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Prevalence of Coccidiosis in Commercial Chickens of Bangladesh: Species Identification with Age and Seasonal Associations

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ABSTRACT

Coccidiosis is one of the most economically significant diseases in the poultry industry, resulting in substantial economic losses through treatment costs, reduced growth rates, and decreased body weight gain. The present study aimed to determine the prevalence of different *Eimeria* (*E.*) species in commercial chickens and to assess age-specific and seasonal patterns of coccidiosis. A total of 595 chicken fecal samples were randomly collected from three different chicken types, namely broiler breeds (n = 227), layer breeds (n = 205), and Sonali (a dual-purpose crossbred, n = 163) chickens between April 2022 and March 2023, across 27 different farms in the Pirojpur district of Bangladesh. The farms were selected for sampling based on the presence of chickens having clinical signs such as diarrhea, decreased feed consumption, impaired weight gain, lameness, and increased mortality. After sacrificing the suspected chickens, the intestine was carefully inspected and examined for gross pathological lesions. Mucosal scrapings from different intestinal segments and fecal samples were analyzed microscopically for the presence of oocysts using standard parasitological methods. The identification of different *Eimeria* species was conducted based on the morphological and morphometric characteristics of the oocysts. The result revealed that the overall prevalence of coccidiosis was 13.78%. Among the chicken types, Sonali demonstrated the significantly highest prevalence (21.47%), followed by layers (13.66%) and broilers (8.37%). Five different *Eimeria* species were identified, with *E. tenella* (45.12%) being the most prevalent, followed by *E. acervulina* (18.29%), *E. maxima* (15.85%), *E. brunetti* (10.98%), and *E. necatrix* (9.76%). No significant influence of age or season on coccidiosis prevalence was observed in broiler and layer chickens. In Sonali chickens, the prevalence of coccidiosis increased significantly with age, while no significant effects of season were observed. It has been concluded that the total prevalence of coccidiosis was 13.78%, with Sonali chickens exhibiting the highest prevalence. Five distinct species of *Eimeria* were identified, with *E. tenella* being the most common species. Furthermore, no effects of season and age on prevalence of *Eimeria* species were observed, except for Sonali chickens, where the prevalence increased with age.

Keywords: Coccidiosis, *Eimeria*, Morphometry, Poultry, Prevalence, Sonali chicken

INTRODUCTION

The poultry industry plays a vital role in supplying humans with animal protein, particularly through meat and eggs, while making a significant contribution to the national economy in Bangladesh (Hamid et al., 2016). However, several diseases, including coccidiosis, colibacillosis, and chronic respiratory disease, pose significant challenges to the growth and development of this sector. Despite these challenges, the industry continues to employ a large portion of the population, including rural and marginal farmers (Gupta et al., 2019; Yadav et al., 2020). Among these diseases, coccidiosis is considered the most significant parasitic disease affecting the global poultry industry, resulting in substantial economic losses due to both decreased productivity and the need for control measures (Munoz-Gomez et al., 2024). Coccidiosis imposes a substantial economic burden due to decreased productivity, poor feed conversion efficiency, growth retardation, increased mortality, and the associated expenses of treatment and prevention. The disease is caused by *Eimeria* (*E.*), an apicomplexan protozoan parasite that poses a serious threat to the poultry industry (Peek and Landman, 2011). Among the different types of poultry raised in Bangladesh, Sonali chickens, derived from a cross between Rhode Island Red (RIR) cocks and Fayoumi hens, have become a significant part of poultry production. Due to their phenotypic similarity to the native chickens, these crossbred chickens (*Gallus gallus domesticus*) have gained popularity and wider acceptance among farmers as a favorable alternative to broiler chickens (Uddin et al., 2015).

