

## Full Length Research Paper

# Prevalence and impact of bovine trypanosomiasis in Mayo Rey division, a Soudano-Sahelian zone of Cameroon

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For several years, pastoralists in Mayo Rey division have reported the presence of trypanosomiasis within their herds, and have used trypanocides in the complete absence of laboratory diagnosis. This present study aimed to establish the prevalence of trypanosomiasis and its impact on local cattle. A parasitological survey was carried out in 24 herds for a total of 270 cattle selected and followed-up for a period of one year. Blood samples were collected aseptically and screened using the Buffy coat technique, and the packed cell volume (PCV) was measured. The results showed that 149 animals were found infected with trypanosome at least once during the four follow-ups, corresponding to an annual prevalence and incidence rates of 55.2 and 31.9%, respectively. The risk of bovine trypanosomiasis was higher in the rainy season. Three species of trypanosome were identified: *Trypanosoma congolense*, *Trypanosoma brucei* and *Trypanosoma vivax*. *T. congolense* was the most abundant species. The PCV was significantly higher for mixed and single infections with *T. vivax*. Analyses have shown that cattle breed and age group affect significantly the prevalence of trypanosomiasis. The effect of trypanosomiasis on weight loss was noticeable, but significant in the rainy season only. This study has established the prevalence and the endemicity of trypanosomiasis in the Mayo Rey division; it suggests that tsetse flies and other mechanical vectors may be abundant in the zone and raise the need for entomological investigations.

**Key words:** Cattle, trypanosomiasis, Buffy Coat Test, packed cell volume, Soudano-Sahelian region, Cameroon.

## INTRODUCTION

Cameroon is one of the largest producers of beef in the Economic Community of the Central Africa States

(CEMAC) region with an estimate of ten million cattle (Minepia, 2003; Ankoqui-Mpoko et al., 2010). The northern

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region of the country is one of the most important cattle breeding regions; it supplies both the local and the international market demands. In this region, pastoral activities are focused in the Mayo Rey division which concentrates 50% of all the pasture (Labonne et al., 2003). However, herds' productivity is unable to satisfy the constantly growing local demands of the population and it is known to be gravely impeded by problems related to water and feeding, breeding practices and health. Among the health issues is animal trypanosomiasis (Minepia, 2009).

Animal trypanosomiasis is a parasitic disease that causes serious economic losses to pastoralists (Winrok Inter, 1992); it manifests anemia, loss of condition, agalaxia and emaciation. Many untreated cases are fatal (Troncy et al., 1981). The prevalence of this disease in Africa overlaps with the distribution of its biological vector, the tsetse fly, endemic between latitude 15°N and 29°S (Leak, 1999). One quarter of economical losses due to animal pathologies is attributable to trypanosomiasis (De Hann and Bekure, 1991). In Cameroon, animal trypanosomiasis had been ravaging for many years following the invasion of tsetse flies that occurred in the fifties and precisely in the Adamawa region (Mamoudou et al., 2009); since then many studies on the epidemiology of this disease were conducted in the region (De Wispelaere, 1994; Boutrais and Cuisance, 1995; Mamoudou et al., 2006, 2008; Mpouam et al., 2011). This region is limited northward by the north region where trypanosomiasis had been reported nearly two decades ago by Ndamkou and Chare (1995) and where little is known of the current situation of this disease. In Mayo Rey division, a Soudano-Sahelian zone in the north region, adjacent to the Vina division (Adamawa region), the presence of trypanosomiasis has been reported by pastoralists who attribute huge economic losses to this disease in the complete absence of laboratory diagnosis.

The present study was carried out to ascertain the prevalence of bovine trypanosomiasis in the Mayo Rey division in order to improve the understanding of its impact and epidemiology.

