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A Comparative Study of Single Helminths and Concurrent Helminths and Trypanosome Infections in Red Mbororo Cattle in the Semi-Arid-Zone of Northeastern Nigeria

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ABSTRACT

A comparative study of single helminths and concurrent helminths and trypanosome infections in red Mbororo cattle in the semi-arid-zone of northeastern Nigeria were monitored from January to December 2008. Out of the 200 animals examined, 30 (15%) had single infection while 62 (31%) had concurrent infections. The seasonal prevalence showed that infections occurred only during the rainy season with the concurrently infected cattle ($p<0.05$) than those singly infected. The concurrently infected young cattle (<12 months) or male and female were significantly ($p<0.05$) more infected than their singly infected counterparts. The concurrently infected cattle also had higher faecal egg output than those singly infected. The helminth egg types encountered in concurrently infected cattle were *Strongyle* (70.9%), *Strongyloides* (16.1%), *Schistosoma* (3.2%), and *Dicrocoelium* (9.7%). On the other hand, those singly infected harboured only *Strongyle,* (56.7%) and *Strongyloides* (43.3%) egg types. The larvae isolated from those concurrently infected were mainly *Haemonchus contortus*, *Trichostrongylus colubrioformis*, *Oesophagostamum columbianum, Cooperia* sp and *Strongyloides pappilosus* while those singly infected harboured mainly *Haemonchus contortus*, *Trichostrongylus colubrioformis and Strongyloides pappilosus*. The concurrently infected cattle also harboured *Trypanosoma vivax* (80.65%), *T. brucei* (8.06%) and *T. congolense* (11.22%) while those singly infected had none. It is therefore, concluded that the red Mboro cattle harboured more concurrent than single infections.

Key words: Single infection, concurrent infection, red Mbororo cattle, Nigeria

INTRODUCTION

Nigeria has a large population of domestic ruminants with goats estimated at 22.4 as the most numerous followed by cattle and sheep at 11 and 7.6 million respectively (ILCA, 1985). These animals constitute the major source of animal protein in the country. However, in spite of the large population of domestic ruminants, animal protein consumption is far below the national requirements. This short fall in animal protein availability has been linked to the poor productivity of Nigerian's domestic stock (ILCA, 1985).

According to Schillhorn van veen (1973), gastro-intestinal helminthosis, especially parasitic gastro-enteritis (PGE), is a major health problem and thus the main constraint on the production of small ruminants in Nigeria. Several factors however, have been shown to have modulating effects on the pathogenecity of parasitic gastro-enteritis (PGE) in animals in the field. Chiejina (1987) reported that trypanosomosis and malnutrition frequently complicated field outbreaks of PGE in animals in the Nigerian Savannah.

Although most of the livestock in Nigeria are located outside the tsetse-trypanosomosis belt (Leeflang, 1974), it has been reported that the scarcity of water and fodder during the dry season forces them to migrate into tsetse-infested areas with the attendant high risk of infection (Schillhorn Van Veen, 1974; Aliu, 1975). Trypanosomosis is caused by blood protozoan parasites of the genus, *Trypanosoma* and several members including *Trypanosoma vivax, Trypanosoma brucei* and *Trypanosoma congolense* are involved in the disease causation in livestock in Nigeria (Mbaya, 1988; Nawathe *et al*., 1994; Anosa *et al*., 1995). Although trypanosomosis and helminthosis are common in endemic areas of Nigeria and can occur together in animals in the field during all seasons, information is lacking on their occurrence in the red Mbororo cattle predominant cattle breed in the tsetse free arid zone of

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northeastern Nigeria. The arid region of northeastern Nigeria holds the highest concentration of cattle in the country (Bourn *et al*., 1994). This study was therefore, designed to study the effect of single and concurrent trypanosomes and helminths infections in red Mbororo cattle in the tsetse free arid- zone of northeastern Nigeria.

MATERIALS AND METHODS

Study area

The study was conducted at Maiduguri Municipal Abattoir and Maiduguri Cattle Market. The area lies between latitudes 11^0 05′N and 11^0 40′N and longitudes 13^0 05N′E and 13^0 25N′E and located within the semi-arid zone (Sahel savannah) characterized by a short rainy season of 3 - 4 months (June-September) followed by a prolonged dry season for the rest of the year (Udoh, 1981).

