Protozoal infections of young turkeys in the conditions of industrial farms

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Abstract. The article presents the results of monitoring of parasitic protozoa of young turkeys in industrial-type farms of the Central region of Russia. Fecal samples, scrapings from the floor and passages, and the contents of the gastrointestinal tract during slaughter were systematically examined in birds of different ages. The age and seasonal dynamics of their infection with eimeria, as well as contamination of environmental objects by protozoan oocysts, were established. At the same time, the following species were identified in turkeys: Eimeria meleagrimitis (80%), E. meleagridis (15%), E. adenoids (5%). The prevalence in males of 35-49 days old, and in females of 35-49-63 days old was the maximum and amounted to 30–45 and 5–30%, respectively. The obtained results should be used in the organization of therapeutic and preventive measures against parasitic protozoa of young turkeys.

1 Introduction

Many years of experience has shown that breeding turkeys in industrial-type farms can dramatically increase production efficiency. With intensive rearing of young animals, multiple acquisition of the parent flock from one average annual bird, up to 200 eggs and more than 600 kg of meat can be obtained. Turkey meat is an excellent raw material for deep processing and preparation of a variety of ready-to-eat dietary products recommended for hypertension, atherosclerosis, diseases of the gastrointestinal tract [3, 4, 19].

Currently, in the conditions of the development of the industry on an industrial basis, when a large number of birds are kept in a limited area, there is a high risk of eimeriosis, cryptosporidiosis, histomonosis and other parasitic diseases [1, 2, 5-19].

Turkey eimeriosis (coccidiosis) is an acute, subacute or chronic disease of young animals aged 7 to 90 days and older, manifested by exhaustion and lethargy, enteritis, diarrhea, weight loss and productivity. The causative agent is unicellular protozoa with a complex development cycle. Coccidia of the genus *Eimeria* are homo– and monoxenic parasites developing in a single host. Invasive oocysts enter the digestive tract of birds with food or water, their shell is destroyed, the released sporozoites are introduced into the intestinal epithelial cells and begin to multiply intensively (Fig.1). The prepatent period of development

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of eimeria, depending on the type, lasts 4-6 days, and the patent period lasts 5-20 days. The maximum duration of sporulation of oocysts in the external environment at 24 °C, the required humidity and oxygen access is 1-2 days. In short, the development cycle of eimeria is as follows: immature oocysts with droppings are released into the external environment (1), which mature and are swallowed by a bird (2). In the gastrointestinal tract, oocyst shells dissolve and sporozoites (3) enter the intestinal lumen, which are embedded in intestinal epithelial cells (4) and form trophozoites (5). From trophozoites, meronts of the first generation (6) are formed, which destroy intestinal epithelial cells (7), and in large numbers merozoites of the first generation (8) enter the intestinal lumen, then they are introduced into intestinal epithelial cells (9). Meronts of the second generation (10-11) are formed from merozoites, which destroy intestinal epithelial cells (12) and in large quantities, merozoites of the second generation (13) enter the intestinal lumen and subsequently are introduced into intestinal epithelial cells (14), where microgamonts (15) and macrogamonts (15a) are formed. Microgametes (16) and macrogametes (16a) are formed from micro- and macrogamonts. The formed microgametes (17) and macrogametes (17a) destroy intestinal epithelial cells and exit in large numbers into the intestinal lumen, where microgametes and macrogametes (18) merge to form a zygote (19). The zygote is covered with a protective shell and becomes an oocyst, which is excreted into the external environment with droppings (20).

Turkeys are parasitized by 7 species of Eimeria: *Eimeria meleagridis, E. dispersa, E.meleagrimitis, E.adenoides, E.gallopavonis, E.innocua* and *E.subrotunda*. The source of the invasion, as a rule, is a sick young, as well as an adult bird, which may be a carrier of eimeria. The reservoir of the pathogen is feed contaminated with oocysts, water, feeders, drinkers, care items, rooms with a significant accumulation of droppings.

