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Anthelmintic effectiveness of modern preparations against *Heterakis gallinarum* nematodes parasitizing in chickens

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In poultry farming, heterakosis is one of the most widespread parasitic diseases and causes significant damage to the industry. At present, for chemoprophylaxis and treatment of poultry for this infestation, manufacturers have offered a sufficient number of preparations that have nematocide effect. At the same time, the effectiveness of anthelmintic preparations available on the domestic market has not always been studied and highlighted in scientific papers. The purpose of the research was to study the effectiveness of preparations with different active substances and different methods of application for spontaneous chicken heterakosis. Anthelmintics in the form of powder – Levamisole 80 (the active substance is levamisole hydrochloride) and Albendazole Ultra 10 % (the active substance is albendazole), as well as in the form of the solution and suspension with the analogous active substances – Levamisole-plus 10 % and Albendazole 10 %, were tested. A high effectiveness of Levamisole-plus 10 % for chicken heterakosis was established by the conducted studies, where on the 14th day of the experiment, the extense- and intenseeffectiveness reached 100 %. The efficacy indicators of this preparation on the 3rd day were 70 and 95.44 %, respectively, and on the 7th day they already reached 100 %. Albendazole suspension and Levamisole 80 turned out to be moderately effective. The indicators of extense- and intenseeffectiveness on the 14th day of treatment with Albendazole suspension were 80 and 95.67 %, and with Levamisole 80 – 80 and 78.78 %. During the experiment, the effectiveness of Albendazole suspension gradually increased and was 60 and 91.63 % on the 3rd day and 80 and 96.57 % on the 7th day, respectively. When applying Levamisole 80 to the diseased poultry, the indicators of extenseeffectiveness increased from the 3rd to the 7th day from 30 to 80 %, and intense-effectiveness decreased from 83.77 to 81.13 %. Albendazole Ultra10 % preparation turned out to be insufficiently effective: its indicators of extense- and intenseeffectiveness on the 14th day of the experiment made 60 and 73.93 %, respectively. During the experiment, the efficacy indicators of Albendazole Ultra 10% gradually increased from the 3rd to the 7th day – from 20 to 80 % and from 76.45 to 76.71 %. On the 14th day, the indicators of extenseeffectiveness remained at the same level, and those of intenseeffectiveness decreased. The obtained results of experimental studies allow recommend Levamisole-plus 10 % anthelmintic preparation for effective control and prevention of chicken heterakosis.

Keywords: parasitology, heterakosis, chickens, anthelmintic preparations, effectiveness.

Антигельмінтна ефективність сучасних препаратів за паразитування в курей нематод *Heterakis gallinarum*

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У птахівництві гетеракоз є одним з найбільш поширених паразитарних захворювань і завдає значної шкоди галузі. В даний час для хіміопрофілактики та лікування птиці за цієї інвазії виробниками запропоновано достатню кількість препаратів, що мають нематоцидний ефект. Разом з тим, ефективність наявних на вітчизняному ринку антигельмінтних препаратів не завжди вивчена і висвітлена у наукових працях. Метою досліджень було вивчення ефективності препаратів з різними діючими речовинами та різним способом застосування за спонтанного гетеракозу курей. Випробувано антигельмінтики у вигляді порошку – Левамізол 80 (діюча речовина – левамізолу гідрохлорид) та Альбендазол Ультра 10 % (діюча речовина – альбендазол), а також у вигляді розчину й суспензії з аналогічними діючими речовинами – Левамізол-плюс 10 % та Альбендазол 10 %. Проведеними дослідженнями встановлено високу ефективність за гетеракозу курей препарату Левамізол-плюс 10 %, де на 14 добу експерименту екстенс- та інтенсефективність сягали 100 %. Показники ефективності цього препарату на 3 добу становили відповідно 70 та 95,44 %, а на 7 добу – вже сягали 100 %. Помірно ефективними виявилися препарати Альбендазол суспензія та Левамізол 80. Показники екстенс- та інтенсефективності на 14 добу лікування Альбендазол суспензії становили 80 та 95,67 %, а Левамізолу 80 – 80 та 78,78 %. Впродовж експерименту ефективність Альбендазол суспензії поступово зростала і становила на 3 добу – 60 та 91,63 %, а на 7 добу – 80 та 96,57 % відповідно. При застосуванні хворій птиці Левамізолу 80 показники екстенсефективності зростали з 3 до 7 доби – з 30 до 80 %, а інтенсефективності знижувалися – з 83,77 до 81,13 %. Недостатньо ефективним виявився препарат Альбендазол Ультра 10 %, де його показники екстенс- та інтенсефективності на 14 добу експерименту відповідно становили 60 та 73,93 %. Впродовж експерименту показники ефективності Альбендазол Ультра 10 % поступово зростали з 3 до 7 доби – з 20 до 80 % та з 76,45 до 76,71 %. На 14 добу показники екстенсефективності залишилися на тому ж рівні, а інтенсефективності знижувалися. Отримані результати експериментальних досліджень дозволяють рекомендувати антигельмінтний препарат Левамізол-плюс 10 % для ефективної боротьби та профілактики гетеракозу курей

