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Full Length Research Paper

Epidemiology of haemonchosis in sheep and goats in Benin

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A helminthological study was carried out from December 2010 to November 2011 in order to establish the epidemiology of *Haemonchus contortus* infections in small ruminants of Benin. A total of 756 abomasums, collected from randomly selected goats and sheep from all regions of Benin has been examined. An examination of the conjunctiva's colour has been associated with parasitic diagnosis to assess the degree of anaemia in animals. The study disclosed an endemic evolution of haemonchosis. The overall prevalence was of 55.56% (SD= 0.50) with a mean burden of 175 worms per infested animal. No significant influence could be attributed to host's species or age. The season has been a significant variation factor (p< 0.001). The prevalence of haemonchosis was higher in wet seasons (79.41% ± 0.40) than in dry (36.06 ± 0.48 %). The worm's burden was also higher in rainy seasons than dry. Elsewhere, a strong correlation (p<0.001) was found between the conjunctiva colour and the worm burden but with a reverse influence of the season. In rainy seasons, degrees of anaemia have been low even though worm burdens were high. Inversely, moderate worm burdens induced detectable anaemia during dry seasons.

Key words: *Haemonchus contortus*, epidemiology, goats, sheep, Benin.

INTRODUCTION

In Benin, the population of small ruminants is approximately 3 million of sheep and goats. The West African Dwarf and the Fulani are the two predominant breeds. Widely, small ruminant's productions involve small holders living under poor conditions (traditional system with mainly family farms). Moreover, the sector receives little support and is hampered by various constraints including feeding and health problem, gastrointestinal parasite notably. According to several authors (Bizimenyera et al., 2008; Mirhadi et al., 2011), gastrointestinal parasitism are very prejudicial for livestock. Infections with *Haemonchus contortus* are widely identified as the most important wire worms (Jiménez et al., 2010; Khan et al., 2010; Tariq et al., 2010; Osakwe et al., 2007; Barry et al., 2002).

In Benin, there is very limited available information on this parasite. Thus, the parasitic risk is often underestimated or mismanaged in practice. Consequently, rural populations are unduly burdened by poverty while their activities may be better capitalized. This study aims to determine the prevalence and seasonal variations of haemonchosis in sheep and goats in Benin in order to propose an appropriate management plan against this impoverishing parasite.

MATERIALS AND METHODS

Study area

The study was conducted in Benin (6° 28′ N 2° 36′ E; 114 763 km^2). It covers the whole country territory divided into two major agro-ecological areas bounded from north to south according to geographic and climatic homogeneity. The northern areas covers Alibori, Borgou, Atacora, Donga and Collines Departments and is

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characterized by one dry season (September to March) and one rainy season (from April to August with a rainfall of 700 to 1300 mm/year). The southern areas covers Zou, Couffo, Mono, Atlantique, Plateau, Ouémé and Littoral department and is characterized by two dry seasons (from December to March and from August to September) and two rainy seasons (from September to November and from April to July with a rainfall of 800 to 1400 mm/year).

Animal materials

From December 2010 to November 2011, on average, 63 Dwarf or Fulani small ruminants were monthly purchased from different parts of the study areas. In total, 756 post weaned animals (366 sheep and 390 goats aged 9 to 36 months) of both sexes were randomly selected from national livestock markets or from breeders, constituting Two groups of ages, young (< 1 year) and adult (> 1 year). Animals were identified by an individual number and some of their characteristics (species, origin, age, sex and general condition) are recorded.

Eye examination

The colour of each animal's conjunctiva were examined and characterized. Three levels of colour (red = no anaemia, pale = anaemia and white = severe anaemia) have been defined and used on the basis of the FAMACHA system (Burke et al., 2007; Van Wyk et al., 2002).

Parasitological examination

Animals were mostly slaughtered at the abattoir of Cotonou. Then, they underwent a helminthological autopsy in order to reap and to identify adult worms in the abomasums especially those of *Haemonchus* genus. The abomasums of each animal was extirpated from all other abdominal viscera after a double ligation of both ends and incised longitudinally. The content was carefully collected in a container. The mucosa of the organ and its folds were thoroughly washed in tap water above the container so as to collect all content (food juice, waste, worms, etc.). The container was slightly stirred to wash the parasitic elements. The supernatant was then declined to reveal the macroscopic worms. The worms are then harvested in a fixing solution of 5% formalin for identification and counting following the diagnosis keys provided by Zajac et al. (2006). Any abomasums hosting at least one (1) worm of *Haemonchus* genus was considered positive. The presence of other genus of worm was also recorded but without counting.

Statistical analysis

Animal's characteristics, the conjunctiva colour, the burden of *H. contortus* and the presence of other lungworms were recorded into an Excel 2007 spreadsheet. Analysis was performed using STATA version 11 and following a multiple logistic regression to study the prevalence of haemonchosis and its variation factors. The analysis of the parasite burden has meanwhile followed Poisson distribution. The possible correlation between the conjunctiva's colour and the parasite burden was assessed using the Chi^2 test.

