

Susceptibility of indigenous beef cattle breeds of pastoral farms in the North West Region of Cameroon to natural trypanosome challenge

Godlove MUSONGONG^{1*}, Prudentia Yensi LAWAN², Harriet NDOFOR-FOLENG³

¹*PhD, Bamenda University of Science and Technology (BUST), Bamenda, Cameroon

*Corresponding author

² DVM, Divisional Delegation of Livestock, Fisheries and Animal Industries, Mezam, North West Region, Cameroon

³ PhD, Department of Animal Science, University of Nigeria, Nsukka, Nigeria

Abstract: There is paucity of documentation on susceptibility of indigenous beef cattle of pastoral farms in the administrative divisions of the North West Region of Cameroon to trypanosomiasis. A survey was carried out in seven divisions namely Boyo, Bui, Donga-Mantung, Menchum, Mezam, Momo and Ngoketunja during the transhumance period when the cattle move to pasture of communal grazing grounds in the dry season. Indigenous beef cattle breeds of pastoralist farms were identified and their susceptibility to trypanosomiasis was assessed. Blood samples from the cattle brought for slaughter to the Bamenda Municipal Abattoir during the period of study were screened and laboratory results and responses to questionnaires by pastoralists, butchers and animal health service providers were collated and analyzed. Results showed that the main breeds of indigenous beef cattle found in all the seven divisions in the North West Region are Gudali, red Fulani, white Fulani and their crosses. The overall susceptibility of cattle to trypanosomiasis in the region was 28.1% and the prevalence of individual trypanosome species identified was *Trypanosoma congolense* (16.7.0%), *T. vivax* (6.7%) and *T. brucei* (4.7%). Fulani cattle were more susceptible than Gudali cattle. Biting flies were identified as *Glossina spp* (83.3%), *Tabanus spp* (10%) and *Stomoxys spp* (6.7%). It was concluded that indigenous beef cattle of the North West Region of Cameroon are highly susceptible to trypanosomiasis which affects their productivity.

Key Words: Gudali, Fulani, Bovine, Trypanosomiasis, Susceptibility, Cameroon

INTRODUCTION

Trypanosomiasis also known as “nagana,” in cattle is one of the serious disease constraints to cattle production and a threat to food security in sub-Saharan Africa (Salihu *et al*, 2014; Sherefaw *et al*, 2016). Susceptibility to infection varies according to host species and even breed of host. The impact of trypanosomiasis on susceptible cattle cannot be under estimated since it is associated with reduced productivity manifested as poor growth and carcass quality, abortions, low milk production and mortality. Cameroon lies within the tsetse fly belt and so cattle in the North West Region of Cameroon are very likely to be exposed to tsetse flies, other biting flies and trypanosomiasis challenge which may cause an average annual death of up to 245 beef cattle worth up to US \$98000. This is equivalent to 49 million FCFA (DREPIA-NW, 2018). Trypanosomiasis is common in cattle grazing in the plains, plateaux and valleys of the northern parts of Cameroon (Mpouam *et al*, 2011; Achukwi *et al*, 2013) but the North West Region of Cameroon is deficient in adequate information on susceptibility of indigenous beef cattle to trypanosomiasis, yet determination of disease prevalence or susceptibility of host is the first step to attempting disease eradication (Ehodaghe, *et al*, 2018).

MATERIALS AND METHODS

The study area

The North West Region of Cameroon is located between latitudes 5° 45' and 9° 9' N and longitudes 9° 13' and 11° 13' E (Plate 1) which is within the tsetse fly belt (14⁰ N and 29⁰ S). It has a surface area of 17,836 km² and had a human

population of about 1,728,953 a few years ago (Lawan, Musongong and Neba Che, 2020; Lawan *et al*, 2020). The region is characterized by diverse climatic conditions, ecological zones and topography which favor beef cattle production but provide habitats for tsetse flies and other biting flies (Mamoudou, *et al*, 2016; Murray, *et al*, 1977; Lawan, Musongong and Neba Che, 2020). The region holds about 1,568,431 cattle with herds made up of mixtures of different cattle breeds (EPIASTAT, 2017). The Bamenda Municipal abattoir pools cattle for slaughter from all divisions of the region namely Boyo, Bui, Donga-Mantung, Menchum, Mezam, Momo, and Ngoketunja. Cattle owners take their cattle on transhumance during the dry season to communal grazing grounds and return to their respective grazing grounds at the end of the period.

