



UDC: 576.89;591.69

<https://doi.org/10.59849/2409-4838.2026.2.186>

AGE-RELATED DISTRIBUTION DYNAMICS OF EIMERIA SPECIES PARASITES IN DOMESTIC CHICKENS IN THE JULFA DISTRICT OF THE NAKHCHIVAN AUTONOMOUS REPUBLIC

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In studies conducted in the Julfa region of the Nakhchivan Autonomous Republic, the prevalence of Eimeria species in domestic chickens raised on special farms in various natural geographical areas (lowland, foothills, and mountains) was examined in relation to age. Since the age of chickens directly affects the course of parasitic diseases and the intensity of infection, the effect of this factor is particularly important. For this purpose, 402 fecal samples collected from chickens of different age groups between 2021 and 2024 were examined under laboratory conditions, and morphological analyses revealed differences in the distribution of E. tenella, E. maxima, E. acervulina, E. praecox, E. mitis, E. necatrix, and E. brunetti species according to age groups. It was determined that the infection level was higher in chickens aged 0-3 and 4-7 months, especially in the foothills of the region. The results obtained during the study show that the age of chickens plays an important role in the spread of Eimeria species. These results are of great importance in terms of establishing effective control and prevention strategies in the region.

Keywords: Nakhchivan Autonomous Republic, Julfa region, poultry, domestic chickens, invasive diseases, Eimeria

INTRODUCTION

Poultry farming is one of the most important branches of animal husbandry, playing a vital role in providing the population with affordable and high-quality protein. However, the productivity of this sector is significantly affected by parasitic diseases, among which coccidiosis, caused by protozoa of the genus *Eimeria*, is considered one of the most widespread and economically harmful infections in chickens [2]. This disease leads to intestinal damage, growth retardation, decreased feed conversion efficiency, and, in severe cases, high mortality rates.

Numerous studies have shown that the prevalence and severity of coccidial infections in chickens are strongly influenced by age. Young chickens, particularly in the age range of 0-3 weeks, are highly susceptible due to their underdeveloped immune system and lack of previous exposure to *Eimeria* oocysts [3]. A study in Kashmir reported the highest mortality due to coccidiosis in chickens aged 3-4 weeks [5]. As birds grow older, especially after 3-4 months of age, they generally develop a certain level of acquired immunity, thereby reducing the intensity of infection. Nevertheless, the level of resistance largely depends on the species of *Eimeria*, environmental conditions, and management practices of the farms [8].

According to Conway and McKenzie [3], the highest morbidity and mortality associated with coccidiosis are recorded in younger flocks, while older chickens often act as carriers with subclinical infections. McDougald [8] and Chapman [2] also emphasized that the peak of *Eimeria* infections occurs in early life stages, which has a direct impact on the economic viability of poultry pro-



duction. Therefore, understanding the age-related dynamics of *Eimeria* infections is essential for developing effective preventive and control measures.

In the conditions of Azerbaijan, particularly in the Nakhchivan Autonomous Republic, poultry production in private households is widespread, yet scientific data on the age-related prevalence of *Eimeria* species remain limited. The specific ecological and management conditions of Julfa district may influence the distribution and intensity of infections among different age groups of chickens.

The present study was therefore conducted to investigate the prevalence and intensity of *Eimeria* species in domestic chickens of Julfa district, with particular emphasis on the dependence of infection rates on the age of birds. The results are expected to contribute to a better understanding of the epizootiology of coccidiosis in the region and provide useful insights for improving poultry health management.

MATERIAL AND METHODS

The study was conducted in Julfa district of Nakhchivan Autonomous Republic between 2021 and 2024. The study covered both plain areas (Yayci, Arazin), foothill areas (Abraqunus, Bananiyar, Gazanchi), and mountainous areas (Arafsa, Leketagh). Samples were mainly from domestic chickens kept in family and private subsidiary farms. Farm conditions, age groups and seasons were taken into account in the selection of samples. During the study period, fecal samples from a total of 402 chickens were collected in sample containers immediately after defecation, water and 2% $K_2Cr_2O_7$ were added and transported to the laboratory. The samples were kept open-mouthed in the laboratory for 48-96 hours with frequent stirring. After the oocysts in the samples were sporulated, they were stored in the refrigerator at $+4^{\circ}C$ until morphological analyses were performed.

