Avian Coccidiosis

presented by

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Introduction

Coccidiosis is one of the most important poultry diseases world wide.

- the most prevalent disease affecting the broiler industry.
- is caused by intracellular parasite of the genus *Eimeria*, member of the phylum *Apicomplexa*, family *Eimeriidae*

Economic importance of coccidiosis

- Retarded growth, poor uniformity.
- Downgrading of carcasses.
- Significantly increase condemnations
- Increase morbidity and mortality rate.
- Reduce feed efficiency.
- Increase medication costs
- Costs of prevention and control programs.
- Resistance-causing parasites to survive
- environmental challenges as well as the emergence of drug resistance.

Epidemiology of Coccidiosis

Coccidia host specific tissue specific

1-Natural Hosts

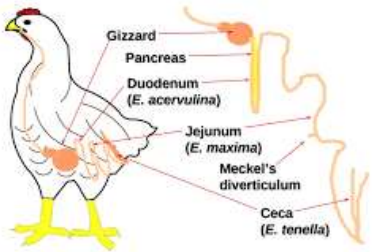
The chicken is the only natural host of these 9 species of *Eimeria* (*E. acervulina*, *E. brunetti*, *E. maxima*, *E. mitis*,*E. mivati*, *E. necatrix*, *E. praecox*, *E. Tenella*, *E. hagani*)

2-Susceptible age of infection

chickens of all ages and breeds are susceptible.

Broilers

Outbreaks are common at 3–6 weeks of age and in SASO 3-8 wk



several outbreaks of Coccidiosis are possible in the same flock

Breeder pullets and layer pullets

kept on litter for 16 weeks or more, the infections with *E. acervulina*, *E. tenella*, *E. mitis*, *E. mivati*, *E. praecox*, and *E. maxima* are seen at 3–6 weeks of age

E. Necatrix at 8–14 weeks of age.

E. brunetti is seen both early and late.

3-Transmission

Ingestion of viable sporulated oocysts (tetra-sporocytic –di zoic sporulated oocyst)

-litter-pecking or the contamination of food or water.

-from farm to another -by movement of personnel and equipment

-from insects in poultry litter (The darkling beetle, common in broiler litter, is a mechanical carrier of oocysts.)

4- Incidence and Distribution

Coccidia are found wherever chickens are raised.

5- predispose factor for coccdiosis

a- factors related to the parasite

b- factors related to the host

c- environmental factors

d- nutrition

e- immunity

f- host parasite relationsh

Factor related to the parasite

- pathogenicity- highly pathogenic as *E. tenella*, *E necatrix*.
- Intermediately pathogenic as *E. acervulina*, *E. brunetti*, *E. maxima*, *E. Mitis*
- Low pathogenic as *E.mivati*, *E. Praecox*, *E. Hagani*
- Oocyst production, oocyst number, Masking effect of *E. Tenella to E. Necatrix in the ceci*

Environmental

A- Sporulated Oocysts may survive for many weeks in soil- reported from the dust inside and outside broiler houses, survive up to 602 days in the exogenous environment

B- The first grow out of chickens until the introduction of coccidia to a completely susceptible flock.outbreaks, often more severe than those on older farms, are often called “the new-house syndrome

C- coccidiosis incidence lower in hot, dry weather and greater in cooler, damp weather

D- Bad quality litter

E- Bad ventilation

Nutrition

Deficiency of vitamins A, E, amino acids, which affect on integrity of mucous membrane
Higher level of vitamin B1, B6 , folic acid
Higher level of CP

Immunity

The tissue damage and changes in intestinal tract function
Immunosuppressive diseases may act in concert with coccidiosis to produce a more severe disease.
Marek's disease
may interfere with development of immunity to coccidiosis
infectious bursal disease (IBD) exacerbate coccidiosis

Host parasite relationship

- Tissue location (villi, Sub-Epithelia)
- Immunogenicity

(according to pathogenicity, No. of cycles for immuncomptancy)