## MATERIALS AND METHODS

### Study area

The study was conducted in Yoko village, Mayo Rey subdivision, north region of Cameroon. Ecologically, this area is classified as a Soudano-Sahelian zone (annual rainfall varies between 400 mm and 1200 mm). There are two main seasons: the rainy season (from early May to September) and the dry season (from October to April). Farming and animal husbandry are the main income generating activities. Animal husbandry is practiced mostly by Mbororo and Foulbe tribes for centuries (Bronsvort et al., 2003). However, pastoral systems have remained primarily subsistence-orientated rather than capitalist-orientated. The pastoralists exploit common pool grazing resources composed mostly of

*Andropogon gayanus*, *Brachiaria bryzantha*, *Loudetia togoensis* and *Pennisetum pedicellatum*. The sampling was done in four villages: Bini, Kombo, Gada Raou and Kaou (Figure 1).

### Study design

#### Sampling procedure and data collection

A total of 24 herds of about 70 animals each were selected for the survey. Animals were sampled randomly and their number varied between 11 and 14 animals. A survey questionnaire was developed and administered to collect background data on animals (age, sex, breed and weight). Weight of the animals was estimated by the formula developed by Njoya et al. (1998). The blood samples of each of the 270 animals (identified by code) included in the survey was collected via ear vein into heparinized micro-haematocrit centrifuge capillary tubes and onto glass slides, as thick and thin blood smears. Blood samples were collected twice in the dry season (November, 2012 and March, 2013) and twice in the rainy season (May and September, 2013) on the same animals. The surface around the ear vein were sterilized with ethanol before each blood collection.

#### Diagnostic of trypanosome infection

Blood samples were used for paraclinical (packed-cell volume, PCV) and parasitological detection of trypanosomes by buffy-coat technique (BCT), thick and thin smears analyses (Paris et al., 1982). The capillary tubes were sealed with "cristoseal" (Hawksley) and centrifuged immediately in a micro-haematocrit centrifuge for 5 mns at 9000 rpm. After centrifugation, PCV was determined. The Buffy coat and the upper most layers of red blood cells of each specimen were extruded on to a microscope slide and examined for the presence of motile trypanosomes. Samples were examined with a phase contrast microscope with a 40x objective lens. Giemsa – stained thick and thin blood smears were examined under 100x oil immersion objective lens for trypanosome identification. Trypanosome species were identified by reference to criteria defined by Murray et al. (1977). The specificity (Sp) of BCT is unequivocal (no false positive reactions) but sensitivity (Se) is low because BCT cannot detect parasitaemia below 200 to 1000 trypanosomes/ml (Murray et al., 1977)

#### Data analysis

Data were processed in Microsoft excel. The prevalence and incidence rates of trypanosome infections as well as the prevalence of species of trypanosomes identified were compared by Chi-square ( $\chi^2$ ) at a precision level of 5% using the XLSTAT software version 2014. Real prevalence was estimated with the formula below (Toma et al., 1996).

$$PR = \frac{PA + Sp - 1}{Sp + Se - 1}$$

Where PR = real prevalence; PA = apparent prevalence (test); Se = test sensitivity; and Sp = test specificity.

Prevalence referred to the proportion of the study population diagnosed with trypanosomiasis either during the dry or the rainy seasons or throughout the study period; the incidence referred to the proportion of new cases of trypanosomiasis diagnosed within the study population case at the above periods. The paired-sample

