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THE INFLUENCE OF DIARRHOEA, PREGNANCY AND MANAGEMENT METHOD ON THE GASTRO INTESTINAL PARASITE INFECTION OF GOATS IN MAIDUGURI, NIGERIA

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ABSTRACT

A study was conducted to compare the influence of diarrhoea, pregnancy and management method on gastrointestinal parasite infections of goats raised in Maiduguri by the free range and semi-intensive systems of management. Faecal examination was done by the modified McMaster technique with saturated sodium chloride solution as the floating medium. Out of 315 faecal samples comprising 170 from free range and 145 from semi-intensively managed goats, 159 (50.5%), 96 (56.5%) and 63 (43.4%) respectively, contained helminth eggs and/or Eimeria oocysts. The parasite stages recovered in the two management systems were essentially similar. Strongyle type eggs were most prevalent (84.9%) followed by Eimeria oocysts (12.0%), Strongyloides eggs (8.2%) and Moniezia eggs (0.6%). Mixed infections were encountered in 2.5% of the samples. Prevalence of infection was generally higher among female than male; adult than young; diarrheic than non diarrheic and non pregnant than pregnant goats. Strongyle egg counts were generally similar among the groups except that young goats were shedding significantly more eggs than the adults. Between the two management systems, the prevalence of infection was generally higher in the free range than their semi-intensively managed counterparts irrespective of age, sex and pregnancy. Strongyle egg counts were generally similar in the two groups but significantly greater egg counts were recorded among the males, adults, non diarrheic and non pregnant semi-intensively managed goats than their counterparts on free range. Diarrhoea and pregnancy did not appear to have influenced the strongyle egg output of the goats irrespective of management method employed. The results suggest that i) the prevalence of gastrointestinal parasite infection is generally higher in free range animals than semi-intensively managed ones, ii) strongyle type egg predominated in the infection, iii) strongyle egg counts were generally higher in semi-intensive than free range goats and iv) pregnancy and diarrhoea did not appear to significantly influence the strongyle egg output of the goats irrespective of the management method.

***Key words**: Diarrhoea, pregnancy, management, gastrointestinal parasites, goats*

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INTRODUCTION

Sheep and goats are the major domesticated small ruminant livestock in Nigeria and with cattle constitute the main source of animal protein in the country [1,2]. Among the small ruminant stock, goats are much more common than sheep due to the wider acceptability of goat meat by the people, their greater economic potential as a result of their high fertility and early maturity [3,4]. Their hardiness and easy adaptability to both humid and semi-arid environments contribute to their widespread distribution in most rural and urban communities. A further desirable attribute of this species is their ease of management by both children and women who provide the bulk of labour in small holder family farms in Nigeria [2,5]. Consequently, a lot of social and economic importance is

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attached to ownership of small ruminants, particularly goats, which in some cases, may be the only realizable wealth of a rural household [2,6,7]

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However, various diseases, especially parasitic gastroenteritis (PGE) caused by helminthosis have been identified as a major limiting factor on the productivity of domesticated small ruminants in Nigeria [1,7]. For instance, about 20% of the total goat population in Nigeria, currently estimated at 43.45 million [8], were reported to die or be slaughtered *in extremis* as a result of PGE [9]. PGE is a disease syndrome caused by mixed infections with several species of gastrointestinal nematode parasites [10]. In Nigeria, the major nematodes responsible for PGE in small ruminants are species of the genera *Haemonchus*, *Trichostrongylus*, *Oesophagostomum*, *Bunostomum*, *Gaigeria* and *Strongyloides* [7,11,12,13,14].

Grazing animals harbour a variety of nematode species responsible for PGE but clinical disease does not usually occur until worm burdens are significantly heavy to upset the host's resistance [10]. Heavy worm burdens are usually acquired by animals when large numbers of the infective pre-parasitic stage are ingested by the animals over a short interval of time. The transmission of infective stages to grazing animals, their development, pathogenicity and the eventual outcome of disease are influenced by a variety of factors including the age of the animal, pregnancy/lactation, and management factors such as nutrition, intercurrent diseases and husbandry practices [10,11,15].

This study was therefore undertaken to evaluate the influence of pregnancy and husbandry method (extensive/free range and semi-intensive) on the faecal egg output of nematode infected goats as well as the involvement of gastrointestinal nematodosis in diarrhoea and anaemia of goats in Maiduguri, Borno State, Nigeria.

