Indian Veterinary Magazine
a monthly Magazine
of the people, by the people, for the people

Vol 2 Issue 7 July 2026, 897-903 ISSN:3108-1398

Poultry Coccidiosis: A Hidden Threat to Healthy Flocks

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doi.org/10.5281/IndianVetMagazine.21524417

Key Points

- **Coccidiosis** is a major intestinal disease of poultry caused by *Eimeria* species, leading to poor growth, reduced feed efficiency, and economic losses.
- **Early diagnosis and timely treatment** with appropriate anticoccidial drugs are essential, while drug rotation helps prevent resistance.
- **Effective prevention** relies on good litter management, biosecurity, vaccination, hygiene, and regular flock health monitoring.

Abstract

Coccidiosis is one of the most significant parasitic diseases affecting commercial and backyard poultry flocks globally. It is caused by a number of *Eimeria* species, which infiltrate the intestinal lining, hinder the absorption of nutrients, and stunted growth and production. Poor feed intake, depression, ruffled feathers, diarrhoea (often bloody), dehydration, weight loss, and increased mortality especially in young chickens are common symptoms of infected birds. Early diagnosis and treatment with the right anticoccidial drugs or supportive therapy can prevent production losses and lessen the severity of the illness. Long-term control, however, depends on an integrated management strategy that includes vaccination or the strategic application of anticoccidial drugs, stringent biosecurity, appropriate litter management, healthy diet, and routine flock health monitoring. By implementing these evidence-based preventive strategies, the financial burden of coccidiosis is lessened and disease outbreaks, bird welfare, and sustainable chicken production are all improved

Introduction

According to United Nations World Population Prospects, there will be 8.5 billion people on the planet in 2030 and 9.7 billion in 2050. The demand for animal protein which includes both meat and eggs has increased dramatically as a result of this population rise. One of the main sources of animal protein in the globe has always been the poultry industry (Fao, 2025). The availability of inexpensive protein for human consumption will be greatly impacted by any disturbance in the production process caused by infections. Coccidiosis is one of the diseases that impairs the effectiveness of poultry mass production systems; it can endanger global food security and seriously harm the poultry industry's finances (Lee *et al.,* 2022). Protozoa of the phylum Apicomplexa, family Eimeriidae, are the cause of coccidiosis, an intestinal disease that affects chickens. The principal organ for digestion and food absorption is the gastrointestinal epithelial cells, which are infected by these obligatory intracellular parasites (Wickramasuriya *et al.,* 2022). The sickness progresses quickly (4–6 days) and is marked by widespread intestinal mucosal destruction and parasite proliferation in host cells. Malabsorption, enteritis, and an increase in mortality are among the consequences of infection that jeopardise both comfort of birds and economic output (Blake *et al.* 2020). There are a number of ways to prevent coccidiosis, including farm-level management techniques, synthetic chemicals, vaccinations, and anti-coccidials like ionophores.

Etiology

Theodor Eimer (1843–1898), a German zoologist, is credited with discovering the genus. In 1674, Anton Von Leeuwenhoek discovered the oocyst of *Eimeria steidai* in a rabbit's bile. The seven species of Eimeria (*E. acervulina, E. maxima, E. tenella, E. mitis, E. praecox, E. brunetti, and E. necatrix*) cause site-specific intestinal infections in chickens. For instance, the duodenum is infected by *E. acervulina*, the ileum and jejunum by *E. maxima*, the cecum by *E. tenella*, the ileum and rectum by *E. brunetti*, and the jejunum and caeca by *E. necatrix* (Britez *et al.,* 2023). The most dangerous species include *E. tenella, E. necatrix, and E. Brunetti*, which have significant rates of illness and fatality. *E. acervulina* and *E. maxima* are somewhat dangerous. The least dangerous bacteria that attack the duodenum are *E. mitis* and *E. praecox*.