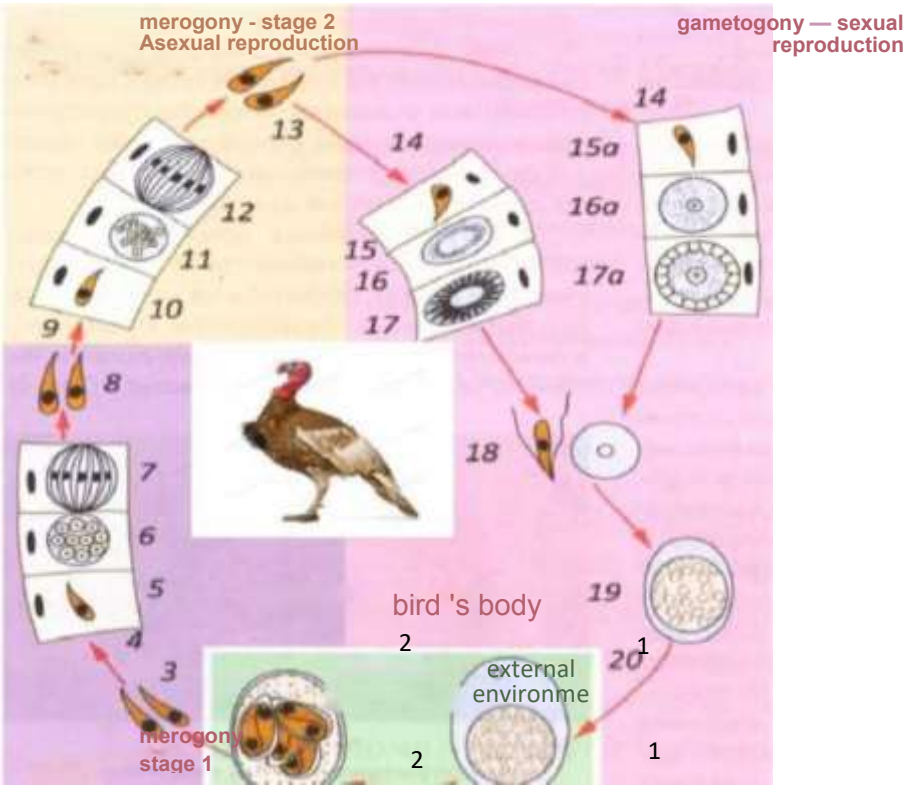

Fig. 1. The development cycle of turkey eimeria.

The diagnosis of eimeriosis is made comprehensively, taking into account epizootological, clinical data and pathoanatomic changes. They are confirmed in the laboratory by the detection of eimeria or stages of their development – schizonts and merozoites in feces and intestinal contents. To do this, swabs are made from scrapings from the intestines and feces are examined using the method of Darling, Fulleborn, etc. Polymerase chain reaction (PCR) has also been used in recent years. However, in this case, a careful analysis of all the results obtained is necessary. Especially the age of the sick bird should be taken into account. With cholera, plague and spirochetosis, in addition to young animals, adult livestock are sick and die in large numbers, which does not happen with coccidiosis. However, the results of coproscopic studies and pathoanatomic data are crucial in the diagnosis of eimeriosis.

Pathoanatomic changes: the corpse is emaciated, anemic, flabby musculature. The caecum is enlarged in size, thickened, the serous membrane is bluish-red, the contents are colored red. The lumen of the small intestine is filled with a bloody curd mass, the mucous membrane is hyperemic, with hemorrhages, grayish-white nodules with a pinhead can be seen on its surface (Fig. 2).

The purpose of the work is to monitor the epizootic situation of turkey eimeriosis in industrial farms.

2 Study methods

Experiments were carried out in poultry farms in the Central region of Russia on turkeys from the age of 7 days to the full completion of the technological cycle of production (males - 140 days, females – 105 days) every 14 days. Lifetime methods of diagnosis of eimeriosis included coproscopic studies according to Darling (with sodium chloride alone, with sodium chloride and glycerin), McMaster and Fulleborn. The intensity of infection was determined by counting the oocysts of protozoa in 1 g of poultry feces under an MBI microscope in 20 fields of view, followed by the calculation of average indicators.