Animals

The Red Mbororo cattle are one of the most common breed within the arid zone of northeastern Nigeria. For the purpose of the study, they were identified as such, based on the description of Devendra and Burns (1983). The age of the animals involved in the study ranged from one to six years as determined according to Holst and Dennery (1980).

Sample collection and examination

Blood samples were collected from randomly selected cattle via the jugular vein into vacutainers containing ethylenediamine tetracetate (EDTA) as anticoagulant. Samples were over a 12-month period in 2008 and separated into age and sexes of the animals. Initial detection of parasitaemia was by the wet film and haematocrit buffy-coat methods (Murray *et al*., 1983) while the degree of parasitaemia was estimated as described by Herbert and Lumsden (1978). Buffy coat and thin smears were stained with 10% Giemsa stain according to Murray *et al*. (1983) and examined for trypanosomes according to standard parasitological criteria (Soulsby, 1982).

Each faecal sample was examined for helminth ova by the direct faecal smear, sedimentation and floatation techniques while faecal egg counts were determined by the modified McMaster technique using saturated sodium chloride solution as the floating medium (Hanseen and Perry, 1994). The identification of helminth ova was done using standard parasitological criteria (Levine, 1973; Anonymous, 1977; Sloss and Kemp, 1978; Soulsby, 1982). Species identification was done by larval culture and recovery using the modified Baermann's technique (Anonymous, 1977; Hanseen and Perry, 1994). In all cases, animals aged less than 12 months were regarded as young while those above that age were grouped as adults

Statistical analysis

The results were summarized as means ± standard deviations (S.D.) and the difference between the means determined using the Student's *t*-test at the 5% level of significance (Mead and Curnow, 1982).

RESULTS

The comparative study between single helminths and concurrent helminths and trypanosome infections in red Mbororo cattle in the semi-arid-zone of northeastern Nigeria is presented in Table 1. Out of the 200 animals examined, 30 (15%) had single infections of helminths while 62 (31%) had concurrent infections of both helminths and trypanosomes. Table 1 also presents the seasonal prevalence between the two groups, where on one hand no statistical variation ($p>0.05$) existed on the prevalence of infection between those singly or concurrently infected during the cold-dry season (November-February). On the other hand, the prevalence of infection was significantly ($p<0.05$) higher among those with concurrent than those with single infections during the hot-dry (March-May) and during the hot-moist (June-October) seasons. The monthly prevalence of concurrent and single infection in the red Mbororo cattle is presented in Fig. 1. Infections were recorded only between April and October for single infections and between April and November for concurrent infections. Prevalence was generally higher among concurrently infected individuals than their counterparts with single nematode infections. The prevalence of infection between the two groups according to sex and age is presented in Table 2. No variation ($p>0.05$) was observed between the singly infected or concurrently infected adults (>12 months). Meanwhile among the young (<12 months), those concurrently infected were significantly more ($p<0.05$) infected than those singly infected. Similarly, the male and female which were concurrently infected, had higher prevalence ($p<0.05$) of infection than those singly infected. Table 3 shows the various helminths egg types encountered in either single or concurrent infections. The helminthes recovered in concurrently infected cattle were *Strongyle* (70.9%), *Strongyloides*, (16.1%), *Schistosoma* (3.2%) and *Dicrocoelium* species (9.7%) egg types. The helminth ova recovered from singly infected cattle were *Strongyle* (56.7%) and *Strongyloides* (43.4%). The infective helminth larvae recovered from those concurrently infected were mainly *Haemonchus contortus*, *Trichostrongylus colubfrioformis*, *Oesophago-stamum columbianum, Cooperia* sp and *Strongyloides pappilosus*, while those singly infected had mainly *Haemonchus contortus, Trichostrongylus*

colubrioformis and Strongyloides papillosus. Among the concurrently infected cattle, *T. vivax* was most prevalent (80.7%) followed by *T. congolense* (11.2%) and *T. brucei* (8.06%). Parasite counts followed the same pattern (Table 4).

