

Prevalence and Associated Risk Factors of Coccidiosis in Chickens Submitted for Necropsy in Kabul City

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ABSTRACT

Avian coccidiosis is one of the most economically important parasitic diseases affecting the poultry industry worldwide. It causes substantial production losses through mortality, poor growth performance, and increased treatment costs. This study aimed to determine the prevalence and associated risk factors of coccidiosis in chickens submitted for necropsy at the Basir Sattar and Waris Nasserli poultry disease diagnostic center in Kabul City, Afghanistan. We conducted a cross-sectional study from April to July 2026 on chickens presented from 225 poultry farms to poultry disease diagnostic centers in Kabul City. We collected data on potential risk factors using a structured questionnaire. Necropsy was performed to identify gross intestinal lesions, and fecal samples were examined microscopically using the flotation technique to detect *Eimeria* oocysts. Microscopic examination confirmed in affected birds, with an overall with anis prevalence of 9.3% (Infection was significantly associated with production type, previous infection history, and farmer experience ($P < 0.05$). In contrast, no significant associations were observed with sex, carcass disposal method, water source, or use of antibiotics and anticoccidials on the farms. Gross lesions, including hemorrhage, necrosis, thickening of the intestinal wall, and ballooning, were predominantly observed in the ceca and small intestine. Coccidiosis remains an important cause of mortality in Kabul city poultry farms. Future studies should investigate apparently healthy chickens to determine the prevalence of subclinical coccidiosis.

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INTRODUCTION

The poultry sector is one of Afghanistan's fastest-growing agricultural industries and has attracted substantial investment over the past decades. Recent reports indicate that private enterprises have invested more than USD 1 billion in the sector (Xinhua, 2025). The sector plays a vital role in enhancing food security, creating employment opportunities, and contributing to the country's economic development. The largest and most important part of

the poultry sector is the broiler farm. According to a recent assessment of Afghanistan's poultry value chain, the country has approximately 10,687 broiler farms, of which about 5,696 were reported to be operational and producing about 149,306 metric tons of chicken meat annually, accounting for 86.7 percent of domestic demand. One major problem in Afghanistan's poultry sector is the domestic production of one-day-old broiler chickens. Recent figures show that 6 breeder farms produce day-old broiler chickens in the country, meeting 21.1% of domestic demand (Pashtoon, 2025).

Although the poultry sector is progressing and nearing self-sufficiency, many problems remain across its sectors. In addition to challenges in producing quality grain at a reasonable price, low-quality medicines and vaccines, and market fluctuations, disease spread remains one of the major problems poultry farmers face (Pashtoon, 2025; Sangary & Mohmand, 2024). Alongside important bacterial diseases such as colibacillosis and chronic respiratory disease (CRD), and viral diseases such as Newcastle disease (ND), infectious bronchitis (IB), and infectious bursal disease (IBD), chicken coccidiosis is one of the most economically important diseases affecting the Afghan poultry industry, causing substantial economic losses annually (Sangary & Mohmand, 2024).

Coccidiosis is a protozoal disease of several domestic animal species, including chickens (Yu & Heo, 2021). Chicken coccidiosis affects all three categories of chickens: breeder, layer, and broiler (Nawarathne et al., 2021). Coccidiosis is a site- and species-specific parasitic infection that primarily affects the gastrointestinal tract and impairs digestion and nutrient absorption (Lee et al., 2022). The disease causes severe economic losses to the poultry industry worldwide (Adamu et al., 2013). Recent estimates put the global economic impact of chicken coccidiosis at approximately USD 13.9 billion annually, driven by production losses and the costs of treatment and preventive measures. (Tallapally et al., 2024).

The causative agent of chicken coccidiosis is a single-celled intracellular protozoan parasite belonging to the *Eimeria* genus of the Eimeriidae family within the phylum Apicomplexa (Adamu et al., 2013; Datta et al., 2025; Snyder, 2021). Nine *Eimeria* species are currently recognized as infecting chickens. Of these, seven species, *E. acervulina*, *E. maxima*, *E. mitis*, *E. tenella*, *E. necatrix*, *E. brunetti*, and *E. praecox*, are the most commonly encountered in poultry. The remaining two species, *Eimeria hagani* and *Eimeria mivati*, are still under investigation (Adamu et al., 2013; Conway & McKenzie, 2007). Chickens can develop two forms of coccidiosis: subclinical and clinical. Subclinical coccidiosis is characterized by decreased feed efficiency, reduced growth rate, and, ultimately, higher mortality and morbidity rates. Symptoms of clinical coccidiosis include ruffled feathers, comb and wattles, paleness of internal organs, yellow drooping of shanks and beaks, catarrhal inflammation of the intestine that leads to malabsorption, bloody droppings, dehydration, and reduced head size (Adamu et al., 2013; Nawarathne et al., 2021). In broiler chickens, diarrhea can be mucoid, watery, or hemorrhagic (López-osorio et al., 2020).

Coccidia are ubiquitous in all environments where chickens are kept or produced (Swayne et al., 2013). The disease is endemic in many tropical and subtropical regions, where

ecological conditions favor oocyst sporulation and the development of the causative agent (Abebe & Gugsu, 2018). Coccidiosis occurs differently across regions and is strongly influenced by the specific *Eimeria* species responsible for infection (Atif et al., 2023). Strong relationships have been identified between *Eimeria* species infections and multiple factors, such as farm location, age and breed of birds, management practices, drinking water source, applied control measures, and the presence of *Clostridium perfringens* type A (Atif et al., 2023; Liao et al., 2024). Chickens are the sole natural hosts for all seven mentioned *Eimeria* species. Any reports suggesting that these *Eimeria* species infect other avian hosts should be regarded as unreliable or unsubstantiated (Swayne et al., 2013).

