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Epidemiological studies of gastrointestinal parasitic infections in ruminants in Jakiri, Bui Division, North West Region of Cameroon

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This study was undertaken to determine the prevalence, intensity of infection and management systems associated with gastrointestinal (GIT) parasites in grazing ruminants (cattle, sheep and goats). Faecal samples were collected from 277 cattle, 104 sheep and 94 goats, from different areas in Jakiri. Samples were analysed using the Formol-ether concentration technique. 318 samples were found positive with one or more parasites giving an overall prevalence of 66.9%. Goats recorded the highest (90.4%) prevalence of GIT parasites, followed by sheep (73.1%), and the least prevalence was observed in cattle (56.7%). Concerning the various management techniques, prevalence of GIT parasites were higher in tethered animals (88.1%) followed by free range grazing animals (60.9%). Animals confined in paddocks had the least prevalence (45.5%). *Eimeria* species recorded the highest prevalence (20.9%) among the various species of parasites encountered during the study in cattle, *Trichostrongylus* species and *Eimeria* spp. in sheep (28.8%) while the highest prevalence in goats was *Trichostrongylus* spp. (55.8). Mixed infections of *Trichostrongylus* spp., *Eimeria* spp. *and Haemonhus* species were most prevalent in all the animal species. The prevalences of *Fasciola* species and *Moneiza* species were significantly low in all the three animal groups in the study area. Adults were more infected compared to young stock animals (lambs and kids). This work provides an important step to minimize economic losses in ruminants by providing information that will help farmers practice the right traditional management techniques.

Key words: Gastrointestinal parasites, ruminants, prevalence, management systems, Jakiri, Cameroon.

INTRODUCTION

Gastrointestinal tract (GIT) parasites are known to be widespread in Cameroon (Ndamukong, 1985) and limit livestock production in many areas and countries of the world (Vlassoff and Leathwick, 2001; Ng'ang'a et al., 2004). Studies have shown that helminth parasites are by far the most serious causes of production losses in farmed ruminants and the nematodes are indisputably the cause of serious production losses to ruminants in sub-Saharan Africa, and indeed worldwide (Ng'ang'a et al., 2004; Odoi, 2007; Kanyari et al., 2009).

Despite the relative importance of nematode parasites in ruminants worldwide, other gastrointestinal parasites like

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like the trematodes, cestodes and coccidians have also shown higher prevalence rates in most countries of the world. The trematodes of traditional veterinary and medical significance are almost all digenetic flukes that require a mollusc or snail as the first intermediate host. Prevalence studies reveal that *Fasciola* species are by far the most economically important trematodes of ruminants in the tropics (Maingi et al., 1997). According to Food and Agriculture Organization (FAO)/World Health Organisation (WHO) (1999), intense fasciolasis has been reported in the following African countries; Northern Nigeria, Kenya, Lake Chad, Zaire, Zambia, Ivory coast, Zimbabwe and Cameroon. The occurrence of flooding, water pans and swamps are important habitats for propagation of the snail intermediate hosts of these flukes. Some of the regions in Cameroon have their borders to the west of the Atlantic Ocean which makes them marshy and swampy, thus suitable for survival of snail intermediate hosts.

Ruminants, the most widespread livestock in Cameroon, are reared in traditional systems. Cattle, goats and sheep rearing systems are: nomadic or pastoral, mixed farming and the peri-urban systems. Production and management systems vary from free range in less populated areas, to year-round confinement and cut-and-carry feeding in densely populated areas. Ruminants under extensive systems rely on natural grazing. Because of shortage of water and forage, malnutrition is often the major limiting factor for profitable production of ruminants particularly during the dry season. Grazers of the Fulani tribe in the North West region of Cameroon seek refuge during dry periods in Wasi-ber, Bangolan of Babesi and Bambalan of Ndop. Animals suffer from stressful and disease effects especially during these transhumance periods.