Research design and sampling method

Questionnaires were administered during the dry season which is the period of transhumance to cattle farmers, butchers, and animal service providers. Contacts with the respondents were made at the Municipal abattoir, cattle grazing land and the Bamenda cattle market. A total of 150 of the questionnaires administered were recovered from the pastoralists and animal service providers in the seven divisions of the region. At the Bamenda Municipal abattoir, 25 samples at least were collected each week over a period of 16 weeks. Data collected included date, origin, breed, age group, sex and body condition score of the cattle. Breeds were identified according to previous knowledge from standard documents (Williamson and Payne, 1965). The origin of each animal was given by the butcher who buys for slaughter. The ages of the cattle were determined through their dentition. Physical examination of the pin bone and prominences of the ribs was done according to Tafese, *et al* (2012) and body condition scores (BCS) were established and scored on a 1-5 scale representing “Poor”, “Medium” and “Good”. A 2ml blood sample was aseptically taken by jugular vein puncture from a total of 400 animals within a wide age range (36-93 months). Screening for trypanosomiasis was done using the Buffy Coat Technique (BCT) as described by Salihu, *et al* (2014). Wet mounts and Giemsa stained thin blood smears were prepared and examined to identify the specific trypanosomes using standard procedures as described by Anders Permin and Hansen (1998); Murray, *et al* (1977); Sam-Wobo, *et al* (2010).

Data on prevalence of trypanosomes was collated and entered into SPSS software version 20.0 and Microsoft Excel. Thereafter the data was analyzed using Chi square and Fisher’s Test. Differences were considered significant at $p < 0.05$.

RESULTS

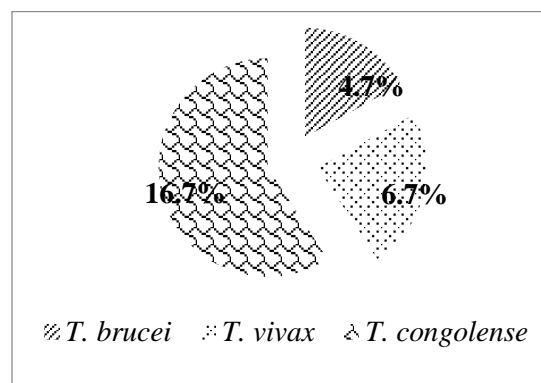


Figure 1: Prevalence of trypanosome species in beef cattle in the North West Region of Cameroon

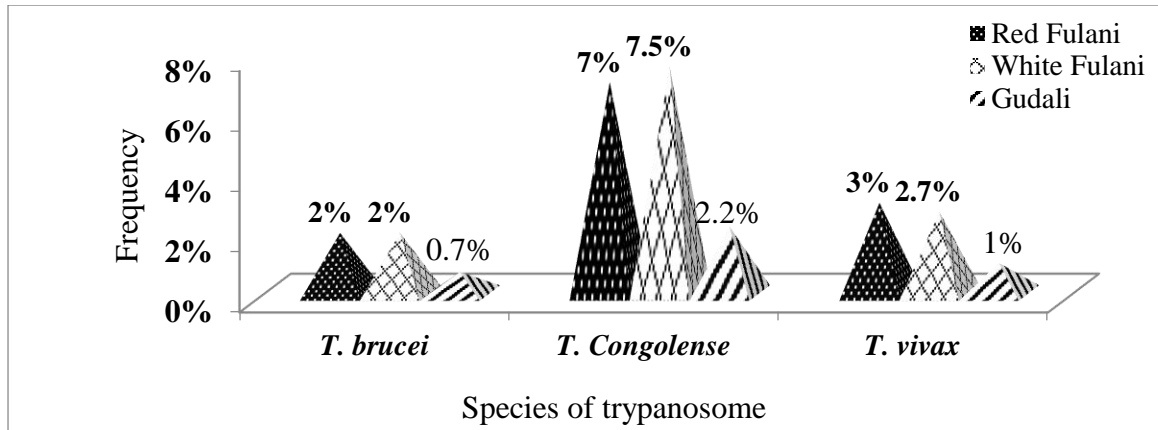


Figure 2: Relative prevalence of trypanosome species in beef cattle breeds of North West Region, Cameroon