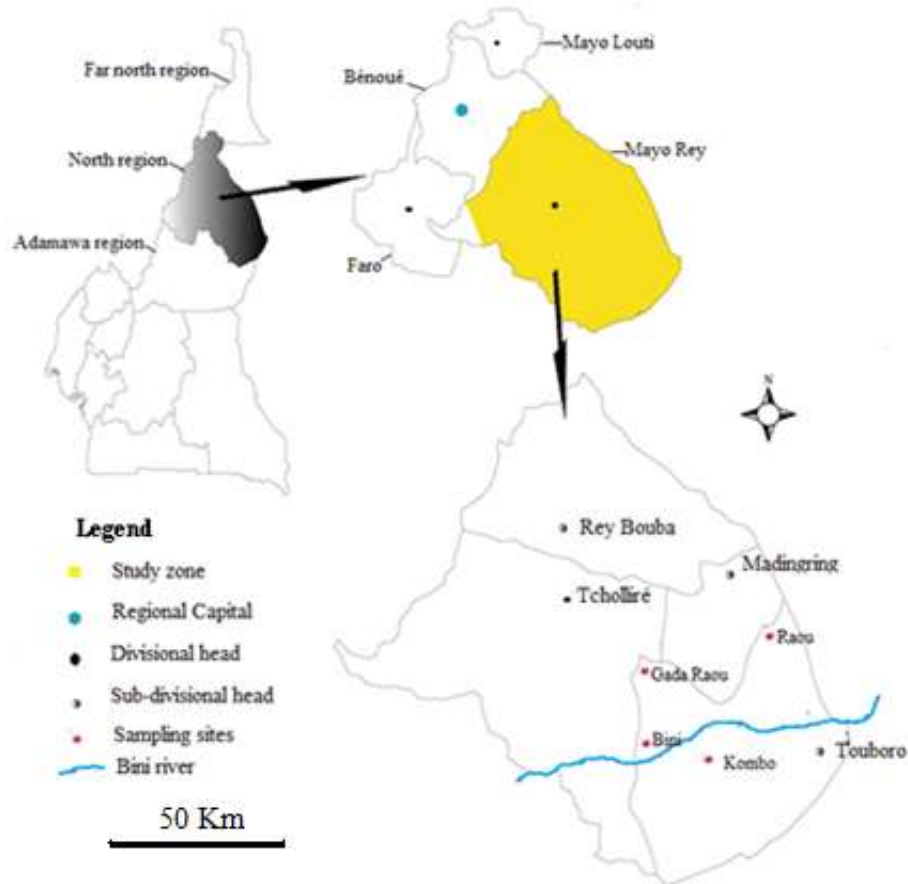


Figure 1. Study zone showing sampling sites.

T-test was used to compare means of PCV and weight. A regression model was used to assess the effect of age category (Adult: > 4 years; Juvenile: > 2 and ≤ 4 years; Young ≥ 1 and ≤ 2), sex and breed on the prevalence of trypanosome infections.

## RESULTS

### Prevalence and incidence of trypanosome infections

The parasitological analysis revealed that 149 animals were found infected with trypanosome at least once, corresponding to an annual prevalence of 55.2%. The majority of these animals, 59.06% (88/149) were found infected once ( $X^2:147.714$ ,  $P<0.001$ ), followed by 26.85% (40/149), 8.72% (13/149) and 2.01% (3/149) for animals infected respectively twice, thrice and four times during the survey. Assuming a BCT sensitivity to be between 0.6 and 0.9 and a specificity of 1, the estimates of true prevalence ranged from 61.33 to 92.00%. The prevalence varied significantly with the season; with more prevalent cases found in the rainy season ( $Z:-3.269$ ;  $P=0.001$ ). No significant difference was found among the prevalence of trypanosome in each village ( $X^2:6.317$ ;

$P=0.097$ ). The annual incidence rate was 31.90%(86/270). The incidence rate was significantly higher in the rainy season ( $Z: 3.340$ ;  $P=0.001$ ) and the estimates of the true monthly incidence in the rainy season is twice as high as that of the dry season (Table 1). The prevalence and incidence were similar among villages (Table 2).

### Species of trypanosomes

Parasitological tests revealed the presence of three species of trypanosome: *T. congolense*, *T. brucei* and *T. vivax*. Among the 234 BCT positive, *T. congolense* was the most prevalent species (64.96%) (Figure 2) and its prevalence was significantly higher than that of the other species ( $X^2:266.826$ ;  $P<0.001$ ).

### Effect of breed on the prevalence of trypanosome infections

All the four cattle breeds (Gudali, White Fulani, Red Fulani and Bokolodji) identified within our sample were

**Table 1.** Estimate of true monthly incidence of trypanosome infections in study site between November, 2012 and September, 2013.