Classical flotation method was used to identify parasites in fecal samples and to determine the species belonging to the genus *Eimeria*. For this purpose, fecal samples were centrifuged in NaCl solution at 1500 rpm for 2 minutes, a drop was taken from the upper surface of the liquid using a circular copper hook, placed on a glass slide, covered with a coverslip and examined on a SMART 3 T2/L microscope with x10, x20, x40 objectives. *Eimeria* species were identified according to the morphological characteristics (shape, size, micropyle, residual body) of the oocysts [3, 7]. Samples were divided into three age groups (0-3 months, 4-7 months, older) and systematized. The degree of infection was assessed by two indicators (extensive invasion - IE, intensity of invasion - II).

RESULTS AND DISCUSSION

According to the results of the studies, it was determined that *Eimeria* genus parasites were common in poultry farms in Julfa district of Nakhchivan Autonomous Republic. The table below shows the distribution of the species we detected in the fecal samples based on morphological analysis according to the age of the chickens. As can be seen from the table, a total of 402 fecal samples were collected from 0-3 months old chickens (135 from 0-3 months old chickens, 149 from 4-7 months old chickens and 118 from old chickens) during the studies covering various parts of Julfa district (Table).



Table

Age-related prevalence dynamics of species of the genus *Eimeria* in domestic chickens in Julfa region during 2021-2024

Age groups	Number of stool samples examined	Eimeria cinsinin növləri																				
		E. tenella			E. maxima			E. acervulina			E. praecox			E. mitis			E. necatrix			E. brunetti		
		Number of infected samples	Prevalence of infestation(%)	Intensity of infestation	Number of infected samples	Prevalence of infestation(%)	Intensity of infestation	Number of infected samples	Prevalence of infestation(%)	Intensity of infestation	Number of infected samples	Prevalence of infestation(%)	Intensity of infestation	Number of infected samples	Prevalence of infestation(%)	Intensity of infestation	Number of infected samples	Prevalence of infestation(%)	Intensity of infestation	Number of infected samples	Prevalence of infestation(%)	Intensity of infestation
Lowland zone																						
0-3	40	16	40,0	1-22	14	35,0	1-13	18	45,0	1-24	16	40,0	1-15	15	37,5	1-14	6	15,0	1-6	3	7,5	1-3
4-7	46	17	36,9	1-16	21	45,6	1-26	16	34,7	1-18	13	28,2	1-11	9	19,5	1-9	11	23,9	1-12	7	15,2	1-6
Adult	36	10	27,7	1-12	12	33,3	1-15	10	27,7	1-13	9	25,0	1-7	8	22,2	1-7	6	16,6	1-5	4	11,1	1-2
Total	122	43	35,2	1-22	47	38,5	1-26	44	36,0	1-24	38	31,1	1-15	32	26,2	1-14	23	18,8	1-12	14	11,4	1-6
Foothill zone																						
0-3	57	27	47,3	1-41	25	43,8	1-31	28	49,1	1-43	24	42,1	1-31	21	36,8	1-24	11	19,2	1-9	10	17,5	1-5
4-7	62	26	41,9	1-33	30	48,3	2-45	27	43,5	1-32	23	37,0	1-24	18	29,0	1-19	19	30,6	1-14	15	24,1	1-9
Adult	53	21	39,6	1-24	22	41,5	1-28	21	39,6	1-26	15	28,3	1-16	9	16,9	1-11	10	18,8	1-5	9	16,9	1-3
Total	172	74	43,0	1-41	77	44,7	1-45	76	44,1	1-43	62	36,0	1-31	48	27,0	1-24	41	23,8	1-14	34	19,7	1-9
Mountain zone																						
0-3	38	16	42,1	1-27	14	36,8	1-24	17	44,7	1-28	15	39,4	1-22	14	36,8	1-16	8	21,0	1-7	6	15,7	1-5
4-7	41	15	36,5	1-20	20	48,7	1-32	16	39,0	1-22	13	31,7	1-18	12	29,2	1-10	11	26,8	1-13	10	24,3	1-10
Adult	29	8	27,5	1-14	11	37,9	1-19	8	27,5	1-15	7	24,1	1-9	7	24,1	1-7	6	20,6	1-6	5	17,2	1-4
Total	108	43	39,8	1-27	45	41,6	1-32	41	37,9	1-28	35	32,4	1-22	33	30,5	1-16	25	23,1	1-13	21	19,4	1-10