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Chickens are frequently infected with different *Eimeria* species, which can result in varying degrees of gastrointestinal disorders (Olufemi et al., 2020). There were nine *Eimeria* species among those; *E. tenella*, *E. maxima*, *E. brunette*, and *E. necatrix* were the most pathogenic, followed by *E. mitis*, *E. acervulina*, and *E. mivati*, *which* were moderately pathogenic. On the other hand, *E. hagani* and *E. praecox* were least pathogenic (Nematollahi et al., 2009). Of these, *E. tenella* and *E. necatrix* are especially detrimental, causing bloody lesions, significant morbidity, and mortality in young chickens (Iacob and Duma, 2009). The severity of infection depends on several factors, including the *Eimeria* species involved, the age and immune status of the host, and the number of ingested oocysts (Attree et al., 2021). Poor sanitary conditions in poultry sheds, combined with improper litter management, further increase the risk of infection. Additionally, young chickens are most frequently affected during the wet seasons (Kaboudi et al., 2016). Coccidiosis is still considered the most economically significant parasitic condition affecting poultry production worldwide, which decreases poultry production by increasing feed intake, reducing weight gain, and increasing treatment costs annually to the tune of two billion euros (Peek et al., 2011). Identification of different species based on the morphology of oocysts was a common phenomenon when using the fecal flotation technique under a microscope. The presence of oocysts in fecal samples is primarily examined using the flotation method, which involves a saturated salt solution and a modified McMaster technique (Sharma et al., 2015). The morphology and/or morphometry of the sporocyst and oocyst, their developmental histories, and the location and magnitude of pathological lesions in the chicken's intestine have all been used to identify *Eimeria* species (Aarthi et al., 2010). Every *Eimeria* species has a distinct location within the intestine, which highlights its particular parasitic behavior (Mesa-Pineda et al., 2021). Microscopic analysis of intestinal lesions and oocyst morphology, distinct to each species, can also be used to identify and differentiate *Eimeria* species (Adam et al., 2022). Seven *Eimeria* species were identified by using morphological methods, including *E. tenella* (50.84%), *E. acervulina* (25.42%), *E. maxima* (20.33%), *E. mitis* (8.47%), *E. necatrix* (3.38%), *E. mivati* (3.38%), and *E. praecox* (1.69%; Nasiri et al., 2024).

The prevalence of the disease may vary depending on several factors, including population density, farm management practices, and geoclimatic conditions (Asfaw et al., 2021). Promoting commercial poultry farming in this region remains challenging without fundamental knowledge of the prevalence and pathophysiology of chicken coccidiosis, which has not yet been determined in these areas. The prevalence of coccidiosis was 34.48% in the overall broiler population of Gazipur district, Bangladesh (Rony et al., 2021), and 82.29% in Sylhet district, Bangladesh (Datta et al., 2025). The studies conducted in the Swabi district of Pakistan indicated the overall prevalence of poultry coccidiosis was 44.4% (Begum et al., 2024), while it was 30.12% in the Meghalaya state of India (Das, 2021) and 42.2% in the Gondar town in Ethiopia (Wondimu et al., 2019).

Although coccidiosis is a common disease in the Pirojpur district, Bangladesh, there is a lack of sufficient published information on its prevalence and distribution. Limited studies have been conducted on the topographical distribution of coccidia species in broiler chickens, and the magnitude of the economic loss associated with specific *Eimeria* species in Bangladesh remains largely unknown. The identification of species based on geographic location is the most crucial step for the effective control and prevention of avian coccidiosis. Therefore, the present study aimed to identify the different coccidian species infecting commercial chickens and to determine the age-specific and seasonal prevalence of coccidiosis in the Pirojpur district of Bangladesh.

MATERIALS AND METHODS

Ethical approval

In accordance with the Bangladesh Veterinary Council Act 2019 (Act No. 13 of 2019), all chickens in the present study were treated following the ethical standards established by the Birds Care Instructions and Use Regulations of the Government of the People's Republic of Bangladesh.

Study area and duration

The investigation was carried out from April 2022 to March 2023 across different small-scale commercial poultry farms in the Pirojpur district of Bangladesh (Figure 1). Pirojpur is situated in Southwestern Bangladesh between 22°09’ and 22°52’ North latitude and 89°52’ and 90°13’ East longitude. The soil is fertile, and the majority of the area consists of low-lying plain land, with elevations ranging from 10 to 19 feet above sea level. The average temperature of this district ranged from 25.6 to 33.4 °C, with humidity levels of 63-84%, and the average annual rainfall in the region was approximately 2181.6 mm (Weather2Visit, 2025). The present study was conducted at the Department of Parasitology, Faculty of Veterinary Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100, Khulna, Bangladesh.

