

Prevalence of Chicken Eimeriasis in Some Regions of the Republic of Armenia

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Abstract – The article presents data on epidemiological features of chicken eimeriasis in poultry farms in Gegharkunik and Tavush regions of the Republic of Armenia. According to research data, chicken eimeriasis is widespread in target areas (extensiveness of the *Eimeria* infection was equal to 22.55% and 34.1% respectively), and often occurs as a mixed invasion with ascariasis, capillariasis, and syngamosis. *Eimeria necatrix* is the most prevalent *Eimeria* species in all targeted regions. *Eimeria acervulina* is the least common species in Armenia. The pattern of *Eimeria* species distribution was the same for both regions. It does not depend on climatic and natural condition, as well as on poultry breed. Poultry eimeriasis is generally registered among chickens of 10 to 180 days of age, while one of the pronounced and frequently occurring pathomorphological changes is hemorrhagic inflammation of the caeca mucous membranes. The extensiveness of eimeriasis depends both on the climatic and geographical features of the region and on the conditions of the poultry keeping, which must be taken into account when carrying out a complex of preventive, veterinary and sanitary measures.

Keywords – Eimeriasis, Chicken, Oocyst, Region, Diagnosis.

I. INTRODUCTION

After gaining independence, small farms began to develop intensively in the Republic of Armenia, in which poultry farming occupies a special place. Relatively limited feed consumption, high precocity and unpretentiousness to the conditions of keeping has made poultry a convenient source of additional profit in the conditions of the economic crisis caused by rising inflation and unemployment. In addition to large poultry farms specializing in breeding of broiler and egg-laying chicken breeds, there are a huge number of small poultry farms in Armenia, numbering from several units to hundreds chickens of local mixed breeds. Such poultry farmsteads, which are available in almost every village dwelling, as well as in houses located on the periphery of cities, effectively supply their owners not only with poultry products, but also with profits received from the sale of chickens, meat and eggs of so-called “home production”. Poultry products from small farms are in great demand among the local population due to such qualities as freshness, good taste and safety due to the use of natural feeds that do not contain antibiotics, hormonal agents and other growth stimulants, unlike large poultry farms.

A serious obstacle to the development of small-scale poultry farming is such infectious and invasive diseases of poultry as infectious mycoplasmosis, Newcastle disease, prosthogonimosis, and eimeriasis. Chicken eimeriasis has the highest specific gravity in the nosological profile of infectious diseases of poultry in Armenia. Economic losses from chicken eimeriasis are formed from the death of sick chickens, a decrease in productivity in adults, the cost of treatment, and a complex of veterinary and sanitary measures [1, 3, 10, 11, 12].

Eimeriasis is acute, subacute or chronic protozoal infection disease of chickens aged 10 to 180 days, although adult birds are also susceptible. The disease is manifested in lethargy, loss of appetite, diarrhea, cachexia, anemia, sometimes convulsions [2, 4, 5].

The causative agents of eimeriasis are Protozoa (Type: Apicomplexa, Class: Sporozoa, Order: Eucoccidia, Family: Eimeriidae, Genus: Eimeria). They are unicellular parasites with a complex life cycle. An endogenous stage of development occurs in the body of birds, and ends with the formation of oocysts, and an exogenous one occurs in the environment. Oocysts excreted from the bird organism, are non-invasive, and cannot infect new hosts. In the presence of oxygen, sufficient humidity, and optimal temperature (+18...+29°C), they become invasive in 24 to 96 hours. 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. One oocyst in 7-10 days can give rise to 88 thousand to 2 million new oocysts. All bird species are susceptible to eimeriasis, and each bird species has its specific eimerian parasites. Chicken eimeriasis (coccidiosis) are caused by nine species of eimeria, the most common of which are *Eimeria tenella* Tyzzer, 1929; *Eimeria maxima* Tyzzer, 1929; *Eimeria acervulina* Tyzzer, 1929; *Eimeria necatrix* Johnson, 1930 [2, 5, 7]. Morphologically, different species of eimeria differ in the shape and size of the oocysts, the structure of the shell, the presence or absence of micropyle, cap, polar granule, residual and Stied's bodies in the oocyst and spores, as well as localization in the tissues of their hosts [2, 9].