To establish the seasonal dynamics of the spread of eimeriosis among turkeys, fecal samples were taken from them in January, April, July and October. In addition, 10 samples of litter and 10 scrapings from the floor and passages were examined every two weeks after the bird was placed (starting from the age of one week), before and after the slaughter. Eimeria oocyst was cultivated in Petri dishes. Droppings with a pre-known number of protozoa was placed in a thermostat at 26 ± 1 °C. In order to determine the timing of sporulation, part of the Petri dishes with oocysts were examined daily under a microscope.

a) b) c)

Fig. 2. Pathoanatomical changes during the autopsy of a turkey with eimeriosis: a) – general appearance; b) – the intestine is enlarged in size, filled with a bloody curd mass; c) – lesions and hemorrhages on internal organs.

To identify the type of eimeria, samples of droppings from infected young animals, intestinal contents and scrapings from the intestinal wall from a fallen bird were placed in a thermostat with the addition of a 2.5% solution of potassium bichromate. Morphological and biological features of parasites were taken into account: shape, length and width, color, character of the shell, presence or absence of micropile, polar granule. The Zeiss Axio Imager 2 microscope (x10 eyepiece, x40 lens) and Axio Imager 2 software were used in the work.

The data obtained during the experiment were subjected to statistical analysis according to the method of N.A. Plokhinsky [13].

3 Research results and discussion

In 2019, in the turkey-breeding farm of the Penza region (500 thousand heads), during the examination of 120 samples of litter and the autopsy of 5 carcasses, it was found that the 25 - 29-day-old young were free of eimeria and 10% infested with cryptosporidia. The prevalence (Pr) of 140-143 days old young animals by eimeria oocysts was 100% with an intensity of infection (II) of up to 30 specimens in the field of vision of the microscope.

In 2019-2020, in the turkey-breeding farm of the Ryazan region (100 thousand heads), during the examination of 360 samples of litter and the autopsy of 12 carcasses of poultry, it was noted that the young 25-day-old were free of eimeria and cryptosporidia. The Pr of 44-day-old turkeys with eimeria oocysts reached 10-20%, 65-day-old – 15 and 114-day-old – 10%. In all periods of research, II was low – up to 10 oocysts in the field of vision of the microscope. Out of 150 scrapings from the floor of poultry houses of different workshops, oocysts of eimeria were isolated in 47 cases (Pr = 31.3%). In this farm, young turkeys from the moment of self-consumption of feed are used coccidiostats Madicox in the dose recommended by the instructions.

In the turkey-breeding farm of the Tula region (550 thousand heads) in 2020, 380 samples of litter from young animals of different ages were examined. The prevalence of eimeriotic invasion in males at 49 days of age was 35%, in females – 25%; at 105 days of age, males were infected by 10%, and females were free of protozoa. At 119 and 133 days of age, no eimeria oocysts were found in females and males. In different periods of research, II ranged from 10 to 30 oocysts or more in the field of vision of the microscope. In this farm, sick turkeys are prescribed coccidiostats lasalocid sodium.

Coproscopic studies conducted during 2020 in a specialized turkey-breeding farm of the Penza region (4.3 million heads) showed that males and females at 7 and 21 days of age were free of oocysts of eimeria. The Pr of males at 35-day age was 45 and females – 5%; in 49-day – 30 and 30%, respectively; in 63-day – 5 and 3%; in 91-day – 3%; in 105-day males – 5%, and in females eimeria not found. At 119 and 133 days of age, turkeys were also free of protozoan oocysts (Fig. 3). For coccidiosis, Monensin is used in this farm.

The intensity of infection in males in this farm reached maximum values (30 specimens) at the age of 35 days, and in females (15 specimens) – 49 days. At 7 days of age, males were free of eimeria, and females at 7 and 105 days of age had minimal II. It should be noted that turkeys aged from 63 to 113 days are less likely to get sick.