In most semi arid and arid regions of sub-Saharan Africa, ruminants play a vital role in rural economies through the provision of meat, milk, household income, manure and skin (Mulugete et al., 2011). In most cases, the animals are run in large flocks or herds, concentrated in confined areas or tethered on pegs where they are likely to pick up infective larva or oocyst from contaminated pastures (Kanyari et al., 2009). These poor management systems have contributed massively to economic losses of ruminant production in sub-Saharan countries (Mulugete et al., 2011). As a result, most of the rural farmers and livestock farmers pay keen attention to parasites that may likely cause the death of their animals.

MATERIALS AND METHODS

The study area

The study was conducted in Jakiri, Bui Division (Figure 2). This rural village is situated at Latitude. 6.1°N and Longitude 10.65°S about 89 km from the capital city Bamenda of the North West region of Cameroon (Jocelyn, 1982). The climate in the area is characterized by a long rainy season from April to October, with annual average rainfall ranging from 1,500 to 2,000 mm and an altitude of about 1,100 m above sea level (Jocelyn, 1982). The dry season stretches from November to March, with monthly average temperatures in June reaching a maximum of about 21°C. Jakiri is a typical mountainous area covered with grass on the hills and valleys which constitute the major natural resource that the ruminant population of livestock depends on.

Mixed crop/livestock production system is the main form of agriculture. Most families are also involved in livestock farming, especially goats and sheep. Flock sizes under the tethering system in Jakiri are in the order of 1 to 10 goats or sheep per household. Cattle herds of large sizes are mostly owned by the Fulani tribes and they form separate communities in the upland grazing quarters of Jakiri.

Selection of study sites and farms

The study sites (Figure 1) were selected on the basis of having a higher concentration of livestock. The sites included small locations (quarters) in Jakiri village: Tan, Sodepa, Vekovi, Nkar, Kiform, Weinamah and Shiy.

Study subjects

A total of 475 ruminants consisting of 131 males and 344 females were examined for intestinal parasites, out of which 277 were cattle, 104 sheep and 94 goats. Also 335 of these animals were adult ruminants, 57 heifers and 83 kids/lambs. For animals to be qualified as subjects, the sheep, goats and cattle must have been living in Jakiri and its environs for at least three months. Samples were collected from ruminants of both sexes. The ages of the animals were determined from interviews with the farmers. Animals with ages ranging from one month to a year were classified as young stock (lambs for sheep, kids for goats) while those from one year and above were categorized as adults. The criteria for cattle were different. Cattle with ages ranging from one month to a year were classified as calves while those from one to three years were classified as heifers and those above three years were categorized as adults.

Study design

A preliminary survey was carried out prior to sample collection to sensitize interested farmers on the objectives of the study. Questionnaires were administered to all the farmers whose animals were to be examined. It included information on the age/sex/breed of the animal, farm management practices and health conditions of the animals. Oral interviews were also conducted to obtain other relevant information about the ruminants and the study site.

Sampling and faecal analysis

Faecal samples were collected directly from the rectum using plastic gloves and put into clean, dry, leak-proof, transparent plastic bottles. The samples were labelled and transported to the laboratory of the National Veterinary Training school for Livestock and Animal Husbandry in Jakiri where they were examined immediately for parasite eggs and oocysts. Stool samples not observed on the same day were treated and stored in the

(a) (b)

Figure 1. Study sites.

