Research Article

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Prevalence of Coccidiosis Among Broiler Farms in Duhok Province, Iraq

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Abstract

This study aimed to determine the prevalence of coccidiosis in broiler farms in Duhok Province, Iraq. A cross-sectional study was performed in Duhok province from June to October 2023. A total of six hundred intestines and cecal specimens were randomly collected from 20 farms in different regions of Duhok City and its surrounding regions, such as Botia, Mangishk, Zaiwa, Amediy Sumel, Zako, and Shekhan. A total of 600 fresh fecal samples were collected from the intestine and ceca after slaughtering chickens of different ages ranging between 2-6 weeks old, and the parasitological examinations were carried out using standard methods by using both direct fecal and flotation fecal methods for searching for coccidian oocysts. In addition, a total of 600 intestines with ceca were collected from the chickens of the same farm for the gross examination and detection of any pathological changes in the intestine and the ceca. The study findings revealed a high prevalence rate of coccidiosis (60%) among broiler farms in Duhok Province Regarding ages, 4-6 weeks were observed to be the most prevalent for infection (66.56%) compared to other age groups. This study revealed that the infection rate of coccidiosis in the months of October, September, and August was highly prevalent with coccidiosis (31.5%, 28.2%, and 21.6%, respectively), and the infection rate was lower in July and June (9.8% and 8.9%). According to the gross examination, most cases showed positive for *Eimeria tenella* (44.33%), which indicates cecal coccidiosis, and (55.7%) were positive with other *Eimeria* spp. Mixed infections with coccidian species were recorded. In conclusion, the prevalence of coccidiosis among broiler farms was high in this study, especially cecal coccidiosis, and this is

associated with several risk factors, such as poor management, bad ventilation systems, humidity, and inadequate biosecurity systems on the farms.

Keywords: Broiler, Cossidiosis, Cecal Coccidiosis, *Eimeria tenella*, Prevalence, Duhok**.**

Introduction

Coccidiosis is an enteric protozoan disease of poultry caused by the intracellular intestinal protozoan parasite named *Eimeria* species (1). There are nine species of *Eimeria*, and *E. tenella*, considered the most common and pathogenic one, responsible for high morbidity and mortality in poultry (2, 3). *Eimeria* affects the epithelial cells of the intestine and the ceca of birds between the ages of 3 weeks and 17 weeks (4). It multiplies in the intestine and causes severe tissue damage that leads to lower feed intake, poor absorption of nutrients, dehydration, blood loss, and secondary bacterial infections (1,2). Broiler coccidiosis is controlled by the inclusion of anticoccidial drugs in the feed (5). Identification of *Eimeria* species based on morphological features of the sporulated oocyst, sporulation time, and location of lesions within the intestine (4,5). Coccidiosis is usually controlled by hygienic measures, anticoccidial drugs, and vaccines (6,7). This study aimed to determine the prevalence of coccidiosis among broiler farms in Duhok Governorate, Iraq.

Material and Methods

Study design and Study area: A cross-sectional study was performed in Duhok province from June to October 2023. A total of six hundred intestines and cecal specimens were randomly collected from 20 farms in different regions of Duhok City and its surrounding regions, such as Botia, Mangishk, Zaiwa, Amediy Sumel, Zako, and Shekhan. Duhok City is embraced by two chain mountains, Bekhair to the north and northeast and Zaiwa, as shown in Figure 1. Duhok City is located in Northwest Iraq and the western part of Kurdistan. Duhok Governorate has rainfall that usually occurs during winter and spring and ranges between (89-415 mm). The temperature varied between 12-45ºC, and RH was never less than 44%.

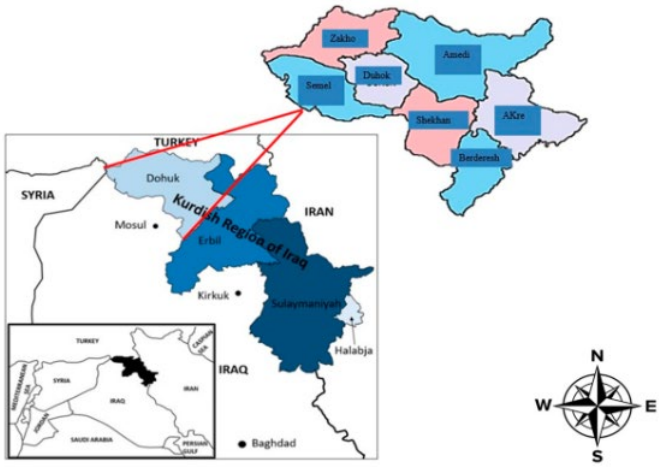

Figure 1: Map show the locations of farms were selected in the present study (10)