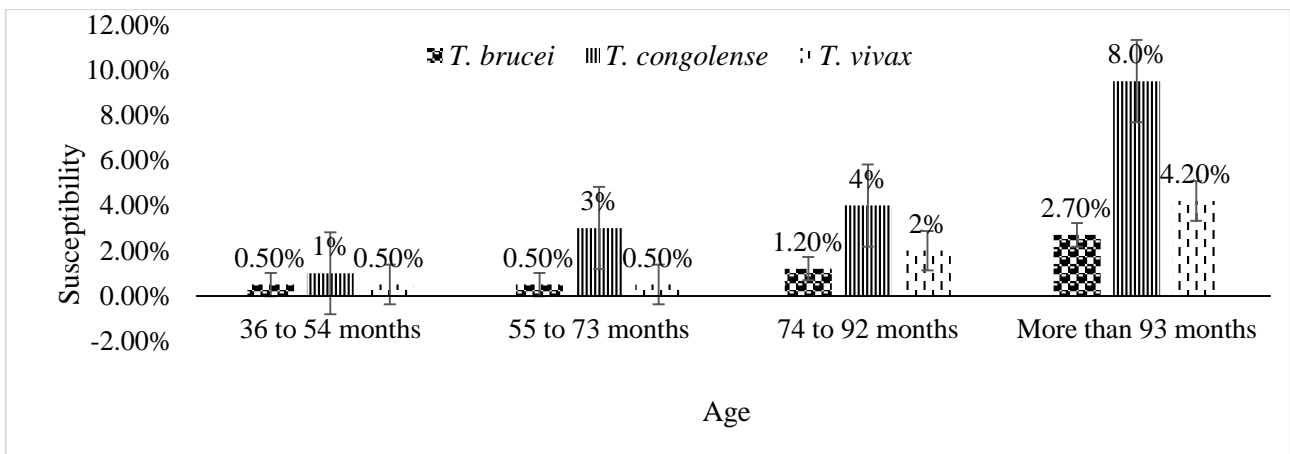


Figure 3: Susceptibility of young and adult beef cattle to trypanosomiasis

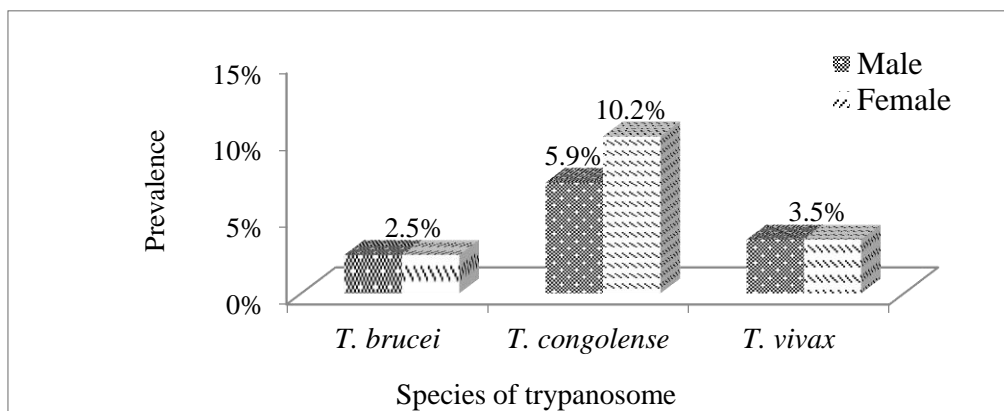


Figure 4: Susceptibility of male and female beef cattle to trypanosomiasis

Plate 2 shows the main breeds of indigenous beef cattle namely, red Fulani, Gudali, white Fulani and their crosses identified in all the administrative divisions. These can be found in various proportions in the cattle market pool (Plate 2c), the Fulani being the predominant breed. There was an overall susceptibility of 28.1% and the prevalence of each trypanosome species identified (Fig.1) was *Trypanosoma congolense* (16.7%), *T. vivax* (6.7%) and *T. brucei* (4.7%). *Trypanosoma congolense* was most prevalent and more so in the Fulani cattle. Figure 2 shows that Gudali cattle were

least susceptible (3.9%) to all the three trypanosome species compared with the red Fulani cattle (12%) and white Fulani (12.2%). The majority of pastoralists (34.5%) also believed that the Fulani breeds of cattle were more susceptible to trypanosomiasis than the Gudali breed. They however also believed that susceptibility of white Fulani is similar to that of Gudali cattle and that the red Fulani cattle were more susceptible than the white Fulani. Furthermore they believed that the crosses between Gudali and Fulani were least susceptible of all breeds. Figure 3 shows that the older the animal the more susceptible it is and that *T. congolense* was again most common in each age group. Figure 4 shows that male cattle were less susceptible to *T. congolense* than female cattle were, while there was no difference in response to infection with *T. brucei* and *T. vivax* between male and female cattle. The worst consequences of cattle trypanosomiasis were general poor growth, reflected in Plate 3, abortions and delayed estrus according to the pastoralists' assumptions. There were some cases of cattle (10%) that they said generally suffered from all the trypanosome species.