Factors such as litter moisture levels above 30%, immunosuppression, inadequate inclusion of anticoccidials in feed, and environmental or management-related stress promote outbreaks of clinical coccidiosis (Abebe & Gugsu, 2018). Various studies have examined the prevalence of coccidiosis within and outside the country, showing that the prevalence and distribution of different *Eimeria* species vary by geographical location.

Although limited research has been conducted on chicken coccidiosis in Afghanistan (Monis, 2025; Sahab et al., 2020; Sangary & Mohmand, 2024), the available studies have primarily relied on gross pathological (macroscopic) lesions for diagnosis. Such diagnostic approaches are relatively less accurate than laboratory-based methods and allow only presumptive identification of the *Eimeria* species involved. Species identification is particularly important for developing and implementing effective coccidiosis control programs, including selecting and applying appropriate vaccines. The primary objective of this study was to determine the prevalence and associated risk factors of chicken coccidiosis in dead chickens referred to Basir Sattar and Waris Nasser Poultry Disease Diagnostic Centers for necropsy. The findings may generate epidemiological information on chicken coccidiosis, supporting the development of evidence-based prevention, control, and vaccination strategies in Afghanistan.

METHODS AND MATERIALS

Study Area

This study was conducted at poultry disease diagnostic centers in Kabul City, Afghanistan. Kabul City, the capital of Kabul Province, Afghanistan, serves as the country's principal administrative, economic, and commercial center. The city is administratively divided into 22 municipal districts (NSIA, 2025). Kabul City is located in eastern Afghanistan at an average elevation of approximately 1,800 meters above sea level. The city has a continental climate with cold winters and warm, dry summers, conditions that may influence the occurrence and transmission of poultry diseases (Sangary & Mohmand, 2024). According to the National Statistics and Information Authority (NSIA), Kabul City's population was reported as 5,361,333 in 2025, representing nearly 14.5% of Afghanistan's total population (36.4 million) (NSIA, 2025). As the country's most densely populated urban center, Kabul has high demand for poultry meat and eggs, which has contributed to the rapid expansion of commercial

poultry farming and associated veterinary diagnostic services. These characteristics make Kabul City an important area for studying the prevalence and distribution of poultry diseases, including coccidiosis. Data on the number of poultry farms and backyard poultry per family in Kabul City should be added here.

Study Design

A quantitative, laboratory-based, cross-sectional observational study was conducted from April to July 2026 at poultry disease diagnostic centers in Kabul City, Afghanistan. Data were collected using a structured questionnaire to obtain information on farm characteristics and potential risk factors such as production type, litter condition, use of anticoccidials, and previous history of coccidiosis on the farm, along with gross pathological examination of necropsied chickens.

Sample Size

The sample size was calculated using the Raosoft online sample size calculator (<http://www.raosoft.com/samplesize.html>), assuming a 95% confidence level, a 5% margin of error, and an expected prevalence of 18% based on findings from previous studies.

Sample Collection and Examination

Chickens exhibiting intestinal pathological lesions during necropsy, including hemorrhage, necrosis, gas accumulation, and thickening of the intestinal wall, were sampled by collecting the affected intestinal tissues along with their contents and submitting them immediately to the Parasitology Laboratory of the Faculty of Veterinary Medicine, Kabul University, for further examination.

Gross Lesions Grading and Laboratory Procedure

In the Parasitology Laboratory, the affected intestinal segments were initially scored from 0 to 4 according to the severity of gross pathological lesions, following established lesion-scoring guidelines (Conway & McKenzie, 2007). We then examined intestinal contents from the affected segments for *Eimeria* oocysts using the centrifugal flotation technique with Sheather's sugar solution. A portion of the liquid from the upper part of the test tube of the positive sample was transferred into a 2.5% potassium dichromate solution and maintained at 27°C for oocyst sporulation.

Laboratory investigations included fecal flotation, microscopic examination, and lesion scoring. These methods were employed to determine the prevalence of chicken coccidiosis and evaluate the associated risk factors. All chickens submitted to these poultry diagnostic centers for necropsy were included in the study, and a standardized data collection form was completed for each corresponding farm. Chickens showing advanced autolysis or decomposition due to delayed submission, as well as those whose farm owners declined to participate in the study, were excluded from the research. Chickens with intestinal lesions

suggestive of coccidiosis on gross postmortem examination underwent further microscopic evaluation to detect *Eimeria* oocysts and assess and grade intestinal pathological lesions.

Data Analysis

The collected data were reviewed, cleaned by correcting data-entry errors, organized, and coded before being entered into SPSS version 25 for statistical analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, where appropriate, were used to summarize the characteristics of the data and present the findings. Tables, charts, and graphs were also used to facilitate the presentation and interpretation of the results.

We calculated and compared the prevalence of coccidiosis across different variables. To assess the association between independent variables and coccidiosis, we first performed univariable binary logistic regression for each independent variable. Subsequently, following the purposeful selection approach described by Hosmer and Lemeshow (Bursac et al., 2008), we considered variables with a p-value < 0.25 in the univariable analysis as candidate variables for inclusion in the multivariable binary logistic regression model to identify independent risk factors for coccidiosis.

In addition, the Chi-square test was used to assess associations between categorical variables and determine the statistical significance of observed differences. For all statistical analyses, a p-value < 0.05 was considered statistically significant. The results were presented using tables, charts, and graphs to facilitate a clear interpretation of the prevalence and associated risk factors of coccidiosis among chickens studied in Kabul City.