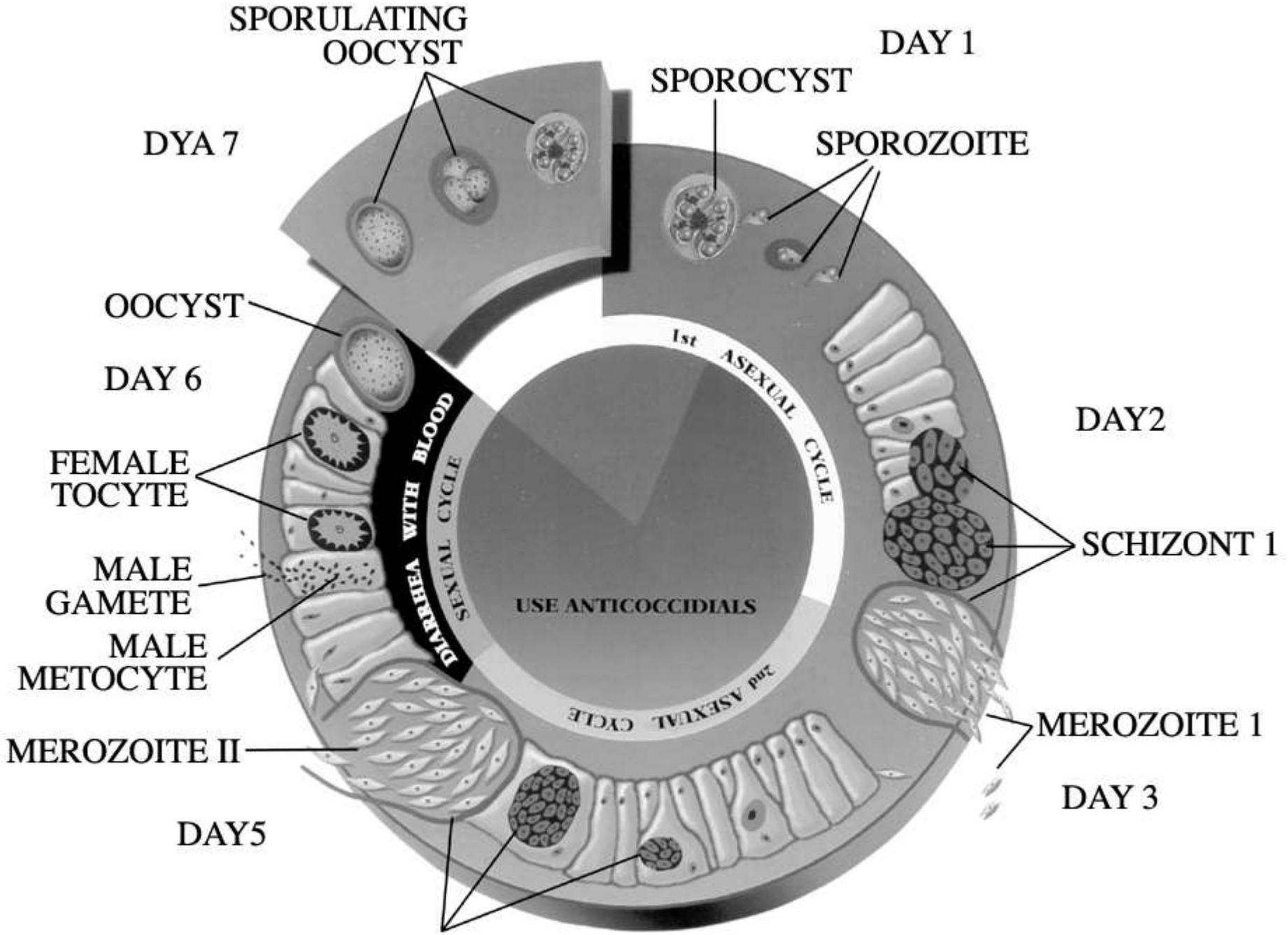
Life cycle of coccidia

- **Exogenous stage** – sporogony
- **Endogenous stage** –include:

Asexual multiplication –schizogony(1^{ST} & 2^{nd} Sz)

Sexual reproduction - gametogony


Unsporulated Oocyst (non-infectious)
Sporulated Oocyst (infectious)
Oocyst swallowed enters gut
Excystation
Oocyst releases sporocysts
Sporocyst releases sporozoites
Sporozoites invade gut cells
Trophozoite
Schizont
Merozoites - released from schizont
Reinfective Cycle
Male and Female Gametes
Developing Oocyst
Oocyst shed in feces
Sporulation occurs outside host requires several days & oxygen
Eimeria Life Cycle


SPORULATING OOCYST
DAY 1
SPOROCYST
DYA 7
SPOROZOITE
OOCYST
DAY 6
DAY2
FEMALE TOCYTE
SCHIZONT 1
MALE GAMETE
MALE METOCYTE
MEROZOITE II
MEROZOITE 1
DAY 3
DAY5
DIARRHEA WITH BLOOD
SEXUAL CYCLE
1st ASEXUAL CYCLE
2nd ASEXUAL CYCLE
USE ANTICOCCIDIALS

Mature oocyst

Sporulated oocyst

Sporocysts with sporozoites

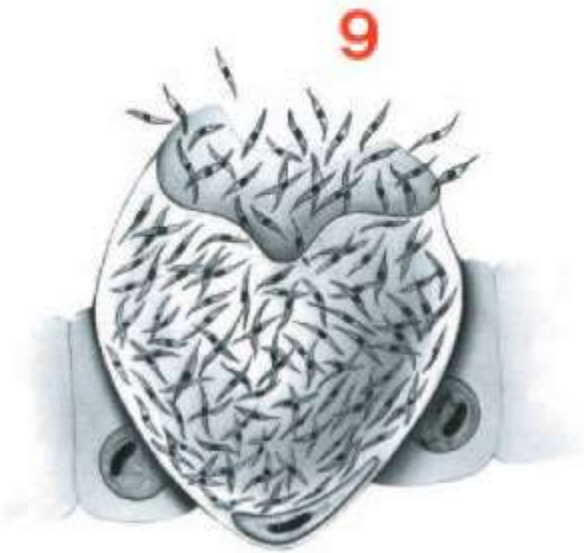
Sporozoite penetrating host cell

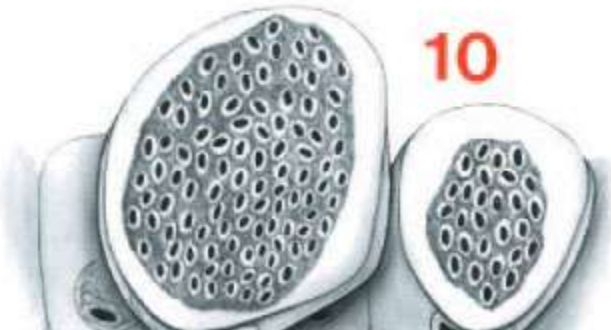
Trophozoite

Immature schizont–1st gene

Immature schizont–1st gener

Mature schizont–1st generation





When sporozoites enter the cells, they divide many times, producing offspring (merozoites). Each merozoite may then enter another intestinal cell, and the cycle may be repeated several times. Due to the cyclic multiplication, large numbers of intestinal cells are destroyed. Eventually, the cycle stops, sex cells are produced and fertilization occurs to
produce an oocyst. The oocyst ruptures from the intestinal cell and passes in the droppings. An infected chicken may pass thousands of oocysts in the droppings;therefore, poultry raised in crowded and/or unsanitary conditions are at great risk of becoming infected.

Causes of outbreaks

- Resistance of sporulated oocysts to environmental conditions and many chemicals
- Crowding of birds.
- Age (previous exposure).
- Pathogenicity of different Eimeria species.
- Immune status of birds.
- Water leakage.
- Effect of ammonia and bacterial products on oocysts in litter.
- Medication.
- Mixer problem.
- Differences in susceptibility of different Eimeria species to different anticoccidials.
- Long withdrawal time of anticoccidials.

High pathogenic coccidia in other species

- **Turkey** (especially poults): *E.adenoeides*, *E. meleagridis* , *E.gallopavonis*,*E.meleagrimitis*, producing watery diarrhea and high mortality.
- **Duck**: *Tyzzeria perniciosa:* producing mucoid, bloody diarrhea.
- **Goose** (mostly goslings): *E. anseris*, *E.nocens* producing mucoid, bloody diarrhea, *E. truncata* parasitises the kidneys causing depression, emaciation, diarrhoea and high mortality.
- **Pheasan**t: *E. colchici*,*E.duodenalis*,*E.phasiani*,all cause enteritis and mortality.