RESULTS

Prevalence of anaemia

Anaemia was detected in 270 animals out of 756 examined examined (35.71%) and almost 9% (66) were severely affected. The anaemia test seemed reliable since the colour of the conjunctiva has been strongly correlated ($p< 0.001$) with the worm burden (Figure 1).

Overall prevalence of *H. contortus* infection in sheep and goats

Overall, 55.56% of the examined animals (420 out of 756) were infested by *H. contortus*. The monthly trend of infections (Figure 2) shows that haemonchosis is endemic in all areas without significant differences according to species or origins. The minimum and maximum recorded infection rate was respectively of 16.9% in January (a dry month) and 88.7% in July (a very wet month).

Variation factors of *H. contortus* infection rates

Statistically, only the season was significantly ($p<0.001$) associated with the haemonchosis rates during the study (Table 1). Haemonchosis has been more frequent in wet season (79.41%) than in dry (36.06%). There was no significant difference relating to animal's origin, species, sex or age even if animals below one year old and particularly goats were the most infected.

H. contortus adults' burden and anaemic condition

The mean burden of *H. contortus* adult was about 175. It was strongly ($p<0.001$) correlated with the season. Whatever the study area, the intensity of infection was higher in wet than dry seasons. Among 270 animals classified in the anaemic groups, 245 (90.74%) were really carrying *Haemonchus*. Moreover, only 36% of non-anaemic subjects were positive to haemonchosis. Considering that the anaemia test used is reliable, haemonchosis has been a main cause of anaemia in the examined animals (Table 2). A correlation has generally prevailed between the worm burden and the degree of anaemia with a reverse influence of the season. In dry seasons, even moderate infestations increased significantly the level of anaemia, while in wet seasons; the intensity of infection appears not to have really influenced the degree of anaemia (Table 3).

DISCUSSION

During the study period, infestations with *H. contortus* have evolved endemic. The overall prevalence of 55.56% reflects the importance of these bloodsucking parasites in Benin. This is still very low compared to the prevalence reported in other countries: 82% in Togo (Bonfoh et al., 1995); 94% in Middle Guinea (Barry et al., 2002) and60% in Eastern Ethiopia (Sissay, 2007). Lower prevalence has

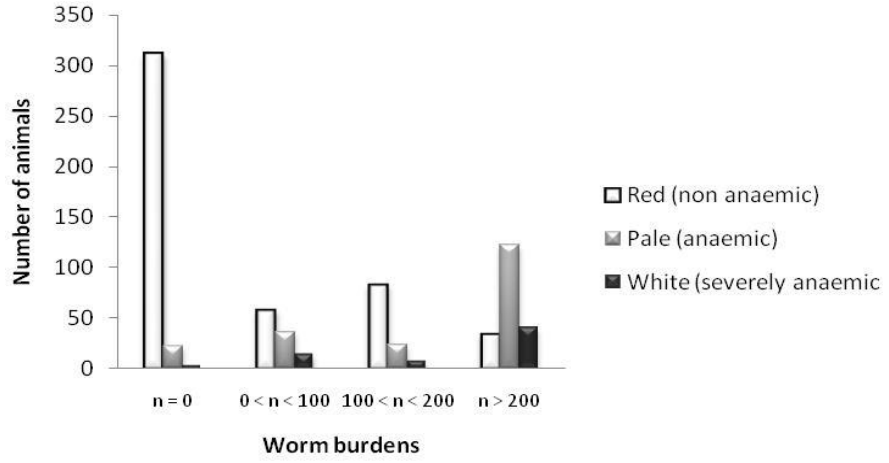

Figure 1. Frequency of anaemia in study animals according to *H. contortus* adult burden.

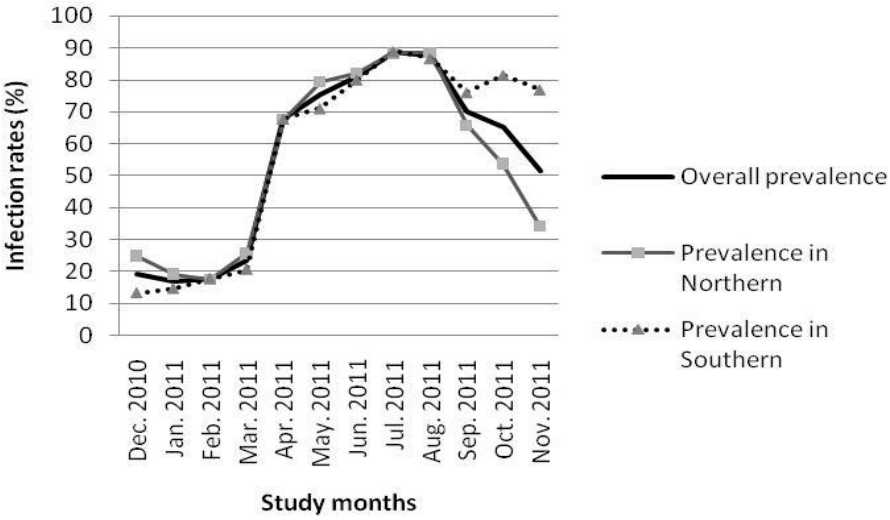

Figure 2. Monthly prevalence of haemonchosis.