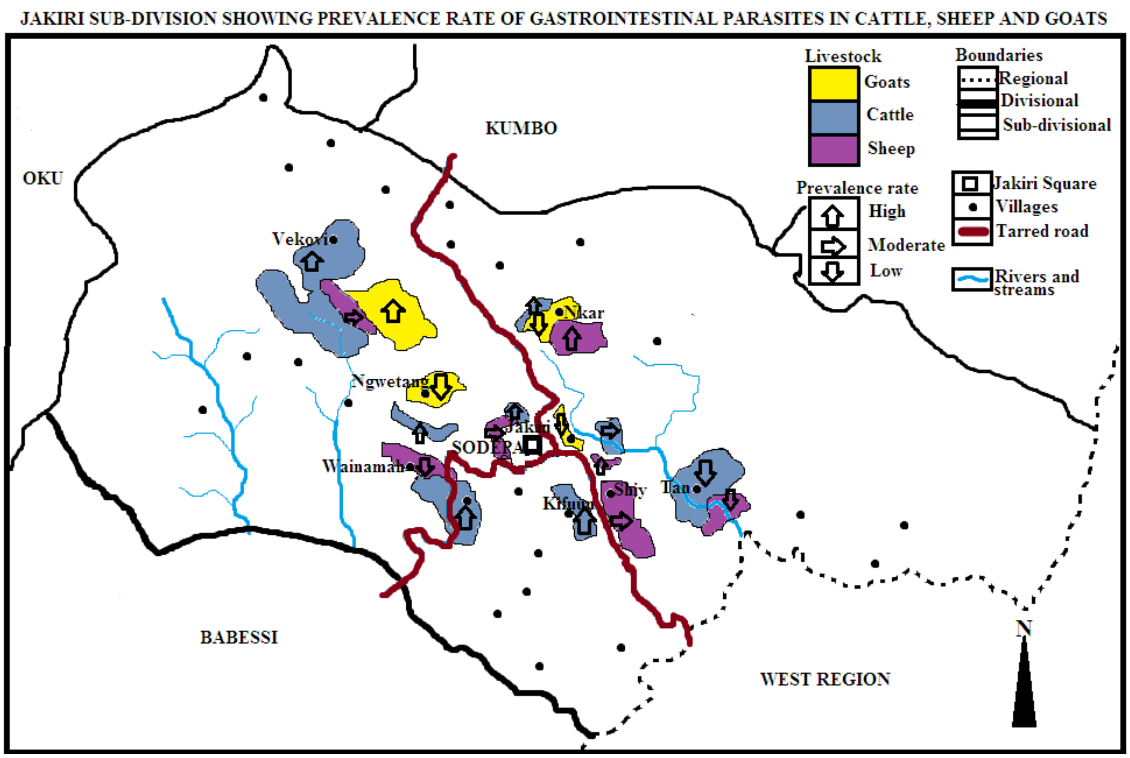

Figure 2. Map showing rate and distribution of cattle, sheep and goats in Jakiri sub-division.

refrigerator for subsequent examination the next day. The formol-ether concentration technique as described by Christensen et al. (1984) was used to detect the presence of helminth eggs and coccidian oocysts. The overall proportion of infective larvae from faecal cultures among management systems was equally determined. Strongyle species were identified based on standard criteria. The eggs per gram (EPG) of feces were quantitatively analyzed to determine the intensity of infection using the modified McMaster technique and the coccidian oocysts quantified (MAFF, 1977).

Statistical analysis

Data was entered into Ms Excel® 2003 (Microsoft corporation, USA) and analysis were conducted using the statistical package statistical package for social sciences (SPSS) version 12. Prevalence was calculated as a percentage of d/n where d is the number of animals infected and n = Total number of animals examined. The association between independent factors (age, and area of origin) and continuous dependent variables (EPG, oocyst numbers per gram (OPG) and intensity of infection) was calculated using one way analysis of variance (ANOVA). The association between the independent factors and the prevalence of the various parasites were evaluated using the Chi-square test (χ^2). In all the analysis, confidence level was held at 95%, and P ≤ 0.05 set for significance.

RESULTS

Out of the 475 ruminants examined, 318 were found positive with one or more parasites, giving an overall prevalence of 66.9%. Goats recorded the highest prevalence of 90.4%, followed by sheep, 73.1% and the least prevalence was observed in cattle, 56.7%. The study revealed a significant difference (p < 0.05) in the prevalence of the gastrointestinal parasites among the ruminants in the study area (Table 1).

Gastrointestinal parasites identified from faecal samples in the study along with their prevalences are shown on Tables 2 and 3. Strongyle nematodes and *Eimeria* spp. were the most prevalent parasites recorded in all the three groups of animals. From the results obtained, goats recorded the highest prevalence rates in *Trichostrongylus* spp. 55.8%, followed by sheep 28.8%, and the least prevalence was recorded in cattle 9.7%. Equally, goats recorded the highest prevalence of *Haemonchus* spp. 49.5%.