FINDINGS

Population Characteristics

The chickens included in this study were submitted for necropsy from farms located in Kabul Province and neighboring provinces, including Logar, Maidan Wardak, Parwan, and Kapisa. The dead chickens included in this study were brought for postmortem examination from 225 farms that housed 756,260 broiler and layer chickens. Of these, 26,929 (3.56%) chickens were affected by various diseases, and 2,116 (7.85%) of the diseased chickens died from various infectious diseases. The distribution of these infectious diseases is presented below (Figure 4). On average, each farm housed $3,385.56 \pm 3,361.37$ chickens, while an average of 4.23 ± 2.65 dead chickens per farm were submitted to the diagnostic centers for necropsy. Among all dead birds, 940 were submitted to the Poultry Disease Diagnosis Centers for postmortem examination and disease diagnosis.

Among the poultry farmers included in this study, 215 provided information regarding their poultry farming experience. The farmers had an average of 5.87 ± 4.75 years of poultry farming experience, ranging from 6 months to 35 years, with 44.6% of the study participants having five or more years of experience. We found a statistically significant association between farmers' experience and coccidiosis occurrence ($\chi^2 = 11.849, p = 0.003$). The highest

prevalence of coccidiosis was observed among farms managed by farmers with 5–9 years of experience (16.4%), compared with 7.1% among those with more than 10 years of experience and 2.5% among those with 1–4 years of experience.

The chickens included in the study ranged in age from 1 to 30 weeks, with a mean age of 4.82 ± 4.66 weeks. The body condition assessment of the chickens submitted for postmortem examination showed that nearly half (49.3%) had a normal body condition. Body condition was not significantly associated with coccidiosis prevalence ($\chi^2 = 2.711$, $P = 0.438$). Of the 224 farms that supplied information about their raising systems in this study, 186 (83.0%) raised birds of a single age group, whereas 38 (17.0%) maintained birds of mixed ages. Regarding production type, 73.2% of farms produced broilers, while 26.3% raised egg-laying chickens (Table 1).

Table 1. Distribution of poultry farms according to production type and chicken strain ($n = 214$)

Flock Type	Strain (Origin)	n	% Within flock type	% of all farms
Broiler	ROSS 308 (Domestic)	45	27.6%	21.0%
	ROSS 308 (Uzbek)	52	31.9%	24.4%
	ROSS 308 (Tajik)	20	12.3%	9.3%
	ROSS 308 (Iranian)	27	16.6%	12.6%
	ROSS 308 (Turkish)	19	11.6%	8.9%
	Total	163	100%	67.2%
Layer	Australorp	42	82.3%	19.6%
	Lohmann	4	7.8%	1.9%
	Fayoumi	5	9.8%	2.3%
	Total	51	100%	23.8%
Grand Total		214		100%

Management and Biosecurity Practice

Most of the farms (96.4%) used well water as the primary source of drinking water for their flocks. Approximately one-third (31.1%) of the farms had good ventilation systems. Rental vehicles were used to transport feed and poultry products, including broiler chickens, to market, by 81.8% of farms. However, only 7.6% of farmers reported disinfecting vehicles before they entered the farm. Most farmers (83.0%) did not allow visitors to enter their farms. Regarding the disposal of dead birds, the most common practice was burial (35.4%) (Figure 1). None of the evaluated biosecurity and farm management characteristics were significantly associated with the occurrence of coccidiosis ($P > 0.05$; Table 2).

The litter was reported to be damp in 10.3% of the farms from which dead birds were submitted for postmortem examination. Most of the farmers (67.3%) reported replacing the litter at the end of the production cycle, whereas 32.7% replaced it when it became wet (Figure 2). High stocking density was observed in 45.3% of the farms included in the study. Regarding drinker and feeder hygiene, 46.7% and 52.0% of farmers, respectively, reported cleaning them daily. There was no statistically significant association between litter type or litter replacement schedule and the occurrence of coccidiosis among the surveyed poultry

farms ($P > 0.05$ for all; Table 2). No statistically significant association was found between housing system and the occurrence of coccidiosis (Fisher's exact test, $P = 0.243$).

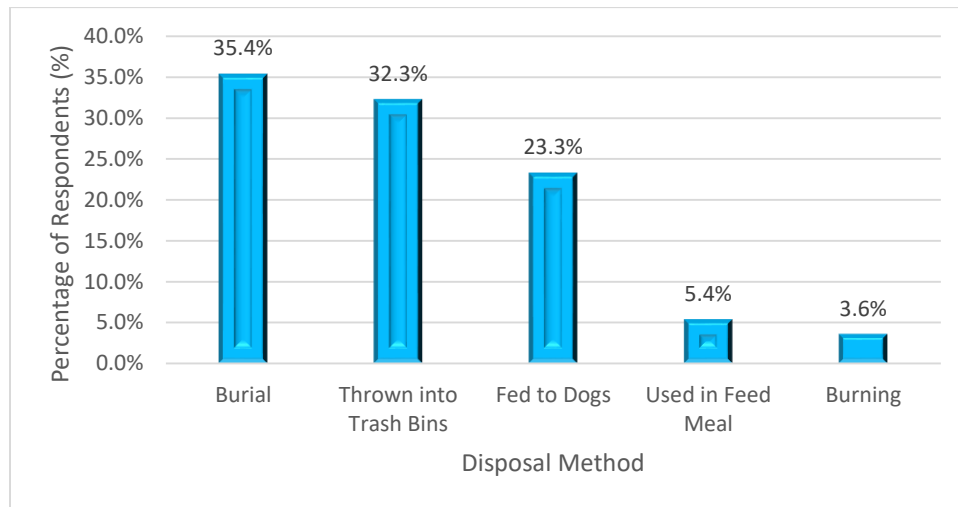


Figure 1. Distribution of respondents according to the methods used for the disposal of dead animals (%)

Table 2. Association between biosecurity and farm management characteristics and coccidiosis positivity among surveyed poultry farms ($n = 225$)