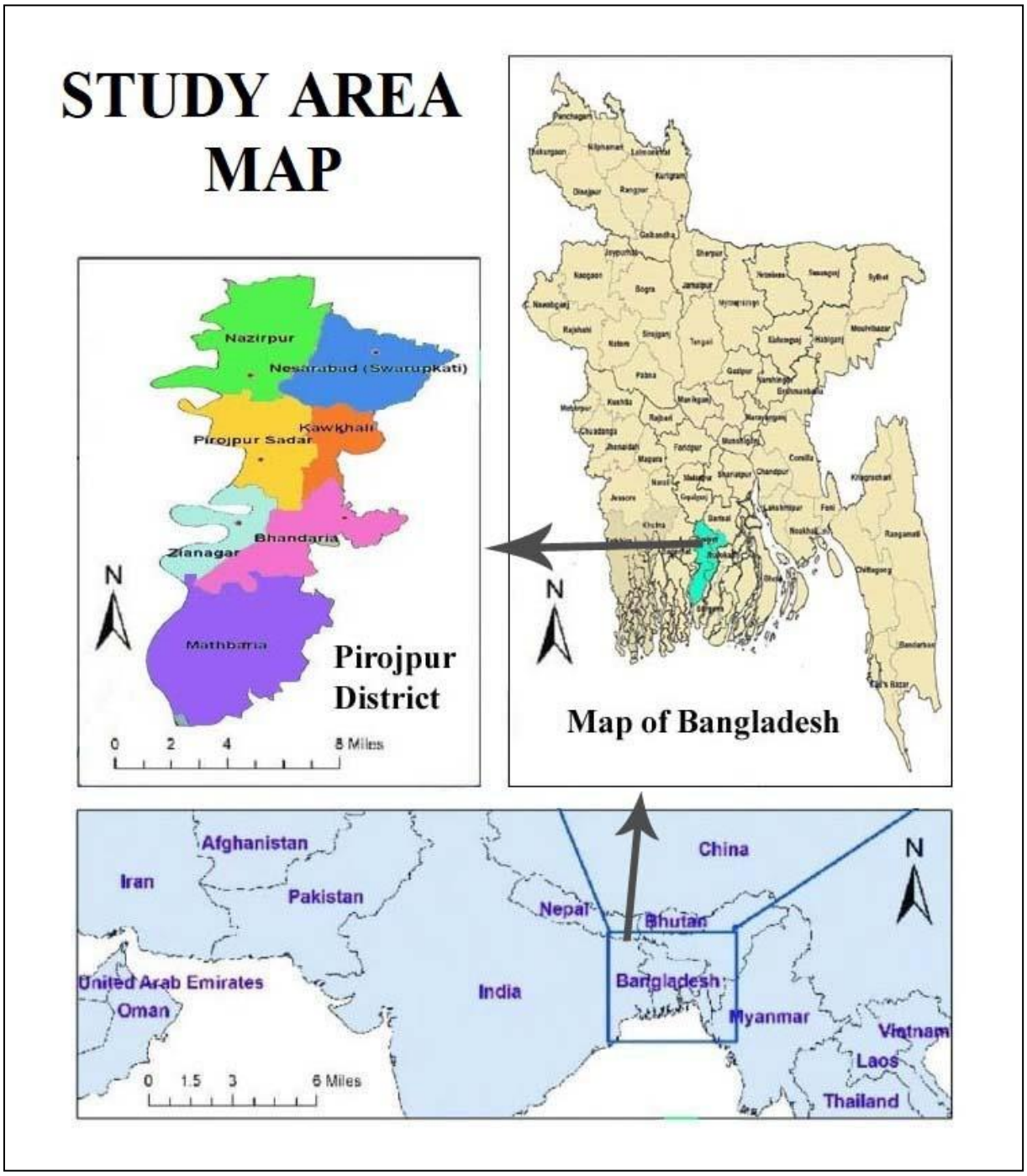

Figure 1. Map of the study area, Pirojpur district of Bangladesh, for investigating coccidiosis in commercial chickens from April 2022 to March 2023

Sample collection

A total of 595 freshly passed fecal samples were randomly collected from several breeds of broiler chickens (n = 227), including different commercial broiler breeds. The Cobb 500 and Hubbard Classic were the most common broiler chickens. The layer chickens (n = 205) comprised different commercial layer breeds, with the most common breeds being Novogen White/Brown and Shaver Brown/White, and the Sonali chickens (n = 163) were found across 27 different farms in the Pirojpur district of Bangladesh. All chickens were reared in floor conditions. The overall number of chickens on each farm varied from 300 to 1500, with ages ranging from 2 to 40 weeks. All farm chickens had no history of vaccination against coccidiosis. Samples were collected from different farms at the farmer's request for the treatment of chickens exhibiting clinical signs, such as diarrhea, decreased feed consumption, impaired weight gain, lameness, and increased mortality. The chickens were taken for necropsy, and fecal samples were collected using a separate spatula for each chicken. Each fecal sample was put into a 50 mL Falcon tube that was previously labeled with the necessary information and transported to the laboratory for parasitological analysis. Upon arrival at the laboratory, these samples

