SPATIAL DISTRIBUTION OF TSETSE FLIES WITHIN FEDERAL CAPITAL TERRITORY OF NIGERIA AND SUBURBS

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ABSTRACT

The study was conducted to determine the occurrence of tsetse and establish the impact of the flies contact with human and livestock in Barangoni community, Bwari Area Council, Abuja, Nigeria. The study employed cross-sectional survey research design and the use of traps. Traps were set to catch tsetse flies along the bank of River Jeffy whereas survey research was used to collect information from herdsmen and community dwellers on impact of tsetse fly contact with livestock and human using structured questionnaire. Random sampling technique was adapted for the study. The sample size of the study was 31 respondents and consists of 19 city dwellers and 12 herdsmen. Data collected was analyzed using frequency count and percentage. The presence of tsetse fly (Glossina palpalis) was confirmed in Barangoni and both herdsmen and city dwellers experienced tsetse bite. The impact of the bites were extreme fatigue, loss of appetite, weight loss, exercise intolerance such that caused the livestock to be weak, lag behind the mob and collapsed or may even die. This result suspects HAT and AAT in the community. Also the presence of tsetse in Barangoni indicates that the community is a tsetse infested area. It is therefore recommended that surveillance be extended to the community so as to map-out definite infested areas and subsequently, vector and disease control strategies deployed.

Keywords: Tsetse fly, Human African trypanosomiasis, Animal African trypanosomiasis, Spatial distribution

INTRODUCTION

Tsetse fly is any dipteran fly of the genus *Glossina* found in Africa south of Sahara that bites both human and animals (Merriam-Webster, 2017). Tsetse flies are large biting flies that inhibit much of tropical Africa and include all the species in the genus *Glossina* that are placed in the family Glossinidea (Rogers *et al*., 1996; Ashford, 2001). The flies exist in nearly 10 million Km^2 stretching across over 37 countries in (sub-Saharan) Africa. The size of the infected area is found between latitude 14^0N and 29^0S (Alsan, 2015). Many parts of the infested area are fertile lands that are yet to be cultivated. Tsetse flies feeds on the blood of human and livestock. They are the primary vectors of trypanosome that causes trypanosomiasis that affects both human and livestock. Tsetse transmitted diseases in human is called sleeping sickness or Human African Trypanosomiasis (HAT),while in livestock it is referred to as Nagana or African Animal Trypanosomiasis (AAT).

Human African Trypanosomiasis (HAT) and Animal African Trypanosomiasis are tropical diseases transmitted by tsetse fly that continue to pose threat to human and animal health despite efforts towards eradicating these diseases. Human African Trypanosomiasisis are of two distinct types; the chronic anthroponotic form which is caused by *Trypanosoma brucei gambiense* is present in 24 countries in West and Central Africa (Nigeria inclusive) and

account for about 98 % of reported cases whereas the acute zoonotic form of the disease is caused by *Trypanosoma brucei rhodesiense* is located in 13 countries in eastern and southern Africa (Wamwiri and Changasi, 2016). The rhodesiense form is a zoonosis, with the occasional infection of humans, but in the gambiense form, the human being is regarded as the main reservoir that plays a key role in the transmission cycle of the disease (Franco *et al.,* 2014). Conversely, animal African trypanosomiasis also is a parasitic disease found mainly in sub-Sahara Africa where it biological vector exist. The disease causes serious economic losses in livestock from aneamia and a threat to food security in sub-Sahara Africa (Holt *et al.*, 2016).

Furthermore, animal African trypanosomiasis and human African trypanosomiasis are regarded as the major causes of rural poverty in sub-Sahara Africa because they wreak havoc on the health of human and cattle that are supposed to be deployed for efficient farming. Land infested by tsetse flies for instance are often cultivated by people using hoes and cutlasses rather than using more enhanced and efficient draught animals, because nagana emaciates and weakens the cattle and often kills these animals that are used for farming. Surviving cattle often produce little milk, heifers are aborted of pregnancy and manure to fertilize worn out soils are not sufficiently available (Shaw *et al.,* 2014). The impact of tsetse transmitted trypanosome on gradual health decline in infected human and livestock can never be over emphasized. In human the disease causes extreme fatigue, fever, lymph nodes swell amongst others. Particularly, the effect on livestock is alarming in the sense that milk and meat production is reduced, abortion rate and livestock death is on the increase. Today annual cattle and human death caused by trypanosomiasis in the sub-Sahara region is estimated at 3 million and 55,000 respectively. While the loss in livestock production and mixed farming alone is valued at 5 billion US dollars yearly in Africa (Samdi *et al.,* 2011).Consequently, the livelihood of farmers who lives in tsetse infested region is threatened since the enormous infected livestock cannot be used to plough the land nor the dead animals be used for meat. In a bid to overcome these challenges, WHO (2013) advocated measures to control or total eradicate the disease. The control measures were hinged on two aspects which are disease and vector control (Wamwiri and Changasi, 2016).The disease can be managed by controlling the vector and thus reducing the incidence of the disease by disrupting the cycle of transmission or by targeting the disease directly using surveillance and curative or prophylactic treatments to reduce the number of hosts that carry the disease (Wikipedia, 2017 a). The effectiveness of the deployment of any of the management mechanism in controlling either the vector or the disease is dependent on comprehensive information on spatial distribution of the vector.