Parameters	Sample size	N° of BCT+	Apparent monthly incidence (%)	True monthly incidence (%)	
	-	-	-	BCT Se = 0.9	BCT Se = 0.6
November, 2012 - March, 2013 (5 months)	270	20	1.48	1.65	2.47
May, 2013 – September, 2013 (5months)	270	45	3.33	3.70	5.55

Monthly average incidence over one 5 months period: (N°BCT+/(Sample size × 5 months)) × 100; True incidence = apparent incidence/BCT sensitivity (with assumptions of two BCT sensitivity, 0.6 and 0.9, and BCT specificity = 1.0).

**Table 2.** Prevalence and incidence of trypanosome infection per village and season in Mayo Rey, between November 2012 and September 2013.

Season	Village	Sample size	Prevalence			Incidence		
			Infected animals (%)	X <sup>2</sup> ; P-value	z; P-value	Infected animals (%)	X <sup>2</sup> ; P-value	z; P-value
Dry season	Bini	67	15 (22.39)			4 (5.9)		
	Kombo	67	15 (22.39)			3 (4.48)		
	Kaou	68	24 (35.29)	5.473; 0.140		6 (8.83)	2.065; 0.559	
	Gada Raou	68	24 (35.29)			7 (10.29)		
	Total	270	78 (28.89)			20 (7.40)		
					-3.269; 0.001			-3.3062 ; <0.001
RainySeason	Bini	67	24 (35.82)			10 (14.92)		
	Kombo	67	25 (37.32)			11 (16.41)		
	Kaou	68	35(51.47)	4.727; 0.234		15 (22.06)	2.149; 0.542	
	Gada Raou	68	30 (44.11)			9 (13.23)		
	Total	270	114 (42.22)			45 (16.67)		

concerned by trypanosome infections. Analysis using general linear models (GLM) showed that breed affects significantly the prevalence of trypanosomiasis infections (X<sup>2</sup>:30.424; P<0.001). The lowest infection rate was recorded in the Gudali (Table 3).

**Effect of Age group and sex on the prevalence of trypanosome infections**

The prevalence of trypanosome infections varied

among age groups; with a significant effect (X<sup>2</sup>:9.260; P=0.010). The prevalence of trypanosome infection was different between male (52.83%) and female (56.71%) with no significant difference (X<sup>2</sup>:0.014; P=0.906).

**Effect of trypanosome infection on PCV**

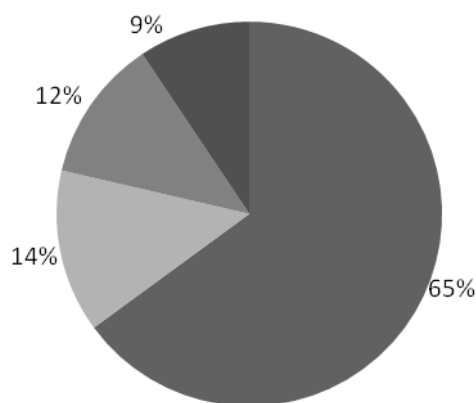
The means PCV were different between the dry (35.07%) and the rainy (35.41%) seasons and this difference was statistically significant (t:-1.999;

P=0.047). This difference was even higher between the beginning and the end of both the dry and the rainy (t: 7.916; P<0.001 and t:-7.310; P<0.001) seasons. The Mean PCV was statistically different among study villages; Kaou had the lowest mean of PCV in both seasons. Moreover, it was found that the PCV also varies within the age category, but the difference observed was not significant (F: 0767; P=0.466). The PCV of infected cattle was significantly lower than that of non-infected cattle in both seasons (P=0.001). Among infected cattle, the means of

**Table 3.** Annual prevalence of trypanosomiasis by cattle breed.

Parameters	Non infected	Infected	Prevalence (%)	Total	X <sup>2</sup> ; P-value	
Cattle breed	Bokolodji	16	23	59	39	-
	Gudali	81	53	40	134	28.413 ; <0.0001
	Red F	9	25	74	34	-
	White F	15	48	76	63	-
Total	121	149	55	270	-	

■ *T. congolense*   ■ *T. brucei*   ■ *T. vivax*   ■ Mixed infections

**Figure 2.** Prevalence of trypanosome species.

PCV varied significantly among the species of trypanosomes in the rainy season only, with the lowest mean recorded for mixed infection, followed by *T. vivax* (X<sup>2</sup>:7,814; P=0.009).

