UNIVERSITI PUTRA MALAYSIA

SPECIES, AGE-PATTERN AND OTHER EPIDEMIOLOGICAL FEATURES OF CAPRINE COCCIDIAL INFECTION IN HULU LANGAT, SELANGOR

JALILA BINTI ABU

FPV 1994 5

SPECIES, AGE-PATTERN AND OTHER EPIDEMIOLOGICAL FEATURES OF CAPRINE COCCIDIAL INFECTION IN HULU LANGAT, SELANGOR

By

JALILA BINTI ABU

Thesis Submitted in Fulfilment of the Requirements for the Degree of Master of Science in the Faculty of Veterinary Medicine and Animal Science, Universiti Pertanian Malaysia

March 1994

ACKNOWLEDGEMENT

First and foremost the author wishes to extend her deepest appreciation and heartfelt thanks to her chairman supervisory comitte of the study, Associate Prof. Dr. Rehana bte Abdullah Sani. I also lush to thank Dr. Pierre Dorny for his advice, encouragement, guidance and assistance throughout the period of my work at Universiti Pertanian Malaysia.

The author is also greatly indebted to Dr. Nadzri bin Salim and Dr. Ridzwan bin Abdul Halim for their valuable help in application of statistical analysis.

The author's gratitude also goes to Dr. Chantal Symoens, Prof. J. Vercruysse and Dr. Zamri bin Saad for giving support while the study was conducted.

The author's survey of smallholder goat farms would not have been possible without the assistance of En. Megat Zaki bin Megat Mahmud. I am especially appreciative of the help and cooperation provided by the farmers while conducting the studies.

Thanks are also due to all who had in one way or anothercontributed to the completion of the study.

This thesis was partly financed by the Malaysia-Belgium Veterinary Project (V.L.I.R, Belgium).

Finally, the author would like to thank her beloved parents, husband (Rijal) and son (Hendra) for their constant encouragement and support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

Abstract of thesis submitted to the Senate of Universiti Pertanian Malaysia in fulfilment of the requirements for the degree of Master of Science.

SPECIES, AGE-PATTERN AND OTHER EPIDEMIOLOGICAL FEATURES OF CAPRINE COCCIDIAL INFECTION IN HULU LANGAT, SELANGOR

By

JALILA BINTI ABU

MARCH 1994

Chairman: **Assoc. Prof. Dr. Rehana Abdullah Sani**

Faculty: **Veterinary Medicine and Animal Science**

Eimerian oocysts were found in 89% of 815 faecal samples from goats of smallholders in Selangor area. Nine species of *Eimeria* identified (and their prevalence of infection) were *E. arloingi* (71%), *E. ninakohlyakimovae* (67%), *E. christenseni* (63%), *E. alijevi* (61%), *E. hirci* (34%), *E. jolchijevi* (22%), *E. caprovina* (12%) *E. caprina(9%)* and *E. pallida* (4%).

The mean opg was significantly ($p<0.05$) higher in the age group less than 16 weeks. Faecal samples where the counts were in the range of 10,000-100,000 and above 100,000 was also high in this age group. After this age, the mean opg generally decreased. The mean opg in the age group less than 16 weeks was high due to the presence mainly of non-pathogenic species.

No clinical coccidiosis was found probably because of *E. ninakohlyakimovae* (the most pathogenic species) being present in low counts throughout the study period. Age of kids, sunshine and hygiene were significantly related to oocyst counts.

Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia bagi memenuhi syarat-syarat ijazah Master Sains.

SPESIS, PENGARUH-UMUR DAN LAIN-LAIN ASPEK EPIDEMIOLOGI KE ATAS INFEKSI CAPRINE KOKSIDIA DI HULU LANGAT, SELANGOR

Oleh

JALILA BINTI ABU

MAC 1994

Pengerusi: **Prof. Madya Dr. Rehana Abdullah Sani**

Fakulti: **Kedoktoran Veterinar dan Sains Peternakan**

Oosista *Eimeria* telah didapati di dalam 89% daripada 815 contoh tinja dari kambing kepunyaan penternak kecil di kawasan Selangor. Sembilan spesis *Eimeria* dikenal pasti (dan prevalens infeksi) adalah *E.arloingi*(71%), *E. ninakohlyakimovae*(67%), *E. christenseni*(63%), *E. alijevi*(61%), *E. hirci* (34%), *E. jolchijevi*(22%), *E. caprovina*(12%), *E. caprina*(12%) dan *E. pallida*(4%).