- The *Eimeria* species are specific to chickens and can not infect other type of fowl or birds or mammals

They are distinguished by:

1. The morphology of their oocytes, the form of resistance and of dissemination of the parasite in the external environment.
2. Their intestinal location for endogenous development.
3. Their pathogenicy:

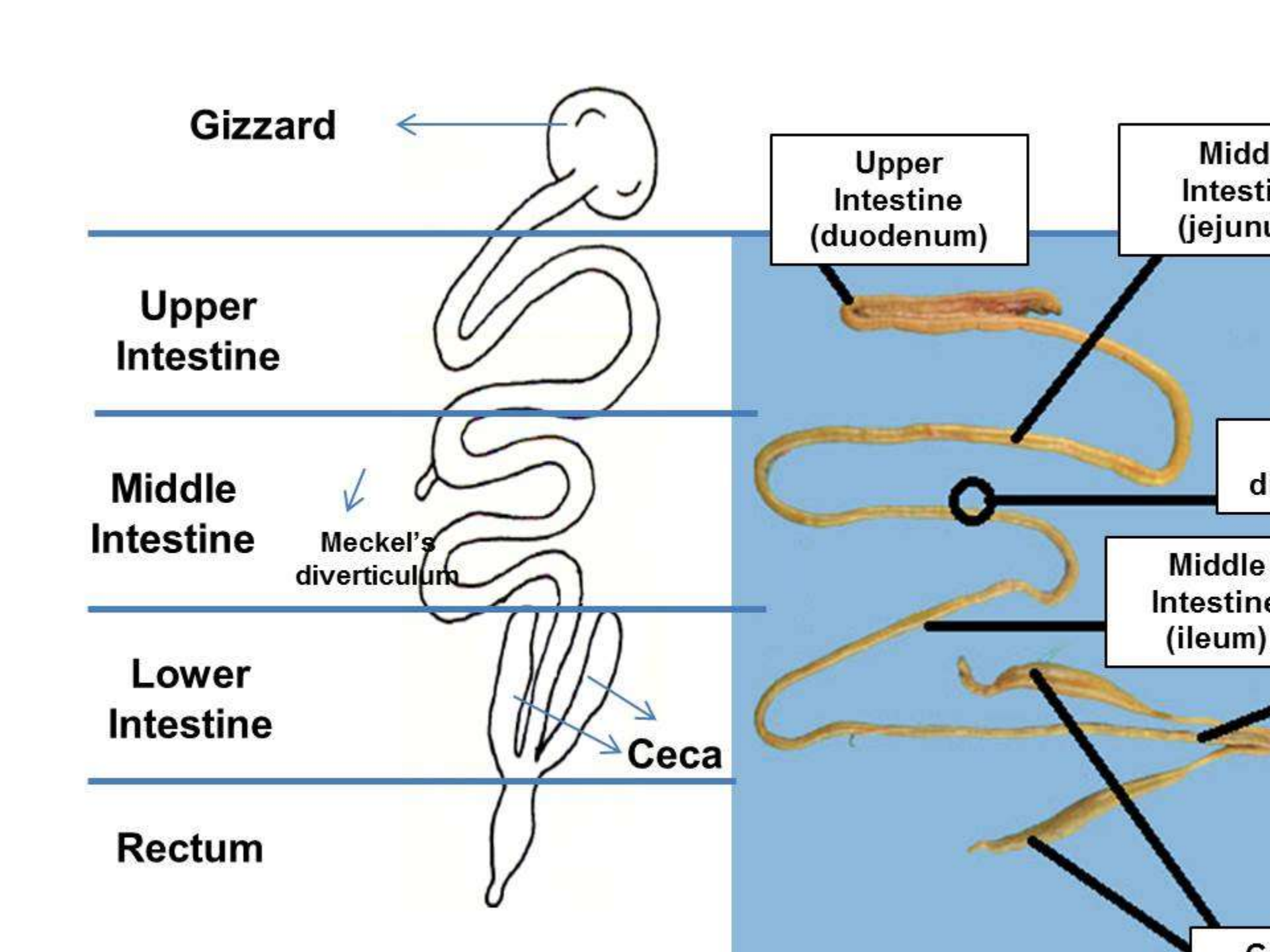
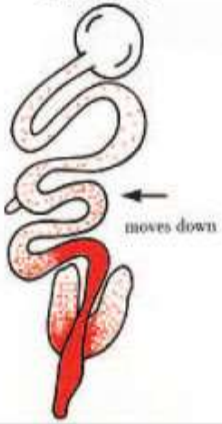
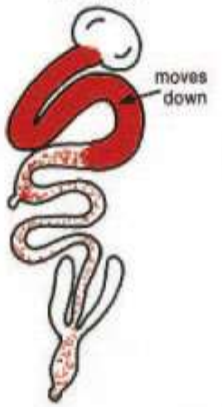
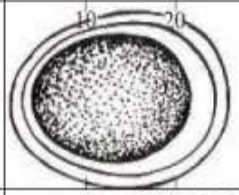
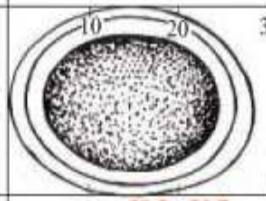
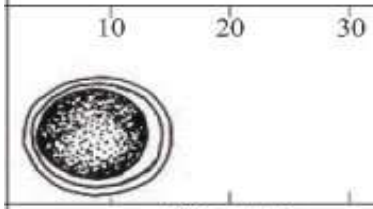
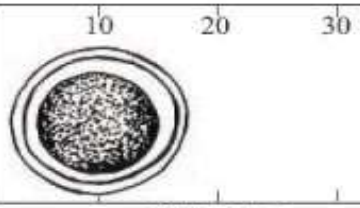
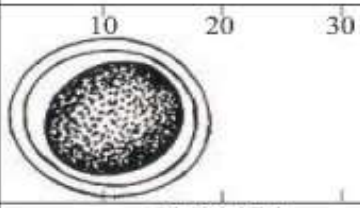
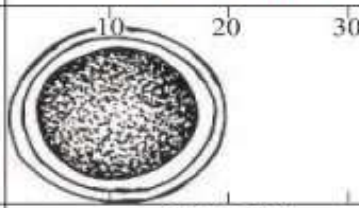