Although chicken eimeriasis is an extremely serious problem of veterinary parasitology, research of this disease in Armenia are fragmentary and insufficient [16]. Numerous aspects of the problem in our country remain unexamined. That is why the relevance of the problem of chicken eimeriasis is obvious.

II. MATERIAL AND METHODS

The objective of current research was to investigate the prevalence of chicken eimeriasis in two regions (marzes) of the Republic of Armenia: Gegharkunik and Tavush, with further development of a set of preventive measures taking into account the geographical and climatic features of these regions.

Selection of the regions was determined by traditional poultry-keeping that is very popular in the mentioned regions (marzes), and thus, the highest risk of the chicken eimeriasis exists there.

The research covered towns and villages in the above-mentioned areas from September 2021 to January 2022. The study of samples of excrements and corpses of birds that fell with signs characteristic of eimeriasis, was carried out in the parasitological laboratory of the Department of Epidemiology and Parasitology of the National Agrarian University of Armenia. In total, 102 samples of chicken excrements, and 10 chicken carcasses from 10 settlements of Gegharkunik Region, as well as 88 samples of chicken excrements and 10 chicken carcasses from 12 settlements of Tavush Region, have been examined.

For microscopic detection of *Eimeria* oocysts in the examined excrement samples, zinc sulfate floatation method has been used. The method consists of 2 stages: sedimentation of excrements with water using centrifuge (5 min, 1500 min⁻¹), and floatation with saturated solution of zinc sulfate (density 1.4 g/ml) using centrifuge with the same regimen.

The diagnosis of the chicken eimeriasis was performed on the basis of characteristic clinical signs, a lifetime

coprological examination of the excrements for the presence of *Eimeria* oocysts, as well as on pathomorphological pattern if carcasses are available, and on direct microscopy of the smears of small intestine and cecum mucous membrane. [6, 8, 15].

Excrement samples were taken from clinically healthy chickens from 1 to 24 months of age, and carcasses of birds died from eimeriasis at the age of 10 to 180 days were subjected to a pathomorphological examination.

III. RESULTS AND DISCUSSION

Totally, 102 poultry excrement samples were collected in Gegharkunik Region, and 88 samples done in Tavush Region. Results of the sample examination are shown in Table 1.

Table 1. The degree of the poultry eimeriasis at poultry farms in Gegharkunik and Tavush regions of the Republic of Armenia.

Gegharkunik Region					Tavush Region				
Locality	Average Altitude, Above Sea Level, m	Number of Examined Excrement Samples	Number of Excrement Samples Containing Oocysts	Extensiveness, %	Locality	Average Altitude, Above Sea Level, m	Number of Examined Excrement Samples	Number of Excrement Samples Containing Oocysts	Extensiveness, %
Sevan	1925	10	2	20	Dilijan	1500	10	3	30
Gavar	1982	10	3	30	Ijevan	755	10	3	30
Martuni	1950	12	3	25	Noyemberyan	820	10	4	40
Tsovagyugh	2023	8	2	25	Paravakar	850	8	2	25
Tsamakaberd	1970	10	2	20	Berd	930	6	3	50
Varser	1917	9	2	22.22	Ayrum	500	8	2	25
Norashen	1940	12	2	33.33	Archis	750	10	2	20
Semyonovka	2114	8	2	25	Chinchin	1290	6	2	33.33
Ddmashen	1798	10	3	30	Itsakar	1150	6	4	66.67
Lchap	1930	13	2	15.38	Aygepar	680	6	1	16.67
					Varagavan	800	4	2	50
					Navur	1490	4	2	50
Total:	-	102	23	22.55	Total:	-	88	30	34.09

Note: Data in a table have been provided by authors.

As a result of the performed research, it was revealed that 23 of 102 poultry excrement samples collected in Gegharkunik Region, contain *Eimeria spp.* oocysts (22.55%).