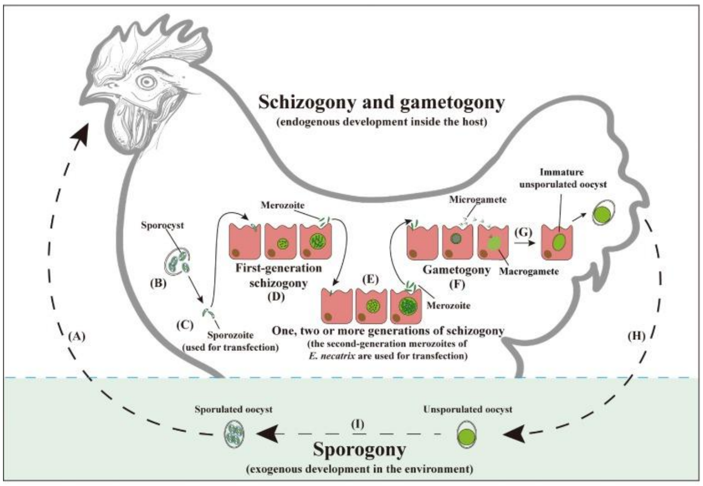
Poultry	**Species**	**Predilection site**	**Lesions**
Chicken	*E. tenella*	Cecum	Accumulation of blood in the cecum.
Chicken	*E. necatrix*	Jejunum, Ileum, Cecum	Thickened intestinal wall with petechial hemorrhage. The intestinal lumen is filled with blood, mucus, and fluid.
Chicken	*Eimeria acervulina*	Duodenum	Whitish, transverse patches in the upper half of the small intestine.
Chicken	*E. maxima*	Jejunum, Ileum	Thickened intestinal wall with

			petechial hemorrhage.
Chicken	*E. mitis*	Duodenum, Jejunum	Mild enteritis
Chicken	*E. brunetti*	Cecum and Rectum	Thickened intestinal wall with petechial hemorrhage.
Chicken	*E. praecox*	Duodenum	Mild enteritis
Turkey	*E. gallopavonis*	Ileum	White spots on the mucosa
Turkey	*E. adenoeides*	Ceca	Normal cecal contents are replaced with watery cecal contents
Turkey	*E. meleagrimitis*	Duodenum and jejunum	Thickened intestinal wall with petechial hemorrhage

Different *Eimeria* sp. affecting Poultry, predilection site and lesions (Nawarathne *et al.,* 2021).

Life Cycle

The oocysts, which contain a zygote that protrudes from the host tissue and is excreted in the faeces, are the first stage of the coccidiosis life cycle. Oocysts are not contagious or sporulated. Under specific temperature and moisture conditions, they undergo sporulation before becoming contagious. The transformation of oocysts from a non-infectious to an infectious state is known as sporulation. In the presence of warmth, 20–30% moisture, oxygen, and temperatures between 25ºC and 30ºC, sporulation takes one to two days. This is a crucial component in the development of coccidiosis. These sporulated oocysts are consumed by the host. In the presence of CO_2, bile, and trypsin, the sporocysts undergo excystation, which produces motile sporozoites. The Stieda body, a protein and carbohydrate plug found in the sporocyst's pointed and narrow end, is removed by the sporozoites inside each sporocyst, allowing the sporozoites to exit into the oocyst cavity. Through the oocyst micropyle, they are released into the intestinal lumen through a process known as excystation. After invading the enterocytes, the sporozoites transform into trophozoites and begin a 12- to 48-hours parasite feeding cycle. First-generation merozoites are created when the trophozoite's nucleus divides by schizogony. After entering epithelial cells, these merozoites continue to reproduce asexually, creating the second generation of schizonts. Under ideal circumstances, these second-generation schizonts mature into micro and macro gametes. Oocysts are produced when these gametes fertilise (syngamy), extrude from the host tissue, and are eliminated in faeces. The time required to complete asexual and sexual reproduction and generate oocysts determines how long the parasite's endogenous or internal phase lasts. *E. tenella* has a life cycle of seven days and a prepatent phase of four to five days. Millions of oocysts can be found in a tiny volume of excrement from a bird with severe coccidiosis. Coccidiosis can result from consuming as few as 10,000 sporulated oocysts.



Life cycle of *Eimeria* sp. in poultry.

Clinical Signs and Lesions

In poultry coccidiosis, lesions occur mostly in intestines and are species-specific. Commonly observed clinical signs are listed below:

- Droopiness
- Listlessness
- Blood or mucus in droppings
- Dehydration
- Pale comb and wattle
- Loss of yellow shank (Habtamu *et al.,* 2019)

Diagnosis

Clinical symptoms, faecal examination for oocysts, gross lesion appearance, oocyst shape, and sporulation time are used to diagnose coccidiosis infections. (Conway and Mckenzie. 2007).

Oocyst examination in faecal droppings: As a suggestive marker for subclinical infections, faecal droppings are analysed using concentration techniques like saturated salt or sugar solution. A low-power objective microscope (10X) is used to examine the sample.

