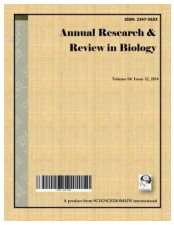

Annual Research & Review in Biology
8(5): 1-6, 2015, Article no.ARRB.15757
ISSN: 2347-565X, NLM ID: 101632869

SCIENCEDOMAIN *international*
www.sciencedomain.org

Effect of Flooding on Trypanosome Infection Rates in Trade Cattle at Central Abattoir, Makurdi Metropolis, Benue State, North Central Nigeria

J. N. Abenga[1*]

[1]Department of Veterinary Pathology and Microbiology, College of Veterinary Medicine, Federal University of Agriculture, Makurdi, Benue State, Nigeria.

Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/ARRB/2015/15757
Editor(s):
(1) Marion McClary, Jr, Co-Director, School of Natural Sciences, Fairleigh Dickinson University, New Jersey, USA.
(2) George Perry, Dean and Professor of Biology, University of Texas at San Antonio, USA.
Reviewers:
(1) Otalu Otalu Jr, Kogi State University, Nigeria.
(2) Petigrosso, Lucas Ricardo, National University of Mar del Plata, Argentina.
(3) Henry Mbah, Family Health International (FHI360), Abuja, Nigeria.
(4) Anonymous, University of Basilicata, Italy.
Complete Peer review History: http://sciencedomain.org/review-history/12124

Original Research Article

Received 16th December 2014
Accepted 8th April 2015
Published 6th November 2015

ABSTRACT

Aim: The aim of the study was to determine trypanosome infection rates in cattle brought to Makurdi central abattoir during a devastating flooding of 2012.
Study Design: Cattle of mixed sexes and breeds were randomly sampled three times a week.
Place and Duration of Study: The investigation which covered the months of September and October was carried out at the Wurrukum central abattoir, South Bank, Makurdi, administrative headquarters of Benue state, North Central Nigeria.
Methodology: Blood samples collected into plastic sample bottles containing EDTA anticoagulant were used for parasitological diagnosis using concentration methods and haematological investigation.
Results: Trypanosome infection rate in cattle was 13.1% which was adjudged three times higher than the average national trypanosome prevalence rate and the result of previous larger surveys obtained from within this area. The dominant infecting trypanosome specie was *Trypanosoma vivax* (42.4%), followed by *T. brucei* (28.6%). Infected cattle had lower PCV(28.2±1.6%) compared to

**Corresponding author: E-mail: jnabenga@yahoo.com;*

those of apparently negative animals (38.1±4.7%).
Conclusion: Previous data had associated wet or rainy seasons with increased tsetse fly density and trypanosomosis outbreaks in sub-Saharan Africa. It was therefore concluded that extended wet season associated with flooding might have created a conducive environment for breeding of tsetse and other haematophagous flies thereby increasing fly-animal contacts and trypanosome infection rates in the cattle.

Keywords: Trypanosome; infection; cattle; Makurdi; Nigeria.

1. INTRODUCTION

Flooding had been defined as the covering of normally dry land by water that has escaped or been released from the normal confines of any lake, river, lake, reservoir, canal, dam or other natural watercourses, whether or not altered or modified [1]. It had also been identified as the most frequent and costly natural disasters in many nations including Nigeria [2-4]. It had been listed along with typhoons and hurricanes as the three most frequent and severe extreme events associated with changes in precipitation regime as a consequence of climate change [5]. In Nigeria, causes of flooding had been described [6]. These include increasing rainstorms, absence or obstruction of drainage systems, poor land use control and maintenance of water reservoirs or dams, among others. All over the world, flood disasters impact negatively on human and livestock health as well as sustainable animal agriculture in general, among others [7,8]. For example, large insect populations and associated diseases, outbreaks of bacteria thrive and multiply in moist environment. Pneumonia and diarrhea from stress and prolonged exposure to cold as well as enteric parasitism such as worm larvae survive much longer on pasture in moist conditions [8]. Climate change associated floods and extended wet periods have been identified as important factors associated with favorable tsetse fly breeding and the spread and outbreak of African Animal Trypanosomiasis otherwise known as Nagana [9,10].