Gizzard
Upper Intestine
Middle Intestine
Meckel's diverticulum
Lower Intestine
Ceca
Rectum
Upper Intestine (duodenum)
Middle Intestine (ileum)

TABLE 1.1. Differential characteristics for eight species of chicken coccidia

	CHARACTERISTICS	*E. acervulina*	*E. brunetti*	*E. maxima*	*E. mivati*
MACROSCOPIC LESIONS	ZONE PARASITIZED				
	MACROSCOPIC LESIONS	light infection: whitish round lesions sometimes in ladder-like streaks heavy infection: plaques coalescing, thickened intestinal wall	coagulation necrosis mucoid, bloody enteritis in lower intestine	thickened walls, mucoid, blood-tinged exudate, petechiae	light infection: rounded plaques of oocysts heavy infection: thickened walls coalescing plaques
MICROSCOPIC CHARACTERISTICS	MILLIMICRONS OOCYSTS REDRAWN FROM ORGINALS	10 20 30 	10 20 30 	10 20 30 	10 20 30 
	LENGTH x WIDTH µm LENGTH = WIDTH =	AV = 18.3 x 14.6 17.7 - 20.2 13.7 - 16.3	24.6 x 18.8 20.7 - 30.3 18.1 - 24.2	30.5 x 20.7 21.5 - 42.5 16.5 - 29.8	15.6 x 13.4 11.1 - 19.9 10.5 - 16.2
	OOCYST SHAPE AND INDEX - LENGTH/WIDTH	ovoid 1.25	ovoid 1.31	ovoid 1.47	ellipsoid to broadly ovoid 1.16
	SCHIZONT, MAX IN MICRONS	10.3	30.0	9.4	17.3
	PARASITE LOCATION IN TISSUE SECTIONS	epithelial	2nd generation schizonts subepithelial	gametocytes subepithelial	epithelial
LIFE HISTORY CHARACTERISTICS	MINIMUM PREPATENT PERIOD-HR	97	120	121	93
	SPORULATION TIME MINIMUM (HR)	17	18	30	12

Compiled from various sources.

E. mitis	*E. necatrix*	*E. praecox*	*E. tenella*
	large schizonts, no oocysts 		
no discrete lesions in intestine mucoid exudate	ballooning, white spots (schizonts), petechiae, mucoid blood - filled exudate	no lesions, mucoid exudate	onset: hemorrhage into lumen later: thickening, whitish mucosa, cores clotted blood
			
15.6 x 14.2 11.7 - 18.7 11.0 - 18.0	20.4 x 17.2 13.2 - 22.7 11.3 - 18.3	21.3 x 17.1 19.8 - 24.7 15.7 - 19.8	22.0 x 19.0 19.5 - 26.0 16.5 - 22.8
subspherical 1.09	oblong ovoid 1.19	ovoid 1.24	ovoid 1.16
15.1	65.9	20	54.0
epithelial	2nd generation schizonts subepithelial	epithelial	2nd generation schizonts subepithelial
93	138	83	115
15	18	12	18

Modified after Long and Reid (1982).

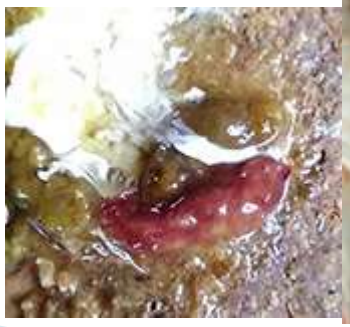
Species	Site of development	Pathogenicity	Gross lesions
E. praecox	Duodenum, jejunum	Least pathogenic	Watery intestinal contents Mucus and mucoid casts
E. hagani	Duodenum, jejunum and ileum	Least pathogenic	Petechiae and white opacities in the upper small intestine Intestinal content may be creamy or watery
E. acervulina	Duodenum, ileum	Less pathogenic	Limited enteritis causing fluid loss. Malabsorption of nutrients.
E. mitis	Ileum	Less pathogenic	Limited enteritis causing fluid loss. Malabsorption of nutrients
E. mivati	Duodenum, rectum	Less pathogenic	Red petechiae and round white spots Severe denuding of the mucosa
E. maxima	Jejunum, ileum	Moderately-Highly pathogenic	Inflammation of the intestinal wall with pinpointed hemorrhages Sloughing of epithelia
E. brunetti	Caeca and rectum	Highly pathogenic	Inflammation of the intestinal wall with pinpointed hemorrhages Sloughing of epithelia
E. tenella	Caeca	Highly pathogenic	Thickened cecal wall and bloody contents at the proximal end Distension of caecum Villi destruction causing extensive hemorrhage and death
E. necatrix	Jejunum, ileum, caeca	Highly pathogenic	Intestine may be ballooned Mucosa thickened and the lumen filled with fluid, blood and tissue debris Lesions in dead birds are observable as black and white plaques (salt and pepper appearance)

Diagnosis

- 1- Clinical symptoms and PM lesion score
- 2- Microscopic examination of lesions or droppings
  - Lesion Scoring
  - Microscopic Scoring
  - Droppings Score
  - Histopathology Methods
- 3- Serology- ELIZA
- 4- DNA- based diagnostic assay- rt-PCR(ITS2 of rDNA)

General symptoms

High mortality
Diarrhea(bloody)
Ruffled feather
Chilling symptoms(squatting position, closed eye)
Prostration
Poor skin pigmentation
(sub acute)
Impaired food absorption(feed particles in feces)
Decreased growth rate, increase culls
low uniformity
High FCR



PM Lesion Scoring

based on gross lesion 0 is normal and lesion from 1 and 4 is the maximum lesion.

E.acervulina +4

Light to moderate infections may effect on weight gain and feed conversion but may cause loss of carotenoid and xanthophyll pigments from the blood and skin because of reduced absorption in the small intestine.