#### Effect of trypanosome infection on weightgain

The overall weight gain of study population at the end of the study period was 27.67 Kg. The mean weight gain of these cattle varied significantly with the seasons; cattle gained 9.48 and 35.33 Kg respectively at the end of the dry season and of the rainy season (t:-31.30; p<0.001). The annual weight gain between non-infected and infected cattle were respectively 30.41 and 25.44; these values were significantly different (t:-3.29; P=0.001) (Figure 3). The mean weight loss among infected cattle was 11.15 kg against 8.80 Kg among non-infected ones; this difference was not significant (t: 1.53; P=0.128) at the end of dry season (Figure 4). In the rainy season cattle gain weight and a significant difference was observed between the mean weight gain of infected cattle (33.95 kg) and of non-infected cattle (39.49 kg) (t:-3.41; P =

0.001) (Figure 5).

#### DISCUSSION

The prevalence of trypanosomiasis among the 270 animals followed-up for one year in the Mayo Rey division was 55.2%. This prevalence was higher than all those obtained in adjacent localities of the Adamawa region; for example in Mbe and Plateau, the prevalence were respectively 15.22 and 8.12% in 2010 (Mpouam et al., 2011) and 40.7% in the Faro et Deo divisions in 2010 (Tanenbe et al., 2010). The difference observed with the latter may be due to the sampling methods. The latter were transversal studies while the present study is longitudinal. Additionally, the samplings in these studies were done during the dry season only. Nevertheless, the prevalence in the Mayo Rey division (28.89%) in the dry season remains higher than that of the Vina but lower than that of the Faro et Deo divisions. This situation could be attributed to the fact that the vector control campaigns which were implemented in these zones reduced

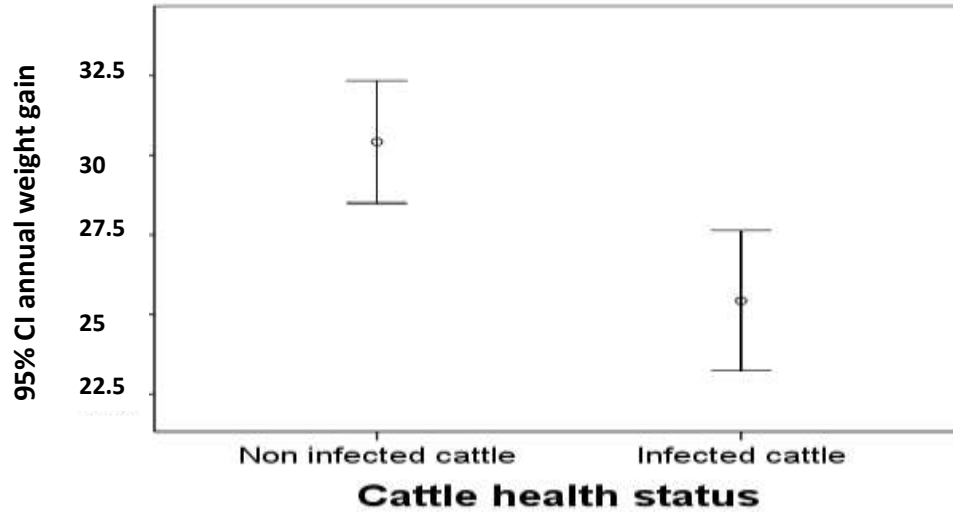


Figure 3. Effect of trypanosomiasis on cattle annual weight gain.