were immediately stored at 4°C until further processing (Wondimu et al., 2019). Information on farm location, flock size, age of the chickens, type of chickens, seasons, owner complaints, clinical history, observed clinical signs (diarrhea, reduced feed and water intake, poor body weight, ruffled feathers, lameness, and drooping wings), mortality rates, and both therapeutic and preventive measures were collected directly from the farmers through a face-to-face interview.

Postmortem examination

In the laboratory, collected chickens were sacrificed by cervical dislocation before necropsy. All visceral organs were initially examined for gross pathological changes. Following a systematic evaluation of all organs, the intestines of each chicken were carefully dissected, opened longitudinally, and inspected for lesions such as whitish spots, petechial hemorrhage, ballooning, reddening, thickening, and caecal cores.

Microscopic examination

The fecal samples were examined for the presence of *Eimeria* oocysts in the parasitology laboratory through standard flotation techniques using concentrated sucrose solution (specific gravity: 1.27) in accordance with the guidelines outlined by Hendrix (1998). A compound microscope (TM450, Meiji Techno Company Limited, Japan) with 10× objectives was used to examine the slides. A sample was considered negative if three separate slides from the same specimen exhibited no oocysts. Positive fecal samples were then sporulated in a wet chamber at 24-26°C in a 2.5% solution of potassium dichromate ($K_2Cr_2O_7$) as described by Al-Quraishy et al. (2009). Mucosal scrapings from different intestinal segments (small intestine and caeca) were collected and analyzed microscopically for the presence and identification of oocysts. Prevalence of coccidiosis and species identification were done based on the morphological traits of sporulated oocysts and sporocysts, including shape, color, micropyle, micropyle cap, presence or absence of polar, residual bodies, as well as the time of sporulation (Soulsby, 1982; Cheru et al., 2023). The morphometric traits, such as length, width, length-to-width ratio, and form index, were evaluated based on the diagnostic guides for identifying sporulated *Eimeria* oocysts outlined by Conway and McKenzie (2007). The results of postmortem and microscopic investigations were compiled and examined comparatively for interpretation.

Statistical analysis

All data collected were entered into a Microsoft Excel 2010 spreadsheet program, and statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26 (SPSS Inc., USA) to determine the prevalence of coccidiosis. The difference among variables was determined by using the chi-square ($\chi 2$) test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The overall prevalence of coccidiosis was 13.78% (n = 82/595) in commercial chickens in the Pirojpur district of Bangladesh (Figure 2). A significantly higher prevalence was recorded in Sonali chickens at 21.47% (n = 25/163), followed by 13.65% (n = 28/205) in layer and 8.37% (n = 19/227) in broiler chickens ($p < 0.05$, Table 1).

Furthermore, Table 2 displays the prevalence of five identified species, including *E. acervulina*, *E. maxima*, *E. necatrix*, *E. tenella, and E. brunetti.* Among these, *E. tenella* was found to be the most prevalent, with a rate of 45.12%. The prevalence of *E. acervulina*, *E. maxima, E. brunetti, and E. necatrix* was 18.29%, 15.85%, 10.98%, and 9.76% respectively, in commercial chickens.

Based on the findings in Table 3, the highest prevalence of coccidiosis infection (10.09%) was observed in broiler chickens aged between 15 and 35 days, although the difference was not statistically significant ($p > 0.05$). No significant seasonal variation in the prevalence of coccidiosis was observed ($p > 0.05$); however, the rainy seasons demonstrated the highest prevalence (11.63%), followed by winter (6.76%) and summer (5.97%).

The highest prevalence of coccidiosis infection (18.60%) was detected in chickens aged less than eight weeks, with no statistically significant difference in layer chickens ($p > 0.05$). The highest prevalence occurred during the summer (16.67%), followed by the rainy (12.28%) and winter (8.70%) seasons, despite there being no significant association between prevalence and season ($p > 0.05$; Table 4).