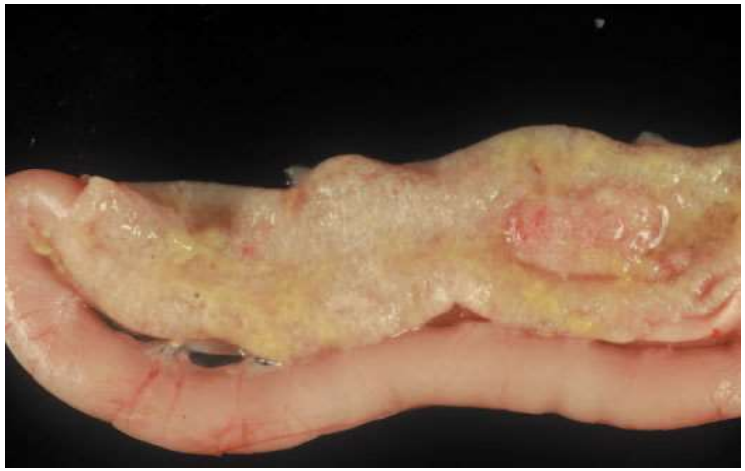
The intestine pale and contain watery and mucoid fluid.

light infections is limited to the duodenal loop, with only a few plaques

heavy infections,

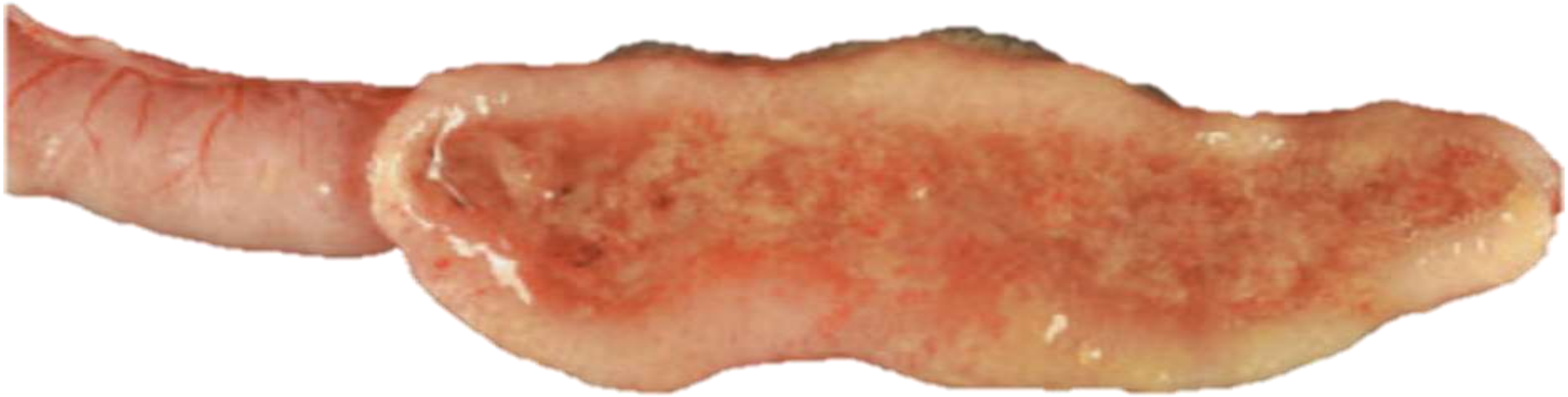
plaques may overlap or coalesce.

the tips of villi are broken off, leading to truncation and fusion of villi and thickening of the mucosa