Table 1. A comparative study on the seasonal prevalence of single and concurrent helminthosis and trypanosomosis in red Mbororo cattle in the semi-arid zone of northeastern Nigeria

Seasons	Single infection		Concurrent infection	Total
	No. examined	No. infected (%)	No. infected (%)	
Cold- dry (November-February)	48	0 (0%)^{a}	0 (0%)^{a1}	0 ^{a}
Hot-dry (March-May)	55	2 (3.64)^{a}	4 (7.27)^{b}	6 (10.91) ^{b}
Hot-moist (June – October)	97	28 (28.87)^{a}	58 (59.80)^{c}	86 (88.66) ^{c}
Total	200	30 (15%)	62 (31%)	96 (48)

Keys: Concurrent infection: = (Helminths/Trypanosomes); Single infection: = (Helminths only); $^{a\,\&\,a1}$ Superscripts in rows did not differ significantly ($p>0.05$);$^{;\ a\,\&\,b;\ a\,\&\,c}$ Superscripts in rows differed significantly ($p<0.05$)

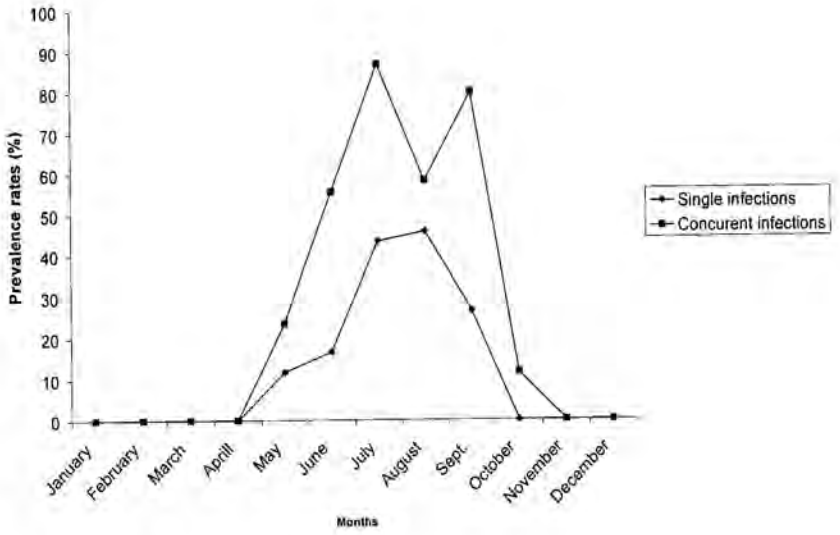

Fig. 1. A comparative monthly prevalence of single and concurrent helminthosis and trypanosomosis in Red Mbororo cattle in the semi-arid zone of northeastern Nigeria; **Keys:** Concurrent infection: = (Helminths/trypanosomes); Single infection: = (Helminths only).

Table 2. A comparative prevalence of single or concurrent helminthosis and trypanosomosis in red Mbororo cattle in the semi-arid zone of northeastern Nigeria according to sex and age.

Parameters	Infection status			Total
	No. examined	Concurrent infections (%)	Single infections (%)	
Age: >12 months (adult)	110	17 (15.45%)^{a}	16 (14.55%)^{a1}	33 (30) ^{a}
<12 months (young)	90	45 (50%)^{b}	14 (15.56%)^{b1}	59 (65.6) ^{b}
Sex:				
Male	115	42 (36.52%)^{c}	18 (15.65%)^{c1}	60 (52) ^{a}
Female	85	20 (23.53%)^{d}	12 (14.12%)^{d1}	3 (37.6) ^{b}

Keys: Concurrent infection: = (Helminths/Trypanosomes); Single infection: = (Helminths only); ^{a,a1} Superscripted values in rows did not differ significantly ($p> 0.05$) However, $^{a,\ b}$ in first column differed significantly ($p < 0.05$); $^{b,\ b1;\ c,\ c1;\ d,\ d1}$= Superscripted values in rows differed significantly ($p < 0.05$)

Table 3. Various egg types of helminths recovered from red Mbororo cattle infected either concurrently or singly in the semi-arid zone of Northeastern Nigeria

Status	Egg types/prevalence	EPG	Species of larvae recovered
Concurrent infection	i. *Strngyles:* 44 (70.9%)[a]	1,240 ± 0.85[a]	i. *H. contortus* ii. *T. colubriformis* iii. *O. columbianum* iv. *Cooperia* spp.
	ii. *Strongyloides:* 10 (16.1%)[b]	857 ± 0.65[b]	i. *S. papillosus*
	iii. *Schistosoma*: 2 (3.2%)[c]	825 ± 0.60[b]	
	iv. *Dicrocoelium*: 6 (9.7%)[d]	600 ± 0.57[c]	
Single injection	i. *Strngyles:* 17 (56.7%)[e]	357 ± 0.37[d]	i. *H. contortus* ii. *T. colubriformis*
	ii. *Strongyloides:* 13 (43.3%)[e]	150 ± 0.65[e]	i. *S. papillosus*