Concerning the intensity of infection of the nematode species, the study revealed that, mean egg per gram was notably high for almost all the Strongyle nematodes observed in small ruminants (sheep and goats). However, faecal egg counts revealed overall low egg per gram in all of the recovered worm egg types in cattle (Table 2). Most of the animals had mix infections, with most of the combinations being *Trichostrongylus* spp./*Strongyloides* spp. (Table 4).

Village based prevalence revealed that, in cattle; gastrointestinal parasites had the highest prevalence in Wainamah (80.6%). Infection rates in goats were highest in Vekovi (97.8%) and in sheep; Shiy recorded the highest prevalence (87.5%). It was found that in all the three groups of animals, statistically significant difference (P ≤ 0.05) was not observed in the prevalence with respect to the various villages (Tables 5, 6 and 7).

A total of 335 adult ruminants, 57 heifers and 83 kids/lambs were examined during the study. Out of these lots, adult goats recorded the highest prevalence of gastro-intestinal parasites (93.3%), followed by the young goats (kids) (78.9%), and the least prevalence was observed in adult cattle (53.1%). However, the overall prevalence of gastrointestinal parasites among the different age groups showed that generally, the youngest animals (calves, lambs and kids) had the highest prevalence (71.2%) (Figure 3). Chi square value however revealed no significant differences among the different age groups (P ≥ 0.05).

The present study also revealed details on the prevalence of gastro intestinal tract (GIT) parasites in animals kept under different traditional management systems. It was found that, animals confined in paddocks recorded lower prevalence rates compared to free range grazers and tethered animals. For both sheep and goats, tethered animals had highest infection rates of 85.4 and 90.4%, respectively. Cattle and sheep that grazed in confined paddocks had prevalence rates of 37.7 and 56.8%, respectively. Free range grazers had prevalence rates of 61.2 and 73.3% for cattle and sheep, respectively. A significant difference in prevalence was observed in both cattle and sheep practising the different grazing systems (Tables 8, 9 and 10).

DISCUSSION

The present study revealed an overall prevalence of GIT parasites in the ruminants to be 67.45%, with 56.7, 73.1 and 90.4% in cattle, sheep and goats, respectively. These results are in line with the findings of Fikru et al. (2006) and Biu et al. (2009). The high prevalence of GIT parasites in small ruminants as a whole agrees with most reports (Odoi et al., 2007; Fufa et al., 2009; Kanyari, 2009; Mulugete et al., 2011). The higher prevalence rate in goats and sheep in the study area might be due to poor management systems. In Jakiri, mixed crop livestock production predominates where few numbers of small ruminants are kept together. Majority of the sheep and goats are tethered on farm lands. As a result of this, most of the animals are re-infected due to pasture contamination as they graze within a confined region for several months. Ticks also posed a major health problem to ruminants in Jakiri. Seven out of 15 farmers from whom we collected faecal samples complained of their animals passing out blood tinged urine which is a sign of babesiosis; a tick-borne infection. Under such conditions, gastrointestinal parasites thrive best due to reduced immunity in the ruminants. This led to increased mortality rates in ruminants prior to the research. The higher prevalence of GIT parasites in goats compared to sheep is in agreement with the report of Ndamukong (1985) in Momo division, North West Region of Cameroon. This result however, contradicts the findings of Kanyari (2009) whose assertions explained that the grazing habits of sheep (grazing closer to the earth soil) warrants these animal species to be more infected than goats. However; in the present survey, the difference in philosophy with the previous findings may be because the majority of the goats are kept under poor veterinary infrastructure and medication. More importantly, this may be due to low or