Variable	Category	Total, n (%)	Positive, n (%)	χ^2	P-value
Source of drinking water	Well water	216 (96.0)	18 (94.7)	1.139	0.566
	River water	5 (2.2)	1 (5.3)		
	Spring water/Karez	3 (1.3)	0 (0.0)		
Vehicle	Farm's own vehicle	42 (18.6)	3 (15.8)	0.113	0.737
	Rented vehicle	183 (81.3)	16 (84.2)		
Vehicle disinfection at farm entry	Yes	42 (18.7)	5 (26.3)	0.741	0.389
	No	180 (80.0)	14 (73.7)		
Footbath at farm entrance	Yes	17 (7.6)	2 (10.5)	0.338	0.561
	No	206 (91.5)	16 (84.2)		
Visitor access to the farm	Yes	37 (16.4)	2 (10.5)	0.435	0.509
	No	185 (82.2)	16 (84.2)		
Farm ventilation system	Good	70 (31.1)	5 (26.3)	3.332	0.189
	Moderate	126 (56.0)	9 (47.5)		
	Poor	29 (12.9)	5 (26.3)		
Housing system	Closed	156 (69.6)	16 (84.2)	—	0.243 [†]
	Semi-closed	56 (25.0)	2 (10.5)		
	Open	12 (5.4)	1 (5.3)		
Litter type	Wood shaving	185 (84.1)	18 (94.7)	1.796	0.407
	Wheat straw	32 (14.5)	1 (5.3)		
	Rice husk	3 (1.4)	0 (0.0)		
	When damp	73 (32.7)	4 (21.0)		
Litter replacement schedule	End of production	150 (67.3)	15 (78.9)	1.287	0.257

†Pearson's Chi-square test was used for all variables except housing system, for which Fisher's exact test (Monte Carlo estimate) was used because the assumptions of the Chi-square test were not met.

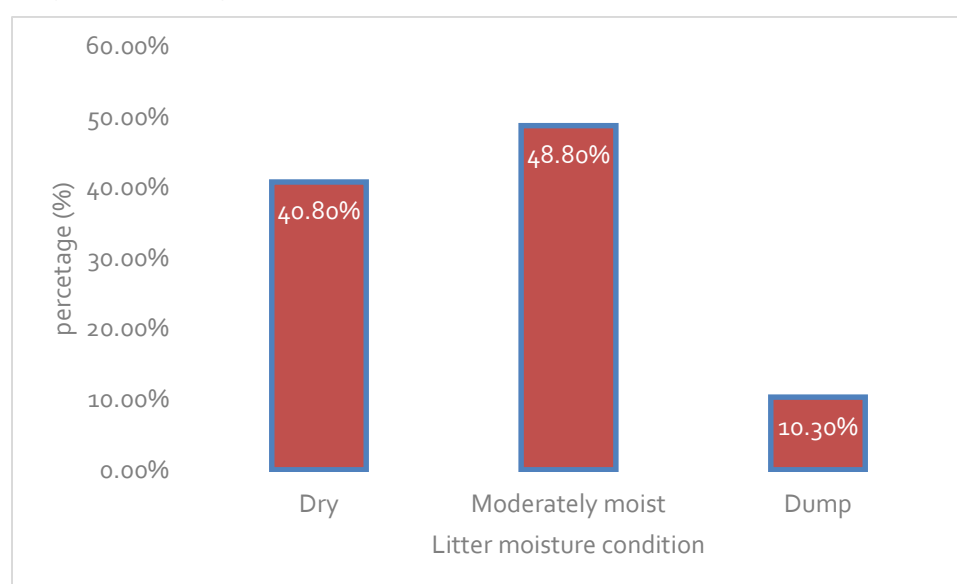


Figure 2. Litter moisture status in the poultry farms included in the study

Disease Prevention Strategies

Among the poultry farmers included in this study, 41.0% reported using antibiotics prophylactically to prevent diseases. In addition, 30.0% of the farmers reported administering anticoccidial drugs to their poultry flocks during the study period, whereas the remaining 70.0% did not report using these medications. There were no statistically significant associations between antibiotic use ($\chi^2 = 0.845$, $P = 0.358$) or anticoccidial use ($\chi^2 = 0.902$, $P = 0.342$) and the occurrence of coccidiosis. None of the farms included in this study used a coccidiosis vaccine. Among the 144 (64.0%) chicken farms with a previous history of coccidiosis, 19 (13.2%) were microscopically diagnosed with coccidiosis during this study, while 125 (86.8%) were negative. We observed a statistically significant association between a previous history of coccidiosis and the occurrence of coccidiosis ($P < 0.05$). Detailed results of this risk factor analysis are presented in the Risk Factors section of the Results.

The highest prevalence of coccidiosis was observed among farms that disposed of dead chicken carcasses by burial (13.9%). In contrast, no cases of coccidiosis were detected among farms that disposed of carcasses by burning (0%); however, this category included very few farms ($n = 8$). Nevertheless, the association between carcass disposal method and the microscopic diagnosis of coccidiosis was not statistically significant ($\chi^2 = 5.502$, $p = 0.240$).

Coccidiosis Prevalence

Among all the 225 farms chickens included in the study, chickens from 205 farms were diagnosed at necropsy based on postmortem microscopic changes, and the remaining 20 farms (8.9%) were not diagnosed satisfactorily. Among all diagnosed diseases, coccidiosis and enteritis had the most cases (Figure 3).

