

Coccidiosis in rabbits:

A guide for the differential diagnosis of *Eimeria* species

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Coccidiosis caused by different species of the protozoan parasite, Eimeria is one the most important diseases affecting all age groups and is a major cause of morbidity and mortality in rabbits. In commercially reared rabbits, coccidiosis occurs in subclinical form leading to growth retardation and altered feed conversion. Studies on coccidiosis as a clinical entity has been well studied in rabbits but information on coccidial species and differential diagnosis is hardly attempted. The present communication is an insight into the problem, the causative agent, differential diagnosis and preventive measures for control of rabbit coccidiosis.

RABBIT production has already attained commercial status in many parts of the world including India and has the potential to become one of the major livestock species. This industry is picking up for wool production in hilly areas of Himachal Pradesh, Uttarakhand and Jammu & Kashmir and lately in Sikkim and Arunachal Pradesh and as a broiler industry in areas of temperate and subtropical climate in West Bengal, Asom, Manipur, Andhra Pradesh, Tamil Nadu, Kerala and Karnataka. In many tribal and backward areas rabbits are blazing a new trail in the field of self-employment and picked up as cottage industry by small and marginal farmers. Among diseases of rabbits, coccidiosis caused by different species of the protozoan parasite, *Eimeria* is one of the most important diseases affecting all age groups and is a major cause of morbidity and mortality. In commercially reared rabbits, coccidiosis occurs in subclinical form leading to growth

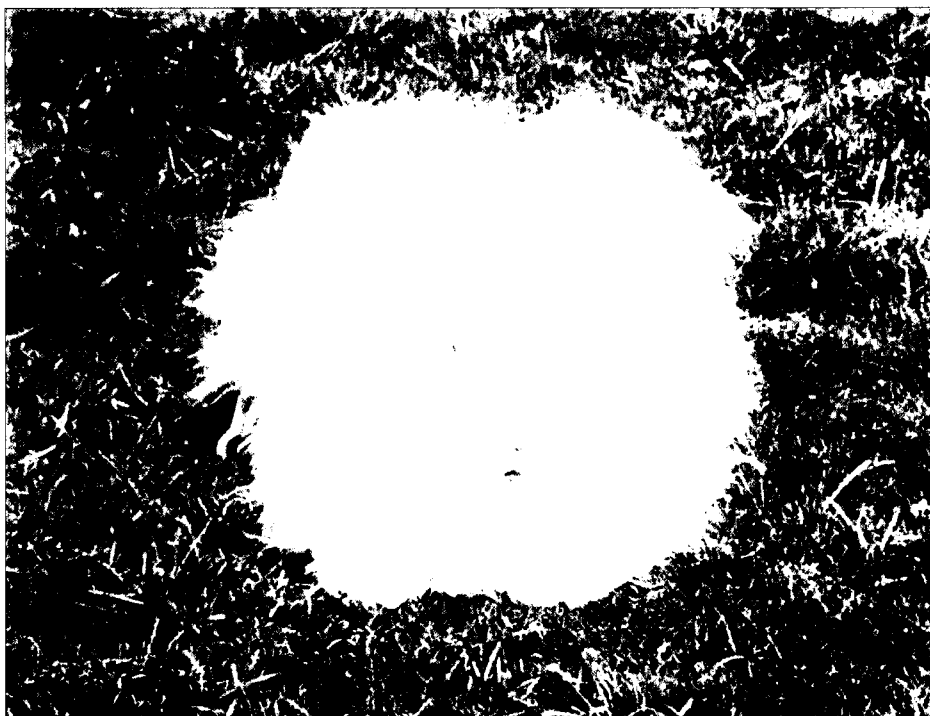
retardation and altered feed conversion. Studies on coccidiosis as a clinical entity has been well studied in rabbits but information on coccidial species and differential diagnosis is hardly attempted. The present communication is an insight into the problem, the causative agent,

differential diagnosis and preventive measures for control of rabbit coccidiosis.

The parasite

The coccidia of the genus *Eimeria* are members of the subphylum Apicomplexa and the family

A German Angora rabbit



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Eimeriidae. Though more than 25 species of *Eimeria* are reported to cause coccidiosis in rabbits, only 11 species were isolated in pure culture and are well characterised without ambiguity. These species are *E. stiedai*, *E. perforans*, *E. media*, *E. magna*, *E. irrsidua*, *E. intestinalis*, *E. exigua*, *E. vejtdovskyi*, *E. coecicola*, *E. flavescens* and *E. piriformis*, listed in the order in which they parasitize the gastrointestinal (GI) tract, the first one being in the liver. Many other reported species of *Eimeria* from rabbit has been considered as synonyms by various workers. Mixed infections with 2 or more species of *Eimeria* are the rule in nature in various combinations.