Sampling and Methods: Six hundred fresh intestines and cecal specimens were collected from chickens of different ages ranging between 2-6 weeks old. The parasitic examinations were carried out using standard methods, such as both direct fecal and concentration flotation methods, for searching for coccidian oocysts. A direct stool smear examination was performed using previously mentioned methods (8). The first was the direct fecal examination; a small amount of stool sample was mixed with a few drops of normal saline (0.85%), put on a cover slide, and examined directly under the microscope. From each sample, at least three slides were prepared and examined (8,9). The second one was by the concentrated flotation method by using a saturated sugar solution (1800 grams of sugar/1000 ml of distilled water), mixed with about 2 grams of the intestinal content and mixed with 20 ml of the saturated sugar solution and filtered through double layers of the gauze. The filtered solution was poured into a test tube and filled the top, and a cover slide was put on and left for at least 30 minutes. Then, the cover slide was removed, put on another clean slide, and examined under the microscope (9). After postmortem examination, all collected intestines and ceca were examined for any pathological lesions on the intestine or ceca (9,10).

Statistical Analysis: The statistical analysis was performed using analysis of variance (ANOVA). The values were statistically significant when $p < 0.05$

Results

Microscopic Examination:

Out of 20 broiler farms in the current study, only 12 were positive for coccidiosis. Out of all examined fecal samples, 50.83% (305/600) collected from the litters were positive with oocysts of coccidiosis, as shown in Table (1) and Figure (2), and 22.5% (135/600) of the intestine and cecal specimens were detected with *Eimeria tenella* mentioned in Table (2). Some positive cases of cecal coccidiosis were found with mixed infections with different species of *Eimeria* 42 (31.11%), as mentioned in Table 4. This variation was statistically significant at P value < 0.05.

Table 1: The prevalence rate of coccidiosis in broiler farms in Duhok Province, Iraq:

Total examined fecal samples	Positive samples (No.)	Negative Samples (No.)	%
600	305	295	50.83

*The P value = 0 .001 and this is statistically significant at P value < 0.05.

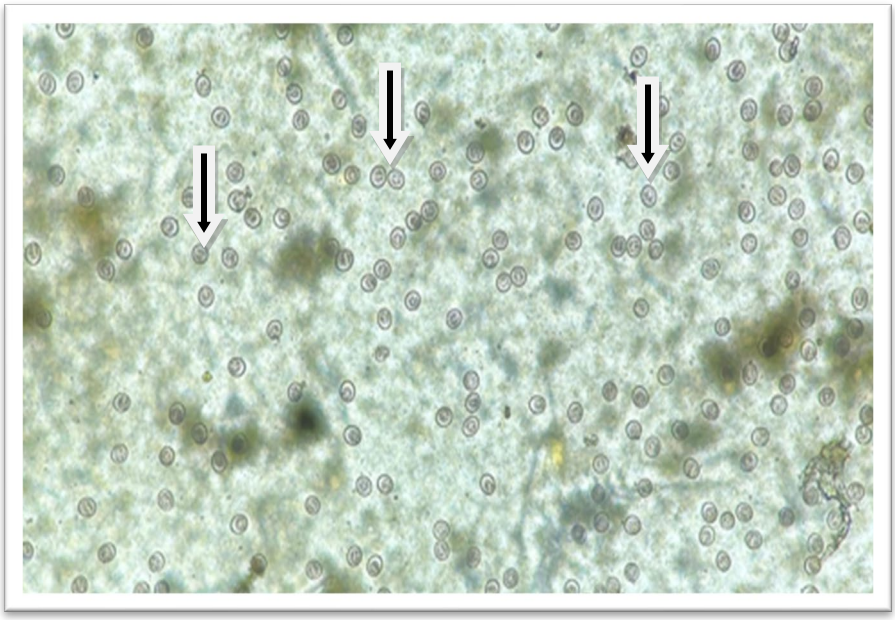

Figure 2: Oocysts of Coccidia in the fecal sample with flotation concentrated method (using saturated sugar solution) under the microscope (10 X)

It is clear from Table (2) that the prevalence rate of coccidiosis was higher in the age group between 4-6 weeks followed by age groups 2-4 and 6-8 weeks, and the lowest prevalence rate was recorded in the age group between 1-2 weeks. This difference was statistically significant at P value < 0.05.

The present study revealed that October, September, and August were highly prevalent with coccidiosis (31.5%, 28.2%, and 21.6%) respectively, and the infection rate was lower in July and June (9.8% and 8.9%) respectively, as seen in Table 3. This variation was due to increased humidity increase in humidity during the autumn season, which increased the risk of coccidiosis in farms.

