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Eimeriosis in dairy cattle farms in Morogoro municipality of Tanzania

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Abstract

Coccidial oocysts were detected in 35% of 445 cattle in four medium-scale and 20 small-scale dairy farms in Morogoro municipality, Tanzania. The highest prevalence (56%) was observed in animals aged between 5 and 18 months, whereas lower prevalences were observed in calves (29%) aged between 12 days and 4 months and adults (30%). No coccidial oocysts were detected in calves less than 12 days old. The oocyst output was high in calves, followed by weaners; adults had the lowest oocyst output. The number of oocysts per gram of faeces was significantly higher ($P < 0.001$) in diarrhoeic animals than in non-diarrhoeic animals, and more so in young calves. *Eimeria* species infecting the animals included *Eimeria bovis* (68%) and *Eimeria zuernii* (57%), *Eimeria ellipsoidalis* (25%), *Eimeria cylindrica* (23%), *Eimeria auburnensis* (22%), *Eimeria alabamensis* (12%) and *Eimeria subspherica* (5%). Mixed infections involving two or three species were common. Our findings indicate that eimeriosis is common in cattle in Morogoro municipality. Published by Elsevier Science B.V.

Keywords: *Eimeria*; Cattle; Prevalence; Tanzania

1. Introduction

Bovine coccidiosis appears to be a cosmopolitan disease in major cattle-raising countries and is primarily a disease of young animals (calves aged 3–6 months; Levine, 1973). The disease is more frequent in housed animals than in those on pastures (Hasbullah et al., 1990; Mage et al., 1990). Together with other enteropathogens,

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coccidia have been found to be important causes of diarrhoea in calves (Bohrmann, 1991; Iwamatsu et al., 1991; Mage and Reynal, 1992).

Of late, the livestock industry in Tanzania has undergone an important change, with the introduction of exotic breeds and the increased desire to improve milk production. Dairy-animal husbandry is common in many urban and peri-urban areas in Tanzania. This sector, together with the large-scale farms, supply much of the milk consumed in urban areas in Tanzania.

Most animals in urban areas are kept in a zero-grazing environment, where animals are given little space and are sometimes in obviously overcrowded pens. This system of keeping animals is thought to contribute to increased incidences of various diseases (Lema and Bunda, 1991) such as diarrhoea, which is a major cause of calf mortalities in dairy farms in Tanzania (Shoo et al., 1992). To date, there is no concise information concerning the aetiological agents responsible for diarrhoea in dairy cattle. Therefore, the aim of this study was to establish the prevalence and burdens (indicated by oocysts per gram of faeces (OPG) values) of coccidia oocysts in cattle in medium- and small-scale dairy farms/units and relate them to the occurrence of diarrhoea.

2. Materials and methods

2.1. Source of animals and faecal sampling

This study was carried out between May 1994 and April 1995. Faecal samples were collected from animals in three farms belonging to Sokoine University of Agriculture (University (SUA) Farm, Magadu and Otitis Project) and private farm 'M' (all medium-scale farms with a range of 50–150 animals per farm), and from 20 small-scale dairy units (with a range of 4–10 animals per unit) in Morogoro municipality. All farms kept Friesian × Tanzania Shorthorn Zebu crossbred animals. The choice of herds depended on the cooperation of the animal owners. The level of house hygiene was higher in small-scale dairy units compared to the medium-scale farms.

Animals in all the selected herds were screened. Faecal samples were collected directly from the rectum of all animals in the study herds using plastic hand gloves, each glove being marked to indicate the name of the farm and animal's age and identification number. Samples were taken to the laboratory immediately after collection and preserved at 4°C until examined. Animals were also examined clinically for evidence of diarrhoea. Animals with fluid faeces and/or soiled hind-quarters were categorized as diarrhoeic, while those not manifesting these features were considered to be non-diarrhoeic. Animals aged between 1 day and 4 months were regarded as calves, those aged > 4–18 months were categorized as weaners and those > 18 months were considered as adults.