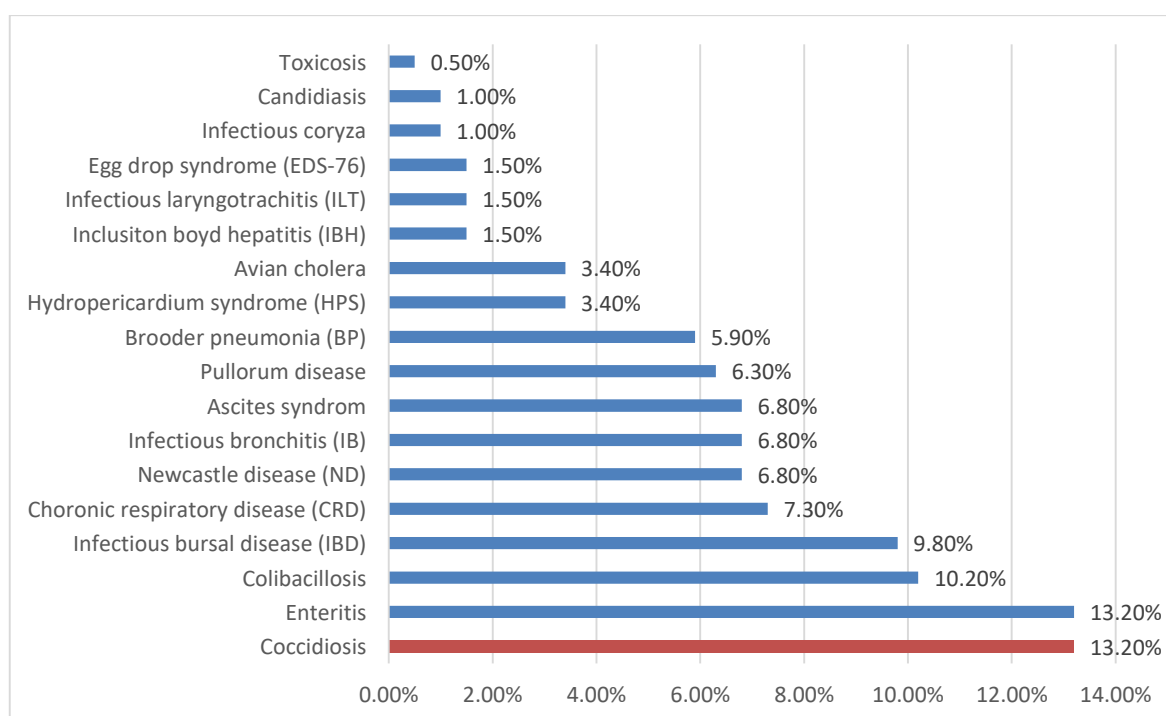


Figure 3. Prevalence of diseases diagnosed in birds submitted for postmortem examination (n = 205)

Among the 205 farms from which birds were submitted for postmortem examination, 27 carcasses were suspected (diagnosed) of having coccidiosis based on gross pathological lesions observed during necropsy. We collected intestinal samples from these suspected birds and examined them using the flotation technique to detect *Eimeria* oocysts. Of the 27 suspected farms, 19 farms tested positive for *Eimeria* oocysts by fecal flotation. Based on the flotation results, the overall prevalence of coccidiosis was 9.3% (19/205) among the farms diagnosed based on gross pathological changes. Therefore, the confirmed prevalence of coccidiosis among necropsied poultry farms was 9.3%. The descriptive results suggest that coccidiosis was most common among chickens 3–4 weeks of age. The highest prevalence of coccidiosis was observed in 4-week-old birds (15.8%; 9/57), followed by 3-week-old (9.3%; 4/43), 6-week-old (7.7%; 1/13), 5-week-old (6.5%; 2/31), and 2-week-old birds (3.1%; 1/32). No positive cases were detected among birds aged 1 week or those older than 6 weeks. However, the Pearson Chi-square test showed no statistically significant association between age and coccidiosis occurrence ($\chi^2 = 9.675$, $p = 0.786$).

Among the 2,116 chickens that died from infectious diseases, 104 (4.9%) were diagnosed with coccidiosis. Species identification based on infection site showed that 1 (5.3%) positive sample was *E. acervulina*, 4 (21.1%) was *E. necatrix*, and 14 (73.7%) was *E. tenella*. We graded macroscopic pathological lesions in the positive samples according to the established lesion-scoring system of Conway & McKenzie (2007). Of the 19 positive samples, 9 (47.4%) exhibited moderate lesions (Grade 4), whereas 10 (52.6%) showed severe lesions (Grade 5), as shown in Figures 5 and 6. Samples in which unsporulated *Eimeria* oocysts were detected by microscopic examination (Figure 7) were transferred to a 2.5% potassium dichromate solution for sporulation. After 2–3 days of incubation, sporulated oocysts containing four sporocysts were observed under a light microscope (Figure 8).



Figure 4. Gross pathological lesions of *E. tenella* type of coccidiosis showing Grade 4 (a) and Grade 3 (b) lesions on the intestinal serosal surface before opening the intestine

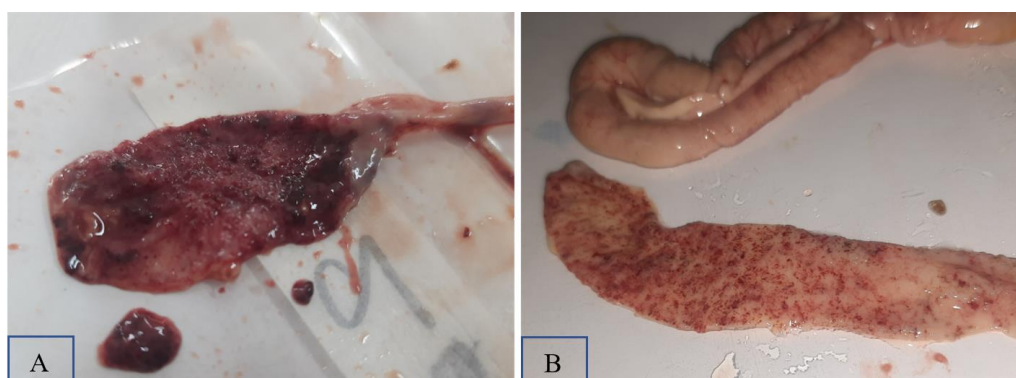


Figure 5. Gross pathological lesions of the cecal mucosa in *E. tenella* coccidiosis after opening the cecum. Mild cecal wall thickening with moderate hemorrhage (a); severe cecal wall thickening with extensive hemorrhage and blood clots in the cecal lumen (b)

