

# Coccidiosis



- Phylum: Apicomplexa
- Class: Conoidasida
- Order: Eucoccidiorida
- Family: Eimeriidae
- Genus: Eimeria
- Genus: Isospora

- an **acute invasion** and **destruction** of **intestinal mucosa** by protozoa of the genera *Eimeria* or *Isospora*.
- Characterized by diarrhea, fever, inappetence, weight loss, emaciation, and in extreme cases, death.
- Coccidiosis is an economically important disease of cattle, sheep, goats, pigs, poultry

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- ***Eimeria*** and ***Isospora*** typically require only **one host** in which to complete their life cycles.
- Coccidia are **host-specific**, and there is **no cross-immunity** between species of coccidia.
- Coccidiosis is panzootic, most commonly in **young animals** housed or confined in small areas contaminated with oocysts.

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- Coccidia are **opportunistic pathogens**; if pathogenic, their virulence may be influenced by various **stressors**. Therefore, clinical coccidiosis is most prevalent under conditions of poor **nutrition**, poor **sanitation**, or **overcrowding**, or after the stresses of **weaning**, **shipping**, sudden changes of feed, or severe **weather**.

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- In general, for most species of farm animals, the infection rate is high and rate of **clinical disease** is low (**5%–10%**), although up to 80% of animals in a high-risk group may show clinical signs.
- Most animals acquire *Eimeria* or *Isospora* infections of varying severity when between **1 mo and 1 yr old**.
- **Older animals** usually are **resistant** to clinical disease but may have sporadic inapparent infections.
- **Clinically healthy**, mature animals can be **sources of infection** to **young**, susceptible animals.

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- **Twelve *Eimeria* spp** have been identified in the feces of cattle worldwide, but only three (***E. zuernii*, *E. bovis*, and *E. auburnensis***) are most often associated with clinical disease.
- The other *Eimeria* spp have been shown **experimentally** to be **mildly or moderately** pathogenic but are not considered important pathogens.

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- Coccidiosis is commonly a disease of young cattle (**1–2 mo to 1 yr**).
- “**Summer coccidiosis**” and “**winter coccidiosis**” in range cattle probably result from severe weather stress and crowding around a limited **water source**, which concentrates the hosts and parasites within a restricted area.
- Although particularly severe **epidemics** have been reported in **feedlot** cattle during extremely cold weather, cattle confined to **feedlots** are susceptible to coccidiosis **throughout the year**.

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- Outbreaks usually occur within the first month of confinement. Cows may contribute to environmental contamination of *E. bovis* oocysts through **a periparturient increase** in **fecal oocyst counts**.

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- Infestation with *Eimeria* is one of the most economically important diseases of **sheep**.
- ***E. crandallis*** and ***E. ovinoidalis*** (*ninakohlyakimovae*) are pathogens of lambs (usually 1–6 mo old); *E ovina* appears to be somewhat less pathogenic.
- **Older sheep** serve as **sources of infection** for the young.
- All other *Eimeria* of sheep are essentially nonpathogenic, even when large numbers of oocysts are present in feces.

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- ***E arloingi*** and ***E christenseni*** are highly pathogenic in kids.

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# Pathogenesis

- Infection results from **ingestion** of infective **oocysts**.
  - Oocysts enter the environment in the feces of an infected host, but oocysts of *Eimeria* and *Isospora* are **unsporulated** and therefore **not infective** when passed in the feces.
  - Under **favorable conditions** of oxygen, humidity, and temperature, oocysts **sporulate** and become infective in **several days**.
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- During sporulation, the amorphous **protoplast** develops into small bodies (**sporozoites**) within secondary cysts (**sporocysts**) in the oocyst.
  - In *Eimeria* spp, the sporulated oocyst has **four sporocysts**, each containing **two sporozoites**; in *Isospora* spp, the sporulated oocyst has **two sporocysts**, each containing **four sporozoites**.