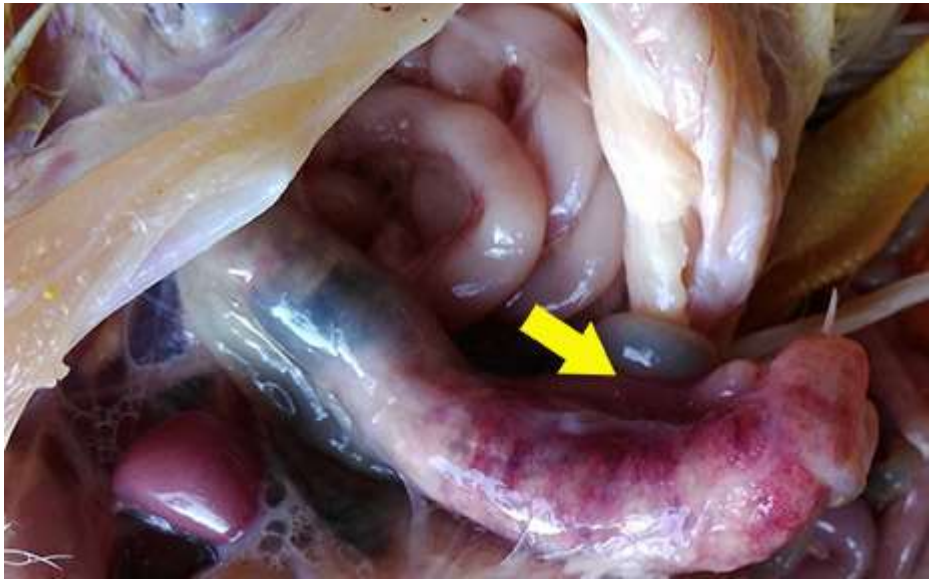


E. Necatrix +4

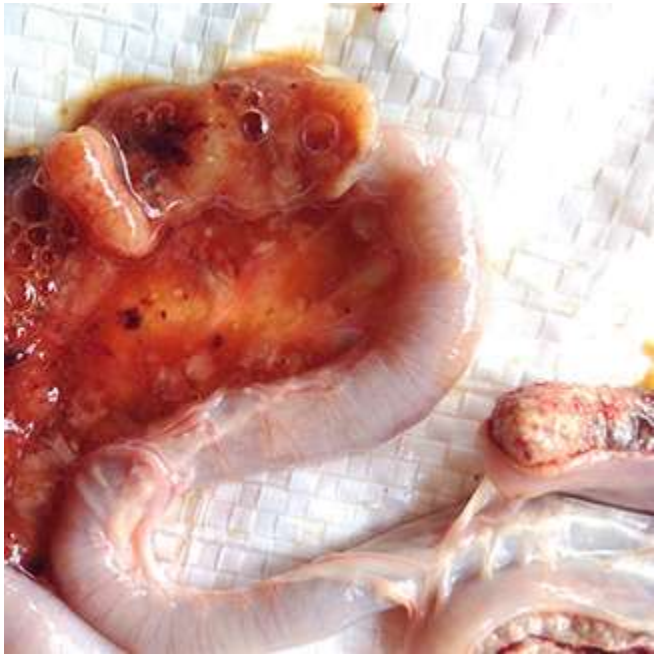
E. maxima +3



E .Tenella +4



E. mivati +4.



Differential Diagnosis

- Necrotic Enteritis
- Histomeniasis

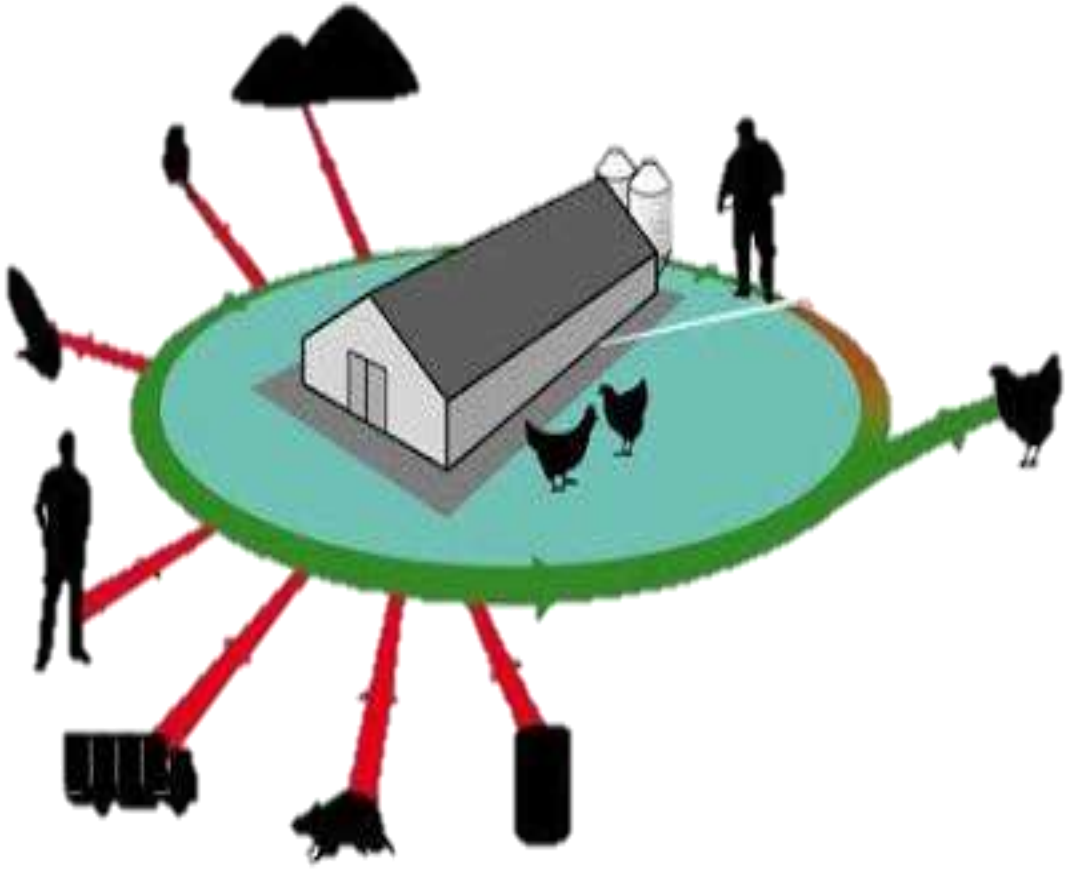
Coccidiosis control

- ✓ Enviromental management
- ✓ biosecurity
- ✓ disinfection and litter management.
- ✓ medication programs (chemotherapy)
- ✓ natural alternatives to controlling coccidiosis
- ✓ immunization against chicken coccidiosis.

Environmental management

- Litter management(water system provision)
- Stocking density
- RH of house
- Ventilation
- Rearing system
- Nutrition

Biosecurity



Disinfection and litter management.

- Ammonia releasing compounds
- Chlorocresol compound(odestruction. A product available
- in some countries contains an ammonium salt and sodium hydroxide (OO-cide).ocyct)

Medication programs

broilers:

A. Straight program.

One anticoccidial for year-

SD. Resistance

C. Shuttle method. One for starter

for grower and finisher also use different

Improve flock performance, maintain efficacy, reduce lesion score, reduce resistance development, improve profitability

D. Rotation method. Use one anticoccidial (static)in maximum two grow out cycle and shift to an other (cidal or static)

Prevent resistance

Layers and replacement flocks.

Shuttle or Dual Programs:

- One product in the starter and another in the grower feed.
- The 2 products have different mechanisms of action: as chemical (nicarbazin or halofuginone) vs. ionophore.
- This model reduces buildup of drug resistance.

Switch Program:

- **A single product will be used from day 1 to slaughter, or with a withdrawal period of 3-7 days. Then changed in the next cycle.**

Rotation of Products:

- Anticoccidial change in the spring and in the fall.

Use of Anticoccidial In

- broilers, the objective is to produce the maximum growth and feed efficiency with minimum of disease

layers or breeders, the objective immunization

broiler farms with poor history of responding to anticoccidial drugs might be vaccinated for 2 cycles to change farm microflora.

In recent years

it has become a common practice to incorporate live coccidiosis vaccines in the rotation program,

Anticoccidials in layers and replacement flocks:

1- using preventive anticoccidial in the feed for 6-22 weeks (lower than broiler levels), mostly in week 14.
2- using anticoccidial when and if coccidiosis break out in the flock
3- using anticoccidial if accidental overexposure to strains that do not exist in the vaccine or over replication of coccidial vaccinal strains or vaccinal breakdown.

Programs Used in Breeders and Layers

- Pullets started on the floor and later reared as caged layers are not as dependent on immunity to coccidiosis as are floor layers.
- Breeder pullets that will be kept on the floor during lay should have immunity to coccidiosis
- Setting up of immuniton(develop immunizing infections despite the presence of the drug.)
- Step-dowen program
- By amprolium 1 kg/ton for 6 wk then 750 g/ton for 6 wks then 500 g/ ton for 6 wk

characteristics of anticoccidial drugs:

1.Spectrum of activity.
2. Mode of action.
3. Coccidiocidal versus coccidiostatic.
4. Effect of drugs on the chicken.
5- Drug interaction (s).
6- Reduce efficacy and/or drug resistance.