Life cycle

Rabbit coccidiosis is initiated by oral ingestion of the sporulated oocysts by the susceptible hosts and the infection develops into the disease in young rabbits primarily, whereas adults are mostly carriers. Since infection occurs in specific part of an organ on a specific type of cells, coccidiosis has been classified in two types: intestinal coccidiosis and hepatic coccidiosis. The life cycle in epithelial cell, in general, is the same for all *Eimeria* species. The *Eimeria* species parasitizing rabbits undergo a complex life cycle, having both intracellular and extracellular stages, and asexual and sexual reproduction, which is quite similar to that of *Eimeria* species parasitizing other hosts like chickens. The only peculiarity of the life cycle of rabbit *Eimeria* species is that two types of schizonts, which later on develop into microgamont and macrogamont for the formation of oocysts, can be distinguished even at the first schizogony. The prepatent period is quite precise for a particular species. It is 16-18 days for *E. stiedai*, 5-6 days for *E. perforans* and *E. media*, 7 days for *E. magna* and 9-11 days for all the remaining intestinal coccidial species. In all the intestinal types, the

patent phase lasts for 5-32 days, whereas in *E. stiedai* it is 21-30 days and mortality generally occurs during this period.

Intestinal localisation of the development of *Eimeria* spp.

Generally, *Eimeria* species are very host and site specific. The specific site of development for each *Eimeria* species of the rabbit may vary though for some species, some parts of the endogenous development takes place in another site of the intestine. The gross lesions within the gut and their intensity depend upon the dose of oocysts ingested. However, host specificity, developmental site, prepatent and patent periods, and pathogenicity varies from species to species. Gross lesions within the gut are most visible when gamogony occurs. Although, overlaps in the preferred sites of development occur, macroscopic intestinal lesions can be used, in association with other criteria, in the species identification (Table 1). Only *E. flavescens*, *E. coecicola* and *E. piriformis* complete their development in the caecum, vermiform appendix and colon, respectively. In hepatic coccidiosis, the parasite completes its development in the bile ducts of the liver.

Signs and symptoms

The main clinical symptoms in the affected animals include diarrhoea, anorexia, progressive loss of condition and emaciation before death. The gross lesions within the gut and their intensity depend on the dose of the oocysts ingested and the age of the animals. The intestinal form of coccidiosis mainly affects young animals of 6 weeks to 5 months. The symptoms of the disease include reduced weight gain; poor feed conversion, diarrhoea, anaemia and growth retardation. In intestinal coccidiosis, the disturbances in water and electrolyte balance occur in the parasitized part of the intestine before the appearance of the macroscopic

lesions and are essentially characterised by a loss of water and sodium. The loss of sodium is compensated by the exchange of potassium from the blood, thereby leading to hypokalaemia and causing death of the animal. The coccidia, which parasitize the ileum, caecum or colon cause pathognomic lesions, which are more characteristic of the organs, involved than of the parasite species. In hepatic coccidiosis, which affects rabbits of all ages, the parasite completes its development in the bile duct epithelial cells. While most infections are mild, severe infections can result in progressive emaciation, liver enlargement with slightly raised white nodules (1-3 mm dia), or cords develop on it, which later on tend to coalesce and thereby interfere with liver function. The animal is characterized by thirst, wasting of the back and hind quarters, with enlargement of abdomen. The animals may have diarrhoea and their mucous membranes may be icteric. This form of coccidiosis runs either as a chronic course for several weeks before death.

Pathogenicity

Coccidia are specific pathogenic agents. They are highly contagious; induce same lesion and same symptoms with low prognosis. The duration of detectable lesions does not exceed 3 or 4 days and their intensity depend on the dose of the infection. The coccidiosis in rabbits can be classified into 4 types when clinical parameters like body weight gain, diarrhoea and mortality are taken to consideration. These are non-pathogenic (*E. coecicola*), slightly pathogenic (*E. perforans*, *E. exigua*, *E. vejtdovskyi*), moderately pathogenic (*E. media*, *E. magna*, *E. irrsidua*, *E. piriformis*) and very pathogenic (*E. intestinalis*, *E. flavescens*). The causative agent of hepatic coccidiosis, *E. stiedai*, can also be classified as moderately pathogenic (Table 2). In field conditions, pathogenicity of *E. magna* and *E. irrsidua* is enhanced by bad

hygienic conditions or intercurrent infections like *Escherichia coli*. Animals that survive the disease may acquire species specific and in some instances strain specific immunity.