MATERIALS AND METHODS

Study area and sites

This study was conducted between June and October 2008 in Maiduguri, Borno State, Nigeria. Maiduguri is the capital and largest urban centre in Borno State. The state lies within the semi arid zone of northeastern Nigeria characterised by a mean annual rainfall of 533mm and a short rainy season from June to September followed by a prolonged dry season for the rest of the year [16].

Animals

The goats used in the study were predominantly of the Borno white breed and comprised young (≤ 12 months) and adult (> 12 – 60 months) animals [17,18] of both sexes. Goats sampled were selected from either the slaughter slab of the Maiduguri metropolitan abattoir or from small holder household farms within Maiduguri city. Most of the goats slaughtered at the abattoir are trade animals brought for sale and slaughter in Maiduguri from various parts of Borno State where they were previously raised by the free range (extensive) system of management. The household farms are usually maintained by the semi-intensive system of management in small numbers within households where they are usually released during the day to forage for food and housed overnight. Traditional small ruminant feeding under this management system in the study area is based on grazing (especially during the dry season), aftermath grazing and occasional supplementation with crop residue and household wastes [2].

Collection of samples

Faecal sample were collected directly from the rectum of the selected goats into a polythene bag, transported to the laboratory and examined immediately for gastrointestinal parasite stages. Blood samples were collected only from animals maintained under the free range system of management. Blood samples were collected through the jugular vein into appropriately labelled sample bottles containing ethylene tetra acetic acid as anti–coagulant. The study was conducted during the rainy season (June to September 2008) in the study area.

Processing of samples
Faecal examination was done by the simple floatation method while egg counts were determined by the modified McMaster technique using saturated sodium chloride solution as the floating medium [19]. Faecal culture, larval recovery and identification were done by the test-tube filter paper method as described by Harada and Mori [20]. In all cases, parasite stages present were identified using standard parasitological criteria [19,21]. Packed cell volume (PCV) was determined by the microhaematocrit method [22].

Statistical analysis
Data collected during this study were summarized as percentages and means ± standard deviations. Differences between means were determined at the 5% level of significance using the student 't' test [23].

RESULTS
Out of 315 goats comprising 170 under the free range and 145 under the semi-intensive management systems examined, 159 (50.5%), 96 (56.5%) and 63 (43.3%) were, respectively, infected with gastrointestinal parasites (Table 1). Female, adult, diarrheic and pregnant goats had relatively higher prevalence than male, young, non diarrheic and non pregnant goats, respectively. In all cases, goats on free range management had relatively higher prevalence of infection than those under semi-intensive management system irrespective of their sex, age and whether or not they were pregnant. On the other hand, higher prevalence was recorded among non diarrheic goats under semi-intensive than free range management system.
The mean faecal strongyle egg count was 746.2 ± 300.3 eggs per gram of faeces (Table 2). Egg counts were significantly ($P < 0.05$) greater among goats maintained under semi-intensive than free range management system. The same pattern ($P < 0.05$) was noted among sexes, age groups of the goats and irrespective of their health (diarrhoea) and pregnancy status.

The major gastrointestinal parasite eggs recovered were strongyle, *Strongyloides* and *Moniezia* eggs and *Eimeria* oocysts (Table 3). Strongyle type eggs were most prevalent and comprised mainly *Haemonchus* (64%), *Oesophagostomum* (20%), *Trichostrongylus* (16%). Strongyle type eggs were relatively more prevalent in semi-intensive than free range management system. Mixed infections were encountered only in animals under the free range management system.

Among the free range animals, PCV was significantly ($P < 0.05$) higher in non infected than infected goats (Table 4). The same pattern was noted among males, adult and young goats and irrespective of whether or not the animals were diarrheic or pregnant. Infected and non infected female goats had similar ($P > 0.05$) PCV. Most of the respondents under the semi-intensive management system did not allow blood collection from their animals to warrant any meaningful analysis of PCV for this group.

DISCUSSION
Gastrointestinal parasite infections constitute an important constraint to livestock production especially the small ruminants (Sheep and goats). In Nigeria, they have been associated with severe pathological changes and enormous economic losses [12,13,14,24,25,26,27]. The faecal egg and oocyst output of infected animals is an important source of pasture contamination with infective stages of gastrointestinal parasites. Most gastrointestinal parasite infections are acquired through the ingestion of such contaminated pasture. In this study, the prevalence of 50.5% recorded is lower than the 77 – 100 % reported in previous studies in this and other geographical zones of Nigeria [7,11,13,25]. Animals in more humid areas of the country usually have higher faecal egg and oocyst counts but the reasons for the lower counts recorded in the present study when compared to previous reports in the same study area are not immediately obvious. However, the relatively high prevalence and faecal egg and oocyst counts recorded in this study may be due to the fact that the study was conducted during the rainy season. Earlier reports show that nematode egg and *Eimeria* oocyst output of goats are usually relatively higher during the rainy than dry season in the study area [2,7].