Table 2: The prevalence of coccidiosis in positive broilers chicken by direct fecal examination according to age of chickens.

Age Group	Positive samples (No.)	%
1-2 weeks	0	0.0
2-4 weeks	60	19.67
4-6 weeks	203	66.56
6-8 weeks	42	13.771
Total	305	100.0
The P value = 0 .001 and this is statistically significant at P value < 0.05.		

Table 3: The prevalence of coccidiosis in positive broilers chicken by direct fecal examination according to months of the study

Month	Positive samples (No.)	%
June	27	8.9
July	30	9.8
Augusts	66	21.6
September	86	28.2
October	96	31.5
Total	305	100.0
The P value = 0 .001 and this is statistically significant at P value < 0.05.		

Postmortem Examination

Regarding macroscopic examination, about 44.3% (135/305) of ceca samples were found filled with clotted blood and the presence of severe hemorrhage on the mucous of the ceca, and this indicated identical lesions of the cecal coccidiosis in chicken (*Eimeria tenella*) and the other 55.7% (170/305) of intestine samples were positive with other species of *Eimeria* as clear from the Table 4 and Figures 3, 4, and 5.

Table 4: The prevalence of coccidiosis among broiler chickens in farms of Duhok Province, Iraq.

No. of examined intestines and ceca	Positive samples (*No.*)	%	Positive samples (No.)	%
305	135	44.31	170	55.7

*The P value = 0 .001 and this is statistically significant at P value < 0.05.

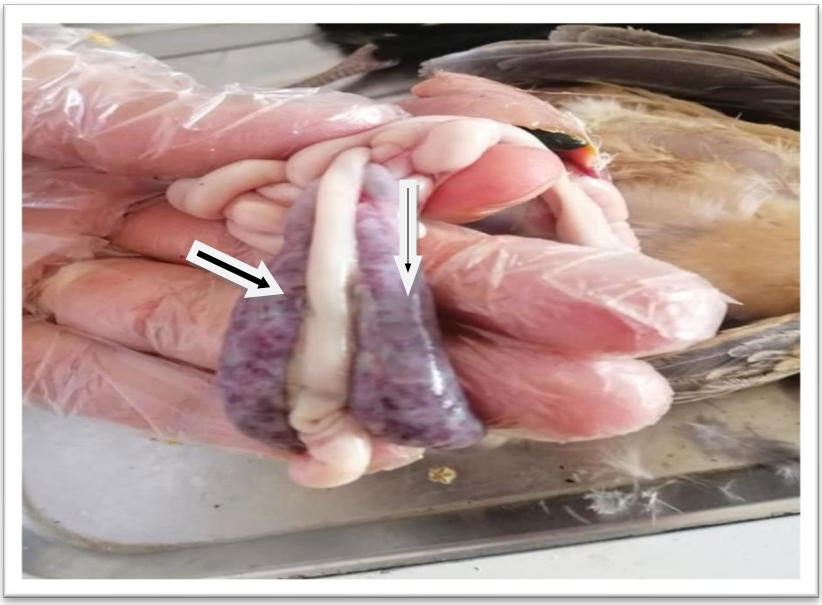

Figure 3: Severe cecal coccidiosis, ballooned shaped ceca filled with clotted blood (*Eimeria tenella*)

Figure 4: Severe cecal coccidiosis (*Eimeria tenella*)

