and tsigro (ACI is from 160.4 to 177.1), in the case of absence of chickens’ death in all groups receiving preparations. It should be taken into account that partial preparations resistance of coccidia can be transmitted genetically and will only increase over time. Therefore, there is a need for constant monitoring and rotation of preparations on this farm. At the same time, it is necessary to control the sanitary condition of the poultry complex before settling in the bird, to carry out high-quality disinfection and disinfestation of the premises, to maintain an optimal microclimate. Only comprehensively carried out preventive measures will make it possible to maintain the welfare of the poultry population in terms of eimeriosis and to obtain normative indicators of productivity.

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