Purata oosista per gram tinja bagi anak kambing yang berumur kurang dari 16 minggu mempunyai perbezaan yang bermakna ($p<0.05$). Contoh tinja di mana kiraan oosista di dalam lingkungan 10,000-100,000 dan melebihi 100,000 juga tinggi di dalam kumpulan umur ini. Purata osista per gram tinja bagi kumpulan yang berumur kurang dari 16 minggu adalah tinggi disebabkan oleh spesis yang tidak patogenik.

Tiada keadaan klinikal koksidiosis didapati. Ini disebabkan *E. ninakohlyakimovae* (spesis yang paling patogenik) hadir di dalam jumlah yang rendah sepanjang jangkamasa kajian. Umur anak kambing, cahaya matahari dan kebersihan mempunyai pertalian yang bermakna ke atas kiraan oosista.

CHAPTER 1
INTRODUCTION

Goat production in Malaysia is undertaken mainly in rural areas by smallholders engaged in mixed cultivation and by landless estate workers (Peter, Mukherjee and Deichert, 1980). Very few large farms of more than hundred heads exist except in govermental or institutional farms (Mahyuddin, 1993). The goat population in Peninsular Malaysia is about 288,516 heads (Department of Veterinary Services, 1992) which consists of indigenous kambing Kacang (Katjang), several exotic purebreds and crossbreds. The Kacang breed represents 84% of the total Malaysian goat population (Peter, Diechert, Drewes, Fichtner, Moll, Chavarria and Diakite, 1979).

Infectious disease is one of the main constraints to the goat industry. Parasitic diseases in Malaysia as in many other countries play an important role in the lowered productivity, morbidity and mortality in domestic animals (Amin Babjee, 1993). Most parasitology research in small ruminants in this country is directed towards studies on strongyles. There are only a few studies on coccidia probably because of the rare occurrences of clinical case. The few studies reported were by Syed Sultan Mohna (1976), Fatimah, Borhan and Whitten (1989), Amin Babjee, Lee, Sheikh Omar and Mohna (1990) and Daud (1990). All of these studies involved goats in institutions and slaughter houses. Only Daud (1990) reported an epidemiological component in the study.

As there is no work on coccidia involving goats in smallholders in Malaysia, this study was conducted with the following objectives:

1) to identify the species of coccidia in goats on smallholder farms,
2) to monitor the coccidia pattern in kids from birth onwards, and
3) to study some epidemiological factors in coccidial infection.

CHAPTER II
LITERATURE REVIEW

Coccidia

Classification

Coccidia belongs to the phylum Apicomplexa, class Sporozoea, subclass Coccidia, order Eucoccidiida, suborder Eimeriina, family Eimeriidae and genus *Eimeria* (Society of protozoologist, 1980). They are generally intracelullar parasites of the epithelial cells of the intestine (Soulsby, 1986).

Life Cycle

Eimeria are generally host specific. Members ofthe genus *Eimeria* have life cycle involving asexual (schizogony) and sexual (gametogony) stages in one host. The basic pattern of the life cycle of *Eimeria* has been described by Foreyt (1990).

Unsporulated oocysts are passed in faeces frominfected goats. The schizogony phase starts when sporulated oocysts are ingested by goats. Eight sporozoites are released from each oocyst through the action of bile and trypsin. Sporozoites penetrate intestinal cells, forming trophozoites, which divide many timesand form schizonts (meronts). When the schizont ruptures, the merozoites contained within are released into the intestinal lumen; each of the merozoites penetrating a new intestinal cell. Either

another asexual cycle or the sexual cycle follows, depending on the species involved.

One to three cycles may precede gametogony. During gametogony, microgametocytes (male) and macrogametocytes (female) develop into microgametes and macrogametes, respectively. The microgametes are released into the intestinal lumen, fertilizing intracelular macrogametes to produce zygotes or oocysts. Host cells rupture and release unsporulated oocysts into the intestinal lumen, and oocysts exit the host via faeces. The entire life cycle in the host takes two to three weeks and may extend for several months.