2.2. Examination for oocysts and counting

A 1 g poirtion of faecal material was mixed thoroughly with 14 ml of saturated sodium chloride solution. The resultant faecal suspension was poured through a tea

strainer into a beaker. A small amount of the sample was then aliquoted into a McMaster slide chamber and examined under the microscope at 400 × magnification.

2.3. Culturing and examination for sporulated oocysts

For identification of *Eimeria* species, 100 randomly selected (using random numbers drawn from a Casio calculator FX 3400P) faecal samples with more than 500 OPG were cultured. Two gram portions of positive faecal samples were mixed thoroughly with 2% potassium dichromate solution (BDH, Poole, UK), passed through a tea strainer and then incubated at room temperature for 48 h. Thereafter, the suspension was centrifuged for 5 min at 3000 rpm and the supernatant was discarded. The sediment was then well mixed with saturated sodium chloride solution and the resultant suspension was passed through a tea strainer into another test tube. An aliquot was put into a modified McMaster slide chamber and examined by light microscopy at 400 × magnification with an eye piece mounted with a micrometer scale. Size of the sporulated oocyst, presence or absence of the micropyle, shape of the oocysts, arrangement of the sporozoites and colour of oocysts were the criteria used for the identification of *Eimeria* species (Ministry of Agriculture, Fisheries and Food, 1986).

2.4. Data analysis

Data were analysed using using Epi Info, Version 6 statistics program (Dean et al., 1994). Differences in the prevalence of infection between farms, age groups and between diarrhoeic and non-diarrhoeic animals were compared by the chi-square test (two-tailed). The 95% confidence intervals on prevalences were also computed. The oocyst burdens (OPG) were compared by the Mann–Whitney rank sum test (W). The level of significance was taken to be 5%.

3. Results

Of the 445 animals screened, 35% were positive for coccidial oocysts (Table 1). Lower prevalences were in the 'M' herd and the small-scale dairy units than in SUA, Otitis and Magadu farms.

Oocysts were demonstrated in all age groups of animals of more than 12 days of age. However, it was evident that the prevalence of the disease was significantly higher in weaners than in either calves or adults (Table 2). The prevalences in calves and adults were comparable. More young stock (calves and weaners) were excreting a high number of oocysts compared to adults (Table 3). For instance, whereas 93% of the calves were excreting > 5000 OPG, this output in weaners and adults was detected in 57% and 18% of the animals respectively.

Clinical examination showed that 61 animals out of those screened were diarrhoeic, most (49%) of which were calves. The prevalence of coccidiosis was significantly higher ($P < 0.001$) in diarrhoeic animals than in non-diarrhoeic ones (Table 4). This difference was more apparent in calves than in other age groups. The median OPG in

Table 1
Prevalence of coccidial oocysts in various cattle herds in the Morogoro municipality, Tanzania (May 1994 to April 1995)

Farm	No. of animals screened	No. of positive animals	% of positive animals	95% CI
University farm [a]	92	48	52	41.5–62.7
Otitis [a]	114	47	41	32.1–50.8
Magadu [a]	127	44	34	26.4–43.6
'M' [a]	50	9	18	8.6–31.4
20 small-scale farms (pooled) [b]	62	8	13	5.7–23.9
Total	445	156	35	30.6–39.7

[a] Medium-scale farms.
[b] Small-scale farms.
CI, confidence interval.
[ab] $\chi^2 = 15.53$, d.f. = 1, $P = 0.0001$.

Table 2
Coccidial oocysts in various age groups of cattle [a] in Morogoro, Tanzania (May 1994 to April 1995)

Age category	No. of animals screened	No. of positive animals	% of positive animals	95% CI
Calves (< 4 months)	139	41	29	22.1–37.8
Weaners (4–18 months)	90	50	56	44.7–66.0
Adults (> 18 months)	216	65	30	24.1–36.7
Total	445	156	35	30.6–39.7

[a] $\chi^2 = 20.84$, d.f. = 2, $P = 0.00030$; CI, confidence interval.

diarrhoeic animals was also significantly higher than that of non-diarrhoeic animals ($P < 0.001$).