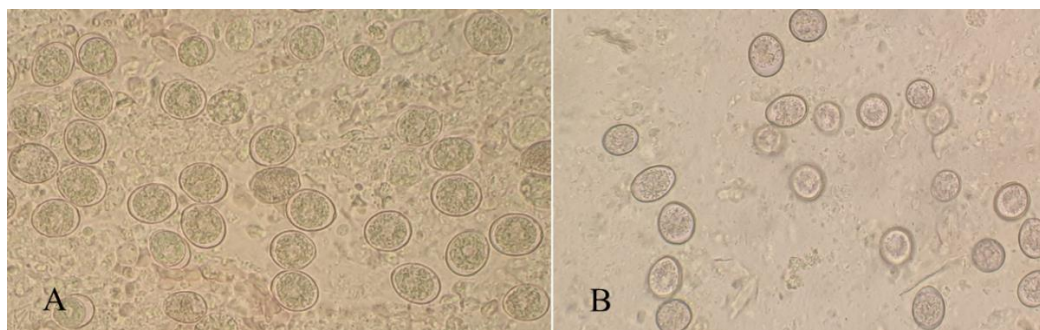


Figure 6. Photomicrographs of unsporulated *Eimeria* oocysts isolated from chicken intestinal contents. (A, B) Oocysts observed under a light microscope at 10x objective magnification

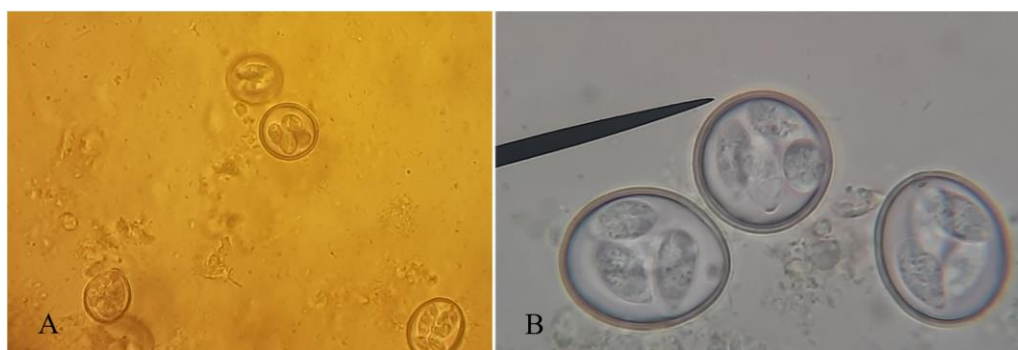


Figure 7. Photomicrographs of sporulated *Eimeria* oocysts observed under a light microscope at 40x (A) and 100x (B) objective magnification

Risk Factors

The chi-square test showed a statistically significant association between production type and coccidiosis occurrence ($\chi^2 = 7.55$, $p = 0.006$). Of the 165 broiler farms, 19 (11.5%) were positive for coccidiosis, whereas no cases of coccidiosis were detected among the 60 layer farms. The results showed a statistically significant association between litter condition and coccidiosis occurrence ($\chi^2 = 15.856$, $P < 0.001$). Coccidiosis occurred in 5 of 91 farms (5.5%) with dry litter, 7 of 109 farms (6.4%) with moderately moist litter, and 7 of 23 farms (30.4%) with dump litter. These findings indicate that coccidiosis was considerably more prevalent on farms with dump litter than on those with dry or moderately moist litter. The analysis of the association between a previous history of coccidiosis and its occurrence showed a statistically significant relationship between previous infection and current disease occurrence ($\chi^2 = 11.673$, $p = 0.001$). All 19 positive cases of coccidiosis were identified in farms with a previous history of coccidiosis; among the 144 farms with such a history, 19 (13.2%) were positive, and 125 (86.8%) were negative.

In contrast, no positive cases of coccidiosis were detected among the 81 farms with no previous record of avian coccidiosis (0%). These findings indicate that a history of coccidiosis is associated with a higher likelihood of current disease occurrence. It would be more interpretable if you conducted logistic regression analysis of the data; chi-square data shows associations, but not the directions

Table 3. Association of selected risk factors with the occurrence of coccidiosis in poultry farms

Variable	Category	Total, n (%)	Positive, n (%)	χ^2	P-value
Production type	Broiler	165 (73.3)	19 (100.0)	7.546	0.006
	Layer	60 (26.7)	0 (0.0)		
Previous history of coccidiosis	Yes	144 (64.0)	19 (100.0)	11.673	0.001
	No	81 (36.0)	0 (0.0)		
Litter condition	Dry	91 (40.8)	5 (26.3)	15.856	<0.001
	Moderately moist	109 (48.9)	7 (36.8)		
	Damp	23 (10.3)	7 (36.8)		
Farmer experience (years)	1-4	118 (55.4)	3 (15.8)	11.849	0.003
	5-9	67 (31.4)	11 (57.9)		
	>10	28 (13.1)	2 (10.5)		

To identify independent risk factors for coccidiosis in chickens, we entered all variables with a P-value < 0.25 in the univariate binary logistic regression analysis into the multivariate binary logistic regression model. These variables included litter condition, chick breed, carcass disposal method, ventilation, and farmer experience. The multivariate binary logistic regression results showed that litter condition was the only independent risk factor significantly associated with coccidiosis occurrence ($B = 1.416$, $Wald = 7.788$, $P = 0.005$). The odds of coccidiosis occurrence were approximately 4.12 times higher in farms with wet or unsuitable litter compared with farms maintained with dry and appropriate litter conditions ($OR = 4.119$, 95% CI: 1.524–11.131). The other variables included in the model, namely chicken

breed ($P = 0.146$), carcass disposal method ($P = 0.417$), ventilation ($P = 0.403$), and farmer experience ($P = 0.165$), were not significantly associated with the occurrence of coccidiosis after adjusting for the effects of the other variables in the model.