The prevalence of coccidiosis in Sonali chickens differed significantly among age groups ($p < 0.05$). The highest prevalence was observed in chickens aged 21-50 days (32.88%), which was significantly greater than in the chickens aged over 51 days (14.55%) and those under 20 days (8.57%) of age. According to the present investigation, Sonali chickens were affected by coccidiosis throughout the year, with only slight seasonal variations. Although the seasonal variations were not statistically significant ($p > 0.05$), a higher prevalence was recorded during the rainy seasons (27.54%), followed by the winter (24.39%) and the summer (11.32%) seasons ($p > 0.05$, Table 5).

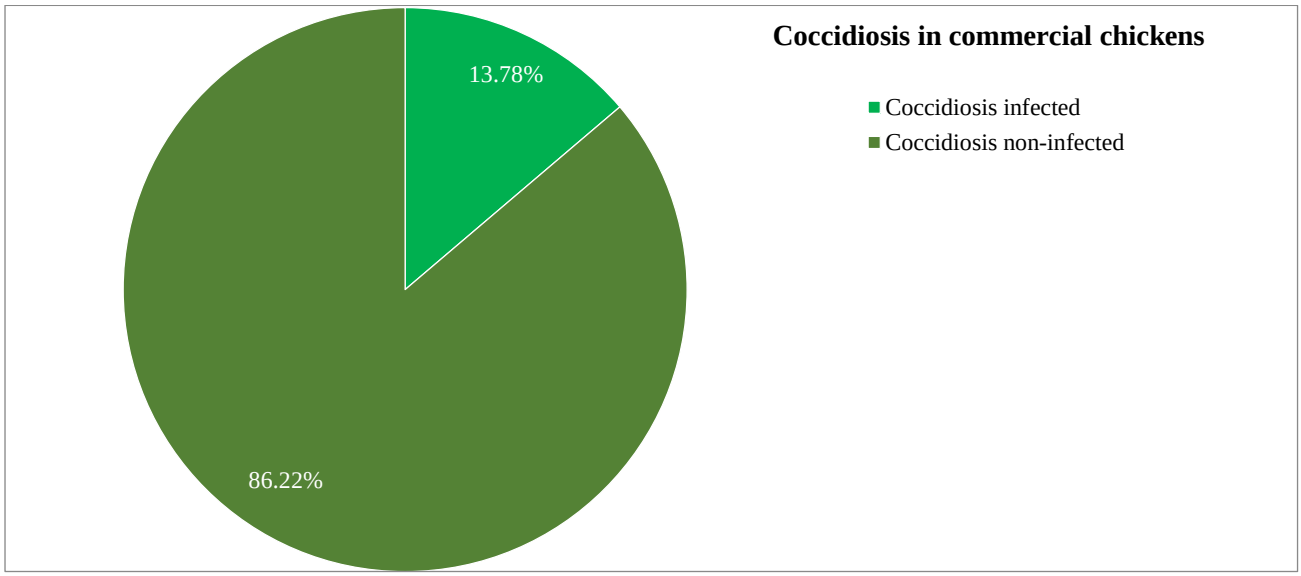

Figure 2. Overall prevalence of coccidiosis in commercial chickens from April 2022 to March 2023 in the Pirojpur district of Bangladesh

Table 1. Prevalence of coccidiosis in commercial chickens in relation to the type of chickens from April 2022 to March 2023 in the Pirojpur district of Bangladesh

Type of chicken	Tested samples		Positive samples		Prevalence	$\chi 2$	p-value
	Total number = 595	(%)	N = 82	(%)	(%)		
Broiler breeds	227	38.15	19	23.17	8.37		
Layer breeds	205	34.45	28	34.15	13.66	13.71	0.001
Sonali chickens	163	27.39	35	42.68	21.47		

N: Number of positive samples, $\chi 2$: Chi-square value, p-value less than 0.05 is considered statistically significant ($p < 0.05$). Note: Sonali is a dual-purpose crossbred (Rhode Island Red ♂ × Fayoumi ♀) chicken type in Bangladesh.