Pathogenesis and Pathology

Damage to the host is primarily that of cell disruption, caused by stages of the parasite invading and destroying cells. Cells damaged allow the leakage of blood and tissues and this result in watery diarrhoea (usually without visible blood), dehydration, weight loss, tenesmus, rectal prolapse, anaemia and death (Foreyt, 1990). These clinical signs are usually seen either during the late asexual or the early sexual phase of the life cycle (Howe, 1980).

Signs of clinical coccidiosis are observed most commonly in four to eight week old lambs and kids housed with their dams,in lambs and kids two to three weeks after weaning, or in sheep and goats of all ages after entering feedlots, following a change in diet, or after stressful situations,

such as inclement weather, shipping, handling, or intercurrent disease (Foreyt, 1990).

The severity of the disease depends upon the species of coccidia involved, the age and resistance of the host, the number of host cells destroyed, the number of oocysts that initiated the infection and the degree of reinfection (Cheng, 1986). In the study by Yvore and Esnault (1987), they found that *E. ninakohlyakimovae* was the most pathogenic. They used only *E. ninakohlyakimovae* and *E. arloingi* because these two are the most common coccidial species found in domestic goats. They found that counts of 200,000 *E. ninakohlyakimovae* oocyst/g faeces caused severe diarrhoea, depression and death of some animals while counts of 24 million *E. arloingi* oocyst/g faeces showed mild, transient diarrhoea.

At post-mortem the intestinal lesions in coccidio-sis are flat white spots 1 to 2mm in diameter, raised areas of enlarged villi and proliferative lesion that protrude into the intestinal lumen (Norton, 1986).

Diagnosis

The diagnosis of clinical coccidiosis is based on the history (management, housing), observation of clinical signs, conformation by finding a massive number of oocysts in the faeces and determining the species of the oocysts (Schillhorn, 1986; Yvore and Esnault, 1987 and Foreyt, 1990).

Demonstration of antibodies (for example by fluorescent antibody technique) is not very useful for clinical disease because many infected animals carry antibodies but do not show disease (Schillhorn, 1986).

In dead animals, diagnosis can be made by the presence of the intestinal lesion as mentioned above. Conformation by histology also helps in diagnosis where there may be denudation of the intestinal epithelium and stages of the parasites will be observed in epithelial cells (Schillhorn, 1986; Foreyt, 1990).

Treatment

Generally the treatment of coccidiosis involved the use of coccidiostat and supportive treatment according to symptoms (Fitzgerald, 1980). The treatment of sheep and goat coccidiosis is almost the same. In the report by Bergstorm and Maki (1974), the effect of monensin (coccidiostatic antibiotic) in a three month old lamb with naturally occuring coccidiosis showed that lambs in the control group discharged moderate numbers of oocysts and had some diarrhoea. Lambs treated lambs for 22 and 44 days discharged few or no coccidial oocyst after day 9, had little or no diarrhoea, and had no evidence of toxic effects attributable to the monensin. In this study, monensin was given at the rate of 33 mg/kg of feed (1.6 mg/kg body weight daily).

In an outbreak of coccidiosis in an experimental flock of local goats of Sikkim (Mishra and Ghei, 1982), this was controlled by the administration of sulphadimidine (I.D.P.L.) @ 0.2 gm/kg body weight on the first day followed by half the dose for the following four days. Two

animals died on day 3 and 5 of initiation of treatment. The rest of the animals were cured. The consistency of faeces became pellet-like in 4 to 5 days, while shedding of coccidean oocysts in the faeces was reduced to a great extent within these days. Complete recovery of normal appetite and general appearance took about a fortnight after the cessation of treatment.

Control

In general two basic steps to control coccidiosis are by improved management and chemoprophylaxis (Pellerdy, 1976; Howe, 1980; Yvore and Esnault, 1987; Foreyt, 1990). Improved management involved sanitation and reduction of stressors. Steps to reduce reingesting excreted oocyst include cleaning animal facilities, frequent removal of faeces from animal pens, prevention of faecal contamination and animals walking into feeders and waterers and practises of deep litter system especially for intensive system as in poultry farming. Reasonable animal densities and adequate nutrition are other measures recommended.