Table 4. Multivariate Binary Logistic Regression Analysis of Risk Factors Associated with the Occurrence of Chicken Coccidiosis

Variables	B	SE	Wald χ^2	Adjusted OR	CI ^{95%}		P-value
					Lower level	Lower level	
Litter condition	0.507	1.416	7.788	4.119	1.524	11.131	0.005
Breed	-0.233	0.160	2.112	0.793	0.579	1.084	0.146
Carcass disposal method	-0.219	0.269	0.660	0.804	0.474	1.362	0.417
Ventilation	0.411	0.491	0.701	1.509	0.576	3.951	0.403
Farmer's experience	0.079	0.057	1.925	1.082	0.968	1.209	0.165

To assess the goodness of fit of the multivariate binary logistic regression model, we performed the Omnibus and Hosmer–Lemeshow tests. The Omnibus test indicated that the final model was statistically significant compared with the null model containing no predictors ($\chi^2 = 16.428$, $df = 5$, $P = 0.006$), showing that including the independent variables significantly improved the model's ability to predict the occurrence of coccidiosis. The Hosmer–Lemeshow test showed no statistically significant difference between observed and model-predicted outcomes ($\chi^2 = 6.411$, $df = 8$, $P = 0.601$), indicating adequate model fit to the observed data.

DISCUSSION

In the present study, the overall prevalence of avian coccidiosis, determined by fecal flotation and microscopic detection of *Eimeria* oocysts, was 9.3%. This prevalence is comparable to the 10.63% prevalence reported by Yaqub et al. (2023) in central Kashmir among chickens examined during necropsy, where coccidiosis was diagnosed using postmortem findings and parasitological examination. This finding is comparable to the 8.0% prevalence reported by Sangary & Mohmand (2024) among chickens brought to diagnostic laboratories for necropsy in Kabul City. The slightly higher prevalence observed in the present study may be attributed to differences in the study period and seasonal variation. The similarity between the three studies may be attributed to their comparable study design, as all investigated chickens submitted for necropsy rather than apparently healthy birds. In contrast, Sharma et al. (2015) and Kaboudi et al. (2016) reported substantially higher prevalence rates of 39.58% and 30.8%, respectively, based on postmortem findings and fecal examination.

In the present study, species identification revealed that *E. tenella* was the predominant species, accounting for 73.7% (14/19) of the positive samples, followed by *E. necatrix* (21.1%) and *E. acervulina* (5.3%). Similarly, Sharma et al. (2015), Yaqub et al. (2023), Kaboudi et al. (2016), and Sagolsem et al. (2021) also reported that *E. tenella* was the predominant *Eimeria* species infecting chickens. These studies agree that *E. tenella* is the dominant species across

diverse poultry production systems and geographical regions. One possible explanation for the higher prevalence of *E. tenella* and *E. necatrix* observed in the present study is the nature of the study population. The study was conducted on chickens submitted for necropsy following mortality, allowing identification of *Eimeria* species based on characteristic gross pathological lesions. Because *E. tenella* and *E. necatrix* are among the most pathogenic *Eimeria* species in chickens (Chung et al., 2025; El-shall et al., 2022; M. K. Sharma & Kim, 2024) and are frequently associated with severe intestinal lesions, and increased mortality, they are more likely to be detected in necropsied birds than less pathogenic species. This may have contributed to their higher observed prevalence in the present study. In contrast, *E. praecox* and *E. mitis* are generally considered less pathogenic because they rarely cause mortality or produce characteristic gross lesions (Allen & Fetterer, 2002; Chung et al., 2025). Consequently, these species are less likely to be detected in necropsied birds, which may partly explain their non-detection in the present study.

In the present study, the highest prevalence of coccidiosis was observed in 4-week-old chickens (15.8%), followed by 3-week-old (9.3%), 6-week-old (7.7%), 5-week-old (6.5%), and 2-week-old birds (3.1%). A comparable age-related pattern was reported by Sharma et al. (2015), who found the highest prevalence of coccidiosis in chickens aged 31–45 days (58.86%), followed by those aged 16–30 days (49.27%), 46–60 days (39.87%), 61–75 days (25.67%), and 0–15 days (19.49%). The age-related distribution observed in the present study is consistent with the findings of Adhikari et al. (2008), who reported the highest prevalence of coccidiosis in layer chickens aged 31–45 days (48%), the lowest prevalence in birds aged 0–15 days (6%), and no positive cases in birds older than 90 days. These studies agree that chickens between 3 and 6 weeks of age are most susceptible to coccidiosis. Chickens of this age are more susceptible to coccidiosis due to the decline of maternal immunity, increased exposure to infective oocysts, and the incomplete development of acquired immunity. In contrast, the lower prevalence in 2-week-old chicks may be attributed to residual maternal immunity and limited environmental exposure. Our findings are consistent with previous research, which reported that chicks are most susceptible to cecal coccidiosis at 4 weeks of age, whereas those at 2 weeks of age exhibit the greatest resistance during the first six weeks of life (El-shall et al., 2022).