Spatial distribution is the specific location or arrangement of continuing or successive object, phenomenon or thing in space (Medical Dictionary, 2017). Wikipedia (2017 b) defined spatial distribution as the arrangement of a thing or phenomenon across the surface of the earth. From the foregoing, spatial distribution of tsetse can be defined as specific space existence or location of tsetse flies. It is used to describe area inhibited by tsetse population. The information on spatial distribution of the vector or epidemiological data of the disease provides awareness on geo-reference of possible trypanosome infected or tsetse infested region. This awareness will therefore help in realization of potential area to localize or deploy control mechanism for effective management of the disease. In this regard, several empirical studies have been conducted around the Federal Capital Territory (FCT) of Nigeria and suburbs with the aim of providing detailed epidemiological information and data on the vector (tsetse fly) for proper mapping and surveillance for subsequent disease control or elimination as the case permits. As evidenced, available studies conducted around this region include; a study in Kaduna State (bound North to the FCT) on prevalence of trypanosomiasis in cattle at slaughter in Kaduna central abattoir by Samdi *et al.* (2011). Kaduna State is bounded to the FCT on north. Niger State that bounds the FCT to

the west had witnessed a number of studies amongst which are empirical studies of Ahmed (2004) and Adama *et al.* (2010) on peri-domestic population of the tsetse fly *Glossina palpalis palpalis* at Kontagora town, Niger State, Nigeria, and incidence of trypanosomes among white Fulani and Sokoto Gudali breeds of cattle in Niger State, Nigeria, respectively.

Furthermore, to the eastern boundary of FCT is Nassarawa State which had also recorded a number of studies which include Oluwafemi (2010) on prevalence and distribution of tsetse fly in BICOT project area in Lafia Local Government of Nassarawa State, and its implication for sustainable agricultural development amongst others. Evidences emerging from the review of literature revealed the presence of the vector around the suburbs (Niger, Kaduna and Nassarawa states) of the FCT with no literature on its occurrence within the FCT. However, rising population and levels of geographical development within the FCT have caused increased land pressure thereby pushing people into areas suspected to be marginal areas infested by tsetse. One of such suspected area is Barangoni community located in Bwari area council, Abuja. Though there have been varying views on occurrence of tsetse flies in Abuja, some claims that the FCT is tsetse free but this is without any empirical support. Therefore, there is need for factual information on the distribution of tsetse flies in the FCT. This necessitated this study that aimed at determining the spatial distribution of tsetse flies in FCT and its suburbs. The specific objectives of the study were to: (i) determine the occurrence of tsetse fly in Barangoni community and (ii) establish the impact of tsetse flies contact with human and livestock in Barangoni community, Bwari Area Council, Abuja.

MATERIALS AND METHODS

Study Area: The study was undertaken in Barangoni community of Bwari Area Council, FCT-Abuja. Bwari is Area Council in the Federal Capital Territory, Nigeria. The Area council is located between Latitudes 90^0 14′ 38.28″N and 90^0 20′ 01.41″N and between Longitudes 70^0 21′ 44.58″E and 70^0 23′ 28.00″E, located in the geographical centre of Nigeria bordering Niger State and covers a total land mass of $914km^2$ (Tawose, 2015). Bwari has the presence of Federal Government offices amongst which are the Joint Admissions and Matriculation Board (JAMB) and Nigerian Law School.

Barangoni is one of the oldest communities in Bwari Area Council and has River Jeffy as the only source of water for both human and livestock in the community. The original dwellers of Bwari who are predominantly farmers are the Gbagyi speaking people. However, a notable presence of herdsmen has been attracted to the community because of River Jeffy that is used as drinking water for their cattle.