Anticoccidial	Mode of Action
Sulphonamides, ethopabate, Diaverdine 2,4 diaminopyrimidine	Inhibition of folic acid biosynthesis (which is an important for DNA production and cell division) from Para-aminobenzoic acid (PABA), by inhibition of dihydrofolate reductase.
Amprolium	Thiamine analogue, Inhibition of Thiamine (vit B1) uptake acts early between the first and second schizogony,
Ionophores Lasalocid, monensin and salinomycin	upset the osmotic balance of the protozoan cell by altering the permeability of cell membranes for alkaline metal cations. lead to failure of Na, K pump and accumulation of large amounts of Na inside the sporozoite cells and K ions outside the sporozoite and its death.
Clopidol,	Chemical anticoccidial inhibit energy metabolism in the cytochrome system of the coccidia, thus inhibit nucleic acid formation

	Class	Dose	Target	Uses	Drawbacks
clopidol	pyridinols	125 ppm feed	Sporozoite	prevention	Latent coccidiosis
Buquinolate, Decoquinate, Deccox, Nequinate.	Quinolones	Free from toxicity	Sporozoite		Fastest drug resistance
Monensin	(antibiotic, product of streptomycis)	99-121 ppm feed broiler 100ppm replacement	1st generation schizont	prevention	Very toxic in over dose, Week drug resistance
Lasalocid	Closely related to monensin	75-125 ppm for broilers, *Not approved for replacement	= monensin	=monensin	Wet dropings
Salinomycin	Closely related to monensin than Lasalocid	60 ppm (??66 ppm????)	= monensin	= monensin	
Robenidine	chemical	33 ppm	1st generation schizont (day 2)		Rabid resistance Undesirable taste of egg & meat
Amprolium	Chemical		1st generation schizont (day		

Diclazuril (DIET) DZL	Benzenactonitrile- triazins Coccidiostatic	In chicken -1 mg/kg In turky 1 mg/kg tolerant upto 25-100 time dose			**RESISTANCE**
Toltrazuril (w) TZL	Triazin coccicidal	7 mg /kg bw	all stages	-treatment not impair immunity development	
Nitromezuril NZL	Triazin coccidicidal	3 mg/kg bw in diet	all stages	highly effective on high pathogenic eimeria	
Sulfaclozine sodium					

Anticoccidial drugs recommended for the therapeutic treatment of coccidiosis in chickens

Chemical Name	Route of Application	Use Level	Treatment Schedule
Amprolium	Feed	250 ppm	2 weeks
	Water	0.006%	1–2 weeks
	Water	0.012%–0.024%	3–5 days
Sulfadimethoxine	Water	0.05%	6 days
Sulfaguanidine	Feed	10,000–15,000 ppm	5–7 days
Sulfamethazine	Feed	4,000 ppm	3–5 days
	Water	0.1%	2 days
	Water	0.05%	4 days
Sulfaquinoxaline	Feed	1,000 ppm	2–3 days on, 3 days off; then 500 ppm for 2 days on, 3 days off, and 2 days on
	Feed	500 ppm	3 days on, 3 days off, 3 days on
	Water	0.04%	2–3 days; then 3 days on plain water; then 0.025% for 2 days on, 3 days off, and 2 days on
Sulfaquinoxaline + pyrimethamine	Water	0.005% + 0.0015%	2–3 days on, 3 off, and 2 days on
Furazolidone	Feed	110 ppm	5–7 days; then 55 ppm for 2 weeks
Nitrofurazone	Feed	110 ppm	5 days
	Water	0.0082%	5 days
Toltrazuril	Water	0.0025%	2 days continuous medication
		0.0075%	6–8 h./day for 2 days

Note: Follow local regulatory requirements for required withdrawal periods prior to slaughter. Some of these drugs may not be available in specific countries because of regulatory limitations.

Contemporary anticoccidial drugs used for the prevention of coccidiosis in chickens

Chemical Name	Approved Poultry Type		Use Level in Feed (ppm)
	Broilers	Layers	
Chemical drugs:			
Amprolium	Yes	Replacements only	125–250
Amprolium + ethopabate	Yes	Replacements only	125–250 + 4
Arprinocid[1]	Yes	No	60
Clopidol	Yes	Replacements only	125
Decoquinate	Yes	No	30
Diclazuril	Yes	No	1
Dinitolmide (zoalene)	Yes	Replacements only	125
Halofuginone hydrobromide	Yes	No	3
Nequinate	Yes	Replacements only	20
Nicarbazin	Yes	No	125
Robenidine hydrochloride	Yes	No	33
Polyether ionophores:			
Lasalocid	Yes	No	75–125
Maduramicin	Yes	No	5–6
Monensin	Yes	Replacements only	100–120
Narasin	Yes	No	60–80
Narasin + nicarbazin	Yes	No	54–90 of the 2 drugs
Salinomycin	Yes	No	44–66
Semduramicin	Yes	No	25
Natural extract:			
Steroidal sapogenins[2]	Yes	No	3.4–13.6

Peak activity on:

- Sulfonamides acts on:
  - development schizonts (2nd generation)
  - sexual stages
- Amprolium hydrochloride act on:
  - first generation schizont, prevent differentiation of the merozoites. May suppress the sexual stages and sporulation of the oocysts.
- Robenidine:
  - 2nd day of E.tenella life cycle (1st generated multinucleated schizont)

Peak activity on:

- Nicarbazin, robendin, zoaline destroy:
  the first- or second-generation schizont

- Quinolones & ionophores arrest or kill:
  sporozoite or early trophozoite

- Diclazuril acts in:
  E. tenella - early schizogony
  E. acervulina- late schizogony
  E. maxima- maturing macrogamete

Spectrum of activity:

- (combination of drugs for reduce levels of toxicity{at relatively save levels}, increase spectrum of activity, may overcome drug resistance, and increase potency {synergism})

Amprolium:

Good activity: E. tenella, E. acervulina

Marginal activity: E. maxima, E. mivati, E. necatrix, E. brunetti.