Anticoccidial drugs are often used in an attempt to prevent or minimize effects of clinical disease (Foreyt, 1990). There are many coccidiostats available in the market which are used as chemoprophylaxis or therapy. The use of coccidiostat in goats or sheep was as a result of its efficacy in poultry and bovine.

Gjerde and Helle (1986) studied the efficacy of toltrazuril in the prevention of coccidiosis in naturally infected lambs on pasture. The reduction in oocysts production was dose related. This study showed that single-dose treatments of lambs with toltrazuril at 15 or 20 mg/kg on day

10 after turnout was capable of controlling the severity, or preventing coccidiosis due to the initial coccidial infection on pasture.

In the repeated study by the same researchers in 1991, they found that toltrazuril at 20 mg/kg given on day 7 or day 10 after turnout on pasture, proved to be highly efficacious in preventing clinical coccidiosis. Toltrazuril reduced the oocyst output to very low levels and prevented the development of soft faeces. Lambs treated with toltrazuril on Day 7 seemed to be as immune as untreated lambs to natural reinfections with coccidia later in the grazing season.

Foreyt (1990) suggested the administration of coccidiostat in feed or salt (1) when sheep or goats are overstocked or in wet, muddy areas; (2) before and when lambs or kids are stressed by weaning, transport or severe weather; (3) when lambs enter feedlots and (4) when based on historical data, the disease is imminent. Preventive treatment should be administered for 30 consecutive days or longer, depending on the severity of the situation and should begin before the disease is predicted. A coccidiostat should be used at a level that causes shedding of a few oocysts, to allow the host to develop resistance to later challenge, but will prevent clinical or economic disease.

Coccidia Species in Goat

Species of coccidia are generally regarded asubiquitous parasites of wild and domestic animals. Surveys based on the examination of ruminant faeces have shown that most animals are infected with a variety of species from an early age (Vercruysse, 1982). In goats, at least elevan species of *Eimeria* occur; *Eimeria alijevi*, *Eimeria arloingi*, *Eimeria aspheronica*, *Eimeria caprina*, *Eimeria caprovina*, *Eimeria christenseni*, *Eimeria hirci*, *Eimeria jolchijevi*, *Eimeria ninakohlyakimovae*, *Eimeria kocharli* and *Eimeria pallida* (Fernando, 1957; Syed Sultan Mohna, 1976; Vercruysse, 1982; Norton, 1986; Bahirathan and Weilgama, 1986; Manual of veterinary parasitology laboratory techniques (MAFF), 1986; Pwn Kanyari, 1988; Fatimah *et al.*,1989; O'Callaghan, 1989; Foreyt, 1990).

It was known that the same species were present in sheep and goats, but cross-infection tests have shown that coccidia isolated from either of these hosts do not develop in the other except for *E. caprovina* and *E. pallida* (MAFF, 1986).

Characters Used for Species Identification

The study on species differentiation is needed because the recommended method for examining faeces is a quantitative examination of individual specimens in which only the pathogenic species are differentiated. Differential diagnosing all of the species present is unnecessary (Yvore and Esnault, 1987).

Measurement of the oocyst and sporozoites and morphological characteristics are commonly used for species identification (Pellerdy, 1974; Vercruysse, 1982; Bahirathan and Weilgama 1986).

Some of the differences between the species is summarized in Table 1. The smallest oocyst is *E. pallida* and the largest is *K. kocharli.* Their shapes are mainly ovoid or ellipsoidal. The presence or absence of micropyle cap is also an important character used for species identification.

Epidemiology

Risk Factors

There were only very few studies on risk factors of coccidial infection. The risk factors studied were age (Daud, 1990) and temperature (Christenseni, 1939).

Coccidia Studies in Malaysia

The studies on coccidial species has done by Mohna (1976) and Fatimah *et al.*(1989). The species were *E. parva* (*E. alijevi*), *E. ninakohlyakimovae*,*E. arloingi*, *E. crandalis* (*E. hirci*),*E. christenseni*, *E. pallida* and *E.faurei* (*E. aspheronica*). *Eimeria aspheronica* was found in Fatimah *et al* (1989) only. Mean prevalence for coccidia in that study was 79%. *Eimeria arloingi* was the most common coccidia identified. In Mohna's survey on records in Animal Institute, Kluang, he found that goat mortality as a result of coccidiosis was only 1.46%.