DISCUSSION

Variability in susceptibility to infection is commonplace and this may depend on variability in underlying characteristics of the host species and many other epidemiological factors as suggested by results of the present survey. The present results imply that trypanosomiasis is more common in indigenous beef cattle of the North West Region (Figure 1) relative to those of the northern parts of Cameroon shown by previous works (Achukwi and Musongong, 2009; Mpouam, *et al*, 2011). Cattle in these parts of Cameroon might have had a considerable longer period of trypanosome challenge than those of the North West Region, a possible reason for higher susceptibility. Gene diversity indices may be some of the underlying factors playing a major part in susceptibility of the red Fulani which are also described as red Mbororo in other places (Ibeaga-Awemo and Erhardt, 2006). The coat colour of Fulani cattle may be a phenotypic marker of trypanotolerance based on genetic constitution that needs to be investigated since the red coated cattle seem to be less susceptible. Cattle breeds of the northern regions of Cameroon are predominantly Gudali followed by Namchi/Doayo and Kapsiki all known to be virtually trypanotolerant (Achukwi and Musongong, 2009; Fasanmi, *et al*, 2014). It has been suggested that indigenous cattle breeds in three subdivisions (Bafut, Bali, Santa) of Mezam Division of North West Region are more susceptible to trypanosomiasis than those of the northern regions (Mamoudou *et al*, 2016) but information about the other divisions is lacking. The present work complements this information. Figure 3 suggests that Gudali breeds tend to be resistant to trypanosome infection. Freshly bitten cattle may not show trypanosomes in the blood immediately after a fly bite for many reasons. Some breeds are able to withhold trypanosomes in the cutaneous layer of the skin for some time after the bite and these stages may die without penetrating the circulatory system. This makes it difficult for easy detection by some laboratory techniques soon after a bite. *Trypanosoma vivax* can be retained in the chancre for up to 8 days after a tsetse fly bite and only appears in the circulatory system 12-24 hours after that (Gardiner, 1989). This can be a mechanism of resistance which makes Gudali cattle either truly or apparently less susceptible. Several prevalence values (13.5%-46.8%) have been recorded using the PCR-RFLP technique which is more sensitive (Mamoudou, *et al*, 2006). This implies that the present results could even be higher than observed.

In the absence of tsetse flies *T. vivax* in particular is known to be transmitted by other biting flies (Gardiner, 1989). This may be a reason for its higher prevalence than that of *T. brucei*. The other types of flies than the tsetse flies bite all the breeds of indigenous cattle (Figure 2) thus increasing the prevalence and intensity of infection. Furthermore it is very common to see herds of mixed breeds together with their crosses in the same farm. This is a factor that may confuse reliability of breed-related data about animals from interviews in this kind of study. The pastoralists would not say with high accuracy and certainty how the offspring originate in a mixed production system and so susceptibility of crosses may also be variable.

Susceptibility to trypanosome infection in the cattle of North West Region of Cameroon results in pathological consequences which are manifested as reduced growth, weight loss / emaciation (Plate 3), abortions, delayed estrus and increased calving intervals. The pastoralists are very familiar with these consequences as these are common in the field (Figure 4, Plate 3).

Some pastoralists usually present for sale some of those animals that they consider are apparently not very healthy and so these are the animals mostly seen in the abattoir. It is thus possible that butchers purchase more carriers of

trypanosomiasis amongst apparently healthy cattle in the market than they would purchase directly from the field. This can also contribute to high variation between the present results and those of other workers. Crossing animals in the farms between Gudali and Fulani is mainly for the improvement of meat quantity and quality. Coincidentally the crosses also tend to show lower susceptibility to trypanosomiasis. This information confirms it that the Gudali is a trypanotolerant breed and so can be a very useful breed to be included in the measures of control of trypanosomiasis of cattle in the North West Region of Cameroon.

Age-related variation in susceptibility to infection could also be associated with the management practice in which young animals very often are tethered and fed at home while their parents go out to graze until the young attain a reasonable age to go about with their parents, so they are less exposed at that age. Furthermore some calves from infected cows may be born with maternal antibodies acquired from their infected mothers to confer to them some immunity (Mamoudou, *et al*, 2016) which wanes by the time they are turned out. However female cattle under physiological stress may show decreased immunity despite equal chances of exposure with the males to the vectors on common grazing land. Female animals stay longer in the herd and are given more attention than their male counterparts which in most cases are sold earlier for slaughter as reported by Lawan *et al*. (2020). There would be more male samples from the abattoir than directly from the field. The duration of fly challenge of females is also longer. However prevalence of infection in bulls can naturally be higher than in cows (Mamoudou, *et al*, 2016; Tafese, *et al*, 2012) because bulls secrete pheromones which also attract biting flies to them (Seifert, 1996). This suggests that sex of animal may not be a reliable epidemiological factor playing a role in susceptibility to trypanosomiasis and control of the disease. The results presented in Figure 5 are frequent observations in cattle of other places (Achukwi and Musongong, 2009; Fasanmi, *et al*, 2014; Sam-Wobo, *et al*, 2010). Some trypanosomes secrete antigens that are not able to stimulate immune response and so may result in older cattle being more susceptible despite the long period of exposure to tsetse fly challenge (Seifert, 1996).

