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Constraints in the Control of African Trypanosomiasis the Prevailing Factors in Kurmin Kaduna, Northern, Nigeria (Review Article)

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Abstract: The aim of this review is to further highlight the prevailing factors in the control of African trypanosomosis in Nigeria. The effectiveness of trypanocides as a means of control is being curtailed by, wide spread drug resistance, lack of alternative drugs, multiple resistance, fake drugs,insufficient veterinary services, proliferation of quacks, high cost of trypanocides and the ability of the parasite to survive in cryptic foci poorly accessible to drugs. Trypanotolerance is a relative rather than absolute trait, severely affected by heavy challenge, malnutrition, stress, breed, age, season, and concurrent disease, Trypanotolerant breeds are poorly utilized and accepted because of their size, productivity and traction power compared with the large zebu breeds. Use of insecticide has been the most effective and reliable method of control but fear of emergence of resistance, cross resistance, environmental damage, accumulation in food chains with damaging effect on fertility etc constitute a major drawback on its use. Poor policies formulation and enforcement, human beliefs and behaviors, tsetse redistribution, mechanical transmitters and reservoire host has hindered effective control. The scanty information on distribution, prevalence and economic impact of trypanosomosis in Nigeria, coupled with corruption, lack of community participation, inability to implement cost effective control strategies, these has resulted in the negative attitude of national governments and international funding organizations towards control of the disease, leading to collapse of many control projects. There is no control method that can be used alone; rather a combination of different control methods has proven effective due to the social, economical and cultural behaviors of Nigerians.

Key words: Insecticide, policy formulation, trypanocides, trypanosomiasis, tsetse flies and trypanotolerant breeds

INTRODUCTION

African trypanosomiasis is a complex, debilitating and Zoonotic Protozoan disease of man and animals. The disease is found in many regions of the world, but mainly in sub-Saharan Africa between latitude 14ºN and 29′S (WHO, 1998).

It is currently estimated that about 60 million people (WHO, 1998) and 48 million cattle (Kristjanson *et al*., 1999) are at risk of contracting African trypanosomiasis from the 23 species and 33 subspecies of tsetse flies infesting 10 million km^2 of Africa stretching across 40 countries. Tsetse transmitted African trypanosomiasis is responsible for 55,000 human and 3 million livestock deaths annually (Mulumba, 2003; Abenga *et al*., 2002). The loss in livestock production and mixed agriculture alone is valued at 5 billion US dollars yearly in Africa. For nearly 40 years in most African countries chemotherapy is the primary method of trypanosomiasis control.

It is estimated that about 35 million doses of trypanocides are administered annually in Africa (Geerts and Holmes, 1998) with fake or substandard drugs accounting for up to 60% of the drug market in most developing countries (Feldmann and Hendrichs, 2001; Broussard, 1996). The use of trypanocides for control is further hindered by the emergence of resistant trypanosomes (Cojia *et al*., 1993) in 13 countries, with multiple resistant strains reported in 8 countries (Cojia *et al*., 1993) including Nigeria.

Only 5% of the 173 million cattle in the 40 African countries where tsetse flies are endemic have natural resistance (Goldmer *et al*., 1999; Adeniji, 1993). In Central and West Africa only 7.6 million cattle out of the 26.4 million cattle are trypanotolerant (Kaufmann *et al*., 1990).

Nigeria the largest, most populated country in Africa with highest number of cattle in West Africa (Kristjanson *et al*., 1999) is infested with eleven of the twenty-three species of tsetse flies found in Africa. The area infested by tsetse species extends from latitude 4ºN (Atlantic west) to approximately latitude 13ºN with northern extension along Hadeja-Jama'ari river valley infesting about 75-80% of the 928,300 km^2 land mass. The most important species

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of trypanosome causing disease in livestock and man in Nigeria are *Trvpanosoma brucei brucei, T.congolense, T.vivax, T. simiae, T. evansi* (NAERLS, 2002) and *T. gambiense,* the only human endemic specie in West Africa. The economic loses in livestock production in Nigeria due to this disease is estimated at N837.20million in six states of Nigeria (Onyiah, 1997).