Table 1

Characters Used for Species Identification

Species	Author	Oocyst measurement (in micron) length	width	Shape[a]	Micropyle cap
E. pallida	MAFF(1986)	14	10	E	absent
E. alijevi	MAFF(1986)	17	15	E, S, O	absent
E. hirci	Pellerdy(1974)	18-23	14-19	O	present
	Bahirathan and Weilgama(1986)	18-27	16-22	E, S	present
	MAFF(1986)	23	18	E, S	present
E. ninakohlyakimovae	Pellerdy(1974)	20-22	14-16	S, O	absent
	Vercruysse(1982)	22-27	16-24	E, O	absent
	MAFF(1986)	24	19	E	present
E. arloingi	Pellerdy(1974)	17-42	13-27	E, O	present
	Vercruysse(1982)	27-35	17-24	E, O	present
	MAFF(1974)	28	20	E	absent
E. caprovina	Lima(1980)	26-36	23-28	S, O	absent
	MAFF(1986)	30	24	E	
E. jolchijevi	Bahirathan and Weilgama(1986)	25-33	19-24	Broad shouldered urn	present
	MAFF(1986)	31	24	E, O	present
E. aspheronica	MAFF(1986)	31	23	O	absent
E. caprina	Lima(1979)	13-17	7-10		absent
	MAFF(1986)	32	23	E, O	absent
E. christenseni	Pellerdy(1974)	34-41	23-28	E, O	present
	Vercruysse(1982)	40-46	25-30	O	present
	MAFF(1986)	38	25	E, O	present
E. kocharli	MAFF(1986)	47	32	E	

There was also a study on adult indigenous goats by Amin Babjee *et al.* (1990) obtained from the slaughter house. Ninety seven percent of the faecal samples contain oocysts. Oocyst counts ranged from 100 to 39,800 per gram of faeces.

In Daud's (1990) study of 46 kids which were monitored from birth to fifty-eight weeks of age, ocysts were observed as early as three weeks of age from faecal smears. Percent prevalence of coccidia in goats age less than 3 months was 84.8%, 100% in 3-6 months old kid, 93.7% in more than 6-12 months and 100% in kids more than 12-19 months-old.

He also studied the relationship between oocyst count and age. He found that kids below three months of age had oocyst counts that were positively correlated to age. At 3 to 6 months of age, oocyst counts were not correlated to age. In animals aged above 6 months to 12 months, oocyst counts were negatively correlated to age suggesting reduction in oocyst output. Above 12 to 19 months, coccidia oocyst counts were again not correlated to age. He found that at the 3 to 6 month period initial development of immunity may have occurred, thus supressing oocyst production but not to the extent of reducing output.

Sporulation and Survival of the Oocyst in the Environment

It is known that coccidia oocysts do not sporulate inside the intestine of the host because of prevailing anaerobic conditions. Oocysts discharged from the host sporulate within two to three days, provided conditions of

temperature, moisture and oxygen tension are optimum (Christensen, 1939).

In general, sporulation of oocysts is most rapid at 28°C to 31°C. Low temperature of 0 to 5°C retards sporulation. Temperatures aboves 63°C are lethal to oocysts and sunlight is detrimental to oocyst survival (Foreyt, 1990). Therefore the conditions which coccidial oocyst develop rapidly and survive well are most likely in moist shaded areas (Schillhorn, 1986) such as the surroundings of drinking throughs or wet soiled litter (Pellerdy, 1974).

Vercruysse (1982) worked on coccidia in the area of northern and eastern part of Senegal, a zone with a long dry season (October-June). The overall epidemiological picture presented was that of moderate oocyst counts (range of 1000-5000 opg) in goats throughout the year without seasonal fluctuation. The different climatic factors (moisture, rainfall and temperature) in Senegal did not influence the coccidial infection.

In a study by Chhabra and Pandey (1991) in Zimbabwe many species of coccidia were identified. The workers considered the moderate climate to be conducive to the development and survival of a wide variety of coccidia oocysts.

Immunity

Infections with coccidia generally declined with age. Older goats discharge almost continously oocysts belonging to various species. From this it can be concluded that in these animals a certain, but not complete,