- When the **sporulated oocyst** is **ingested** by a susceptible animal, the **sporozoites** escape from the oocyst, invade the **intestinal mucosa** or epithelial cells in other locations, and develop **intracellularly** into multinucleate schizonts (also called **meronts**).
- **Each nucleus** develops into an infective body called a **merozoite**; merozoites enter new cells and **repeat the process**.
- After a variable number of asexual generations, merozoites develop into either **macrogametocytes** (females) or **microgametocytes** (males).
- These produce a **single macrogamete** or a **number of microgametes** in a host cell.
- After being **fertilized** by a microgamete, the **macrogamete** develops into an **oocyst**.
- The oocysts have **resistant walls** and are discharged **unsporulated** in the feces.
- **Oocysts** do not survive well at temperatures below **~30°C** or above **40°C**; within this temperature range, oocysts may **survive ≥1 yr**.



- The numerous species of *Eimeria* or *Isospora* that can infect a particular host, **not** all are **pathogenic**.
- **Concurrent infections** with two or more species, some of which may not normally be considered pathogenic, also influence clinical disease.
- Within **pathogenic species, strains** may **vary** in **virulence**.

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- Sporulation (several days) → infective
- Most ruminants are exposed to **low levels** of coccidia early in their life → **subclinical infestations & immunity**.
- Immunity is **not sterile** & many clinically normal ruminants shed **low levels** of oocysts in their faeces.
- Clinical coccidiosis → in non-immune, stressed animals (feedlots).

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- Pathogenic coccidia of cattle can **damage the mucosa** of the **lower small intestine, cecum, and colon**.
- The major damage is due to the **rapid multiplication** in the intestinal wall & subsequent **rupture** of the cells of the intestinal lining.
- **Destruction of the intestinal epithelium** and, frequently, the underlying connective tissue of the mucosa.
- This may be accompanied by **hemorrhage** into the lumen of the intestine, catarrhal **inflammation**, and diarrhea.

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- Widespread loss of intestinal mucosa allows loss of fluids, **plasma proteins (albumin)** and **blood** into the bowel lumen.
- Serum protein and electrolyte concentrations (typically **hyponatremia**) may be appreciably altered, but changes in Hgb or PCV are seen only in severely affected animals.
- **Sever villous atrophy**

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## Type of Diarrhoea??



- **Concurrent (coronavirus).**
- During the acute period, some calves die; others die later from secondary **complications** (eg, **pneumonia**).
- **Recovering** animal remain unthrifty & compared to unaffected **fail to gain weighted.**

# Incubation period

- **17-21 days**

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# Clinical signs

- **A- Mild infestation:**

- 1- The most typical syndrome of coccidiosis is **chronic or subclinical disease** in groups of **growing animals**.
- 2- Calves may appear **unthrifty** and have **fecal-stained perineal areas**.
- 3- In light infections, cattle appear healthy and oocysts are present in normally formed feces, but **feed efficiency is reduced**.
- 4- The most characteristic sign of clinical coccidiosis is **watery feces**, with **little or no blood**, and animals show only slight discomfort for a few days.

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## • B) Severe infestation:

- 1- Rare, severely affected cattle **develop thin, bloody diarrhea** that may continue for **>1 wk**, or thin feces with **streaks or clots of blood**, shreds of **epithelium**, and **mucus**, (**dysentery**).
- 2- They may develop a **fever**; become anorectic, depressed, and **dehydrated**; and **lose weight**.
- 3- **Tenesmus** is common because the most severe enteritis is confined to the **large intestine (rectal prolapse)**, although pathogenic coccidia of cattle can damage the mucosa of the lower small intestine, cecum, and colon.
- 4- During the acute period, secondary complications (eg, **pneumonia**).

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- 5- Calves that survive severe illness can **lose significant weight** that is not quickly regained or can remain **permanently stunted**.
- 6- Calves with **concurrent** enteric infections (eg, *Giardia*) may be more severely affected than calves with coccidia infections alone.
- 7- In addition, **management factors**, such as weather, housing, feeding practices, and how animals are grouped, are important in determining the **expression of clinical coccidiosis** in cattle.

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- 8- **Nervous signs** (eg, muscular tremors, hyperesthesia, clonic-tonic convulsions with **ventroflexion of the head and neck, nystagmus**) and a high **mortality rate** (80%–90%) are seen in some calves with acute clinical coccidiosis.
- 9- commonly in a **laterally recumbent position** with a mild degree of **opisthotonos**.