A devastating flood wreaked havoc to both humans and their livestock in Nigeria and was described as a national disaster and the worst in the living history of the country [11]. It affected over 36 states of the Federation including Benue state which is named after River Benue, the second largest river in Nigeria. The flood was caused by the release of water from the Ladgo dam in Cameroun making the river to overflow its banks and causing devastation influences over 5 kilometres in radius [12]. Makurdi, the Benue state capital, located at the river bank, was not spared resulting to the displacement of persons from their homes and submerging of houses and loss of livestock in Makurdi metropolis. There is no known record in this part of Nigeria on effect of flooding on livestock diseases and trypanosomosis in particular.

Although animal trypanosomiasis still causes a major threat to food security in several parts of sub-Saharan Africa including Nigeria [13,14], there is limited data on the impact of flooding on trypanosomosis there by resulting to poor or absent, pre and post flooding strategies against the disease. The last decade witnessed resurgence in African trypanosomiasis resulting to increase in risk and impact of the disease on animals [15]. However the roles of climate change on this resurgence and the ensuing debacle in livestock agriculture had yet to be adequately investigated. Tsetse fly population increases in the rainy season resulting to encroachment on livestock and human settlements resulting to increased fly to animal or fly to man contact and risk of trypanosomiasis in Nigeria [16,17]. Mechanical transmission of African trypanosomes also occurs involving *T. vivax* and *T. evansi* through the mouth parts of tsetse and other hematophagous flies, especially members of tabanidae and stomoxydae [18]. This had been identified as mode of transmission and spread of African trypanosomiasis to tsetse fly free belts [19].

The aim of the study was therefore to investigate the effect of flooding on the transmission of trypanosomosis in cattle grazed in the Makurdi part of the river Benue trough and presented at the central abattoir for slaughter.

2. MATERIALS AND METHODS

This study was carried out at the Wurrukum central abattoir, South Bank, Makurdi on cattle brought for slaughter during the devastating flood that wreaked havoc to both humans and their livestock living along river Benue near Makurdi,

the Benue state capital between August and November, 2012. In some parts, people living about 8km away from the river bank were affected by the flood. The study covered the months of September and October 2012. By the end of October, the flood waters begun to recede which also marked the peak of the flooding period. About 5mls of jugular blood for haematology and haemoparasites screening was collected randomly from a total of 214 cattle of mixed sexes and breeds at the point of slaughter into EDTA sample bottles. Each animal was physically examined for presence or absence of clinical signs (cachexia and pale ocular mucous membranes) suggestive of trypanosomiasis.

The blood samples were kept cool by placing them in cold boxes containing ice packs after collection until they were examined in the same day. Haemoparasites screening for trypanosomes was done in the laboratory using the haematocrit centrifugation technique (HCT), Buffy coat method (BCM) and examination of Giemsa stained thin smears under oil immersion magnification (x100) of a light microscope as previously described [20]. Trypanosome species were identified based on their motility using the BCM and morphological characteristics from Giemsa stained slides.

Heparinized capillary tubes were ¾ filled with whole blood, one for each sample. One end of the tubes was sealed with plasticine and centrifuged at 12000G for 5minutes in a microhematocrit centrifuge. The packed cell volumes (PCV) were determined on a microhematocrit reader [20].

Ethical clearance and informed consent were obtained from the Benue State Ministry of Agriculture prior to the survey and cattle owners respectively before samples were obtained.

3. RESULTS

Out of the 214 animals that were sampled, 28(13.1%) were parasitological positive for different species of trypanosomes (Table 1). Of the total number of infected samples, 13(42.4%) and 8(28.6%) infections were single infections due to *T. vivax* and *T. brucei* respectively while 6(21.4%) and 1(03.6%) were mixed infections arising from *T. vivax/ T. brucei* and *T. brucei/ T. congolense* respectively. The infected animals had an overall lower mean PCV of 28.2±1.6% as against that of 38.1±4.7% of the apparently parasitologically negative animals (Fig. 1). A careful examination of the PCV of infected animals revealed that the PCV of animals with mixed infection was lower compared with that of animals with single infections (Fig. 1). Infection rates in males and females were 49.0% and 51.0% respectively. About 80.0% of the parasitological positive animals exhibited cachexia and pale mucous membranes.