Ключові слова: паразитологія, гетеракоз, кури, антигельмінтні препарати, ефективність.

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Introduction

Helminthoses cause significant economic damages to poultry farming, as a result of the decrease in egg productivity and body weight gain, lag in the development and growth of young poultry, the decrease in the quality of products obtained from diseased poultry, the death of chickens, as well as the expenses on conducting medical and preventive measures [1–4]. Moreover, the nematodes of *Heterakis gallinarum* species are one of the most widespread parasites of the intestinal tract of poultry. These parasites can cause, especially with a significant intensity of infestation in young poultry, significant pathological changes in various organs, primarily the caecum and liver [5–9]. It has also been proven that heterakises' eggs are the reservoir of *Histomonas meleagridis* protozoa, where they can be stored for 1 year. This can lead to association heterakosis-histomonosis progress of invasion in poultry and its high mortality [10–14].

To control nematodes successfully and prevent the emergence of resistant parasites' populations, it is necessary to have a set of anti-helminthics of different chemical nature and mechanism of action. The success of therapeutic and preventive treatment of poultry largely depends on the correct choice of the preparation, taking into account its indicators of extense- and intense-effectiveness, which differ significantly in different anthelmintics [15–17]. In particular, it was determined that the effectiveness of the commercially available product based on flubendazole against *H. gallinarum* parasitizing in chickens on the 12th day of the experiment reached 99.4 % [18].

In other studies, the test was conducted with Fenbendazole 4 % (Panacur, Hoechst) for chicken heterakosis. It was found that on the second day of treatment, the scientists observed a noticeable decrease in the number of helminthes' eggs in feces, and on the seventh day after the last treatment, heterakises' eggs were not detected in the litter. The postmortem study after 15–21 days showed that the preparation was 100 % effective against *H. gallinarum* at a dose of 10 mg/kg when it was administered together with feed for three days in succession [19].

There are scientific reports where Fenbendazole was tested for spontaneous heterakosis and ascariasis (orally, in the form of solution at a rate of 5.0 mg/kg of body weight) and Albendazole (orally, in the form of suspension at a rate of 10.0 mg/kg of body weight). It was established that the effectiveness of Fenbendazole was 85.5 and 89.5%, respectively, and that of Albendazole was 0 and 71.5 % [20].

The efficacy of Vermal preparation (active substances are albendazole and natural organic elements) developed at the National Research Center "IEKVM" was tested by Ukrainian researchers in relation to the association development of heterakosis causative agent with capillariids in pheasants. The preparation was administered in a dose of 10 mg/kg of body weight for two days in succession. It was found that its effectiveness for heterakosis made 100 % [21].

Therefore, it is relevant to test the existing on the domestic market anthelmintic preparations for chicken heterakosis and recommendations for the use of the most effective ones.

The purpose of the study

The purpose of the research was to study the efficacy of preparations with different active substances and different methods of application for spontaneous chicken heterakosis.

Materials and methods

The work was carried out during 2024 on the basis of the laboratory of the Department of Parasitology and Veterinary and Sanitary Expert Examination of Poltava State Agrarian University and on a private peasant farm in Poltava region (Poltava district, village of Varvarivka).

Anti-helminthics in the form of powder – Levamisole 80 (the active substance is levamisole hydrochloride), produced by "Reagent" private JSC, Ukraine and Albendazole Ultra 10 % (the active substance is albendazole) produced by O.L.KAR, Ukraine, as well as the preparation in the form of solution – Levamisole-plus 10 % (the active substance is levamisole hydrochloride) manufactured by "Product" LLC, Ukraine and Albendazole 10 % suspension (the active substance is albendazole) produced by Basalt-Animal Health, Ukraine were tested.

4 experimental and one control group of chickens (10 heads in each) aged over 17 weeks spontaneously infested with heterakises were formed.