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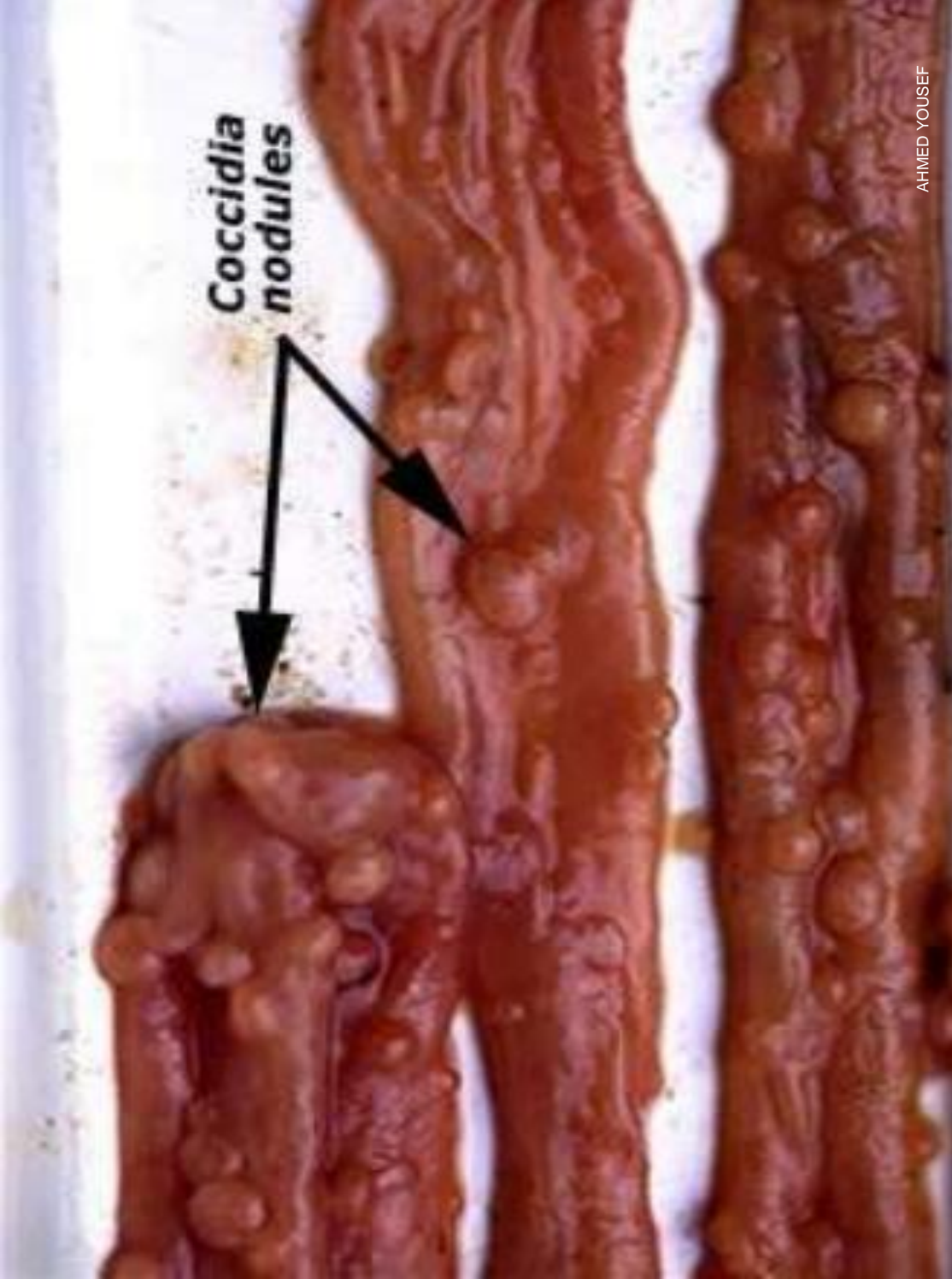
## Kounour, AMA



## Lesions

- Congestion, hemorrhages and thickening of the caecum, colon, ileum and rectum.
- Eroded lining of these regions with blood in the lumen.
- Small white cyst-like bodies (large shizonts) terminal ileum (villi).
- Ulceration or sloughing of the mucosa.