4. DISCUSSION

The overall trypanosome infection rate of 13.1% obtained from cattle in this investigation was by far and about three times higher than the approximated 4% national prevalence rate of animal trypanosomosis in Nigeria [14] and the prevalence rates of 1.8% [21] and 3.8% [22] previously obtained in dry season survey of some Local Government Areas of Benue state and abattoir surveys [23,24] respectively.

Although this result may not represent the true bovine trypanosomosis situation of the state, it is safe to assume, this overwhelming infection rate is associated with the extended wet period occasioned by flooding of the Benue trough. The high infection rate due to *T. vivax* is consistent with findings in Benue state [21,22] and other parts of Nigeria [14] signifying the important role of other hematophagous flies in transmission of trypanosomosis in this case and in Nigeria as a whole. A more concerted initiative must be directed against mechanical transmitters of trypanosomosis in Nigeria and the rest of Sub-Humid Africa where trypanosomosis is pandemic. More than half of the number of infections was due to *T. brucei* which is sorely Tsetse transmited. This is also higher than earlier reports obtained in a wider survey of Benue state [22]. This suggests that flooding created enabling climatic conditions for breeding of Glossina, their abundance, increased fly-animal as well as fly-man contacts. The high number of *T. brucei* infections recorded in cattle is of human health significance as this area is part of the old Gboko sleeping sickness focus [25]. *Trypanosoma brucei gambiense*, the causative parasite of Sleeping Sickness in this area is morphologically indistinguishable from *T. brucei* infective to animals. Cattle also serve as one of the animal reservoir hosts and play roles in epidemiology of Sleeping Sickness (Human African Trypanosomiasis, HAT) in Africa [25,26].

Table 1. Flood period Trypanosome infection rates in cattle at slaughter

Cattle age	Number sampled	Number positive (%)	*T. vivax (%)**	*T. brucei (%)**	*T. congolense (%)**	Tv/Tb mixed (%)*	Tb/Tc mixed (%)*	Overall infection rate (%)
≤ 1 year	2	0	0	0	0	0	0	
> 1 year	212	28(13.2)	13(42.4)	8(28.6)	0(00.0)	6(21.4)	1(03.6)	
Total	214	28(13.1)	13(42.4)	8(28.6)	0(00.0)	6(21.4)	1(03.6)	13.1