Chemotherapy and Chemoprophylaxis: Although chemotherapy and chemoprophylaxis remains the means of trypanosomosis control in Nigeria, the effectiveness of trypanocides as a means of control is being curtailed by, wide spread drug resistance, lack of alternative drugs, multiple resistance, fake drugs, lack of sufficient veterinary services, proliferation of quacks, high cost of trypanocides and the ability of the parasite to survive in cryptic foci poorly accessible to drugs (Diack *et al*., 1998; Boa, 1997; Toure, 1997). The Nigerian standard drug regulating body National Agency for Food Drug and Control (NAFDAC) charged with the regulation of all drugs has no well-established veterinary unit resulting to only partial control of standard, distribution and acquisition of trypanocides. These constitute important obstacles in effective chemotherapeutic control of trypanosomosis in Nigeria.

Trypanotolerance: Trypanotolerance is a relative rather than absolute trait, which is severely affected by heavy challenge, malnutrition, stress, breed, age, season, and concurrent disease (Feldmann and Hendrichs, 2001; Kalu, 1995). Trypanotolerant breeds are poorly utilized and accepted in husbandry practice because of their size, productivity and traction power compared with the large zebu breeds (Chater, 2002; Shaw and Hoste, 1987). Only 200,000 out of the 10 to 14 million cattle in Nigeria are trypanotolerant (Adeniji, 1993). The trypanotolerant breeds of animals in Nigeria include; N'dama and Muturu cattle, West African Dwarf (WAD) Sheep and Goats Enwezor and Lawal (2003). Recently Abenga *et al.* (2005) described tolerance in local dogs infected with *T.congoIense* (Abenga and Lawal, 2005). Trypanotolerant cattle serve as reservoir host of trypanosomes (Kalu, 1996) while the absence of practical reliable markers of resistance or susceptibility is a constraint in selection for breeding, as trypanotolerance is not only a breed characteristic but a heritable trait that is not valued for all association but lost rather quickly with combinations of crosses which are economically inferior to improved breeds. The importation of trypanotolerant animals form other countries is further hampered by cost, susceptibility to local strain of trypanosomes and difficulty of importation permit. The absence of centers to subsidies, supply and adaptation of trypanotolerant animals by pastoralist as a means of control has further hindered the use of this method as a control strategy against trypanosomosis in Nigeria.

Sterile Male Insect Technique (SIT): The breeding and maintenance of tsetse flies colonies requires microclimate that is cost intensive and also requires skills and technical staff (Seifert, 1996). SIT requires large number of flies while tsetse flies have low reproductive potential which makes establishment of a colony very difficult. Where numerous species are involved several breeding colonies are required with each of the colonies treated separately (Chater, 2002), which is cumbersome and expensive. SIT is more effective in isolated tsetse belts, and areas of low tsetse density. Lack of awareness multiplicity/ inaccessibility of affected areas, re-invasion and natural resilience of tsetse population further hamper it while sexually sterilized males are efficient mechanical vector as the fertile wild males (Chater, 2002; Moloo, 1987). These complex logistics and high cost makes sustenance difficult. The Bicot project at Vom Plateau state is, for example, only partially operational due to complex logistics and funding. In spite of the shortcomings of SIT, its application led to reclaiming of land from tsetse in Lafia area of Nasarawa State, Southern Guinea Savannah of Nigeria, but was abandoned due to inconsistent government polices and low funding leading to reinvasion of the area by tsetse flies.

Human Beliefs and Behaviours: In Africa no disease is natural but either a punishment from gods, or evil spell cast by sorcerers or jealous men (Allsopp and Hursey, 2004). In Nigeria, trypanosomiasis infected individuals in the Niger delta are believed to be witches or have been bewitched (Airaulu *et al*., 2001) and orthodox medicine cannot cure it only native doctors. These individuals serve as a source of infection and their families are stigmatized. While in some parts of West Africa (Chad) it is believed that blood samples collected by survey teams are used for commercial purposes (Touko *et al*., 1997) and blood collected from cattle may kill or make them ill, these hinders survey, treatment and control of trypanosomiasis.

Nigeria has experienced a host of conflicts (wars, civil disturbances, natural disaster and population displacement) due to political, religious or ethnic reasons (Zakari, 2001) leading to dismantling of control facilities, inaccessibility and lack of community participation. These socio-cultural factors play key roles in hindering control of the disease in man and animals. The migration of mobile Fulani and their herds as they trek from north to greener pasture and cattle markets in the South (Riordan, 1976) is believed to contribute to the introduction and spread of trypanosomiasis, prevention of participation in control activities, and the territorial expansion of tsetse flies through transportation by animals and man from one region to another.