Diagnostic methods

A diagnostician may find low graded infection in any healthy rabbit on faecal examination or an impression smear of the liver for the presence of coccidia. Here care should be taken to differentiate from rabbit specific yeasts. The degree of infection can be assessed by faecal floatation and by counting the coccidian oocyst per gram (OPG) of faeces. However, an infection of pathogenic significance is often accompanied by diarrhoea, decrease in weight gain or loss of weight and distinctive lesions. Many workers make little efforts to differentiate between the different species found in rabbits. *E. steidai* found in liver, is less difficult to identify.

Sporulation of oocysts and shipment

The sporulation time of oocyst is one of the most important criterions in the identification of the species. It is mainly influenced by population density of the oocysts, oxygen tension and ambient temperature. In controlled conditions, the sporulation time varies from 22 hours for *E. perforans* to 70 hours for *E. piriformis* when the oocysts are incubated at 20°C. Live oocysts may be desired by researchers to verify species diagnosis and to characterize different strains. Oocysts sporulate within 48 hr if maintained at 27°C in petri dishes. The sporulation time varies according to the species, but in practice the duration varies from 24 hr for *E. exigua* and *E. perforans*, 72 hr for *E. intestinalis*, *E. coecicola* and *E. piriformis* and 48 hr for the other species. Oocysts remain viable for many weeks at room temperature and many months under low temperature. After sporulation the material may be

Table 1. Macroscopic lesions of digestive tract and liver of rabbits by different *Eimeria* spp.

Species	Post-mortem lesions
<i>E. media</i>	Non-specific lesions of the duodenum (the endogenous development takes place in the jejunum and the ileum)
<i>E. coecicola</i>	Non-pathogenic lesions of vermiform appendix in heavy infection.
<i>E. magna</i>	Lesions on the jejunum and more pronounced on the ileum, dose dependent lesion
<i>E. irresidua</i>	Lesions occur on the jejunum and to a lesser extent on the ileum
<i>E. flavescens</i>	Marked lesions on the caecum and colon
<i>E. intestinalis</i>	Marked lesions on the ileum and on the lower part of the jejunum
<i>E. piriformis</i>	Only the colon (proximal and distal). Pathological lesions consist of catarrhal inflammation of the small intestine.
<i>E. stiedai</i>	Lesions of the biliary ducts white nodules and the liver hypertrophy
<i>E. vej dovskyi</i>	Lesions only on the ileum and the distal part of the jejunum
<i>E. exigua</i>	No pathogenicity associated with this species. Moderate to severe intestinal inflammation mainly in ileum.
<i>E. perforans</i>	Mild to moderate lesions in duodenum and ileum.

Table 2. Pathogenicity of different species of rabbit coccidiosis

Pathogenicity	Species	Symptoms
Non pathogenic	<i>E. coecicola</i>	No sign of disease
Slightly pathogenic	<i>E. perforans</i> <i>E. exigua</i> , <i>E. vej dovskyi</i> ,	Slight decrease of growth, no diarrhoea, no mortality
Mildly pathogenic or pathogenic	<i>E. media</i> , <i>E. magna</i> , <i>E. stiedai</i> , <i>E. irresidua</i> , <i>E. piriformis</i> ,	Decrease of growth, diarrhoea dose dependant mortality
Highly pathogenic	<i>E. intestinalis</i> , <i>E. flavescens</i>	Severe decrease of growth, Severe diarrhoea, high mortality.

Table 3. Morphological features of *Eimeria* spp. of rabbits

Species	Length (mm) (mean ± SD)	Breadth (mm) (mean ± SD)	Shape Index (mean length/width)
<i>E. steidai</i>	34.00 ± 2.44	20.20 ± 1.46	1.68
<i>E. perforans</i>	18.64 ± 1.80	14.60 ± 0.96	1.28
<i>E. media</i>	30.62 ± 1.40	17.09 ± 1.24	1.79
<i>E. magna</i>	36.49 ± 3.58	23.41 ± 2.14	1.56
<i>E. irresidua</i>	32.40 ± 3.64	18.60 ± 1.48	1.74
<i>E. intestinalis</i>	29.37 ± 1.73	19.49 ± 1.70	1.51
<i>E. coecicola</i>	38.80 ± 1.49	24.92 ± 1.26	1.56
<i>E. piriformis</i>	30.62 ± 1.40	17.12 ± 1.21	1.79
<i>E. exigua</i>	18.0 ¹	16.0 ¹	1.10
<i>E. vej dovskyi</i>	31.5 ²	19.1 ²	1.65
<i>E. flavescens</i>	30.0 ²	21.0 ²	1.43

stored in a bottle, leaving half of the bottle left empty to provide needed air space.