As can be seen from the table, 122 fecal samples were collected from chickens raised on private farms in villages located in the lowland zone of Culfa district. Looking at the distribution of samples by age group, 40 fecal samples were collected from chickens aged 0-3 months, 46 fecal samples from chickens aged 4-7 months, and 36 fecal samples from older chickens. Morphological



analyses conducted on the 122 fecal samples collected from the plain villages revealed that 43 (IE-35.2%) samples were positive for *Eimeria tenella*. Of these samples, 16 were recorded in 0-3 month old chickens (IE-40.0%; CI: 1-22), 17 in 4-7 month old chickens (IE-36.9%; CI: 1-16), and 10 in older chickens (IE-27.7%; CI: 1-12). Overall, the infestation intensity in samples containing *E. tenella* ranged from 1 to 22.

E. maxima was detected in a total of 47 (IE-38.5%) fecal samples. Of these, 14 were found in 0-3 month old chickens (IE-35.0%; CI: 1-13), 21 in 4-7 month old chickens (IE-45.6%; CI: 1-26), and 12 in older chickens (IE-33.3%; CI: 1-15). The overall infestation intensity for this species ranged from 1 to 26.

E. acervulina was detected in a total of 44 (IE-36.0%) samples. Of these, 18 samples were found in 0-3-month-old chickens (IE-45.0%; CI: 1-24), 16 samples in 4-7-month-old chickens (IE-34.7%; CI: 1-18), and 10 samples in older chickens (IE-27.7%; CI: 1-13). The infestation intensity for this species ranged from 1 to 24.

E. praecox was detected in 38 (IE-31.1%) fecal samples. Of these, 16 samples (IE-40.0; CI: 1-15) were detected in 0-3-month-old chickens, 13 samples (IE-28.2; CI: 1-11) in 4-7-month-old chickens, and 9 samples (IE-25.0; CI: 1-7) in older chickens. The infestation intensity of this species ranged from 1 to 15.

E. mitis was detected in a total of 32 (IE-26.2%) fecal samples. Of these, 15 samples were found in 0-3-month-old chickens (IE-37.5%; CI: 1-14), 9 samples in 4-7-month-old chickens (IE-19.5%; CI: 1-9), and 8 samples in older chickens (IE-22.2%; CI: 1-7). The CI index for this species ranged from 1 to 14.

E. necatrix was detected in a total of 23 (IE-18.8%) fecal samples. Of these, 6 samples were found in 0-3 month old chickens (IE-15.0; CI: 1-6), 11 samples in 4-7 month old chickens (IE-23.9; CI: 1-12), and 6 samples in older chickens (IE-16.6; CI: 1-5). The infestation intensity of this species was recorded between 1 and 12.

E. brunetti was found in 14 (IE-11.4%) fecal samples. Of these, 3 samples were from 0-3-month-old chickens (IE-7.5%; CI: 1-3), 7 samples were from 4-7-month-old chickens (IE-15.2%; CI: 1-6), and 4 samples were from older chickens (IE-11.1%; CI: 1-2). The infestation intensity for this species ranged from 1 to 6.