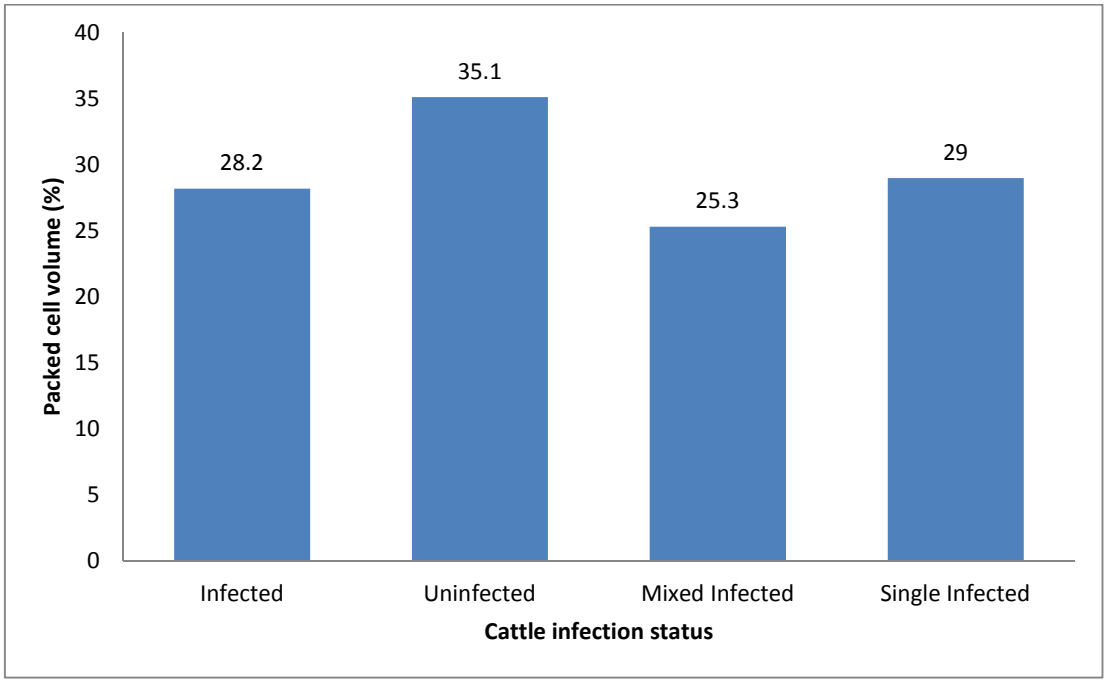

Fig. 1. Flood period mean packed cell volume of infected and uninfected cattle at slaughter

Although no current infections had been detected in recent years, the disease in animals remains high [22,27] and suspect while a molecular characterization of *T. brucei* field isolates of animal origin obtained from Benue state is highly recommended as a watch against resurgence of the human disease. The role of animal reservoir hosts in resurgence of HAT had earlier been described [26]. The presence of infection with mixed trypanosome species is of therapeutic importance as there is specie variation in susceptibility of trypanosomes to drugs [28]. Trypanosome infected cattle had lower Packed Cell Volume, which indicated anemia. Although anemia could also arise from other infections such as Fasciolisis, Anaplasmosis, Babesiosis and enteric helminthosis, none has devastating effect on cattle as trypanosomosis [13]. Furthermore anemia represented by low PCV was more in cattle with mixed infection (Fig. 1).

5. CONCLUSION

It is concluded that flooding of the Benue trough was associated with high trypanosome infection rate in cattle brought to the Makurdi central abattoir during the flood. This report may be the first on impact of the 2012 flooding of Benue state on trypanosome infection in livestock. Strategic therapeutic and prophylactic initiatives are required as an integral part of pre and post flood control of animal trypanosomosis in this part of Nigeria in order to limit impact of flooding on livestock production.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Zevenbergen C, Herk SV, Rike J, Kabat P, Bloemen P, Ashley R, Speers A, Gersonius B, Veerbeek W. Taming global flood disasters. Lessons learned from Dutch experience. Nat Hazards. 2013;65:1217– 1225.
2. WHO. Floods: Climate change and adaptation strategies for human health. Report on a WHO meeting, London, United Kingdom; 2002.
3. FEMA. Flooding- nation's most frequent and costly natural disaster. Fact sheet on flooding, FEMA, USA; 2010.
4. Nwilo PC, Olayinka DN, Adzandeh AE. Flood modeling and vulnerability assessment of settlements in the Adamawa state floodplain using GIS and cellular framework approach. Global J Hum Soc Sci. 2012;12(3). Version 1.0 February.
5. Michener WK, Blood ER, Bildstein KC, Brinson MM, Gardner LR. Climate change, hurricanes and tropical storms, and raising sea level in coastal wetlands. Ecol. Applications. 1997;7(3):770-801.
6. Agbonkhese O, Agbonkhese EG, Aka EO, Joe-Abaya J, Ocholi M, Adenkule A. Flood menace in Nigeria: Impacts, remedial and management strategies. Civil Environ Res. 2014;6(4):32–40.
7. Gichere SK, Olado G, Anyona DN, Matano AS, Diga GO, Abuom PO, Amayi J, Ofulla AVD. Effects of draught and floods on crop and animal losses and socioeconomic status of households in the lake Victoria basin of Kenya. J Emerg Trends Econ Manage Sci. 2013;4:31-41.
8. DEPI. Floods and livestock. Practical Flood Recovery Information Page, Department of Environment and Primary Industry, State of Victoria, Australia, 10th April; 2014.
9. FAO. Training manual for Tsetse control personnel, Vol 2; Ed JN Pollock. Food and Agriculture Organization of the United Nations, Rome. 1982;1-79.
10. Bourn D, Milligan K, Wint W. Paper 5: Tsetse, trypanosomiasis and cattle in a changing environment. In: Livestock Systems research in Nigeria's Sub-humid zone. Proceedings of the second ILCA/NAPRI symposium held in Kaduna, Nigeria, 29th October – 2nd November 1984; Eds R Von Kaufman, S Chater, R Blench; International Livestock Centre for Africa, Addis- Ababa, Ethiopia; 1984.
11. FMWR. Report of the 2012 colloquium on flood disasters in Nigeria, Nigeria Hydrological Services Agency, Federal Ministry of Water Resources, held at NICON Luxury Hotel, Abuja on 10th – 11th December; 2012.
12. Upa CT, Iyortyer CT. Current issues in flood disasters: Challenges and implications for science and technology to enhance environmental education. Acad J Interdisciplinary Studies. 2013;2:61-65.
13. PAAT. Current situation. In: Linking sustainable human and animal African trypanosomosis control with rural development strategies. PAAT Technical and Scientific Series Vol 10, WHO Geneva and FAO Rome. 2010;3-8.