- *The poultry of the first experimental group* were given Levamisole 80 powder in a dose of 0.5 g/10 kg of body weight one time.

- *The poultry of the second experimental group* were watered with Levamisole-plus 10 % solution in a dose of 1 ml/250 ml of drinking water for three days in succession.

- *The poultry of the third experimental group* were given Albendazole Ultra 10 % powder in a dose of 0.5 g/10 kg of body weight for five days in succession.

- *The poultry of the fourth experimental group* were watered with Albendazole 10 % suspension in a dose of 0.5 ml/10 kg of body weight for five days in succession.

- *The chickens of the control group* were not dehelminthized. The effectiveness of anthelmintic preparations was determined on the 3rd, 7th and 14th day after their last application according to the indicators of extense- and intenseeffectiveness (EE and IE, %) as a result of coproovoscopic studies of chickens of the experimental and control groups using the flotation method [22].

Mathematical analysis of the obtained data was carried out using the Microsoft "EXCEL" applied program package by determining the arithmetic mean (M) and standard error (m).

Results and discussion

The conducted studies established the high effectiveness of Levamisole-plus 10 % preparation for chicken heterakosis, where on the 14th day of the experiment its extense- and intenseeffectiveness reached 100 %. The efficacy indicators of this preparation on the 3rd day made 70 and 95.44 %, respectively, and on the 7th day they already reached 100 % (***Figs. 1, 2***).

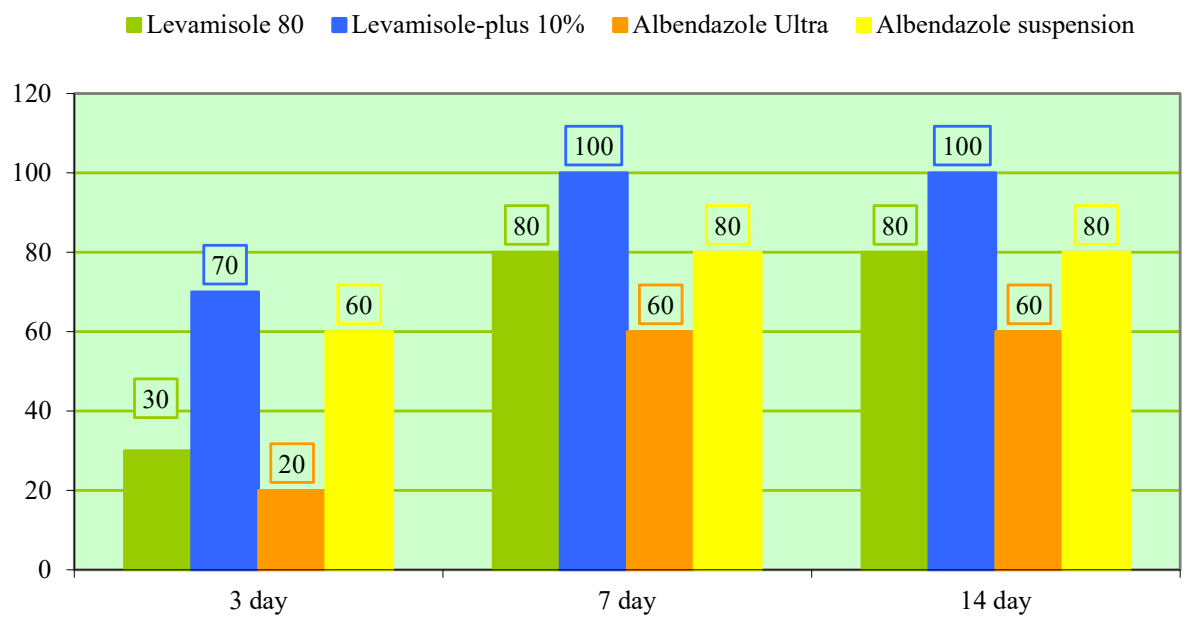

Fig. 1. Indicators of extenseeffectiveness (%) of anthelmintics for chicken heterakosis

