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Popular Article

Coccidiosis In Poultry

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Coccidiosis is an intracellular protozoan infection caused by Eimeria sp, which are highly host-specific. The poultry birds are usually affected by seven species of Eimeria (*E. acervulina, E. brunetti, E. maxima, E. mitis, E. necatrix, E. praecox* and *E. tenella*), out of which *E. acervulina, E. maxima, E. necatrix* and *E. tenella* are more pathogenic having an economic impact. Coccidiosis varies significantly in its severity and subsequent impact on health and productivity of the flock, depending on the species, infectious dose, age and immune status of the infected bird.

Due to the significant economic and animal welfare impacts of coccidiosis, the need for management and control of *Eimeria* sp is essential for poultry industry.

Life cycle of Coccidia

The life-cycle is short, has a direct life cycle, has both sexual and asexual stages and begins with the bird ingesting sporulated oocysts. The sporulated oocysts contain four sporocysts (each with two sporozoites) and inside the gut, there is release of sporocysts and sporozoites. Sporulated oocysts can survive outside the host for very long periods. At suitable temperature of 25-30˚C, sporulation takes place within 1-2 days The sporozoites invade the duodenal mucosa epithelial cells before undergoing phases of growth and multiplication with release of merozoites. There are three development phases: schizogony (agamogony/merogony with formation of merozoites), gametogony (gamete formation for sexual reproduction), and sporogony. The merozoites develop within the duodenal cells as gametes, in the form of both macro- and microgametocytes. These develop into a zygote and then an oocyst which is shed in

the feces. The transmission occurs via fecal-oral route and infection begins with the ingestion of sporulated oocysts.

Impact of climatic factors

The coccidian oocysts have a thick wall, resistant to most disinfectants. High temperature of more than 50 °C and ammonia can act on the oocyst. Also, high humidity levels (75% and more) influence the survivability and sporulation of oocyst. Usually, wet and damp surroundings of poultry houses facilitate oocyst survivability, the optimal temperature of sporulation being 25–30 °C , though oocysts can survive in temperatures of 4 °C.

Risk factors for coccidiosis in poultry

Young birds, birds reared on litter (especially wet litter), birds having weak immune system are always at risk. High stocking rates and the resulting environmental conditions like poor ventilation are important factors. Warm, wet and under-ventilated conditions are ideal for massive parasite multiplication. When birds are in direct contact with their droppings, then the risk of infection is greatly increased. Poor hygiene related to personnel, feeding and drinking was important.

Pathogenesis and Symptoms

Coccidiosis is common in birds of 3-6 weeks old, before they have acquired immunity. The infected birds have ruffled feathers, blood in the droppings, diarrhea leading to flock mortality. In case of less virulent species, there is poor growth and reduced feed efficiency, along with reduction in feed and water intake. The infected birds suffer from varied clinical manifestations ranging from reduced weight gain, feed conversion, egg-production, malabsorption, diarrhea, severe enteritis and eventually death.

Coccidiosis rarely occurs in layers and breeders as they have acquired immunity to this infection, although in case of breakdown of immunity, the pathogenic *Eimeria* species may cause a severe drop in egg production for about three to six weeks. Due to tissue damage and changes in the intestinal tract, there is chance of co infection with bacteria, like *Salmonella typhimurium*, or *Clostridium perfringens*, causing necrotic enteritis.

The most common form of the disease is cecal coccidiosis due to *Eimeria tenella*, occurring in birds 4 to 6 weeks of age. There is a rise in mortality and affected birds show anaemic appearance. They affect caeca with presence of cecal cores. There is blood in the feces, loss of weight, loss of appetite, anemia, dehydration and diminished skin pigmentation.

In case of *E. acervulina* infection, there is mild to severe coccidiosis. There may be watery or mucoid faeces. The gross lesions in the intestine are usually located in the duodenum, with presence of white plaques but can extend into the rest of the small intestine if the infection is severe.

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E. maxima infection is moderately to severely pathogenic in nature that can cause poor weight gain, diarrhea, ruffled feathers, loss of appetite and pale skin, affecting the mid-gut however, heavy infections can be seen throughout the small intestine. The necrotic lesions show edematous, flaccid and thickened intestine with increased mucus and blood. In severe infections, the mucosa can slough off.

E. brunetti is found mostly in the lower intestine with moderate mortality rates. In the gastrointestinal tract, petechiae, watery contents, thickened mucosa, pallor and, in heavy infection, erosion of the mucosal layer. In faeces, evidence of digested or coagulated blood is observed.

E. necatrix lesions are found in the small intestine, majorly in pullets and older birds. It is pathogenic *Eimeria* spp. causing high morbidity and mortality. There is reduced body weight, fall in egg production, emaciation and secondary infections. In intestine, thickened mucosa and blood leading to a "salt-and-pepper" appearance because of white and black plaques seen in the mucosa.