In the present study, poultry farmers had an average farming experience of 5.87 ± 4.75 years. Nearly half (44.6%) of the respondents had five or more years of poultry farming experience, indicating that a considerable proportion of farmers had accumulated practical knowledge in poultry production. This finding is broadly comparable to that of Grakh et al. (2023), who reported that 53.8% of poultry farmers in Haryana, India, had more than five years of farming experience. The similarity between the two studies suggests that poultry farming in both settings is largely managed by individuals with several years of experience. Despite this, the present study demonstrated a significant association between farmers' years of experience and the occurrence of coccidiosis ($\chi^2 = 11.849$, $p = 0.003$). Coccidiosis prevalence was highest among farmers with 5–9 years of experience (16.4%), followed by

those with >10 years (7.1%) and 1–4 years (2.5%). These findings suggest that farming experience alone does not ensure effective disease prevention. The lower prevalence among the most experienced farmers may reflect better biosecurity and flock management practices, whereas farmers with intermediate experience may not have fully adopted effective disease control measures.

This study found that 64% (144/225) of poultry farms had a history of coccidiosis. However, only 13.2% (19/144) of these farms were microscopically positive for coccidiosis at the time of the study. In comparison, Grakh et al. (2023) reported that only 28.8% of poultry farmers had experienced coccidiosis on their farms at any time since entering poultry production. The higher proportion of farms with a previous history of coccidiosis observed in the present study may be attributed to differences in geographical location, season of the year, poultry management practices, biosecurity measures, and farmer awareness.

In the present study, coccidiosis was detected only in broiler farms, with 11.5% (19/165) of broiler farms testing positive, whereas no cases were detected among the 60 layer farms. In contrast, Grakh et al. (2023) reported a higher occurrence of avian coccidiosis in layer flocks (63.64%) than in broiler flocks. The discrepancy between the two studies may be attributed to differences in geographical location, farm management practices, and flock characteristics. In the present study, 40% of layer farms were managed under semi-closed or open housing systems, where coccidiosis occurrence is low. This finding may be explained by the older age of layer birds, which generally develop protective immunity following repeated exposure to *Eimeria* spp. However, the relatively smaller number of layer farms included in this study (n = 60) compared with broiler farms (n = 165) may also have reduced the likelihood of detecting infected layer flocks. The findings of the present study are consistent with those of Lawal et al. (2016), who also reported a substantially higher prevalence of coccidiosis in broiler chickens (68.7%) than in layer chickens (3.3%).

In the present study, only 7.6% (17/225) of poultry farms reported the prophylactic use of anticoccidial drugs, whereas 92.4% did not. Moreover, no statistically significant association was observed between the prophylactic use of anticoccidial drugs and the occurrence of coccidiosis ($P = 0.342$). A similar finding was reported by Grakh et al. (2023), in which 25.0% (13/52) of poultry farmers used anticoccidial drugs for prophylactic or therapeutic purposes, and the use of these drugs was likewise not significantly associated with the occurrence of coccidiosis ($P = 0.377$). The absence of a significant association in both studies suggests that the prophylactic use of anticoccidial drugs alone may not be sufficient to prevent coccidiosis. This may be attributed to inappropriate drug selection or administration, incorrect dosage or timing, poor compliance with recommended prophylactic programs, the development of anticoccidial drug resistance, or inadequate biosecurity and litter management practices that allow continued environmental contamination with *Eimeria* oocysts.

CONCLUSION

The findings demonstrated that coccidiosis remains an important disease affecting commercial poultry farms in Kabul and neighboring provinces despite the implementation of various management practices. Among the 205 farms for which a definitive diagnosis was established, the overall prevalence of coccidiosis confirmed by fecal flotation was 9.3%. Most affected birds were 3 to 4 weeks old, with the highest prevalence in 4-week-old broiler chickens. Species identification revealed that *E. tenella* was the predominant species, accounting for 73.7% of all positive cases. Gross pathological examination showed that all positive cases had moderate to severe intestinal lesions, with more than half of infected birds showing severe lesion scores. Several important risk factors were identified. Coccidiosis occurred significantly more often in broiler farms than in layer farms. Damp litter was strongly associated with disease occurrence, emphasizing the importance of litter moisture control in preventing the development and transmission of *Eimeria* oocysts. Likewise, farms with a history of coccidiosis were significantly more likely to experience new infections, suggesting persistent environmental contamination and incomplete elimination of infective oocysts between production cycles.

This study was limited to dead chickens submitted to poultry disease diagnostic centers and therefore may not reflect the true prevalence of coccidiosis in the overall poultry population. In addition, *Eimeria* species were identified based only on the site of intestinal infection without molecular confirmation, and the short study period (April–July 2026) did not allow assessment of seasonal variation. Nevertheless, this study provides valuable baseline data on the prevalence and epidemiology of avian coccidiosis in poultry farms in Kabul, Afghanistan. Future research should focus on detecting subclinical coccidiosis in commercial poultry farms through quantitative oocyst counts and accurate *Eimeria* species identification using validated diagnostic methods, particularly molecular techniques, to improve disease surveillance and control strategies.

Authors Contributions

Mohammad Sangary conceived and designed the study, conducted the research, collected and analyzed the data, and drafted the manuscript. Ahmad Jan Abi supervised the research, contributed to the laboratory procedures, and critically reviewed the manuscript. Mohammad Naiem Alizada contributed to the data analysis and critically reviewed and revised the manuscript. All authors read and approved the final version of the manuscript.

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Conflict of Interest Statement

The authors declare that they have no known competing financial or non-financial interests, personal relationships, or professional affiliations that could have appeared to influence the work reported in this manuscript.

Data Availability Statement

The datasets generated and analyzed during the current study are included in this published article and its supplementary materials. Additional data supporting the findings of this study are available from the corresponding author upon reasonable request.

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