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## Diagnosis

- Diagnosis of coccidiosis is by finding oocysts on **fecal flotation or direct smear** or by the **McMaster** technique.
- **Faecal samples (fresh)**
- Dead animals (**ileum**) chilled ice box and segments in **formalin** for histopathology.
- Sugar flotation methods.
- Dried faecal smear stained with

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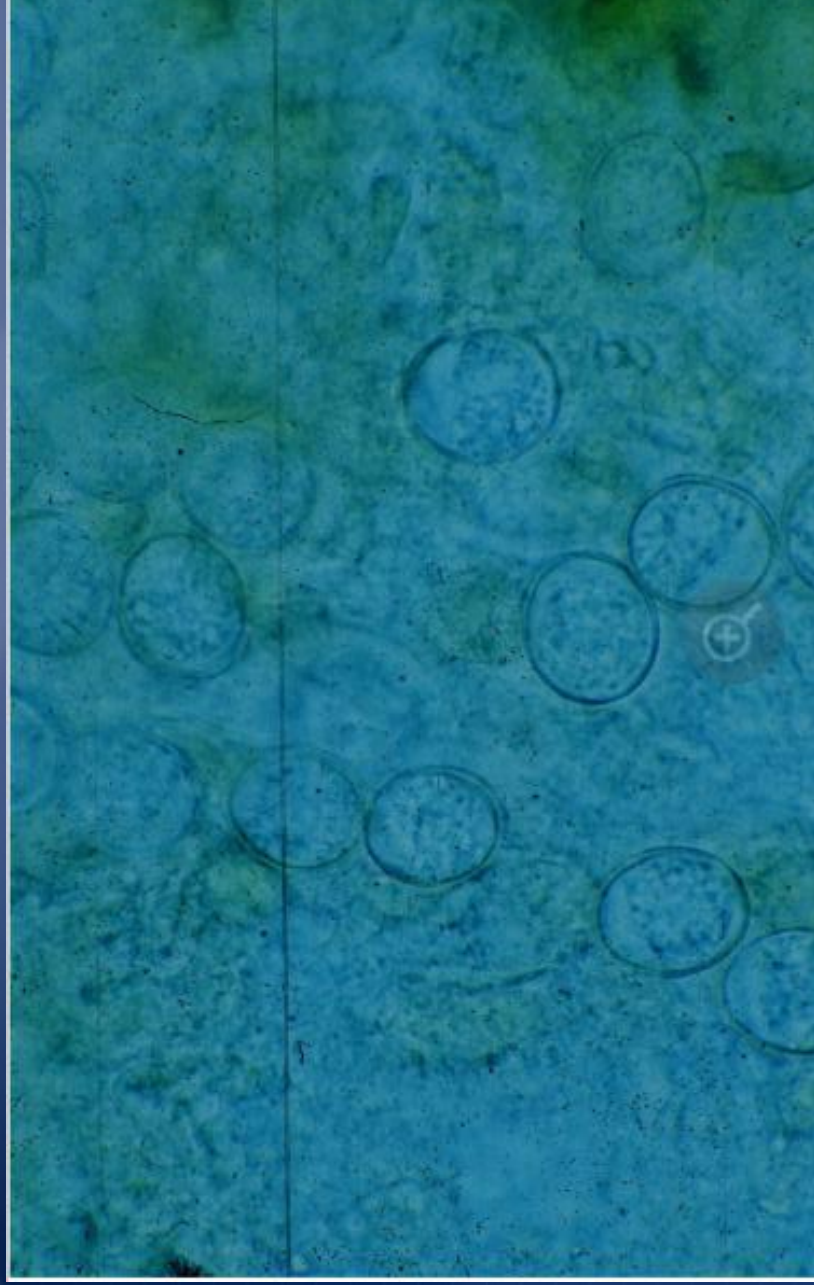
- Finding appreciable numbers of oocysts of pathogenic species in the feces is diagnostic (**>100,000 oocysts/g** of feces in severe outbreaks), but because diarrhea may precede the heavy output of oocysts by 1–2 days and may continue after the oocyst discharge has returned to low levels, it is not always possible to find oocysts in a **single fecal sample**; **multiple fecal examinations** of one animal or single fecal examinations of animals housed in the same environment may be required.