Diagnosis

The routine methods for the evaluation of *Eimeria* infections include macroscopic diagnosis with observation of clinical signs in infected animals, the location and appearance of gross lesions during necropsy; and microscopic diagnosis, which focuses on evaluating the size and shape of oocysts. The infections can be confirmed by the presence of oocysts in the feces. Microscopic examination may reveal the presence of oocysts, though they don't indicate clinical disease. The causative organisms are identified and classified by morphological characteristics, their location in the intestines, histological examination of lesions and size of meronts in mucosal smears The morphological diagnosis can be complemented by molecular methods like PCR, Random Amplified Polymorphic DNA (RAPD) and Loop-Mediated Isothermal Amplification (LAMP).

Coccidiosis may be diagnosed at post-mortem by the presence of characteristic lesions in the intestinal tract. Scrapings of the intestinal mucosa can be taken to evaluate the presence and shape of oocysts. The intestinal lesion score is complemented with oocysts per gram (OPG) count of feces by McMaster technique.

Chemoprophylaxis

Coccidiostats suppress the development of the parasite and coccidicidal drugs kill the parasite. Anticoccidials should not be used in laying hens because of possible drug residues in eggs for human consumption.

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The anticoccidials can be classified in three categories

1. Synthetic compounds produced by chemical synthesis and has specific mode of action.
   Sulphonamides inhibit folic acid pathway.
   Amprolium, competes for the absorption of vitamin B1 by the parasite.
   Quinolones inhibit the parasite's mitochondrial respiration.
   Other chemicals like Diclazuril, Halofuginone, Robenidine, Decoquinate, Nicarbazin can be utilised for control of avian coccidiosis.
2. Polyether antibiotics or ionophores, produced by the fermentation of Streptomyces spp. or Actinomadura spp. and destroy coccidia by interfering with the sodium and potassium ion balance.

- Monovalent ionophores (monensin, narasin and salinomycin).
- Monovalent glycosidic ionophores (maduramicin and semduramycin).
- Divalent ionophores (lasalocid).

3. Mixed products containing drug mixtures, consisting of either a synthetic compound and ionophore like nicarbazin and narasin.

Poultry housing management

- As the coccidian oocyst accumulate in the litter, feeders and drinkers, high stocking density can lead to rapid transmission through faecal-oral route
- The litter should be dry and there should be proper ventilation of poultry house in order to prevent sporulation of oocysts
- The immunity of the birds can be enhanced by reducing stress factors like overcrowding, high temperatures, feed deficiency and debeaking.
- Preventing the mechanical dispersal of oocysts by changing litter on regular basis.
- Good hygiene of feeding and drinking equipment should be mainlined
- The level of drinkers should be raised as chicks grow to reduce fouling
- If the risk of disease is high, vaccination should be done.
- To avoid development of resistant strains, rotation of chemotherapeutic drugs between flocks, by selecting compounds having different modes of action is essential (anti-coccidial 'shuttle' programs).

Vaccination

Anticoccidial vaccination aims to induce protective immunity against coccidiosis. The first generation of vaccines against coccidiosis consisted of mixtures of wild-type of *Eimeria* oocysts using locally derived strains of parasites without any modification which may differ their natural virulence and were considered to be non-attenuated. Coccivac® having

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E. *tenella* oocysts was the first commercial coccidiosis vaccine launced in 1952. In 1987, Immucox, consisting of sporulated oocysts of *E. acervulina*, *E. tenella* and *E. maxima* was developed.

The second-generation vaccines consisted of live *Eimeria* oocysts from attenuated lines (by heat treatment and x-irradiation). "Precocious" strains of Eimeria populations having short life-cycles, fewer endogenous stages and reduced pathogenicity but with high immunogenicity, has been utilized for attenuated anticoccidial vaccines such as Paracox, Eimerivax, Hipracox, Eimerivac Plus and Immuner Gel-Coc.

Most common methods for vaccine administration include spraying oocysts directly onto newly hatched chicks so that oocysts are ingested during preening, spraying onto food, or by dispersal in drinking water with a viscous agent that keeps oocysts in suspension. Oocyst vaccines can also be administered via eye-drop inoculation at the hatchery.

Probiotic supplementation

The use of probiotics and dietary supplements like essential oils or herbal products has been advocated in recent times. Probiotic additives are live non-pathogenic microorganisms administered through food to improve and maintain gut microbiome as they augment host immune system to protect against intestinal pathogens. Probiotics, such as *Lactobacillus salivarius* and *L. acidophilus*, can alleviate the effects of coccidiosis

Essential oil and organic acid supplementation

Several essential oils have reported antiparasitic action. Oregano, thyme and garlic, have been associated with reduced disease burden by improving body weight gain, reducing oocyst shedding and few pathological lesions They can therefore be supplemented in diets of poultry birds for anticoccidial effects and improving gut health.

Organic acids like acetic and butyrate acid can be supplemented for coccidiosis control due to their effect in improving weight gain, FCR and reducing the shedding of oocyst and lesion scores. They also aid in antimicrobial properties and immune stimulation.

Conclusions

Though it is quite difficult to completely eliminate coccidian infection from the poultry farms at lare, endeavor for strict biosecurity measures, good husbandry practices, supplementation with chemoprophylaxis, usage of alternative control measures, and management of potential risk factors, could be helpful to control avian coccidiosis.

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