Table 2. Distribution of different *Eimeria* species infecting the commercial chickens from April 2022 to March 2023 in the Pirojpur district of Bangladesh

Species	Broiler chicken		Layer chicken		Sonali chicken		Total	
	n_1	(%)	n_2	(%)	n_3	(%)	n	(%)
Eimeria tenella	6	31.58	13	46.43	18	51.43	37	45.12
Eimeria acervulina	5	26.32	4	14.29	6	17.14	15	18.29
Eimeria maxima	3	15.79	6	21.43	4	11.43	13	15.85
Eimeria brunetti	2	10.53	2	7.14	5	14.29	9	10.98
Eimeria necatrix	3	15.79	3	10.71	2	5.71	8	9.76
Total	19	23.17	28	34.15	35	42.68	82	100

n_1: Number of positive samples in broiler chickens, n_2: Number of positive samples in layer chickens, n_3: Number of positive samples in Sonali chickens, n: Total number of positive samples.

Table 3. Coccidiosis prevalence in broiler chickens in relation to ages and seasons from April 2022 to March 2023 in the Pirojpur district of Bangladesh

Factors	Categories	Tested samples		Positive samples		Prevalence	$\chi 2$	p-value
		N = 227	(%)	n = 19	(%)	(%)		
Age group	≤ 14 days	35	15.42	2	10.53	5.71	0.884	0.643
	15-35 days	109	48.02	11	57.89	10.09		
	≥ 36 days	83	36.56	6	31.58	7.23		
Season	Summer	67	29.52	4	21.05	5.97	1.944	0.378
	Winter	74	32.60	5	26.32	6.76		
	Rainy	86	37.89	10	52.63	11.63		

N: Number of tested samples, n: Number of positive samples, $\chi 2$: Chi-square value, p-value less than 0.05 is considered statistically significant.

Table 4. Age and season distribution of coccidiosis in layer chickens from April 2022 to March 2023 in the Pirojpur district of Bangladesh

Factors	Categories	Tested samples		Positive samples		Prevalence	χ2	p-value
		N = 205	(%)	n = 28	(%)	(%)		
Age group	≤ 8 weeks	86	41.95	16	57.14	18.60	3.236	0.198
	9-20 weeks	72	35.12	8	28.57	11.11		
	≥ 21 weeks	47	22.93	4	14.29	8.51		
Season	Summer	102	49.76	17	60.71	16.67	1.835	0.399
	Winter	46	22.44	4	14.29	8.70		
	Rainy	57	27.80	7	25.00	12.28		

N: Number of tested samples, n: Number of positive samples, χ2: Chi-square value, p-value less than 0.05 is considered statistically significant.

Table 5. Prevalence of coccidiosis in Sonali chickens by age and seasonal changes from April 2022 to March 2023 in the Pirojpur district of Bangladesh

Factors	Categories	Tested samples		Positive samples		Prevalence	χ2	p-value
		N = 163	(%)	n = 35	(%)	(%)		
Age group	≤ 20 days	35	21.47	3	8.57	8.57	10.650	0.005
	21-50 days	73	44.79	24	68.57	32.88		
	≥ 51 days	55	33.74	8	22.86	14.55		
Season	Summer	53	32.52	6	17.14	11.32	4.951	0.084
	Winter	41	25.15	10	28.57	24.39		
	Rainy	69	42.33	19	54.29	27.54		

N: Number of tested samples, n: Number of positive samples, χ2: Chi-square value, p-value less than 0.05 is considered statistically significant.

DISCUSSION

With an overall prevalence of 13.78%, the current study demonstrated that coccidiosis remains a significant health issue for chickens in the Pirojpur district of Bangladesh. The current finding was lower than the 15.38% reported by Islam et al. (2020a) in Bogura district, Bangladesh. On the contrary, the present results were higher than those reported by Islam et al. (2013) and Rahman et al. (2017), who observed 7.53% and 5.8% of coccidiosis, respectively, at different parts of Bangladesh. Numerous factors, including sampling time, sample size, geographic location, population density, and local climate, may contribute to the differences in the results.

The present investigation supported the results of Islam et al. (2023), who reported that coccidiosis is more prevalent in Sonali chickens (18.31%), followed by layers (7.45%) and broiler chickens (2.62%). Similarly, Al Mamun et al. (2019) documented the prevalence of 10.70%, 9.16%, and 6.93% in Sonali, layer, and broiler chickens, respectively. Poor litter management and unsanitary poultry housing contribute to the increased risk of coccidiosis infection. However, Islam et al. (2014) and Islam et al. (2020a) reported that broiler chickens had the highest incidence (15.39% and 20.6% respectively), followed by Sonali (5.56% and 10.47%) and layer (7.5% and 10.25%) chickens. Higher stocking densities may be a contributing factor to the comparatively higher prevalence of coccidiosis in Sonali chickens, as indicated by the sample collection. Overcrowding led to the rapid accumulation of fecal materials and moisture in the litter, creating a suitable environment for *Eimeria* oocysts to sporulate. This significantly increases the risk of ingestion and reinfection across the flocks.