A total of 172 fecal samples were collected from chickens raised on private farms in villages located in the foothill zones of Julfa district. Based on the distribution of samples by age group, 57 fecal samples were collected from 0-3 month old chickens, 62 fecal samples from 4-7 month old chickens, and 53 fecal samples from older chickens. Morphological analyses conducted on the 172 fecal samples collected from the villages at the foot of the district revealed that 74 (IE-43.0%) samples contained *Eimeria tenella*. Of these samples, 27 were recorded in 0-3 month old chickens (IE-47.3%; CI: 1-41), 26 in 4-7 month old chickens (IE-41.9%; CI: 1-33), and 21 in older chickens (IE-39.6%; CI: 1-24). Overall, the infestation intensity in samples containing *E. tenella* ranged from 1 to 41.

E. maxima was detected in a total of 77 (IE-44.7%) fecal samples. Of these, 25 samples (IE-43.8%; CI: 1-31) were detected in chickens aged 0-3 months, 30 samples (IE-48.3%; CI: 2-45) in chickens aged 4-7 months, and 22 samples (IE-41.5%, CI: 1-28) in older chickens. The overall infestation intensity for this species ranged from 1 to 45.

E. acervulina was detected in a total of 76 (IE-44.1%) samples. Of these, 28 samples were found in 0-3-month-old chickens (IE-49.1%; CI: 1-43), 27 samples in 4-7-month-old chickens (IE-43.5%; CI: 1-32), and 21 samples in older chickens (IE-39.6%; CI: 1-26). The infestation intensity for this species ranged from 1 to 43.

E. praecox was detected in 62 (IE-36.0%) fecal samples. Of these, 24 samples (IE-42.1; CI: 1-31) were detected in 0-3-month-old chickens, 23 samples (IE-37.0; CI: 1-24) in 4-7-month-old



chickens, and 15 samples (IE-%28.3; CI: 1-16) in older chickens. The infestation intensity of this species ranged from 1 to 31.

E. mitis was detected in a total of 48 (IE-27.0%) fecal samples. Of these, 21 samples were from 0-3-month-old chickens (IE-36.8%; CI: 1-24), 18 samples were from 4-7-month-old chickens (IE-29.0%; CI: 1-19), and 9 samples were from older chickens (IE-16.9%; CI: 1-11). The CI index for this species ranged from 1 to 24.

E. necatrix was detected in a total of 41 (IE-23.8%) fecal samples. Of these, 11 samples were found in 0-3 month old chickens (IE-19.2%; CI: 1-9), 19 samples in 4-7 month old chickens (IE-30.6%; CI: 1-14), and 10 samples in older chickens (IE-18.8%; CI: 1-5). The infestation intensity of this species was recorded between 1 and 14.

E. brunetti was found in 34 (IE-19.7%) fecal samples. Of these, 10 samples were from 0-3-month-old chickens (IE-17.5%; CI: 1-5), 15 samples were from 4-7-month-old chickens (IE-24.1%; CI: 1-9), and 9 samples were from older chickens (IE-16.9%; CI: 1-3). The infestation intensity for this species ranged from 1 to 9.

A total of 189 fecal samples were collected from chickens raised on private farms in villages located in the mountainous zone of Culfa district. Based on the distribution of samples by age group, 75 fecal samples were collected from 0-3 month old chickens, 65 fecal samples from 4-7 month old chickens, and 49 fecal samples from older chickens. Morphological analyses conducted on 108 fecal samples collected from mountainous villages revealed the presence of *Eimeria tenella* in 43 (IE-39.8%) samples. Of these, 16 samples were recorded in 0-3 month old chickens (IE-42.1%; CI: 1-27), 15 samples in 4-7 month old chickens (IE-36.5%; CI: 1-20), and 8 samples in older chickens (IE-27.5%; CI: 1-14). Overall, the infestation intensity in samples containing *E. tenella* ranged from 1 to 27.