E. bovis (68%) and *E. zuernii* (57%) were the most prevalent species infecting the animals. These were followed by *E. ellipsoidalis* (25%), *E. cylindrica* (23%) and *E. auburnensis* (22%). The least prevalent were *E. alabamensis* (12%) and *E. subspherica*

Table 3
Variation of OPG in various age groups of cattle [a] in Morogoro, Tanzania (May 1994 to April 1995)

Range of OPG	Calves		Weaners		Adults	
	No.	%	No.	%	No.	%
100–5000	3	7	21	43	53	82
5001–10000	9	22	7	14	10	15
10001–15000	10	24	6	12	2	3
15001–20000	11	27	12	25	0	0
> 20000	8	20	4	8	0	0

[a] $\chi^2 = 56.04$, d.f. = 2, $P = 0.000000$ (for cattle excreting > 5000 OPG).

Table 4
Prevalence of *Eimeria* and median oocyst counts in diarrhoeic and non-diarrhoeic cattle [a] in Morogoro, Tanzania (May 1994 to April 1995)

Diarrhoeic animals					Non-diarrhoeic animals			
Age category	No. examined	No. positive	% positive	Median OPG	No. examined	No. positive	% positive	Median OPG
Calves	30	19	63	10750	109	22	20	32000
Weaners	20	13	65	8600	70	37	53	7300
Adults	11	4	36	20100	205	61	30	5200
Total	61	36	59	28350	384	120	31	7100

[a] $\chi^2 = 17.83$, d.f. = 1, $P = 0.0000242$; $W = 3934.0$ (95% CI: 5800, 24300), $P = 0.0000$.

(5%). Mixed infection involving two or three *Eimeria* species was observed in 78% of the cultured samples (data not shown).

4. Discussion

Eimeria species infection was found to be very prevalent in cattle farms in Morogoro municipality. Prevalence was higher in medium-sized farms than in small-scale farms. We ascribe this finding to the differences in hygienic conditions of calf pens, stocking density and prophylactic medication that we observed in some farms in our study.

Eimeria oocysts were detected only in calves aged more than 12 days. This concurs with the findings of Karis (1983) and Dzershinskii (1984). The significantly higher prevalence in weaners than in other age groups is in contrast to the observations that coccidiosis is more prevalent in unweaned calves than in weaners and adults (Plotnikov and Kakoulin, 1982; Lipinski and Romaniuk, 1983; Waruiru and Muthia, 1991). The lower prevalences of the disease in unweaned calves is probably due to low stocking rates, leading to less environmental contamination in our farming systems compared to intensive management systems in developed countries.

The higher prevalence of *Eimeria* in diarrhoeic animals than in non-diarrhoeic animals suggests that *Eimeria* species may contribute to the diarrhoea, which may also be caused by other microorganisms such as *Escherichia coli*, *Salmonella*, *Cryptosporidium*, rotavirus, etc. (Reynolds et al., 1986; Hall et al., 1988; Greene and Bakheit, 1984). This is supported by the observation that a high percentage of animals with diarrhoea excreted significantly higher OPG compared with non-diarrhoeic animals.

The seven species identified in this study have also been reported in Kenya (Munyua and Ngoto, 1990). Data from the USA (Boughton, 1945), Kenya (Munyua and Ngoto, 1990) and Saudi Arabia (Kassim and Al-shawa, 1985) showed that oocysts of *E. bovis* and *E. zuernii*, which are the most pathogenic species for cattle (Stewart and Soll, 1994), are often numerous in bovine faecal samples. The high prevalence of these two pathogenic species and the finding that a high percentage of diarrhoeic animals were excreting high OPG, suggest that coccidiosis may contribute to diarrhoea syndromes in young stock in Tanzania. However, more studies are required to further verify the involvement of eimeriosis in the occurrence of diarrhoea in calves.

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