Study Design: The study employed cross-sectional survey research and the use of traps. Cross-Sectional survey was used to collect information from herdsmen and community dwellers on impact of tsetse flies contact with livestock and human using structured questionnaire. While traps were set along the bank of river Jeffy to catch tsetse flies.

Study Population: Population of the study comprised of the city dwellers (adult farmers) and herdsmen (Fulani) who are living in Barangoni community. By random sampling technique, twelve herdsmen and nineteen community dwellers were randomly administered questionnaire to seek their response regarding the impact of tsetse flies contact with livestock and human.

Ethical Considerations: Letter of Acceptance to set traps and collect tsetse flies and also conduct the survey study was obtained from the traditional ruler of Barangoni community. Before visiting the community, the traditional ruler informed consent of all concerned authorities on the behalf of the research team before commencing the study.

Data Collection

Cross-sectional: Data collection for the impact of tsetse flies contact with human and livestock

was done using questionnaire. The questionnaire was administered to the respondents with the help of trained interviewers who were members of the research team.

Trap setting: Data for the occurrence of tsetse flies was done using traps. Traps were set along the banks of River Jeffy to catch tsetse flies. The number of tsetse flies caught was translated to the percentage occurrence of tsetse in the community.

Pre-survey: Following the acceptance to conduct the study, a pre-survey visit to the community was carried out on the 16th February, 2017. During the pre-survey visit, the nature and importance of the work was explained to the traditional leader thereafter the traditional leader appointed a delegation of two focal persons from the traditional cabinet to take us around the community in order to familiarize us with the routes in the community and River Jeffy where traps are to be set, after which a date was fixed for the main survey.

Main survey: In the main survey, five blue bi-conical traps were set by the team of researchers at the bank of River Jeffy on the 27th February, 2017. The traps where harvested after 24 hours. During the harvest, trapped tsetse flies were collected, sorted and recorded accordingly.

Data Analysis: The statistical tool employed for analysing the data collected for the study is descriptive statistics. The frequency count and percentage were used to determine the occurrence and impact of tsetse fly on human and livestock.

RESULTS

Results contained in Table 1 showed the occurrence of tsetse fly in Barangoni community. The table revealed that among the flies caught 4 were male whereas 6 were female representing 40 % and 60 % of the flies in Barangoni respectively.

Table 1: Occurrence of tsetse fly in Barangoni community, Bwari Area Council, Abuja

Glossina palpalis				**Total**
Male		**Female**		
N	**%**	**N**	**%**	**%**
4	40	6	60	100

Key: *N = number of tsetse flies,* % = percentage

Also the result indicated that all (100 %) the flies harvested were *G. palpalis*. The responses of the herdsmen and city dwellers on the impact of tsetse flies contact on livestock and human in Barangoni community, Bwari Area Council revealed that 31(100 %) of the respondents agreed that; they knew tsetse fly, there was tsetse fly within their locality, tsetse do perch on them, they have experienced tsetse bites, tsetse flies fed on their cattle and livestock and lack of apatite was noticed in the cattle. 18(61.2 %) respondents were aware of sleeping sickness whereas 30(97.4 %) were aware of trypanosomiasis in cattle. Majority of the respondents 25(79.6 %) experienced extreme fatigue, 30(97.4 %) respondents noticed weight loss in their cattle and 28(92.1 %) observe exercise intolerance such that caused cattle and livestock to be weak and lag behind the mob in motion among their livestock. Only few respondents 13(41.9 %) agreed that their livestock staggered and gasp for breath and collapsed or died, those that indicated that there were persons with swollen lymph nodes in Barangoni are 13(46.5 %), while 12(38.7 %) indicated that there were pale or yellow gums cattle among their livestock.

DISCUSSION

The study confirmed the presence of tsetse flies (*G. palpalis*) in Barangoni community, thus an extension of tsetse belt to the region. The studies of Basheer *et al.* (2012) and Madsen and Wallace (2012) attributed extensions of tsetse belt to rising geographical development, deforestation and the expansion of agriculture. In this light, the rising human population and geographical development around and within the FCT could be responsible for the extension of tsetse infested region to Barangoni.