Table 1. Prevalence of gastrointestinal parasite infections in goats raised by the free-range (extensive) and semi-intensive management systems in Maiduguri, Nigeria.

		Free-range		Semi-intensive		Total	
		No. exam.	No. (%) infected	No. exam.	No. (%) infected	No. exam.	No. (%) infected
All animals		170	96 (56.5)	145	63 (43.4)	315	162 (51.4)
Sex	Male	96	51 (53.1)	67	29 (43.3)	163	83 (50.9)
	Female	74	45 (60.8)	78	34 (43.6)	152	79 (52.0)
Age	Young	20	11 (55.0)	30	11 (36.7)	50	22 (44.0)
	Adult	150	85 (56.7)	115	52 (45.2)	265	140 (52.8)
Diarrhoea	Diarrheic	55	33 (60.0)	37	14 (37.5)	92	47 (51.1)
	Non-diarrheic	115	39 (33.9)	108	49 (45.4)	223	87 (39.0)
Pregnancy	Pregnant	28	14 (50)	42	21 (50)	70	35 (50.0)
	Non-pregnant	36	17 (47.2)	20	7 (35)	56	24 (42.9)

Table 2. Faecal strongyle egg counts of goats raised by the free-range (extensive) and semi-intensive management systems in Maiduguri, Nigeria

		Free-range		Semi-intensive		Total	
		Mean ± S. D.	Range	Mean ± S. D.	Range	Mean ± S. D.	Range
All animals		475.7 ± 400.8[a]	50 – 1950	1016.7 ± 199.7[b]	50 – 15900	746.2 ± 300.3	50 - 15900
Sex	Male	391.9 ± 313[a]	50 – 1350	1260.3 ± 28.61[b]	100 – 15900	826.1 ± 1587.4[a]	50 - 15900
	Female	564.3 ± 464.7[a]	50 – 1950	808.2 ± 636.2[a]	50 – 2500	686.3 ± 550.5[a]	50 - 2500
Age	Young	1010 ± 454.7[a]	550 – 1500	1945.5 ± 4644.2[a]	150 – 15900	1477.8 ± 2549.5[a]	150 - 15900
	Adult	435.8 ± 370.2[a]	50 – 1950	821.2 ± 604.3[b]	50 – 2500	628.5 ± 487.3[b]	50 - 2500
Diarrhoea	Diarrheic	618.2 ± 402.5[a]	150 – 1500	660.7 ± 453.3[a]	150 – 1200	639.5 ± 427.9[a]	150 - 1500
	Non diarrheic	316.7 ± 228.1[b]	50 – 1000	1118.4 ± 2240.3[b]	50 – 15900	717.6 ± 1234.2[a]	50 - 15900
Pregnancy	Pregnant	485.7 ± 461[a]	100 – 1950	809.5 ± 698.7[a]	50 – 2500	647.6 ± 579.9[a]	50 - 2500
	Non pregnant	500.6 ± 402.3[a]	50 – 1500	1221.4 ± 412.2[b]	350 – 1500	861.0 ± 407.3[b]	50 – 1500

[ab] Figures in the same column with different superscripts within management systems are significantly different ($P < 0.05$)

[jk] Figures in the same row with different superscripts between management systems are significantly different ($P < 0.05$)

Table 3. Gastrointestinal parasite stages recovered from the faeces of goats raised under two different management systems in Maiduguri, Nigeria

	Free-range (n=96)	Semi-intensive (n=63)	Total (n=159)
Strongylye eggs	72 (75.0)	63 (95.5)	135 (84.9)
Strongyloides eggs	11 (11.5)	2 (3.0)	13 (8.2)
Moniezia eggs	0	1 (1.5)	1 (0.6)
Eimeria oocysts	17 (17.7)	2 (3.0)	19 (12.0)
Mixed infections	4 (4.2)	0	4 (2.5)

Table 4. Packed cell volume of infected and apparently healthy goats maintained under free range system of management at Maiduguri, Nigeria.