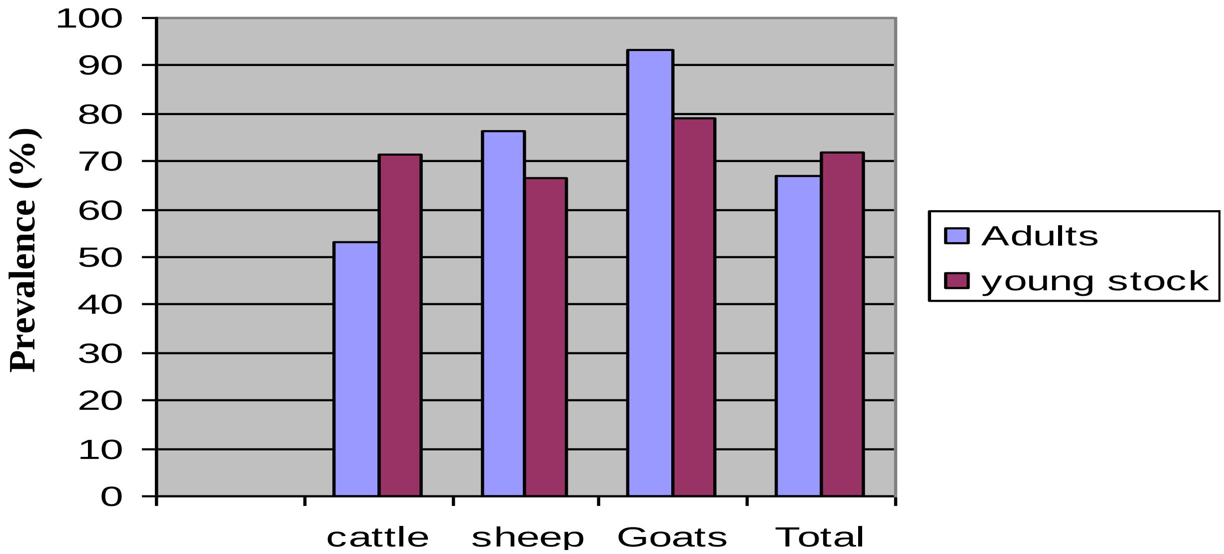

Figure 3. Age related prevalence of GIT parasites in ruminants in Jakiri.

Table 1. Overall prevalence of gastrointestinal parasites of ruminants in the study area.

Ruminant	No. examined	Infected no.	Prevalence (%)	χ^2 (P value)
Cattle	277	157	56.7	38.4 (0.001)
Sheep	104	76	73.1	
Goats	94	85	90.4	
Total	475	318	66.9	

Table 2. Prevalence and intensity of gastrointestinal nematodes in cattle, sheep and goats in study area (N = total number of animals examined).

Parasite species	Cattle (N=277)		Sheep (N=104)		Goats (N=94)	
	Infected no. (%)	Intensity	Infected no. (%)	Intensity	Infected no. (%)	Intensity
Trichostrongylus spp	27 (9.7)	5.19±23.81	30 (28.8)	179.4±1007.2	53 (55.8)	693.4±1903.3
Haemonchus spp	16 (5.7)	2.6±12.47	24 (23.1)	75.4±413.6	47 (49.5)	344.2±1261.7
Oesophagostomum spp	18 (6.5)	11.7±50.7	3 (2.9)	4.4±30.3	5 (5.3)	11.7±50.6
Ostertagia spp	8 (2.9)	1.2±9.0	12 (11.5)	13.8±73.9	30 (31.5)	41.2±97.0
Strongyloides spp	25 (9.0)	4.2±21.0	26 (25.0)	86.7±409.8	46 (48.9)	324.9±831.
Trichuris spp	51 (18.4)	6.8±18.3	8 (7.7)	7.7±27.0	13 (13.9)	14.8±48.9
Other nematodes	17 (6.1)	-	9 (8.7)	-	3 (3.2)	-

N = number of animals examined.

slow development of immunity in goats to GIT parasites as compared to sheep and cattle.

The prevalence of GIT parasites in cattle in the study area was generally low compared to small ruminants, with a majority of the cattle having light infections. These results are in line with the findings of Adrien et al. (2001), Waruiru et al. (2005) and Kenyu et al. (2006). The reason might be due to frequent drenching habits of the farmers.

Table 3. Prevalence of *Trematodes, Cestodes and Eimeria* species in cattle, sheep and goats in the study area.