Keys: Concurrent infection = (Helminths/Trypanosomes); Single infection = (Helminths only); [a, b, c, d, e] = Superscripted values differed significantly ($p < 0.05$)

Table 4. Prevalence and counts of trypanosomes encountered in red Mbororo cattle infected either concurrently or singly in the semi-arid zone of northeastern Nigeria

Status	Parasite species	Prevalence No. (%)	Parasitaemia
Concurrent infection	i. *T. vivax*	50 (80.65%)[a]	25.5 × 103/μl[a]
	ii. *T. brucei*	5 (8.06%)[b]	5.5 × 103/μl[b]
	iii. *T. congolense*	7 (11.20%)[c]	7.5 × 103/μl[b]
Single infection	i. *T. vivax*	0 (0.0%)[d]	0[c]
	ii. *T. brucei*	0 (0.0%)[d]	0[c]
	iii. *T. congolense*	0 (0.0%)[d]	0[c]

Keys: Concurrent infection = (Helminths/Trypanosomes); Single infection = (Helminths only); [a, b, c, d] = Superscripted values differed significantly ($p < 0.05$)

DISCUSSION

The influence of concurrent trypanosomosis on the severity of helminthosis in small ruminants have been demonstrated in domestic small ruminants (Fagbemi and Dipeolu, 1982; Nwosu *et al*., 2001; 2006) and semi-domesticated wild red fronted gazelles (*Gazella rufifrons*) (Mbaya *et al*., 2008; 2009) in Nigeria. Such dual associations in the host frequently result in additive effects as reflected by heterelogous synergistic interactions (Mbaya *et al*., 2008; 2009). Information on such studies in large ruminants is lacking. The results of this investigation revealed a higher prevalence (31%) of concurrent infection as against single infections (15%). In spite of the fact that the arid zone is tsetse free, dry seasonal migration of animals into tsetse-infested areas is the major means by which livestock acquire trypanosome infections. When the cattle return to the arid zone during the rainy season, the circle of transmission between infected and uninfected stock is maintained through the activity of haematophagus arthropod vectors, such as *Tabanus*, *Stomoxys*, *Hippobosca* and *Lyperosia* (Mbaya, 1988; Nawthe *et al*., 1994).

As observed in this study, both single and concurrent infections were observed only during the rainy season. This is because the semi-arid region is characterized by a short rainy season of 3 - 4 months (Udoh, 1981). During the extended dry season, the development, survival and translocation of pre-parasitic stages of nematodes do not pertain in the environment (Mbaya *et al*., 1999; Mbaya *et al*., 2006). Essentially, similar seasonal trend have been reported from studies conducted in sheep and goats in other zones of the country (Fakae, 1990).

The study also revealed that the concurrently infected cattle had more variety of helminths with higher faecal egg counts as compared to fewer parasites and less egg counts among those singly infected. This is probably associated with the fact that synergistic effects of concurrent trypanosomosis enhanced the establishment of the

helminths and prevented the mounting of secondary immune responses with a delay in the normal expulsion of nematodes (Griffin and Preston, 1981a; 1981b; Nwosu *et al*. 2006) while the singly infected cattle were probably expelled most of their helminth populations. Increase in worm burden and faecal egg counts in animals concurrently infected with trypanosomes have been associated with immunosuppression by trypanosomes, which subsequently results in the enhancement of the pathogenecity of helminths as reflected by their proliferation, growth and increased worm load (Specht, 1982; Christensen *et al*., 1987; Fakae and Chiejina, 1993).

The fact that the young cattle (<12 months) were more affected than the adults (>12 months), particularly in those concurrently infected is because young animals are more susceptible to parasitic gastroenteritis than older ones (Soulsby, 1982). Similarly, the fact that the concurrently infected male and female had significantly higher infection rates than their singly infected counterparts is probably associated with immunosuppression caused by trypanosomes in the infection. Allonby and Urquhart, (1975) reported that such variations can occur sequel to concurrent helminthosis, physical stress and poor plane of nutrition.

CONCLUSION

It is therefore, concluded, that the red Mbororo cattle harbour more concurrent infections of helminth and trypanosome than single infections of helminths alone. The high variety of helminths and trypanosomes, with associated high egg out put and parasitaemia showed that the productivity of this breed of cattle might be affected if strategic anthelminthic medication and anti-trypanocidal treatments are not administered concurrently.

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