Eimeria spp. oocysts have been also detected in 30 out of 88 samples of poultry excrements collected in Tavush Region (34.09%). Despite the quantitative superiority of the studied samples taken from the settlements of Gegharkunik Region, the prevalence of chicken eimeriasis in the settlements of Tavush Region was 1.5 times higher. However, according to Fisher`s criterion, the difference between these indices is not statistically significant ($P > 0.05$).

Eimeria spp. oocysts were detected in samples taken from all communities/villages, therefore, there is no evidence of poultry eimeriasis focality in researched regions.

In four samples of excrements collected in Gegharkunik Region, and in one sample of excrements collected in Tavush Region, in addition to *Eimeria spp.* oocysts, *Ascaridia galli*, *Syngamus trachea*, and *Capillaria obsignata* eggs were found.

The relatively high extensiveness of invasion in Tavush Region can be explained by climatic and geographical features of the targeted regions. Thus, Tavush Region, located in the north-east part of Armenia, with an average altitude 732 meters above sea level, is characterized by a subtropical climate: long mild summers (average temperature in July is +24⁰C) and mild low-snow winters (average temperature in January is 0⁰C). In addition, the region is characterized by an abundance of forest cover, and a relatively high average annual humidity (about 73%).

Gegharkunik Region located in the east part of Armenia, at an average altitude of 1995 meters above sea level, is characterized by a moderately cold humid climate, characterized by a short mild summer (the average temperature in July is +16⁰C) and a long cold winter (the average temperature in January is -8 ... -12⁰C), and the average annual humidity is about 67%.

The climatic features of the regions are reflected in specificity of the poultry keeping conditions in farmsteads. In Tavush Region poultry is kept outdoors longer, in a warm, humid climate, and *Eimeria* oocysts become invasive faster, and that is why the intensity of chicken infection increases sharply. On the contrary, in Gegharkunik Region, due to the long winter, birds are kept in closed makeshift poultry houses for most of the year, which are often cleaned and disinfected by the owners, and low air temperature and low humidity delay the maturation of oocysts, which slows down the process of chicken infection with eimeriasis.

The following species of *Eimeria* have been detected in poultry excrement samples: *Eimeria necatrix*, *Eimeria tenella*, *Eimeria maxima*, and *Eimeria acervulina* (see photos 1 to 4).

Prevalence of various species of *Eimeria* in poultry of different regions is demonstrated in table 2.



Photo 1. *Eimeria necatrix* oocysts in poultry excrements (480x).

(Authors` photo)



Photo 2. *Eimeria tenella* oocysts in poultry excrements (480x).

(Authors` photo)

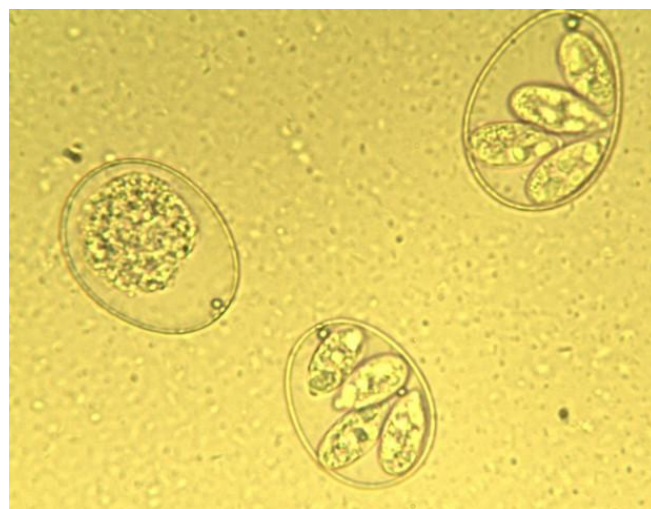


Photo 3. *Eimeria maxima* oocysts in poultry excrements (480x).