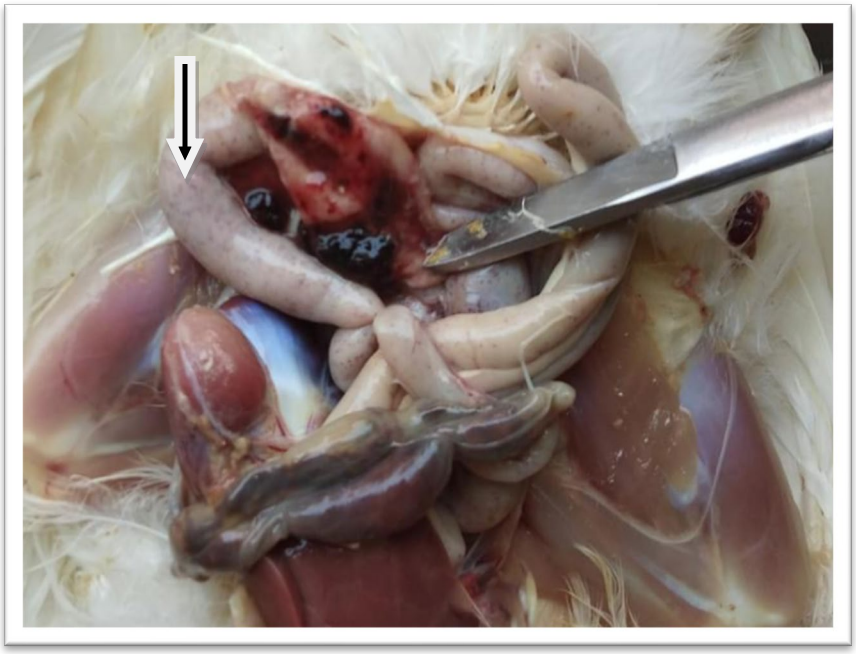

Figure 5: Hemorrhage on the mucous on the intestine (mixed infection including *Eimeria tenella* and other *Eimeria* spp.)

According to the location of lesions within the intestine and ceca samples, 93 (68.89%) were positive for *Eimeria tenella*, and 42 (31.11%) of ceca were found positive for *Eimeria tenella* and with other species of *Eimeria* as seen in Table 5. This is statistically significant at P value < 0.05.

Table 5: The cecal coccidiosis (*Eimeria tenella*) infection was found with mixed infections of other *Eimeria* spp.

Type of Infections	Positive (No.)	%
Cecal coccidiosis (E*imeria tenella*)	93	68.89
Mixed infection (*E. tenella* and other *Eimeria* spp)	42	31.11
Total	135	100.0
The P value = 0 .001 and this is statistically significant at P value < 0.05.		

Discussion

The current research results revealed that coccidiosis was prevalent throughout the investigated area. The overall prevalence rate of coccidiosis among broilers was high in the current study at 0.83% (305/600), which is statistically significant at a P value < 0.05. The difference in the prevalence rate of coccidiosis could be brought about by

variations in weather and climate, availability of sufficient knowledge about coccidiosis in poultry, and variations in farm management strategies (11). The present research findings agreed with the previous Meteab et al. (12) recorded in Diwaniya City, Iraq. Also, this finding was somewhat similar to the results reported by Gharekhani et al. (13), who showed that the highest prevalence in Iran was (49.1%). However, the current research result in a line of study done in Bejaia Province, Algeria, was high (54.28%). Several factors are associated with the high prevalence of coccidiosis in farms in the present study, such as inadequate management methods in broiler breeding, such as leaking water, accumulation of feces, inadequate cleanliness, limited ventilation, and a high population density. The current research findings disagree with the record made by Razmi & Ali Kalideri (14), who recorded a lower prevalence rate of coccidiosis (23.80%) in a study in Iran.

The present study recorded a high prevalence rate of coccidiosis statistically significantly at $P<0.05$ in the ages 4-6 weeks, followed by ages 2-4 weeks and 6-8 weeks, and a low rate in ages. This difference agrees with several studies (15,16,17). Another study suggested that poultry of all age groups are susceptible to coccidiosis (18). he rate of occurrence is directly linked to the age group. This is because different age groups consume different amounts of sporulated oocysts during their life cycle. This is due to the immunity that the mother confers on poultry aged 1-2 weeks. Therefore, this age group showed a low prevalence rate of infection (18).

The current study revealed that October, September, and August were highly prevalent with coccidiosis (31.5%, 28.2%, and 21.6%), respectively, and July and June (9.8% and 8.9%), respectively. Awais et al. (19) (20) and Khan et al. (21) recorded that the prevalence rate of coccidiosis was higher in the autumn than in the summer, and this agrees with the current result. The high rate of infection in the Autumn season is due to optimal temperature and the high humidity in autumn are favorable for the sporulation of oocysts and sporulated oocysts are the infective stage for coccidiosis and poultry infected with it by ingestion of sporulated oocysts (21).

Regarding macroscopic examination, overall, 44.3% of ceca samples were reported positive for *Eimeria tenella*, the most pathogenic one, which is responsible for mortality and morbidity in farms, and 55.7% were positive for other species of *Eimeria.* A similar study in Pakistan showed that the most common *Eimeria* that infected poultry was *E. tenella* (22). Also, 68.89% of ceca samples were positive only for *Eimeria tenella*, and 31.11% of ceca were found to have mixed infection with *Eimeria tenella* and other Eimeria species. *E*As *Tenella* colonizes the intestinal ceca and quickly replicates within the epithelial cells of the ceca, it causes severe hemorrhage, epithelial damage, a ceca filled with clots of blood and mucus, and hemorrhagic enteritis with bloody droppings. All of these things weaken the bird's immune system, change

the intestine's structure and function, and cause the bird to lose weight. (23, 24).