The current results supported the findings of Begum et al. (2024), who reported that *E. tenella* was responsible for the highest prevalence of coccidiosis (42.5%), followed by *E. acervulina* (26.3%), *E. maxima* (20%), and *E. mitis* (11.3%). Similarly, Jan et al. (2022) observed that *E. tenella* was the most prevalent species (20.12%), followed by *E. acervulina* (11.92%), *E. maxima* (10.25%), *E. necatrix* (8.84%), and *E. mitis* (2.69%). However, Bereket and Abdu (2015) reported different findings, with *E. brunetti* (17.8%) demonstrating the highest prevalence of single infection, while lower prevalences of 12.2%, 9.7%, 7.8%, and 6.7% were observed in *E. tenella*, *E. necatrix*, *E. acervulina*, and *E. maxima*, respectively. Additionally, Agishi et al. (2016) identified *E. necatrix* (22.6%) as the most prevalent species, with decreasing prevalence in *E. maxima* (20.4%), *E. tenella* (19.4%), *E. mitis* (15%), *E. acervulina* (10.4%), *E. praecox* (6.9%), and *E. brunetti* (5.3%), which was inconsistent with the present results. In broiler chickens, Meteab et al. (2021) recorded that the highest prevalence of coccidiosis was caused by *E. tenella* (47.05%), followed by *E. acervulina* (23.52%), *E. maxima* (17.64%), mixed infections of *E. maxima* with *E. tenella* (8.23%), and *E. necatrix* (3.52%), consistent with the present results. Conversely, Liao et al. (2024) indicated that *E. acervulina* (36.55%) was the most prevalent species, followed by *E. mitis* (35.28%), *E. tenella* (34.01%), and *E. necatrix* (30.96%) in broiler chickens,

respectively. Additionally, Meteab et al. (2021) recorded that in layer chickens, *E. tenella* (35%) had the highest prevalence, followed by *E. maxima* (25%), *E. acervulina* (15%), mixed infections of *E. tenella* with *E. maxima* (15%), and *E. necatrix* (10%). These variations in findings could be attributed to differences in poultry breeds, management techniques, environmental factors, and study populations.

Broiler chickens aged between 15 and 30 days indicated the highest prevalence of coccidiosis infection. However, there was no significant association between prevalence and age groups. This finding is consistent with the findings reported by Mohamed et al. (2021), who found no infection in broiler chickens aged between 0 and 15 days and above 45 days, while the 15-30-day age groups exhibited the highest percentage of coccidiosis (54.3%), followed by a lower infection rate (45.7%) in the 30-45-day age group. The current results are partially similar to those of Jan et al. (2022) and Amin et al. (2014) who reported that coccidiosis was higher in broiler chicken having 3-4 weeks age (67.23% and 74.90%) followed by those aged 4-6 weeks (23.54% and 17.94%), and lower in chickens less than 3 weeks of age (9.21% and 7.14%). Coccidiosis may be more common in the 15-30-day age group because chickens in this age have not yet developed sufficient acquired immunity against *Eimeria* species and are exposed to a high load of oocysts in the litter. In contrast, chickens aged 0-14 days were protected by maternal immunity. However, some studies have observed a high prevalence of coccidiosis in broiler chickens aged 22-42 days (Nematollahi et al., 2009; Kumar et al., 2014).

According to the present study, the season had no significant influence on the prevalence of coccidiosis in broiler chickens. Nevertheless, the rainy seasons indicated a greater prevalence (11.63%) compared to the winter (6.76%) and summer (5.97%). The disease was detected in broiler chickens throughout most of the year; however, it was most prevalent during the rainy seasons (10.91%), followed by summer (7.31%), and least prevalent in winter (2.37%), as reported by Al Mamun et al. (2019), which is consistent with the present findings. The higher prevalence of coccidiosis in the rainy seasons is attributed to warm and humid conditions that enhance the sporulation, survival, and transmission of *Eimeria* oocysts.