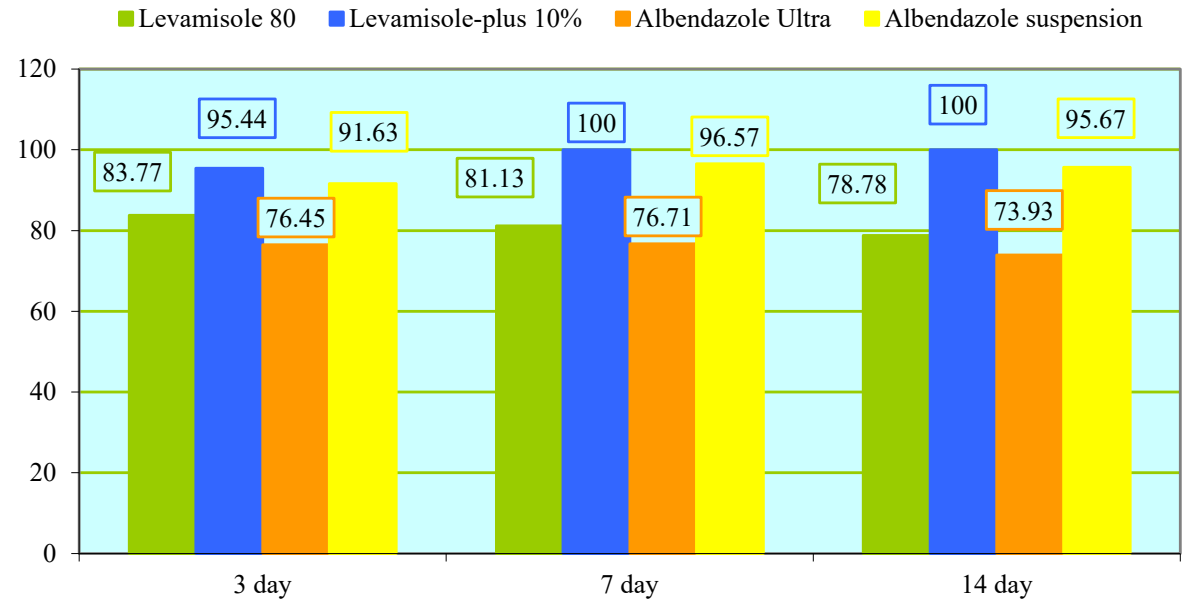

Fig. 2. Indicators of intenseeffectiveness (%) of anthelmintics for chicken heterakosis

Albendazole suspension and Levamisole 80 preparations turned out to be moderately effective, the effectiveness indicators of which were 80 and 95.67 % and 80 and 78.78 %, respectively, on the 21st day of treatment. Moreover, during the experiment, the efficacy of Albendazole suspension gradually increased and made on the 7th day 60 and 91.63 %, and on the 14th day – 80 and 96.57 %. At the same time, when applying Levamisole 80 to the diseased poultry, the indicators of extense-effectiveness increased from the 7th to the 14th day from 30 to 80 %, and intenseeffectiveness decreased from 83.77 to 81.13 %.

Albendazole Ultra 10 % preparation turned out to be insufficiently effective. Its indicators of extense- and intenseeffectiveness gradually increased from the 3rd to the 7th day from 20 to 80 % and from 76.45 to 76.71 %. On the 14th day, the indicators of extenseeffectiveness remained at the same level – 60%, and those of intenseeffectiveness decreased to 73.93 %.

Analyzing the indicators of the prevalence of heterakosis infection in the process of chickens' treatment, it was found that before the treatment in all experimental groups, the prevalence made 100 %. In the experimental group of poultry that was treated with Levamisole-plus 10 %, the prevalence indicators made 30 % on the 3rd day, and on the 7th and 14th day, no diseased chickens were detected by coproovoscopic examinations. In the group of poultry to which Albendazole suspension was applied, the prevalence indicators were 40 % on the 3rd day, and 20 % on the 7th and 14th day. In the experimental group of chickens treated with Levamisole 80 and Albendazole Ultra 10%, the prevalence indicators made 70 and 80 % on the 3rd day, 20 and 40 % on the 7th and 14th day, respectively (***Fig. 3***).