Amprolium 125ppm + ethopabate 4 ppm:

Good activity: E. tenella, E. acervulina

E. maxima, E. mivati, E. necatrix, E. brunetti.

Amprolium (240 ppm) + sulphaquinoxaline (180 ppm):

highly efficacious against E. tenella, E. acervulina

E. maxima, E. necatrix, E. brunetti

Amprolium 80 ppm + ethopabate 60 ppm + sulphaquinoxaline (5 ppm):

Spectrum of activity

- Arprinocid (60-70 ppm):
  highly efficacious against E. tenella, E. acervulina
  E. maxima, E. necatrix, E. brunetti

Quinolone ():
  good efficacy against all chicken coccidial species

Monensin (99-121ppm broiler, 100ppm replacemnt):
  excellent for all species,

Lasalocid (75-125):
  broad spectrum activity but against Eimeria but is weakest against acervulina.

Robenidine :
  very effective against the 6 important species

Dinitolmide
  mainly tenella and necatrix

Sulfonamides:
  more effective against intestinal than ceccal coccidiosis

side effects:

Nicarbazin - high temp. = high mortality
- highly toxic to layers (egg production and quality dramatically affected)

High ionophore doses:

temporary to permanent paralysis and death
slight over dose will decrease body weight

Monensin:

interacts with methionin:

reduce feather growth, over dose highly toxic.

Lasalocid:

stimulate water consumption and excretion

Salinomycin:

highly toxic to turkey

Side effects

Amprolium

(125-250 ppm/ration, 0.006% DW 1-2 w or 0.012-0.024% DW 3-5 d).

, depression, anorexia, dirrhea

polioencephalomalacia in overdose.

Layer:

Reduce egg-thiamine level even at 25 ppm

1000 ppm lead to large No. of dead or weak hatched progeny.

Amprolium + Ethopabate:

Higher ethopabate (>100 ppm) + Amprolium 100 ppm depress weight gain.

Diaminopyrimidine:
(diaveridine, pyrimethamine, ormetoprim)

Pyrimethamine (25-100 ppm in ration) : adversely affect growth, feathering, development of hock joint (perosis).

50-100 ppm in ration: adversely affect RBCs count & hemoglobin.

Arprinocid:

at 100 ppm adversely affect weight gain and FC

Clopidol:

Decrease egg size at 125 ppm.

Robendine:

problem with drug resistance within a year

undesirable taste to meat and egg.

Coccidial vaccines

Can be prepared from both virulent and attenuated strains

- Live

attenuated- precocious strains

non attenuated vaccines- wild type

- Sub-unit vaccines

Non attenuated vaccines

1. Coccivac

- A mixture of wild live drug sensitive strains of oocysts isolated before the invention of most anti-coccidial drugs (before more than 60 years).
- Can be applied by spray in the hatch (with red dye to stimulate chicks to ingest it during preening themselves or their counterparts), or eye drop, D.W., spray in the feed.
- It is used in rotation with the anticoccidial to repopulate the house with drug sensitive strains

Non attenuated vaccines

2. Immucox

- It is a live non attenuated vaccine.
- It is given in water or by placing the gel in the chick boxes on the day of hatching.
- Immucox 1 for broiler chickens (*E. acervulina*, *E. maxima*, *E. tenella*, *E. necatrix*).
- Immucox 2 for broiler breeders and hens (Immucox for chicken 1 + *E. brunetti*).

- Nobilis cox ATM *(E. tenella ,acervulina,maxima*)
- Advent *(E. tenella ,acervulina,maxima*
- Inovocox *(E. tenella ,acervulina,maxima) 18 day inovo*
- Hipracox
- *(E. tenella ,acervulina,maxima,praecox,mitis)*

- Coccivac B
- for broilers (*E. acervulina, E. maxima, E. mivati, E. tenella*).
- Coccivac D
- for broiler breeders and layers (*E. acervulina, E. maxima, E. mivati, E. tenella, E. brunetti, E. necatrix, E. hagani, E. praecox*).

Precautions for vaccination by spray in feed

- Vaccinate not beyond the 4th day of age
- Suitable amounts of diluents
- Thorough mixing of the ampoules in the diluent
- Follow the instruction of the vaccine producer about increasing of the brooding area and transfer of the litter Prepare one feeding tray for each 1000 bird containing feed for 2 hours
- Oxytetracycline, neomycin, doxycyclines, sulphonamides, in water or feed are prohibited for at least 3 weeks PV.
- In case of severe PV reaction (3 wks later) amprol as 1/3 gm/liter for 8 hrs for 2 days, may be used to lighten the reaction.
- It is better to give antibiotics for Clostridia at the time expected for PV reaction (Amoxycillin).

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Advantages of Coccidiosis Oocyst Vaccines

- Vaccination with live sporozoites, induces a low level of infection (subclinical) and induces immunity, without slowing down the growth performance of chickens.
- Cocci vaccines avoid the antagonism between ionophores and tiamutin.
- Cocci vaccines increase the sensitivity of the field strains after vaccination to all anticoccidials even those to which cocci were negative earliar.

Disadvantages of Coccidiosis Oocyst Vaccines:

- ✓ Introduction of unwanted species
- ✓ Lack of uniformity in response
- ✓ post-vaccinal reactions.
- ✓ Don’t induce complete immunological protection against coccidiosis

Attenuated vaccines

1. Paracox

2. Livacox

- An attenuated vaccine, given in D.W. from 1-10 days of age or as a spray in the hatchery.
- Livacox T (E. acervulina, E. maxima, E. tenella) for broilers and breeder
- Livacox D (E. acervulina, E. tenella) for caged chickens

attenuated vaccines
2. livacox

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natural alternatives to controlling coccidiosis

Clove and *Bocconia cordata* extract

Apple cider vinegar

Olive leaf, mustard seed, black seed, cloves, grapefruit seed extract.

Oregan extra virgin olive oil (80% carvacrol)

Natural vegetal extracts

Oregan oil and essential oils

Garlic

Probiotics and prebiotic inulin

Mannan oligosaccharides and beta glucans

Carvacrol (82%) and Thymol (2.4%)

Etheric oils, soya oils, oregan oils

Concentrated blend of herbs and essential oils

Several essential oils

Several essential oils and yeast cell walls

Garlic and cinnamon

Spanish pepper and turmeric

Allium sativum Linn 15%, *Cinnamonum camphora* Nees & Eberum 15%, *Elephantopus scaber* Linn 15%, *Valeriana wallicgii* DC 15%, Sulphur dioxide 25% and NaCl 15%.

Oregan oil (on diatomite)

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