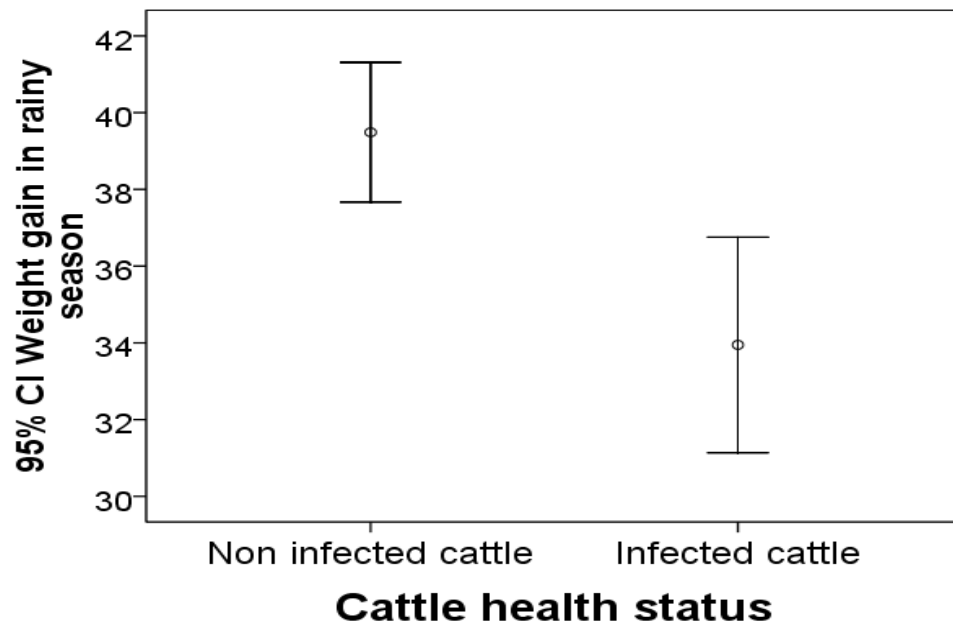


Figure 4. Effect of trypanosomiasis on cattle weight loss in the dry season.

considerably the risk of transmission of trypanosomes and the cattle breeding practices which tend to become semi intensive with limited transhumance (Mpouam et al., 2010).

The difference observed with the Faro et Deo divisions may be due to the fact that herds of this division frequently cross the buffer zone to graze in the tsetseinfested zone, thus increasing their risk of trypanosome infection (Tanenbe et al., 2010). The

difference of prevalence between seasons in Mayo Rey could be due to the direct and indirect impact of climate (temperature and rainfall) variations on the abundance of the vectors. The increase in the abundance of biting flies during the rainy season may have increased the risk of flies-animals contacts and of trypanosome transmission (Tchoumene-Labou et al., 2013). BCT incidences revealed infections in the dry season as well as in rainy season. The true monthly incidence rate of trypanosome