Tsetse Redistribution, Mechanical Transmitters and Reservoire Host: Tsetse flies hitherto did not occur on the Plateau of Jos, Mambilla and Obudu but these areas are now tsetse endemic by Onyiah (1997). The advance of

tsetse into previously uninfested areas could be due to tsetse over population, closeness to endemic areas, presence of cattle routes, and lack of sustenance of control, wind dispersal, increased peri-urban cattle farming and the ability of the tsetse flies to adapt to alternative hosts. This advance increases tsetse territory and the possibility of reinvasion of cleared areas. Mechanical transmitters are important haematophagous vectors of other diseases (Rickettsia and Viruses) that weaken the defence mechanism of the host. Their population is abundant through out the year and contributes to the presence of trypanosomiasis in places like Borno and Delta states where high densities of these flies occur with little or no tsetse activity (Onyiah, 1997). Mechanical transmitters are good flyers with high biotic potential and most often control measures are not targeted at them.

Reservoir host harbour the parasites without showing symptoms of the disease serving as a source of infection. Destruction of reservoir host is difficult because of the large range of animals serving as reservoir host especially where several species of tsetse flies are involved in disease transmission. Hunters bring home wild games to domesticate and they contribute in no small way in the epidemiology of the disease. Animal reservoir hosts are believed to have contributed in the current resurgence of human sleeping sickness (Abenga *et al*., 2005).

Insecticides and Odour Technology: Use of insecticide has been the most effective and reliable method of control. However the fear of emergence of resistance and cross resistance to insecticide, environmental damage, its accumulation in food chains with damaging effect on fertility, high cost of insecticides (Chater, 2002) has been reported. Maintenance of fleet of vehicles, spraying equipment (Magona, 1998), high staff cost, multiplicity/inaccessibility plus rugged terrain, selective efficacy of some of the insecticides and the possibility of reinvasion constitute a major drawback on its use. These high costs and complexity makes it difficult to be carried out by the poor communities and farmers where these flies are mostly found.

Odour technology consists of traps, targets, and screens, pours on and dips (Oloo *et al*., 1999). Traps can only be applied in some types of areas and are species specific to an extent, so where the terrain is bad and several species are involved this limits its application. Traps, targets and screens are often destroyed by flood, strong wind, wild animals, fire, and are damaged or stolen by humans. They are cumbersome, tedious while human behavior (war/migration) can limit their application and efficacy. Pour on and dips are similarly expensive for poor resource farmer plus problems of adulteration and their short residual effects.

Government Policies: Most of the failure in control of African trypanosomiasis is attributed to weak or no policies on Research and Development (R and D), which affect design, formulation and enforcement of policies, implementation of research findings, enforcement of quality control, distribution and use of trypanocides. Lack of adequate budgetary provision has resulted in under funding of research and surveillance studies leading to the collapse of control structures lack of data on the true disease situation and tsetse distribution, and spread of resistant trypanosomes in the country. The gap in information at the level of policy makers and absence of legislation (laws) on tsetse and trypanosomiasis control have favored the spread of the disease and its vector making planning for control difficult. Like in many parts of Sub-Saharan Africa, neglect of human Trypanosomosis (Sleeping Sickness) has led to the resurgence of the disease in the country (Abenga *et al*., 2005).

Problem Statement: A veterinary surgeon in charge of a cattle farm located at Kurmin Kaduna, Chikun LGA Kaduna State reported to the Nigerian Institute for Trypanosmiasis Research Kaduna that his animals being sick showing the following signs; normal appetite, loss of condition, emaciation and death. He requested that they be examined and screened for blood parasites:

MATERIALS AND METHODS

On 7th /May/2009 a team of Research Officers from the Institute went to the farm in Kurmin Kaduna to carry out investigation. On examination the cattle exhibited the following signs: Lacrimation, Pallour of the mucous membranes, dry muzzle, and pyrexia, progressive emaciation despite normal appetite, recumbency, presence of ticks, and a skin infection was also observed.