When studying the seasonal dynamics of infection of turkeys with eimeria, litter samples were taken from both males and females at 35, 49, and 63 days of age, the most susceptible to invasion. In the winter of 2020 (January), in males of 35-day-old age, the Pr was 40%, in 49-day-old – 30 and in 63-day-old – 20%, with II, respectively, 8.7; 7.4 and 5.9 thousand oocysts/g of the sample. In females, the Pr was 30; %, 20 and 10%, respectively, and the II was 6.3; 5.6 and 4.4 thousand oocysts/g (Fig. 4). In spring (April), the prevalence of eimeriotic invasion in males at 35 days of age reached 40%, at 49 days of age - 40 and at 63 days of age - 20%, with the intensity of infection – 8.6, 7.1 and 5.7 thousand oocysts/g, respectively; in females, Pr was 30, 20 and 10%, and II – 5,9; 5,1 and 4,2 thousand oocysts/g

of the sample. In summer (July), among males, Pr at the above age was 40; 30 and 10%, with II – 6.5; 5.6 and 4.4 thousand oocysts/g; in females, Pr – 20; 30 and 10%, with II – 5.7; 4.6 and 4.0 thousand oocysts/g samples. In autumn (October), males of 35-day-old age were infected with eimeria by 30%, 49-day-old – by 20% and 63-day-old - by 10%, and the intensity of infection was 6.4, 5.3 and 4.1 thousand oocysts/g of the sample, respectively. In females, Pr reached 30; 20 and 10%, with II – 5.6; 5.2 and 4.1 thousand oocysts/g of the sample.

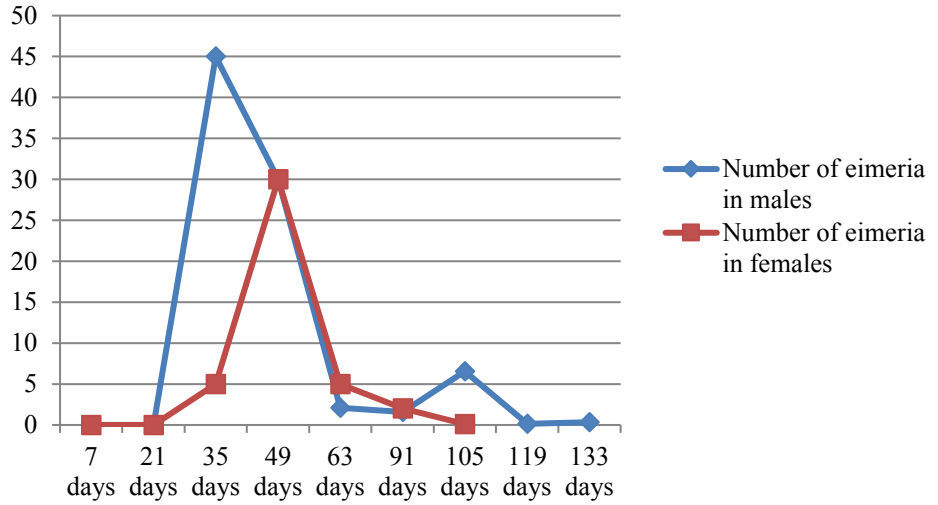

Fig. 3. Age dynamics of infection of male (1) and female (2) turkeys with eimeria during the entire technological cycle.