E. maxima was detected in a total of 45 (IE-41.6%) fecal samples. Of these, 14 samples were found in 0-3 month old chickens (IE-36.8%; CI: 1-24), 20 samples in 4-7 month old chickens (IE-48.7%; CI: 1-32), and 11 samples in older chickens (IE-37.9%; CI: 1-19). The overall infestation intensity for this species ranged from 1 to 32.

E. acervulina was detected in a total of 41 (IE-37.9%) samples. Of these, 17 samples were found in 0-3-month-old chickens (IE-44.7%; CI: 1-28), 16 samples in 4-7-month-old chickens (IE-39.0%; CI: 1-22), and 8 samples in older chickens (IE-27.5%; CI: 1-15). The infestation intensity for this species ranged from 1 to 28.

E. praecox was detected in 35 (IE-32.4%) fecal samples. Of these, 15 samples were found in 0-3-month-old chickens (IE-%39.4; CI: 1-22), 13 samples in 4-7-month-old chickens (IE-%31.7; CI: 1-18), and 7 samples in older chickens (IE-%24.1; CI: 1-9). The infestation intensity of this species ranged from 1 to 22.

E. mitis was detected in a total of 33 (IE-30.5%) fecal samples. Of these, 14 samples were found in 0-3-month-old chickens (IE-36.8%; CI: 1-16), 12 samples in 4-7-month-old chickens (IE-29.2%; CI: 1-10), and 7 samples in older chickens (IE-24.1%; CI: 1-7). The CI index for this species ranged from 1 to 16.

E. necatrix was detected in a total of 25 (IE-23.1%) fecal samples. Of these, 8 samples were found in chickens aged 0-3 months (IE-21.0%; CI: 1-7), 11 samples in chickens aged 4-7 months (IE-26.8%; CI: 1-13), and 6 samples in older chickens (IE-20.6%; CI: 1-6). The infestation intensity of this species was recorded between 1 and 13.

E. brunetti was found in 21 (IE-19.4%) fecal samples. Of these, 6 samples were from 0-3 month old chickens (IE-15.7%; CI: 1-5), 10 samples were from 4-7 month old chickens (IE-24.3%; CI: 1-10), and 5 samples were from older chickens (IE-17.2%; CI: 1-4). The infestation intensity for this species ranged from 1 to 10.

Studies conducted in the plains, foothills, and mountainous areas of the Culfa region have shown that infections caused by *Eimeria* species in domestic chickens are widespread throughout



all regions. However, the prevalence and infestation intensity of the parasite species showed some differences between regions. In the lowland zone, *E. maxima* (38.5%) and *E. acervulina* (36.0%) were more prevalent, followed by *E. tenella* (35.2%) and *E. praecox* (31.1%). Infection rates in these regions were mostly moderate, and infestation intensity ranged from 1 to 26.

The highest rates in the foothill zone were recorded for *E. maxima* (44.7%) and *E. acervulina* (44.1%), followed by *E. tenella* (43.0%) and *E. praecox* (36.0%). In this region, the prevalence and intensity of infestation were higher than in other regions and ranged from 1 to 45.

In the mountainous zone, *E. maxima* (41.6%) and *E. tenella* (39.8%) were followed by *E. acervulina* (37.9%) and *E. praecox* (32.4%). Here, the infestation intensity ranged from 1 to 32.

CONCLUSION

The results of the present study demonstrated that coccidiosis caused by different *Eimeria* species is widely distributed among domestic chickens in Julfa district of the Nakhchivan Autonomous Republic. The most prevalent species were *E. maxima*, *E. acervulina* and *E. tenella*, while *E. brunetti* and *E. necatrix* were detected less frequently. The prevalence and intensity of infections were highest in the foothill zone, followed by the mountainous and lowland zones, indicating that ecological and management conditions influence the epidemiology of the disease [9, 10]. Age related analysis revealed that young chickens (0-3 months) were more susceptible to *Eimeria* infections, highlighting the critical role of early preventive measures [4]. These findings not only provide important baseline data for the region but also emphasize the necessity of implementing effective prophylactic programs, improved farm management practices, and further molecular investigations to accurately identify circulating *Eimeria* species and design targeted control strategies [1, 6].