The highest prevalence of coccidiosis infection in layer chickens (18.60%) was detected in the less than 8-week age groups, with no significant difference observed. The highest prevalence (6.3%) of coccidiosis in layer chickens was recorded by Islam et al. (2020b) in the 0-8-week age group, while 4.9% was recorded in the 9-20-week age group, and none was recorded in the over 20-week age group, in the Gazipur district of Bangladesh. In contrast, Semaka et al. (2022) reported different results, with the highest prevalence of coccidiosis at 83.3% in the 25-30-week age group. The prevalence then decreased to 65%, 64.3%, 58.3%, 53.8%, and 40%, respectively, in the over 30-week, 1-6-week, 7-12-week, 19-24-week, and 13-18-week age groups in layer chickens. The crowding factor may be responsible for the variations in results across different age groups of layer chickens.

The present investigation revealed that the highest prevalence of coccidiosis in layer chickens (16.67%) was in the summer, followed by the rainy (12.28%) and winter (8.70%) seasons, with no significant difference. According to Adhikari et al. (2008), the summer and spring seasons had the highest prevalence of coccidiosis (33%), followed by the winter season (23%), while the autumn season had the lowest frequency (14%) in layer chickens. These findings are consistent with the present study. However, Al Mamun et al. (2019) reported coccidiosis prevalence in layer chickens as 11.48% during the rainy seasons, 8% in summer, and 7.78% in winter. Due to the hot and humid conditions in summer, coccidiosis is more prevalent during this season.

In Sonali chickens, the incidence of coccidiosis was found to be significantly associated with age, with chickens aged 21-50 days being mostly affected. These results are consistent with those of Islam et al. (2020c), who demonstrated that coccidiosis was significantly more common in chickens aged 5-9 weeks (20.0%), and less common in chickens aged 1-4 weeks (5.3%) in the Sirajgonj district of Bangladesh. Similarly, Belal (2017) reported that the prevalence of coccidiosis was higher (47.50%) in grower chickens, aged 5-16 weeks, as compared to 23.75% in younger chickens, aged 1-4 weeks, and with a minimum prevalence (10%) in adult chickens over 16 weeks of age. These investigations also supported the present results. It has been noted that coccidiosis primarily affects young chickens during the rainy seasons (Kaboudi et al., 2016).

Seasons did not significantly affect the prevalence of coccidiosis in Sonali chickens. However, the rainy seasons were found to be the most prevalent. Coccidiosis was more prevalent in the rainy seasons (29.17%) than in winter (18.42%) and summer (16.41%; Tipu et al., 2021), which is consistent with the present investigations. In contrast, Al Mamun et al. (2019) reported that the summer season had the highest prevalence (16.85%) in Sonali chickens compared to the rainy (12.50%) and winter (3.92%) seasons.

CONCLUSION

The present study emphasized coccidiosis as a persistent and economically significant disease affecting the poultry sector in the Pirojpur district of Bangladesh. The highest prevalence was found in Sonali chickens among the commercial

breeds, with an overall prevalence rate of 13.78%. *Eimeria tenella* was the most common species, followed by *E. acervulina*, *E. maxima*, *E. brunette*, and *E. necatrix*. Additionally, it was demonstrated that the seasons and ages were associated with the incidence of chicken coccidiosis. Targeted strategies in poultry farming are crucial for long-term success, given the importance of specific *Eimeria* species, their prevalence, and the associated economic and health consequences. It is recommended to conduct molecular-based studies on the epidemiology and risk factors associated with the incidence of chicken coccidiosis in similar areas.

DECLARATIONS

Competing interests

The study reported in this manuscript is free from any conflicting financial interests or personal relationships, as declared by all authors.

Ethical considerations

The authors affirmed that all ethical considerations, including plagiarism, publication permissions, research misconduct, and duplicate submission or publication, have been thoroughly addressed in accordance with the Journal's standards.

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Author's contributions

This study was carried out in collaboration among all authors. Md. Sahidul Islam, Dilruba Akter Mir, Syidul Islam, Md. Anwar Jahid and Nasrin Akter Sumona designed the study, conducted the laboratory analysis, performed the statistical analysis, and wrote the protocol. Dabobrata Kumar Swar, Nasrin Akter, Sharmin Zaman, and Mosammat Mahamuda Khatun contributed to sample collection and initial draft writing of the manuscript. Md. Ashraful Islam, Md. Asaduzzaman Lovelu, and Md. Emran Nazir managed the literature searches, interpreted the results, and conducted the critical review. All authors read and approved the final edition of the manuscript.

Availability of data and materials

The data are available upon reasonable request from the corresponding author.

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