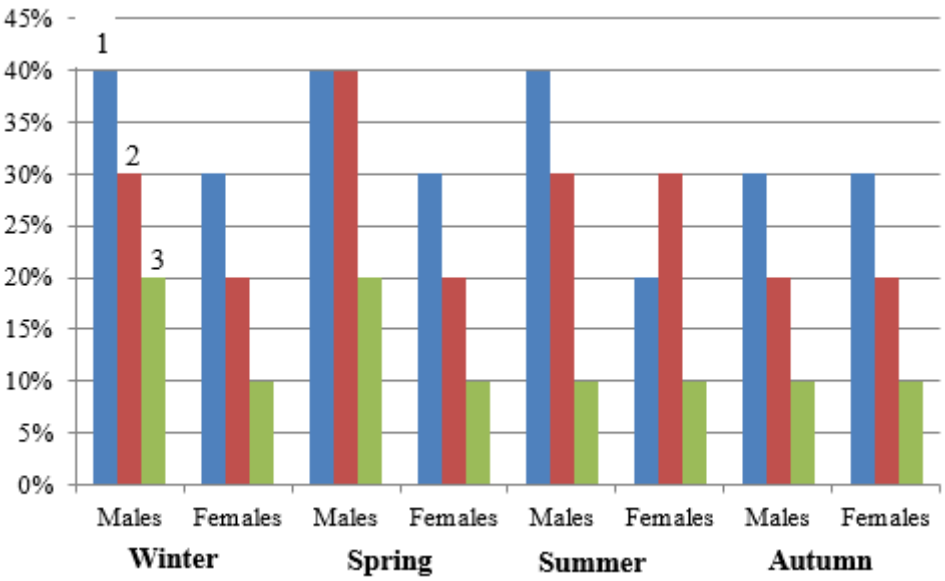

Fig. 4. Seasonal dynamics of turkey infestation 35- (1), 49- (2) and 63-day-old (3) with eimeria, %

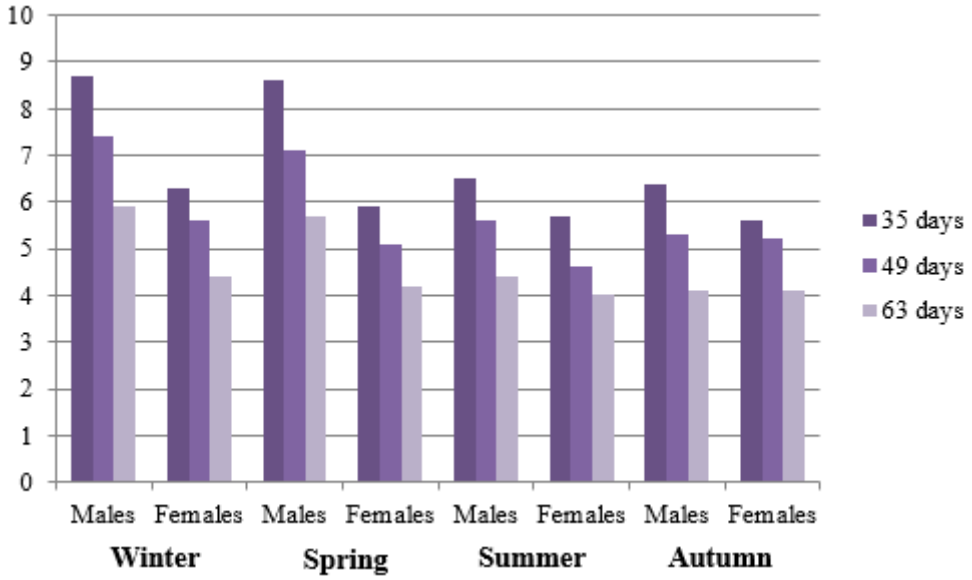

Fig. 5. Intensity of eimeriotic infection in turkeys by seasons, thousand specimens.

Consequently, at this poultry farm in the Penza region, the infection of young turkeys with eimeria with industrial production technology and floor maintenance practically did not depend on the season of the year. Whereas the average intensity of infection in males in winter (7.3 thousand) and spring (7.1 thousand) was slightly higher than in summer (5.5 thousand) and autumn (5.3 thousand). In females, the average II in different periods of the year was 5.4, 5.1, 4.8 and 4.9 thousand oocysts/g of sample, respectively.

When determining the species composition of eimeria in samples of turkey droppings kept in the conditions of the Tula region farm, the following species were identified: *E. meleagrimitis* (80%), *E. meleagridis* (15%), *E. adenoides* (5%).

Fig. 6. Determination of the species composition of eimeria using a Zeiss Axio Imager 2 microscope (eyepiece x10, lens x40).

4 Conclusion

Eimeriosis is the most common parasitic disease in turkey-breeding farms of industrial type in the Central region of Russia. The most infected were males 35-49 days old (Pr = 30-45%) and females 35-49-63-days old (Pr = 5-30%). In farms with industrial production technology,

seasonality did not affect the invasion of turkeys by eimeria. Contamination of environmental objects (floor, walls, feeders) with oocysts of these protozoa varied from 5 to 31.3%. The obtained results should be used in the organization of therapeutic and preventive measures against parasitic protozoa of young turkeys.

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