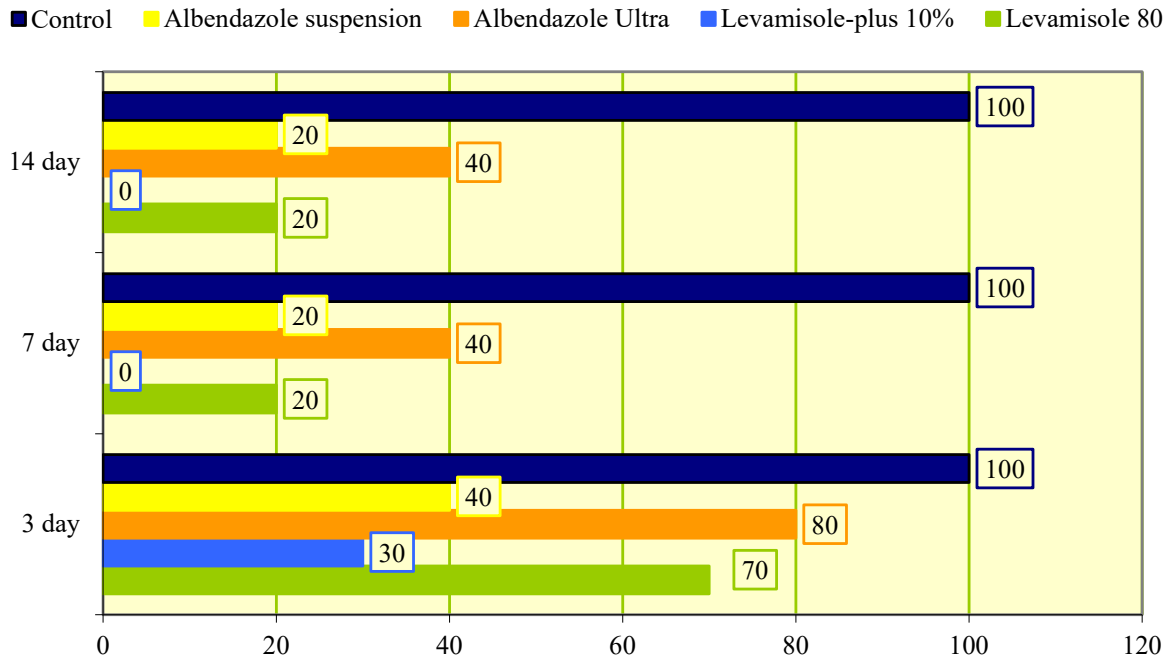

Fig. 3. Indicators of the prevalence of heterakosis invasion (%) of chickens in the process of their treatment

Analyzing the indicators of the intensity of heterakosis invasion in the process of chickens' treatment, it was found that before the treatment in the experimental and control groups of poultry, the indicators of the intensity of the infection ranged from 115.20±12.43 to 152.40±7.97 eggs/g. In the experimental group of poultry that were treated with Levamisole-plus 10 %, the II indicators were 6.77±1.33 eggs/g on the 3rd day, and on the 7th and 14th day, no diseased chickens were detected by coproovoscopic examinations. In the experimental group of poultry treated with Albendazole suspension, the II indicators made 14.00±3.46 eggs/g on the 3rd day, 6.00±2.00 eggs/g on the 7th day, and 8.00±4.00 eggs/g on the 14th day. In the experimental group of chickens that were treated with Levamisole 80 and Albendazole Ultra 10 %, the II indicators were: on the 3rd day – 26.29±3.98 and 42.50±2.92 eggs/g, on the 7th day – 32.00±4.00 and 44.00±6.73 eggs/g, on the 14th day – 38.00±6.00 and 52.00±2.83 eggs/g, respectively. At the same time, in the chickens of the control group, the II indicators gradually increased from 115.20±12.43 to 150.80±6.34 eggs/g (***Fig. 4***).