Table 2: Impact of tsetse flies contact on livestock and human in Barangoni community, Bwari Area Council, Abuja

Impact of tsetse fly on human and livestock	Herdsmen				City dwellers				Total	
	Yes		No		Yes		No		Yes	No
	N	%	N	%	N	%	N	%	%	%
Do you know tsetse fly?	12	100	00	0.00	19	100	00	0.00	31(100)	0.00
Is there tsetse fly within your locality?	12	100	00	0.00	19	100	00	0.00	31(100)	0.00
Are you aware of sleeping sickness in human?	9	75.0	3	25.0	9	47.4	10	52.6	18(61.2)	13(38.8)
Does tsetse fly perch on your body?	12	100	00	0.00	19	100	00	0.00	31(100)	0.00
Have you experienced tsetse bite before?	12	100	00	0.00	19	100	00	0.00	31(100)	0.00
Do you constantly experience extreme fatigue?	9	75.0	3	25.0	16	84.2	3	15.9	25(79.6)	6(20.4)
Are there person(s) with swollen lymph nodes in the community?	8	66.7	4	33.3	5	26.3	14	73.7	13(46.5)	18(53.5)
Has any case of sleeping sickness reported in this community?	7	58.3	5	41.7	5	26.3	14	73.7	12(42.3)	19(57.7)
Are you aware of trypanosomiasis in cattle or livestock?	12	100	00	0.00	18	94.7	1	5.3	30(97.4)	1(2.6)
Does tsetse fly feed on your cattle or livestock	12	100	00	0.00	19	100	00	0.00	31(100)	0.00
Is lack of appetite noticed among your cattle or livestock?	12	100	00	0.00	19	100	00	0.00	31(100)	0.00
Do you notice weight loss in your cattle or livestock?	12	100	00	0.00	18	94.7	1	5.3	30(97.4)	1(2.6)
Does exercise intolerance such that cause cattle or livestock to be weak and lag behind the mob in motion observed among your livestock?	12	100	00	0.00	16	84.2	3	15.8	28(92.1)	3(7.9)
Has your livestock stagger and gasp for breath and collapsed or die?	9	75.0	3	25.0	4	21.1	15	78.9	13(41.9)	18(58.1)
Is there pale or yellow gums cattle among your livestock	11	91.7	1	8.3	1	5.3	18	94.7	12(38.7)	19(61.3)
Total	**11**	**89.4**	**1**	**18.6**	**14**	**72.3**	**5**	**27.7**		

***Key**: N = number of respondents' responses, % = percentage*

Infestation rate is generally affected by climate. Belt extension and life expectancy of tsetse flies is high during the raining season when climatic temperature is relatively low (Madsen and Wallace, 2012). By implication, notwithstanding that scantly tsetse flies were caught, the likelihood of the number of flies increasing is high since the study was conducted in February in dry season in Nigeria which is characterized by high temperature and very low humidity (due to the harmattan trade winds from the northeast) known to be hostile climate to tsetse

activities. As established, several species of tsetse fly exist. G. palpalis is an important vector of human trypanosomiasis (Wamwiri and Changasi, 2016). Hence, it is viewed that the presence of *G. palpalis* in Barangoni could result in serious sleeping sickness problem in the community. And more percentage of female flies to the male suggests the danger of high tsetse reproduction in the area.

The impact of tsetse fly contact with human and cattle/livestock showed that all the herdsmen and city dwellers know tsetse fly because of the presence of tsetse flies in the community. The indication of the respondents that tsetse flies did not only perch on the members of the community but also fed on both human and livestock showed that there could be cases of HAT and AAT. Hypothetically, symptoms of HAT such as constant extreme fatigue and swollen lymph nodes in the community suspect HAT. Cases of extreme fatigue and swollen lymph nodes in tsetse fly belt region often confirm HAT (Wamwiri and Changasi, 2016). In seeking to establish whether case of HAT was actually reported in the community, varying opinion was obtained from the herdsmen and city dwellers. Herdsmen however indicated that they were aware of cases of sleeping sickness whereas, few of city dwellers indicated knowledge of typanosomiasis. Furthermore, high rate of AAT was suspected because all the respondents indicated that tsetse flies fed on their cattle and livestock. This finding could be responsible to lack of apatite, weight loss, exercise intolerance such that cause cattle or livestock to be weak and lag behind the mob in motion, livestock stagger and gasp for breath and collapsed or die and pale or yellow gums cattle found among livestock.

Conclusion: This study confirmed the presence of tsetse flies (*G. palpalis*) in Barangoni Community in Bwari Area Council, Federal Capital Territory, Abuja, Nigeria and the outcome of the survey study suspected HAT and AAT in human and cattle respectively. It is therefore recommended that surveillance be extended to the community so as to map-out definite infested areas in order to deploy adequate vector and disease control mechanism.

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