(Authors` photo)

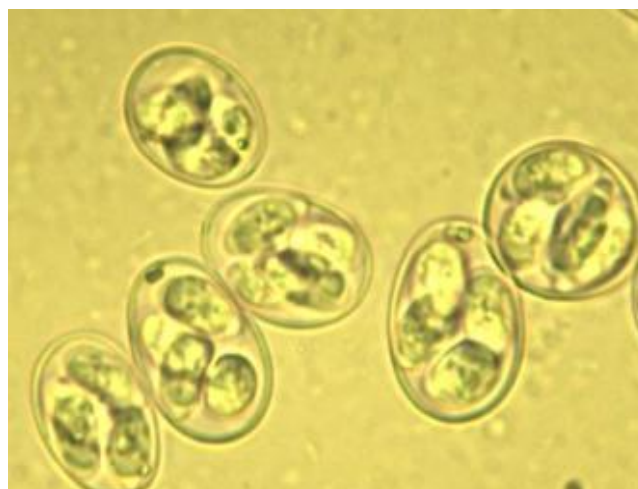


Photo 4. *Eimeria acervulina* oocysts in poultry excrements (480x).

(Authors` photo)

Table 2. Prevalence of various species of *Eimeria* in poultry of different regions

Region/Marz	Examined samples	Eimeria species							
		Samples with <i>E. necatrix</i>	%	Samples with <i>E. tenella</i>	%	Samples with <i>E. maxima</i>	%	Samples with <i>E. acervulina</i>	%
Gegharkunik	102	16	15.69	5	4.9	6	5.88	1	0.98
Tavush	88	22	25	6	6.82	6	6.82	2	2.27
TOTAL	190	38	20.0	11	5.79	12	6.32	3	1.58

Note: Data in a table have been provided by authors.

Results of the research show that *Eimeria necatrix* is the most prevalent *Eimeria* species in all targeted regions. *Eimeria acervulina* is the least common species in our country. Prevalence of *E. tenella* and *E. maxima* is intermediate in all regions researched. The pattern of *Eimeria* species distribution was the same for both regions. It does not depend on climatic and natural condition, as well as on poultry breed.

A pathomorphological study of the corpses of chickens died from eimeriasis has demonstrated changes typical for this disease. Namely, the corpses were exhausted, the feathers in the cloacal area were stained with feces, the earrings, comb and conjunctiva were anemic, the muscle tissue was flabby. The mucous membranes of the large intestine, especially the caeca, were hemorrhagically inflamed, and sometimes covered with blood clots (see photo 5). Granular dystrophy was detected in parenchymal organs.



Photo 5. Cecal hemorrhages in chicken eimeriasis caused by *E. tenella*

(Authors` photo)

For the prevention of chicken eimeriasis at poultry farms of the targeted regions of Armenia, we have proposed the following set of preventive measures:

1. Young chickens should be kept isolated from adult poultry.
2. Poultry houses and walking areas should be periodically cleaned of excrements, and disinfected with 1% to 2% solution of sodium hydroxide heated to +70°C.
3. Avoid high humidity and accumulation of excrements in poultry houses, as well as crowded keeping of po-

-ultry in a limited area.

4. Feeders, drinking bowls, and care items should be scalded with boiling water daily.
5. Walking yards should be arranged in dry places, the soil should be dug up and covered with a layer of sand.
6. In poultry houses located in settlements of Tavush Region, where chickens are kept outdoors for most of the year, it is recommended to dig up the soil in spring and autumn periodically, followed by its ramming.
7. In order to increase the general non-specific immunity, and improve the intestinal microflora of poultry, it is recommended to use feeds rich in vitamins, as well as dairy products: acidophilic milk, curdled milk or milk whey [13, 14].

IV. CONCLUSIONS

Based on the obtained research data, the following conclusions can be made:

1. Eimeriasis of chickens is widespread in Gegharkunik and Tavush Regions of Armenia, while the extensiveness of invasion directly depends on climatic and geographical features and conditions of poultry keeping, so the extensiveness of invasion in Tavush Region exceeds the same indicator in Gegharkunik Region 1.5 times;
2. Poultry eimeriasis is generally registered among chickens of 10-180 days of age, while one of the pronounced and frequently occurring pathomorphological changes is hemorrhagic inflammation of the caeca mucous membranes;
3. Poultry keeping conditions, as well as climatic and geographical features of the region should be taken into consideration during performance of preventive measures against the chicken eimeriasis.

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