Post-mortem lesions: Both internal and external intestinal lesions should be closely examined during a post-mortem examination. The accumulation of blood in the caeca for *Eimeria tenella*, the presence of small white spots adorned with rounded bright or dull red spots for *Eimeria* *necatrix*, whitish transverse patches in the upper half of the small intestine for *Eimeria acervuline* and *Eimeria mivati*, and coagulative necrosis coupled with sloughing of the mucosa throughout the entire intestine for *Eimeria brunetti* are all indicative of the infection (McDougald and Fitz-coy 2008).

Molecular diagnosis: The molecular approach uses a PCR experiment to amplify a particular gene found in the Eimeria parasite's DNA sequences. Using particular primers in the PCR, Multiplex PCR, and qPCR processes, ITS-1 and ITS-2 sequences have been extensively used to identify all nine Eimeria species in chickens (Hamidinejat *et al.* 2010).

Treatment

Various anticoccidial drugs are available for use, broadly these are either Ionophores or Non-ionophores. Anti-coccidial drugs available in market and their application in mg/kg of poultry feed are mentioned in the following table:

Category	Anti-coccidial drug	Dosage (mg/Kg of feed)
Polyether ionophore	Maduramycin	5
	Salinomycin Sodium	50-70
	Monensin Sodium	100-125
	Semduramycin Sodium	20-25
	Lasalocid Sodium	75-125
	Narasin	60-70
Non-polyether ionophore	Nicarbazin	40-50
	Robenidine hydrochloride	30-36
	Halofuginone	2-3
	Diclazuril HCl	1

Resistance is a common issue with anticoccidial use. Long-term use of the same anticoccidial drug results in resistance to that drug. Long-term use of the same anticoccidial drug can lead to cross-resistance, which is resistance to both the drug and other drugs in the same class. After a predetermined amount of time, switching from one anticoccidial molecule to another of a different class using either full or shuttle programs is the only way to address resistance and cross-resistance.

- **Full Program:** One molecule is used in all feed types, including finisher, starter, and pre-starter.
- **Shuttle program:** Using one molecule in one feed phase and another in another, such as one molecule up to the starter and another in the finisher.

Management and Control

Adopting efficient management techniques is necessary to prevent chicken coccidiosis (Ashenafi *et al.* 2004). The best strategy for preventing avian coccidiosis combines the use of anticoccidial chemicals in feed or water with good management techniques. Maintaining dry litter is essential, especially in areas close to feeding troughs (Taylor *et al.* 2007). Immunisation, genetics, and hygiene are now key components of control methods (Jordan *et al.* 2002). In order to stop infections from entering the farm, biosecurity precautions are essential. During the rainy season, when moisture and temperatures ideal for oocyst sporulation are common, more caution is needed.

The following biosecurity precautions are taken to keep Eimeria parasites from entering the farm:

1. **Isolation:** Birds should be kept apart from their surroundings by using fencing, and access by other animals, such as insects and rodents, should be limited.
2. **Traffic control**: To stop the possible spread of infections, this precaution should be applied both within and between farms.
3. **Sanitation:** According to Peek *et al.* (2011), this entails cleaning all materials, people, and equipment that enter the farm and poultry house.

Immunoprophylaxis

Significant immunogenicity is exhibited by Eimeria species, and initial infections can produce significant immunity against comparable threats. As a result, immunological management has been recognised as the main workable substitute for chemotherapy in the treatment of coccidiosis.

Subunit Vaccine: The pathogenic organism's purified antigenic component is used in subunit vaccinations. These vaccines can be made using a variety of technologies and may include native antigens or recombinant proteins made from the DNA of the Eimeria parasite's developmental stages, including gametes, merozoites, and sporozoites. A subunit vaccine called CoxAbic protects chicken from coccidiosis by inducing the generation of maternally derived antibodies.

Attenuated Vaccine: The strains of *Eimeria spp.* used as attenuated vaccines have reduced pathogenicity through laboratory modification. As with *E. tenella* in Livacox vaccines, this decrease in virulence is accomplished through the parasite's repeated passages in chicken embryos.

Conclusion

In the poultry sector, coccidiosis is common and causes large financial losses. The cost incurred for treatment, mortality, culling, control and preventive measures are the main sources of the financial burden. A renewed emphasis on management measures is required due to the disease's recurrence and the emergence of novel Eimeria strains in different geographical areas. Implementing good hygiene practices and giving anticoccidial drugs at approved dosages are essential for managing and preventing coccidiosis. Coccidian oocyst accumulation in intensive production systems can be reduced by choosing a cage method of housing over a deep litter system. The all-in, all-out production technique should be used in intensive farm systems, and it is also desirable to avoid housing different age groups of hens in the same facility.

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