Parasite specie	Cattle (N=277)	Sheep (N=104)	Goats (N=94)
	Infected No. (%)	Infected No. (%)	Infected No. (%)
Fasciola spp	17 (6.1)	3 (2.9)	0 (0)
Entamoeba spp	5 (1.8)	1 (1.0)	13 (13.7)
Moniezia spp	10 (3.6)	8 (7.7)	4 (4.3)
Eimeria spp	58 (20.9)	30 (28.8)	45 (47.9)

Table 4. Prevalence of mixed infections in ruminants in the study area.

Mixed infections	Cattle (N=277)	Sheep (N=104)	Goats (N=94)
	Infected No. (%)	Infected No. (%)	Infected No. (%)
Trichostrongylus spp./*Strongyloidse* spp./*Eimeria* spp.	3 (1.08)	26 (13.06)	36 (38)
Trichostrongylus spp./*Haemonchus* spp.	5 (1.80)	45 (22.61)	12 (12.7)
Strongyloides spp./*Eimeria* spp.	6 (2.1)	36 (18.09)	4 (4.2)
Strongyloides spp./*Trichostrongylus* spp.	8 (2.88)	56 (28.14)	7 (7.4)
Haemonchus/Eimeria	2 (0.7)	1 (0.5)	3 (3.2)
Trichostrongylus spp./*Eimeria* spp.	5 (1.80)	25 (12.56)	11 (11.7)

N=number of animals examined.

Table 5. Prevalence of gastrointestinal parasites in cattle in the various villages surveyed in the study area.

District	No. examined	No. infected	Prevalence (%)	χ^2 (P- value)
Kiform	68	41	60.3	
Nkar	24	15	62.5	
Sodepa	53	20	37.7	
Vekovi	36	18	50.0	4.573 (0.47)
Shiy	-	-	-	
Wainamah	31	25	80.6	
Tan	65	38	58.5	
Total	277	157	56.7	

Also during the dry seasons, larva may develop successfully to infective stages in faeces but might not emerge until moisture levels are optimal. Infected faeces continue to be passed out by the cattle until moisture is available when pasture contamination can then rise rapidly.

The most prevalent GIT parasites were the Strongyles, *Strongyloides* and *Eimeria* oocyst. This result corroborates many findings in Africa (Ndamukong, 1985; Ndamukong and Sewell, 1992; Odoi, et al., 2007; Fufa et al., 2009; Kanyari, 2009; Mulugete et al., 2011). Strongyle nematodes were of the genera *Trichostronglus, Haemonchus, Oesophagostomum, Ostertagia, Cooperia, Charbatia* and Nematodirus. The climatic conditions of Jakiri (warm moist) are highly suitable for survival of strongyles and transmission of the parasites. Another contributing factor towards the high prevalence of strongyle nematodes may be due to poor farm management techniques including constructions, feeding,watering systems and generally poor hygienic conditions of the farms.

The prevalence of *Fasciola* spp. in the study area for all the three animal groups was extremely low. This may be due to the vegetation cover of Jakiri. The typical mountainous area covered with grass on the hills does not favour propagation of the snail intermediate hosts. It is probable that, the few ruminants infected with *Fasciola gigantica* might have gotten their infection during transhumance in Wasi-ber, Bangolan of Babesi and Bambalan of Ndop, a period during which there is scarcity of pasture

Table 6. Prevalence of gastrointestinal parasites in goats in the various villages surveyed in the study area

District	No. examined	Infected No. (%)	χ^2 (P- value)
Kiform	-	-	
Nkar	27	24 (88.8)	
Sodepa	-	-	
Vekovi	45	44 (97.8)	0.377(.0825)
Shiy	22	17 (77.3)	
Wainamah	-	-	
Tan	-	-	
Total	94	85 (90.4)	

Table 7. Prevalence of gastrointestinal parasites in sheep in the various villages surveyed in the study area.

District	No. examined	Infected No. (%)	χ^2 (P- value)
Kiform	-	-	
Nkar	43	34 (79.1)	
Sodepa	37	21 (56.8)	
Vekovi	-	-	1.343 (0.511)
Shiy	24	21 (87.5)	
Wainamah	-	-	
Tan	-	-	
Total	104	76 (73.1)	

Table 8. Prevalence of gastrointestinal parasites in ruminants confined in paddocks.