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NAXÇIVAN MUXTAR RESPUBLİKASININ CULFA RAYONUNDA EV TOYUQLARININ *EIMERIA* CİNSİNİN NÖVLƏRİNƏ YOLUXMASININ YAŞDAN ASILILIQ DİNAMİKASI

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Naxçıvan Muxtar Respublikasının Culfa rayonunun müxtəlif təbii coğrafi ərazilərində (aran, dağətəyi və dağlıq) aparılan tədqiqatlarda fərdi təsərrüfatlarda yetişdirilən ev toyuqlarında *Eimeria* cinsinin növlərinin yayılmasının yaşdan asılılıq dinamikası araşdırılıb. Toyuqların yaşı parazitər xəstəliklərin gedişatına və yoluxmanın intensivliyinə birbaşa təsir göstərdiyi üçün bu amilin təsiri xüsusilə vacibdir. Bu məqsədlə 2021-2024-cü illər ərzində müxtəlif yaş qruplarına aid toyuqlardan toplanmış 402 fekal nümunəsi laboratoriya şəraitində tədqiq edilmiş və morfoloji analizlər zamanı *E.tenella*, *E. maxima*, *E. acervulina*, *E. praecox*, *E. mitis*, *E. necatrix* və *E.brunetti* növlərə görə paylanması fərqlər aşkar edilmişdir. Xüsusilə rayonun dağətəyi rayonlarında 0-3 və 4-7 aylıq toyuqlarda yoluxma səviyyəsinin daha çox olduğu müəyyən edilmişdir. Tədqiqat zamanı əldə edilən nəticələr *Eimeria* növlərinin yayılmasında toyuqların yaşının mühüm rol oynadığını göstərir. Bu nəticələr regionda effektiv nəzarət və profilaktika strategiyalarının qurulması baxımından böyük əhəmiyyət kəsb edir.

Açar sözlər: *Naxçıvan Muxtar Respublikası, Culfa rayonu, ev quşları, ev toyuqları, invazion xəstəliklər, Eimeria*

ВОЗРАСТНАЯ ДИНАМИКА РАСПРОСТРАНЕНИЯ ПАРАЗИТОВ РОДА *EIMERIA* У ДОМАШНИХ ЦЫПЛЯТ В ДЖУЛЬФИНСКОМ РАЙОНЕ НАХЧИВАНСКОЙ АВТОНОМНОЙ РЕСПУБЛИКИ

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В исследованиях, проведенных в Джульфанском районе Нахчыванской Автономной Республики, была изучена распространенность видов *Eimeria* у домашних кур, выращенных на специальных фермах в различных природно-географических зонах (равнинных, предгорных и горных), в зависимости от возраста. Поскольку возраст кур напрямую влияет на течение паразитарных заболеваний и интенсивность заражения, влияние этого фактора является особенно важным. С этой целью в лабораторных условиях были исследованы 402 образца фекалий, взятых у кур разных возрастных групп в период с 2021 по 2024 год, и морфологические анализы выявили различия в распределении видов *E. tenella*, *E. maxima*, *E. acervulina*, *E. praecox*, *E. mitis*, *E. necatrix* и *E. brunetti* в зависимости от возрастных групп. Было установлено, что уровень заражения был выше у цыплят в возрасте 0-3 и 4-7 месяцев, особенно в предгорьях региона. Результаты, полученные в ходе исследования, показывают, что возраст цыплят играет важную роль в распространении видов *Eimeria*. Эти результаты имеют большое значение с точки зрения разработки эффективных стратегий контроля и профилактики в регионе.

Ключевые слова: *Нахчыванская Автономная Республика, Джульфинский район, птица, домашние куры, инвазивные заболевания, Eimeria*