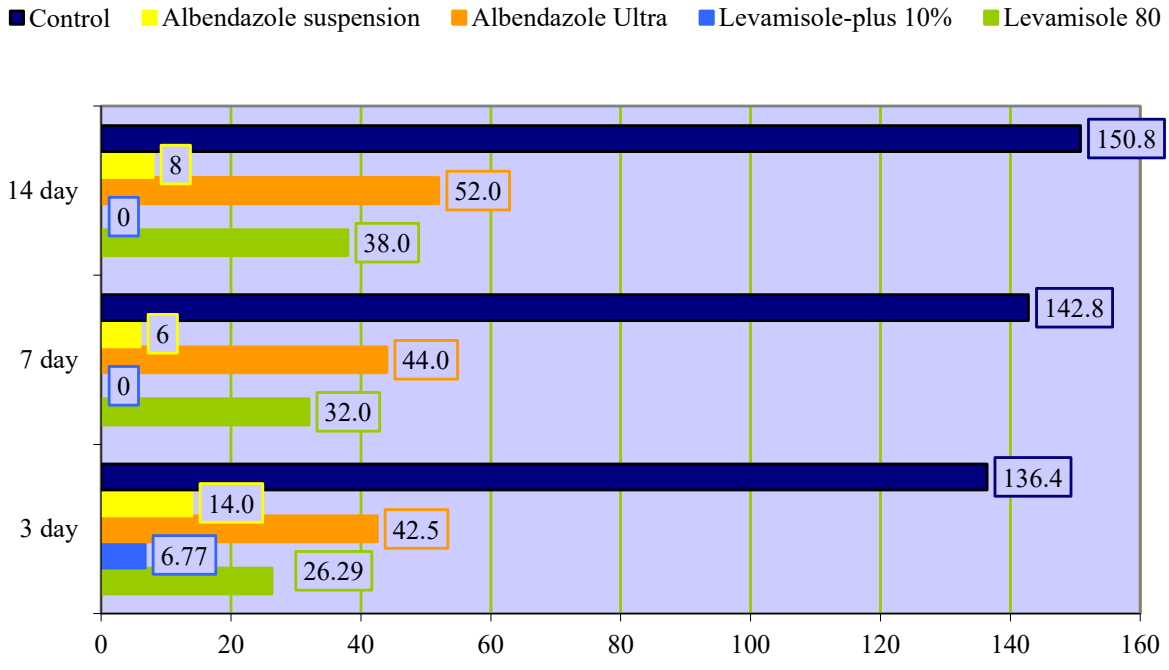

Fig. 4. Indicators of the intensity of heterakosis invasion (II, eggs/g) of chickens in the process of their treatment

The world literature shows that heterakosis is one of the most widely spread parasitic diseases of poultry and causes significant damage to the industry [3, 4, 9]. At present, chemoprophylaxis and treatment of poultry for this infestation, manufacturers have offered a sufficient number of preparations that have a nematocide effect. At the same time, the efficacy of anti-helminthic drugs available on the domestic market has not always been studied and highlighted in scientific papers [15–17]. Therefore, the purpose of our research was to study the effectiveness of preparations with different active substances and different methods of application for spontaneous chicken heterakosis, namely: Levamisole 80 and Albendazole Ultra 10 % powders, Levamisole-plus 10 % solution and Albendazole 10 % suspension. The high effectiveness of Levamisole-plus 10% preparation for chicken heterakosis was established by the conducted studies, where on the 14th day of the experiment its extense- and intenseeffectiveness reached 100%. Albendazole suspension and Levamisole 80 turned out to be moderately effective. The indicators of extense- and intenseeffectiveness on the 14th day of treatment with Albendazole suspension made 80 and 95.67 %, and with Levamisole 80 – 80 and 78.78 %. Albendazole Ultra 10 % preparation turned out insufficiently effective; its indicators of extense- and intenseeffectiveness on the 14th day of the experiment made 60 and 73.93 %, respectively.

There are reports that produced in Ukraine Vermal preparation based on albendazole had 100 % effectiveness in chicken heterakosis treatment [21]. Other researchers while testing Fenbendazole (Safeguard) and Levamisole (Prohibit) found that their effectiveness against poultry ascariasis made from 99.3 to 99.9 % and from 54.6 to 85.8 %, respectively. At the same time, the authors note that during the repeated treatment, the effectiveness of both preparations reached 100 % [23].

We also found that the drugs that were administered in the form of solution and suspension were more effective than those that were given in the form of powder. In our opinion, this is connected with the fact that at invasion diseases, the appetite of the diseased poultry decreases and thirst appears, as a result of which it consumes anthelmintic preparations in full doses. The data obtained by us are confirmed by the earlier conducted studies, in which the medicinal means that were watered were more effective than their powdered analogues in the treatment of chicken capillariasis [24].

The obtained results of experimental studies allow recommend Levamisole-plus 10 % anthelmintic preparation for effective control and prevention of chicken heterakosis.

Conclusions

The high anthelmintic effectiveness of Levamisole-plus 10 % preparation was experimentally established, where on the 14th day of the experiment, its extense- and intenseeffectiveness reached 100 %. Albendazole suspension and Levamisole 80 anthelmintic preparations demonstrated moderate therapeutic effectiveness for chicken heterakosis. Their extense- and intense-effectiveness on the 14th day of treatment made 80 and 95.67 % and 80 and 78.78 %, respectively. When using Albendazole Ultra 10 %, the treatment of chickens infested with heterakises turned out to be ineffective. Its extense- and intenseeffectiveness made 60 and 73.93 %, respectively.

Conflict of interest

The author declare no conflict of interest.

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