Using a 5mls syringes blood samples was collected at random from the jugular vein of the herds and stored in 5mls hepatrinised blood containers and conveyed to Nigerian Iinstitute for Trypanosomiasis Research laboratory Kaduna and the standard trypanosomiasis diagnostic method was employed.

RESULTS and DISCUSSION

Half of the herd showed the aforementioned clinical signs in variation. However, emaciation was seen in about 60-70% of herd along with a normal appetite. *T.congo* was found in 5 of the herds while *B.bigemina* was found in 7 of the herds and Onchocerca gibsoni was found in only one herd (Table 1), 3 of the herds has mix infection of *B. bigemina* and *T. congo,* the PCV was high in animals without infection but there is no difference observed in PCV between the animals infected with either of the parasite (Table 1).

In line with the history and the clinical signs, out of the 28 samples analyzed, four positive cases of *Trypanosomiasis congolense* infection, seven positive cases of *Babesia bigemina* infection and two positive

Table 1: Laboratory Result Findings

S/no	Tag No.	PCV%	BCM	HCT	Films	Other Haemo parasites	Result
1.	450	35	+	-	-	-	*Trypasosoma congolense*
2.	108	38	-	-	-	-	-
3.	144	22	+	+	-	-	*T. congolense*
4.	18	31	-	-	-	-	-
5.	15	30	-	-	+	+	*Bebesia bigemina*
6.	482	60	-	-	-	-	-
7.	120	26	-	-	-	-	-
8.	35	27	-	-	-	-	-
9.	484	33	-	-	+	+	*Bebesia. bigemina*
10.	134	46	-	-	-	-	-
11.	72	28	-	-	-	-	-
12.	435	40	-	-	-	-	-
13.	491	36	-	-	+	+	*Onchocerca gibsoni*
14.	112	27	+	+	+	+	*T. congolense, B. bigemina*
15.	47	18	-	-	-	-	-
16.	105	31	-	-	-	-	-
17.	17	26	-	-	-	-	-
18.	110B	19	-	-	-	-	-
19.	0	34	-	-	-	+	*Bebesia. bigemina*
20.	119	32	-	-	-	-	-
21.	14	38	+	+	+	+	*T. congolense, B. bigemina,*
22.	23	40	-	-	-	-	-
23.	125	30	-	-	-	-	-
24.	110A	26	-	-	-	-	-
25.	19	35	+	+	+	+	*T. congolense B. bigemina*
26.	494	53	-	-	-	-	-
27.	465	-	-	-	-	-	-
28.	495	38	-	-	-	+	*Bebesia. bigemina*
29.	496	49	-	-	-	-	-

Key
- Negative
+Positive

cases of micro filarial worms *(Onchocerca gibsoni)* were observed.

CONCLUSION

There isn't sufficient information on distribution, prevalence and economic impact of trypanosomiasis in Nigeria. The absence of monitoring, surveillance, corruption, lack of community participation and inability to implement cost effective control strategies, have resulted in the negative attitude of national governments and international funding organizations towards control of the disease, leading to collapse of many control projects. There is no control method that can be used alone and their high cost and complex logistics coupled with social, economical and cultural behaviors of many Nigerians is a major constraint in the trypanosomiasis control.

There is need for gathering of adequate information on the current status of tsetse, distribution of resistant trypanosomes and economic impact of the disease through geographical information system and national surveillance. Most of the failures of developmental projects, tsetse and trypanosomiasis control programmes have been attributed to the fact that potential and actual beneficiaries were left out of the process related to design, formulation and implementation of policy. A move away from large scale government supported schemes to a small scale community based intervention where tsetse and trypanosomiasis control can be regarded as a local public good will ensure sustenance and community participation.

All the currently available and environmentally acceptable methods for tsetse and trypanosomiasis control have their specific limitations. Only combination of several methods in an integrated phase approach can effectively advance the control of tsetse and trypanosomiasis in Nigeria. There is need to encourage research in pharmaceutical plants for a new drug and to control the standard, distribution and usage of the existing trypanocides.

The Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC) is a new initiative by African heads of states to eradicate tsetse and trypanosomiasis from the African continent, with the objective of identifying/selection of project areas, mobilization of financial, human and materials necessary for execution of each project. Effective tack-ling of the above factors is therefore necessary to ensure the success of the initiative. A long-term control should also be the focus as short-term control results in reinvasion (Allsopp and Hursey, 2004).

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