CONCLUSION

The main indigenous beef cattle breeds common in all the seven divisions of the North West Region of Cameroon are Gudali, red Fulani and white Fulani. They show variability in susceptibility to *Trypanosoma congolense*, *T. vivax* and *T. brucei*. The Gudali and crosses with Fulani cattle show lower susceptibility to trypanosomiasis and they may be useful in improvement of resistance of indigenous beef cattle of the North West Region of Cameroon to trypanosomiasis. Epidemiological factors such as vector availability, breed of animal and age predispose cattle to susceptibility to cattle trypanosomiasis. Poor growth, abortion and high mortality rate which may be attributed to trypanosomiasis decrease cattle farm production, productivity and food security.

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Prudentia Lawan and Godlove Musongong conceived the study; Harriet Ndofo-Foleng, Prudentia Lawan, Godlove Musongong participated in the design; Harriet Ndofo-Foleng, Prudentia Lawan performed the statistical analysis and interpretation; Prudentia Lawan drafted the manuscript; Godlove Musongong, Harriet Ndofo-Foleng critically read the manuscript.

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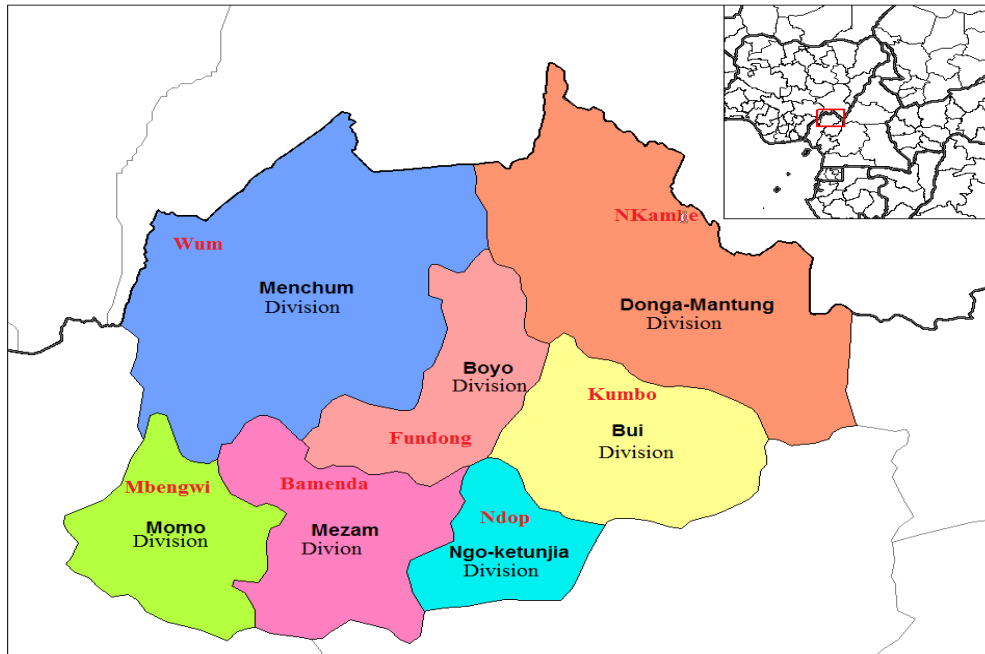


Plate 1: Map of the North West Region of Cameroon showing the seven Divisions.
Source: Anon, June 2019



Plate 2a: Red Fulani cattle breed in a pastoral farm, Bafut
Source: Prudentia Yensi Lawan, May 16th 2019



Plate 2b: White Fulani breed of cattle
Source: Prudentia Yensi Lawan, May 16th 2019



Plate 2c: White Fulani, Red Fulani and crosses in the Bamenda Cattle Market
Source: Prudentia Yensi Lawan, May 16th 2019



Plate 2d: Gudali and its crosses with White Fulani
Source: PrudentiaYensiLawan, May 30th 2019



Plate 3: Susceptible calves with poor growth/BCS in a pastoral farm
Source: Prudentia Yensi Lawan, June 4th 2019