Differential diagnosis of sporulated *Eimeria* oocysts in rabbits

The oocysts of coccidian are often

difficult to differentiate and may require the help of a specialist. Sporulation time, morphology and morphometric parameters are used for specific identification in rabbits. Morphology of the sporulated oocysts is an important criterion in

determination of the *Eimeria* species. The shape differences in the form of shape index (ratio of average length and average width) are also useful in comparing the oocysts, which are subspherical with those of elongated. The measurements and morphological features of different *Eimeria* species in rabbits are shown in Table 3

Influence of coecotrophy on the artificially prolonged prepatent, patent periods, oocysts excretion and sporulation time in the rabbit has been documented. Prepatent period, of course, is difficult to determine in case of coccidiosis due to peculiar behaviour of coprophagy. The species of *E. media* and *E. coecicola* are difficult to identify within mixture as their dimensions and other features overlap between species. However, the sites of infection are different in monospecific infections. Therefore, species diagnosis has to be based on a combination of various characteristics including site of development in the intestinal tract of the host, type of lesions etc. A key for the species identification of sporulated oocysts of *Eimeria* from rabbit is given below.

Identification of other stages

Although, oocysts are the most easily recognised stage in the life cycle, schizonts, merozoites, and gametocytes may also be identified in scrapings of the mucosa. In order to examine the endogenous developmental stages scrapings should be examined from different locations along the intestinal tract. However, species identification by this or by histological method is a matter of specialist's job.

Prevention and control

Prophylactic medication in drinking water and feed was found to drastically reduce oocyst production and almost total inhibition of hepatic and intestinal lesions in rabbits. Treatment of hepatic coccidiosis is difficult and the diseases may remain life long. Many drugs have been tried against coccidiosis in rabbits such as Sulpha drugs, Clopidol, Nitrofurans, Pyrimethamine, Amprolium, Monensin etc. However, the most common drugs are Nitrofurans, Amprolium and Sulpha drugs. The following drugs have been found to be effective against clinical coccidiosis in rabbits during the course of the present study in various farms.

BIFURAN	(Nitrofurazone + Furazolidone), SKF-1 tablet/litre of drinking water for 7 days.
PEQUIN	(Sulphaquinoxaline), RANBAXY- 0.05% in drinking water for 7 days.
CODRINOL	(P-toluensulphonyl-beta methoxyethyleurethane + Tetracycline), HOECHST-1 gm/ litre of drinking water for 7 days.
AMPROLSOL	(Amprolium 20%), GLAXO-0.06 % in drinking water for 7 days.
SULMET	16% solution (Sulphadimethylpyridin), CYANAMID-7.5 ml/ litre of drinking water for 7 days.

SUPERCOX (Sulphaquinoxaline (18.7% w/w) and Diaveridine (3.3% w/w), WOCKHARDT- 10 gm in 10 litres of drinking water or 100 gm powder in 50 kg of final feeds to 5-7 days.

The treatment should take into account the possibility of re-infection especially due to coprophagy in rabbits. Thus a minimum of 2 periods of treatments are recommended preferably 2 periods of 7 days each with a pause of 7 days in between. Apart from medication, good preventive hygiene is the key to successful rabbit production.

SUMMARY

Rabbit production for meat and wool is gaining momentum in India as a micro livestock. Broiler rabbits are reared irrespective of the geographical locations and available in almost all parts of the country. The Angora rabbit which is reared mainly for fine wool production is, however, restricted to the hilly regions of the country particularly in sub-temperate climates. Coccidiosis is a major impediment in rabbit production and the most common protozoan parasitic disease affecting all age groups. This clinical entity is caused by almost a dozen species of *Eimeria* with differential features with respect to the clinical course, the causative agent, differential diagnosis and preventive measures for control of rabbit coccidiosis. ■

A success story of more wheat ...

(Continued from page 14)

emergence spraying of pendimethalin @ 1.5 kg a.i./ha significantly increased the seed yield up to 49.92 q/ha and 48.67 q/ha as compared to farmers' practice (24.33 q/ha in 2001-02 and 22.06 q/ha in 2002-03).

The increased seed yield was significant at both the levels, i.e. 1 and 5 percent of significance. In another trial the number of weeds were reduced up to 51.35 per cent after one year of sowing of wheat

crop through zero-tillage seeding device. The major weeds were *Phalaris minor*, *Chenopodium album*, *Lathyrus aphaca*, *Melilotus alba*, *Cynodon dactylon*. ■