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- The number of **oocysts** present in feces is influenced by the genetically determined reproductive potential of the species, the number of **infective oocysts ingested, stage of the infection, age and immune status of the animal, prior exposure,** consistency of the fecal sample (free water content), and method of examination.

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# Oocysts of *Eimeria zuernii* in a fecal smear from a calf



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## Treatment

- The life cycles of *Eimeria* and *Isospora* are **self-limiting** and end **spontaneously** within a few weeks unless **reinfection** occurs.
- Prompt **medication** may **slow** or **inhibit** development of stages resulting from reinfection and, thus, can shorten the length of illness, reduce **discharge** of **oocysts**, alleviate hemorrhage and diarrhea, and lessen the likelihood of **secondary infections** and death.

- Sick animals should be isolated and treated individually whenever possible to ensure delivery of therapeutic drug levels and to prevent exposure of other animals. However, the efficacy of treatment for clinical coccidiosis has not been demonstrated for any drug, although it is widely accepted that treatment is effective against reinfection and should therefore facilitate recovery.

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- Most **coccidiostats** have a depressant effect on the **early, first-stage schizonts** and are therefore more appropriately used for control instead of treatment.
- Soluble **sulfonamides** are commonly administered orally to calves with clinical coccidiosis and are perceived to be more effective than intestinal sulfonamide formulations (boluses).
- **Sulphaquinoxaline:** 6 mg/lb/day for 3–5 days
- **Sulfaquinoxaline** is particularly useful for weaned calves that develop **bloody diarrhea** after arrival at a feedlot.

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- **Amprolium** is also administered orally to calves, sheep, and goats with clinical coccidiosis **10 mg/kg/day for 5 days**.
- prevention, **amprolium (5 mg/kg/day for 21 days)**, **decoquinatate (22.7 mg/45 kg/day for 28 days)** and lasalocid (1 mg/kg/day to a maximum of 360 mg/head/day), or **monensin (100–360 mg/head/day)** can be used.
- The major benefits of coccidiostats are through **improved feed efficiency and rate of gain**.

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- Clinically affected animals should be **isolated** and given **supportive** oral and **parenteral** fluid therapy as necessary.
- The population **density** of the affected pens should be **reduced**.
- All **feed** and **water** supplies should be high enough off the ground to avoid **fecal contamination**.
- **Mass medication** of the **feed and water** supplies may be indicated in an attempt to prevent new cases and to minimize the effects of an epidemic.

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- Cattle with coccidiosis and **nervous signs** should be brought indoors, kept **well-bedded and warm**, and given fluid therapy orally and parenterally. However, the case fatality rate of calves with coccidiosis and nervous signs is high despite intensive supportive therapy.

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## 5-DAY TREATMENT PROGRAM

1 gallon of CORID is enough for 40 calves (at 400 pounds each) in a five-day treatment program.

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- **Parenteral sulfonamide** therapy may be indicated to control development of **secondary bacterial enteritis** or **pneumonia**, which may be seen in calves with coccidiosis during very cold weather.
- **Corticosteroids** are **contraindicated**, because they increase shedding of oocysts and have induced clinical disease in subclinically infected calves.

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## Prevention

- Prevention is based on **limiting** the **intake** of **sporulated oocysts** by young animals so that an infection is established to induce **immunity** but not clinical signs.
- **Good feeding practices** and **good management**, including **sanitation**, contribute to this goal.
- Neonates should receive **colostrum**.
- Young, susceptible animals should be kept in **clean, dry quarters**.

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Antibodies

Villi



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- **Feeding and watering devices** should be clean and must be protected from fecal contamination; this usually means feed is placed in troughs **above the ground** and positioned so that it is difficult for **fecal contamination** of feed to occur.
- **Stresses** (eg, weaning, sudden changes in feed, and shipping) should be minimized.

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- **Continuous low-level feeding** of decoquinatate, lasalocid, monensin, or amprolium during the **first month** of feedlot confinement has been reported to have preventive value.
- **Ionophorous antibiotics** and **amprolium** have been reported to be effective in goat kids, as have sulfonamides and amprolium in pigs.
- Preventive administration of **coccidiostats** is recommended when animals under various management regimens.

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