prevalence has also been reported elsewhere (Tariq et al., 2010; Dagnachew et al., 2011; Qamar et al., 2011). Haemonchosis has been very prevalent in rainy seasons and the Southern Benin (the wettest area) has registered the highest prevalence. This seasonal effect has already been reported in previous studies (Barry et al., 2002; Regassa et al., 2006; Sutar et al., 2010).

However, contrary to some reported data (Tasawar et al., 2010; Biu et al., 2009) age had no significant influence in the occurrence of infections. Maybe the ages clustering did not allow sufficient variability (just two groups around one year old). Similarly, no difference due to species or sex could be established. This is not in agreement with the reports of Raza et al. (2009), but this is understandable since in the study areas, the increase in planted land is forcing sheep and goats to the same grazing way around houses or on fallow lands where the parasitic risk appears to be identical for all. And likely, the chronic nature of the infection induced some adaptive resistance. It is also possible that a combination of breed and environmental factors are responsible for this observation.

Infections intensity has been high (mean burden of 175 adult worms/infected animal) compared to other observations reported in West Africa (Barry et al., 2002). The seasonal variation of worm burdens was similar to previous observations in Eastern Ethiopia (Sissay et al., 2007). Worm burdens were higher in wet seasons than dry. Nevertheless, no proportional impact was noted on the degree of anaemia. It could be explained by the

Table 1. *H. contortus* infection rate relating to probable variation factors.

Variable	Category	No. examined	No. of Infected	Percentage of infection (mean)	SD	p-value
Origin	Northern	394	210	53.30	0.50	0.193
	Southern	362	210	58.01	0.49	
Species	Sheep	366	199	54.37	0.50	0.526
	Goats	390	221	56.67	0.50	
Season*	Dry	416	150	36.06	0.48	0.000
	Rainy	340	270	79.41	0.40	
Sex	Female	413	229	55.45	0.49	0.856
	Male	343	191	55.68	0.49	
Age	≥ 1 year	504	279	55.36	0.50	0.877
	≤ 1 year	252	141	55.95	0.50	
Anaemic condition*	Non anaemic	486	175	36.01	0.48	
	Anaemic	204	182	89.22	0.31	0.000
	Very anaemic	66	63	95.45	0.21	

*Significant variation factor; SD = standard deviation.

Table 2. *H. contortus* adult burden relating to season and to host's origin, species and age.

Season	Origin	Species	Age (year)	Worm burden (mean value rounded)	SD
Dry	Northern region	Goat	> 1	58	31.32
			≤ 1	67	26.87
		Sheep	> 1	54	21.16
			≤ 1	47	46.08
	Southern region	Goat	> 1	111	77.29
			≤ 1	169	100.12
		Sheep	> 1	142	81.89
			≤ 1	124	100.43
Rainy	Northern region	Goat	> 1	206	60.11
			≤ 1	236	61.61
		Sheep	> 1	230	56.45
			≤ 1	248	65.09
	Southern region	Goat	> 1	198	74.17
			≤ 1	210	62.74
		Sheep	> 1	215	62.96
			≤ 1	240	65.16

SD = Standard deviation.

improvement of food during the wet months. These periods are indeed characterized by forage availability and animals are then able to compensate the spoliation caused by worms; hence their relatively good health condition despite a significant infestation. While in dry season, anaemia is quite common despite the moderate worm burden, anaemia is due to both scarcity of forage and haemonchosis in this period. This agrees with Vatta et al. (2002) who pointed *Haemonchus* spp. as one of the most important helminth in small ruminants from resource-

Table 3. Prevalence (%) of anaemia relative to *H. contortus* adult burden and season.

Worm burden	Dry season			Rainy season		
	Non anaemic	Moderate anaemic	Severely anaemic	Non anaemic	Moderate anaemic	Severely anaemic
Heavy	00.0	72.4	27.6	20.2	60.1	19.7
Medium	32.0	44.0	24.0	83.3	14.5	02.2
Low	48.9	36.5	14.6	91.7	08.3	00.0
None	91.7	07.5	00.8	95.7	02.9	01.4

poor areas.

Conclusion

This study disclosed haemonchosis is a very important parasitic disease in small ruminants in Benin. Its endemicity and intensity are likely some negative factors for productivity. However, the strong influence of the season is a favourable factor to be considered in the prophylactic fight. It would be wise to include in the control of this parasite, targeted therapies using herd management with emphasis on the seasons and the life cycle of *Haemonchus* spp.

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