Ruminant	No. examined	Infected No. (%)
Cattle	53	20 (37.7)
Sheep	37	21 (56.8)
Total	90	41 (45.5)

Table 9. Prevalence of gastrointestinal parasites in tethered ruminants.

Ruminant	No. examined	Infected No. (%)
Goat	94	84 (89.3)
Sheep	48	41 (85.4)
Total	142	125 (88)

and water in Jakiri. The distribution of the snail intermediate host (*Lymnea* spp.) in this area of transhumance is not well understood. The only cestode observed in the study area was *Moniezia* spp with sheep having the highest prevalence of all the three animal groups. These results are in line with the findings of Sissay et al. (2008) and Kanyari (2009). The pathogenic significance of this parasite is not well understood. However, occurrence of this parasite in the tropics is associated with the ingestion of oribatid mites infected with cysts of *Moniezia* spp.

Locations in Jakiri where farmers practiced the traditional management systems showed higher prevalence rates and

Table 10. Prevalence of gastrointestinal parasites in free range grazing ruminants.

Ruminant	No. examined	Infected No. (%)
Cattle	224	134 (59.8)
Sheep	19	14 (73.7)
Total	243	148 (60.9)

intensities of infection compared to areas managed by the government parastatal called" *Societe de Developments des Petite Ruminant"* (SODEPA) under the semi-intensive management system. The low prevalence rate in SODEPA could be explained by the fact that the parastatal has a curved out vast grazing land reserved only for ruminants of the parastatal. Animals kept by SODEPA are well catered for, frequently drenched, well fed with supplemental feed and constantly monitored for any irregularities that might lead to death of the animal.

Upland grazing areas in Jakiri recorded the highest prevalence of gastrointestinal parasites in cattle as compared to lowland grazing areas which had higher prevalence of GIT parasites in small ruminants. The upland grazing areas are occupied mostly by the Fulani Tribes while the vast lowland grazing areas are occupied mainly by the indigenes of Jakiri for crop farming. The Fulani tribes form the minority group and often are faced with a problem of limited grazing land. They often pitch their tents and small huts closer to their cattle herds on mountainous grazing areas for proper supervision of their animals. Most of them rear cattle and few sheep inherited from their parents. They do not keep goats since they attach more religious significance to sheep during Ramadan festivities. This therefore implied that the low prevalence of GIT parasites in small ruminants in the upland grazing community was not due to absence of parasites on contaminated pastures but rather might have been due to a relatively small sample size of small ruminants kept by the Fulani community.

Though infection rates were higher in traditionally managed animals (tethered goats and sheep), a study carried out in Mankon in the North West Region of Cameroon (Ndamukong, 1985) showed that mortality rates were relatively low for all animals reared under the traditional management systems. The reason behind this could be that, local breeds of small ruminants and cattle in the North West region of Cameroon (Cameroon Dwarf goats, Red Sokoto, red Fulani cows, and Dwarf Forest sheep) have acquired strong immunity to infection of GIT parasites due to recurrent infections.

Generally, young stock animals had a slightly higher prevalence rate of GIT parasites compared to the adults. This result is in line with the findings of Ndamukong (1985), Githigia (2001), Almalaik et al. (2008) and Kanyari (2009). Calves, lambs and kids are more susceptible to infection than adults due to low levels of immunity. Higher prevalence in young stock may also be due to failure in separating young stock from the adults at pre weaning age, overgrazing of infested pastures coupled with inappro-priate and inadequate use of anthelmintics (Ndamukong, 1985).

Conclusion

The study clearly indicates that control measures should make use of the variations in helminth prevalence and intensity among management systems and age groups to achieve rational use of anthelmintics. Also, tethered animals should not be allowed to graze on a particular spot continuously for several weeks. Grazing spots should be rotated to reduce the chances of ruminants being re-infected from contaminated pastures. Field veterinarians should assist farmers in strategic deworming with broad spectrum anthelmintics used at the beginning and after the end of the rainy season. Finally, farmers should be educated on the importance of using dry season feed reserves as means to ensure safe feed for zero-grazed ruminants.

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