14. Onyiah JA. African animal trypanosomosis: An overview of current status in Nigeria. *Trop Vet*.1997, 15 : 111-116.
15. Swallow BM. Impacts of trypanosomosis on African agriculture. PAAT Technical and Scientific Series, Vol 2, 2000, FAO, Rome.
16. Maikaje DB. An outbreak of biting flies and bovine trypanosomosis in Kaura LGA, Kaduna State, Nigeria. West Afr J BiolSci. 2002;13:56-65.
17. Ahmed AB, Okiwelu SN, Samdi SM. Species diversity, aboundance and seasonal occurrence of some biting flies in southern Kaduna, Nigeria. Afr J Biomed Res. 2005,8:113-118.
18. Hall MJR, Wall R. Biting flies: Their role in mechanical transmission of trypanosomes to livestock and methods of their control. In: The trypanosomiases, (Eds. 1. Maudlin, P. H. Holmes and M. A. Miles), CABI publishing, Cambridge, USA. 2004;583-594.
19. Jones TW, Davila AMR. *Trypanosome vivax*- out of Africa (Review). Trends Parasitol. 2001;17:99-101.
20. Kelly MR. Veterinary Clinical diagnosis. 2nd Edition Bailliere Tindall, London. 1979;266-274.
21. Omotainse SO, Edeghere H, Omoogun GA, Elhassan EO, Thompson G, Igweh CA, Ukah JAC, Halid I. The prevalence of animal trypanosomisis in Konshisha Local ovemment Area of Benue State. Israel J Vet Med. 2000;55:1-4.
22. Enwezor FNC, Samdi SM, Ijabor O, Abenga JN. The prevalence of bovine trypanosomes in parts of Benue State, North Central Nigeria. J Vector Borne Dis. 2012;49:188–190.
23. Abenga JN, Enwezor FNC, Lawani FAG, Ezebuiro C, Sule J, David LM. Prevalence of trypanosomosis in trade cattle at slaughter in Kaduna, Nigeria. Nigerian J Parasitol. 2002;23:107–110.
24. Ezebuiro OGC, Abenga JN, Ekejindu GOC. The prevalence of trypanosome infection in trade cattle, goats and sheep slaughtered at Kaduna abattoir. Afr J Clin Exper Microbiol. 2009;10:15-25.
25. WHO. Control and surveillance of African trypanosomiasis. World Health Organization Technical Report Series No. 881; 1998.
26. Abenga JN, Lawal IA. Implicating roles of animal reservoir hosts in the resurgence of Gambian trypanosomosis (sleeping sickness). Afr J Biotechnol. 2005;4:134-137.
27. Enwezor FNC, Ikenga MA, Idris II, Okere C, Wuaor MA. A survey of sleeping sickness in parts of Benue state Nigeria. Nigerian J Parasitol. 2010;31:43–54.
28. Geerts S, Holmes PH. Drug management and parasite resistance in bovine trypanosomiasis in Africa. Programme against African Trypanosomiasis, Technical and Scientific series number 1, Food and Agriculture Organization of the United Nations, Rome; 1998.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/12124