Goats/Status		Number examined	PCV (%) Mean ± S. D.	Range
All goats	Infected	96	25.9 ± 3.7[a]	18 - 36
	Non-infected	74	28.7 ± 5.5[b]	15 - 43
Males	Infected	1	25.6 ± 3.8[a]	18 - 32
	Non-infected	45	30 ± 5.5[b]	15 - 43
Females	Infected	45	26.3 ± 3.5[a]	18 - 36
	Non-infected	29	26.9 ± 4.9[a]	17 - 42
Adults	Infected	85	26 ± 3.6[a]	18 - 36
	Non-infected	65	28.5 ± 5.5[b]	15 - 43
Young	Infected	11	24.4 ± 5[a]	18 - 28
	Non-infected	9	29.7 ± 5.3[b]	25 – 42
Pregnant	Infected	14	26.3 ± 3.4[a]	19 - 30
	Non-infected	14	25.4 ± 5.1[b]	17 – 32
Non pregnant	Infected	17	26.3 ± 3.8[a]	18 - 36
	Non-infected	19	27.8 ± 4.6[b]	20 – 42
Diarrheic	Infected	33	24.6 ± 3.9[a]	18 - 32
	Non-infected	22	26.2 ± 5.1[b]	17 – 34
Non diarrheic	Infected	39	27.2 ± 3.1[a]	19 - 36
	Non-infected	76	29.0 ± 5.4[b]	15 – 43

[ab] Figures in the same column with different superscripts within status of goats are significantly different ($P < 0.05$)

The relatively higher prevalence and counts of nematode eggs and oocysts in young than adult goats may be a reflection of the absence or reduced levels of acquired immunity in the younger goats. Immune response to parasitic nematodes, usually manifest, among other ways, by a reduction in the number of infecting larval worms that survive and eventually establish as adults within the host and thus the number of eggs passed out in the faeces [10,28]. Adult animals, as a result of repeated infections, develop acquired immunity to re-infection such that most of the infective larvae are killed, inhibited, stunted or fail to develop to adults [10]. Such adult animals therefore pass out very few eggs in their faeces. The same observations were made in this study.

The higher prevalence of *Strongyle* eggs than either *Strongyloides* eggs or *Eimeria* oocysts agrees with earlier reports [7,14,25]. The results of this study further suggest that *Strongyle* eggs were encountered in moderately high numbers as was earlier reported for red Sokoto goats in the Sokoto area of the Nigerian Savanna [14]. The higher prevalence of infection among diarrheic than non diarrheic goats agrees with earlier reports which showed that infection with *Strongylid* nematodes and *Eimeria* species are usually associated with diarrhoea [10]. These reports were further confirmed by

the higher faecal *strongyle* egg counts recorded among the diarrheic than non diarrheic goats during this study.

In pregnant animals, faecal egg output is known to rise shortly before parturition (periparturient rise), rising to a peak some months after parturition (postparturient rise) before declining to lower levels during spring in temperate regions of the world [10]. However, the phenomenon of spring rise has not been well established to occur in Nigerian animals [11]. It is however possible that the phenomenon may be responsible for the relatively greater egg counts encountered in non pregnant than pregnant goats in this study.

The relatively lower faecal egg counts recorded among free range animals than the semi-intensively managed counterparts may be due to the fact that the former unlike the latter are usually grazed over a large expanse of land such that pasture contamination and ingestion of infective stages are minimal. Similarly, *Eimeria* oocysts are much more common among animals that are kept in confinement due to the development of microclimate conducive for oocyst sporulation and their subsequent ingestion by the animals [25,29]. This may account for the higher faecal egg and oocyst counts in the semi-intensive than free range goats examined during this study.

Among goats on free range, the results also suggest that the PCV of infected goats were generally lower than those of non infected animals irrespective of their age and sex or whether or not they were diarrheic or pregnant. Similar observations were earlier reported in the same study area [30]. However, it was not possible to compare these observations among the management groups due to the refusal of the semi-intensive farmers to allow blood collection from their animals.

CONCLUSION

The results of this study suggest that gastrointestinal parasite infections are common among goats in Maiduguri with higher faecal egg and oocyst output in the semi-intensive than free range animals. Furthermore, nematodes followed by *Eimeria* species were the predominant parasites and these infections were manifested in the form of diarrhoea, reduced PCV and the excretion of nematode eggs and oocyst in the faeces with higher numbers in semi-intensive than free range animals.

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