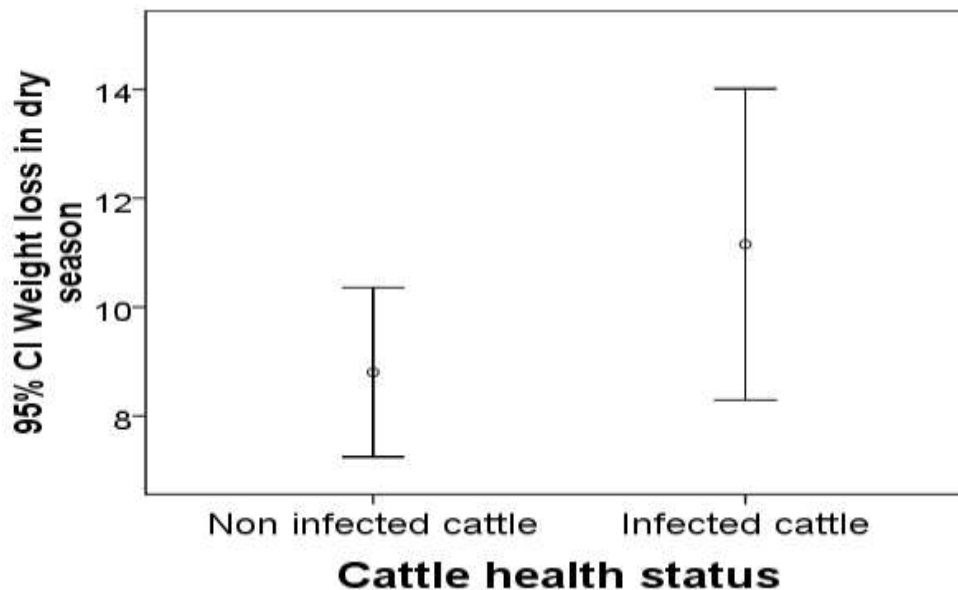


Figure 5. Effect of trypanosomiasis on cattle weight gain in rainy season.

infections shows that the risk for new infections is twice as high in the rainy season.

In this study, three species of trypanosome were identified and among them, *T. congolense* was the most prevalent one. This result is similar to that obtained by Tanenbe et al. (2010). The high predominance of this species may imply the existence of tsetse, the biological vector, and contacts with animals (Hoare, 1972). The risk of infection increased with age. This result corroborates with the findings of Desquesnes et al. (1999) in Burkina Faso and Mahama et al. (2004) in Ghana. The effect of age is most likely due to the longer period of exposure to the risk of infection in adults. The sex prevalence rates revealed a slightly higher percentage among the females. Onyiah (1997), Quadeer et al. (2008) and Sam-Wobo et al. (2010), in Nigeria observed no statistically significant difference in the prevalence rates of cattle by sex. The tsetse flies or other biting flies do not have any criteria to discriminate between male and female when they require their blood meal.

Cattle breed influenced significantly the prevalence of trypanosome infections. The risk of infections is increased in three cattle breeds: Red Fulani, White Fulani and the Bokolodji (mixed). It suggests that these breeds are more susceptible to trypanosomes. Contrary to the latter, the Gudali breed showed the lowest infections rate, suggesting a better adaptability in the study zone. Similar results were found by Sam-Wobo et al. (2010) who compared the white Fulani and the Gudali in Nigeria.

The impact of trypanosome infection on cattle body weight was tracked in this study. This impact varies

normally with the climatic conditions as they influence the availability of fodder. The effects of trypanosome infections on cattle weight gain were noticeable but not significant in both seasons. The non significance of the weight loss in cattle according to their health status could be attributed to a practice common among pastoralist of the north of Cameroon; pastoralists often give additional food to cattle with clinical signs of diseases or other drugs in order to facilitate their recovery (Healy et al., 2013). The significant difference in weight gain observed in the rainy season between the infected and the non infected cattle may be due to the higher abundance of biting flies at this period; their buzz and visual harassment and their painful bites disturb grazing thus reducing cattle weight gain (Foil and Hogsette, 1994; Hollander and Wright, 1980) most importantly among infected animals. The presence of tsetse flies had been reported in this zone many decades ago (Rageau and Adam, 1953). The development of these flies may have been maintained along the Benoué River and facilitated by the importance of transhumance in the zone.

The level of anemia through PCV is one of the reliable indicators of trypanosomes in cattle (Rowlands et al., 2001). In this study, the means of PCV were significantly higher in non-infected cattle. Similar results were found by Quadeer et al. (2008), Sam-Wobo et al. (2010) in the Nigeria and Desquesnes and Dia (2003) in Burkina Fasso. The PCV values equally varied with the species of trypanosome and these values were the lowest with *T. vivax* (in a single infection); this indicates the pathogenic effect of this species.

## Conclusion

The present study has confirmed the presence of bovine trypanosomiasis in a Soudano-Sahelian zone in Cameroon with an annual prevalence which is remarkably high (55.2%). The disease is endemic with a higher risk of infection for cattle in the rainy season. The age group and cattle breed affect the prevalence. The predominance of *T. congolense* mainly transmitted by tsetse flies suggests that the study zone is infested by the biological vector of the disease. The findings call for further entomological investigations on the species of biting flies present in the zone and their distribution necessary for control interventions.

## ACKNOWLEDGMENT

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## Conflicts of interest

The authors declare that they have no conflicts of interest.

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