Mixed infection was present in this study, and 42(31.11%) cases of Eimeria tenella were found with other Eimeria spp., which increased the severity of the infection. Similar results were published in the two studies by Györke et al. (25) and Liao et al. (26). They found cecal coccidiosis in broilers with mixed infection. These results also agreed with the result observed by Haug et al. (27), who detected the mixed infection in the same broiler.

Finally, the present study diagnosed cecal coccidiosis based on the gross examination of all intestines and the intestinal ceca of infected chickens and revealed that 135 (22.5%) cases of intestinal ceca were shown with severe hemorrhagic on the mucous of intestinal ceca and extended ceca filled with blood. The same gross lesions were documented by (18, 28, 29).

Conclusion

The current study findings showed that the highest rate of coccidiosis among chickens was higher in the autumn season, and the highest rate of coccidiosis among chickens was higher in autumn than in summer. The rate of coccidiosis regarding age groups was high in the ages 4-6 weeks, followed by ages 2-4 weeks and 6-8 weeks, and the lower rate in ages 0-2 weeks. Also, the present study found that the most prevalent and pathogenic species was *Eimeria tenella*. Reducing the rate of coccidiosis among broiler farms is related to an effective biosecurity system because biosecurity is considered the main factor associated with coccidiosis occurrence. Therefore, biosecurity should be put at the top of the prevention and control of coccidiosis.

Conflicts of interest

The authors declare that there is no conflict of interest.

Ethical Clearance

This work is approved by The Research Ethical Committee.

Acknowledgement

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انتشار الكوكسيديا بين مزارع الدجاج اللحوم في محافظة دهوك بالعراق

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4-قسم علوم أساسية، كلية اسنان، جامعة دهوك، دهوك، العراق.

الخلاصة

هدفت هذه الدراسة إلى تحديد مدى انتشار الكوكسيديا في مزارع الدجاج اللاحم في محافظة دهوك بالعراق. تم إجراء دراسة مقطعية في محافظة دهوك من يونيو إلى أكتوبر 2023. تم جمع ما مجموعه ستمائة عينة من الأمعاء والأعمدة بشكل عشوائي من 20 مزرعة في مناطق مختلفة من مدينة دهوك والمناطق المحيطة بها، مثل بوتيا ومانجيشك وزايوا وأميدي سوميل وزاكو وشخان. تم جمع ما مجموعه 600 عينة براز طازجة من الأمعاء والسيكا بعد الذبح من دجاج من مختلف الأعمار تتراوح أعمارهم بين 2-6 أسابيع، وتم إجراء الفحوصات الطفيلية باستخدام الطرق القياسية باستخدام طرق البراز المباشر والطفو للبحث عن البويضات الكوكسيدية. بالإضافة إلى ذلك، تم جمع ما مجموعه 600 أمعاء مع زيكا من دجاج نفس المزرعة للفحص الإجمالي والكشف عن أي تغيرات مرضية في الأمعاء والسيكا. كشفت نتائج الدراسة عن ارتفاع معدل انتشار الكوكسيديا (60٪) بين مزارع الدجاج اللاحم في محافظة دهوك. فيما يتعلق بالأعمار، لوحظ أن الأعمار من 4 إلى 6 أسابيع هي الأكثر انتشارا للعدوى (66.56٪) مقارنة بالفئات العمرية الأخرى. كشفت هذه الدراسة أن معدل الإصابة بالكوكسيديا وفقا للأشهر، أكتوبر وسبتمبر وأغسطس كان منتشرا بشكل كبير مع الكوكسيديا (31.5٪ و28.2٪ و21.6٪ على التوالي)، وكان معدل الإصابة أقل في يوليو ويونيو (9.8٪ و8.9٪). وفقا للفحص الإجمالي، أظهرت معظم الحالات إيجابية ل *Eimeria tenella* (44.33٪)، مما يشير إلى الكوكسيديا الرأسية، و (55.7٪) كانت إيجابية مع Eimeria spps الأخرى. تم تسجيل إصابات مختلطة بأنواع الكوكسيدية. في الختام، كان انتشار الكوكسيديا بين مزارع الدجاج اللاحم مرتفعا في هذه الدراسة، وخاصة الكوكسيديا الرأسية، ويرتبط ذلك بالعديد من عوامل الخطر مثل سوء الإدارة، وأنظمة التهوية السيئة، والرطوبة، وعدم كفاية أنظمة الأمن البيولوجي في المزارع.

الكلمات المفتاحية: الدجاج اللاحم، داء الكوسيديا، داء الكوكسيديا العصبي، إيميريا تينيلا، الانتشار، دهوك.