

## Control of African Trypanosomiasis in Nigeria: Time to Strengthening Integrated Approaches (A Review)

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**Abstract:** The aim of this review is to highlight the inadequacies of the current control of African Trypanosomiasis in Nigeria and the need to strengthen the already integrated control approach. African Trypanosomiasis is one of the most devastating diseases of man and animals in Sub-Saharan African countries, Nigeria inclusive. Over the past century numerous methods of control have been developed yet the disease has proved very difficult to eradicate. Current methods to control the disease, in the absence of a vaccine, rely on the use of anti-trypanosomal drugs and vector control. In animals, an additional control method is the use of trypanotolerant breeds of livestock. Unfortunately, all of these methods have disadvantages and none has proved to be ideal. The public health importance of trypanosomiasis, has led to attempts to control the disease nationally and regionally with initiatives such as the Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC) of the African union. At the Nigerian Institute for Trypanosomiasis Research (NITR), a combination of control methods is being used for research development and control efforts against the disease. However, diminishing funding for research development and control activities against the disease has hindered this approach. Hence there is a great need to strengthen these integrated approaches for more effective control of trypanosomiasis. Strengthening intersectoral and inter-agency collaboration is greatly advocated in the fight against trypanosomiasis, in order to improve the effectiveness and efficiency of control, as well as enhance the prospect of sustainability and food security as supported by PATTEC. Hence, further fostering the existing relationship with PATTEC in a bid towards the eradication of trypanosomiasis from Nigeria.

**Key words:** Control, foodsecurity, integrated approach, livestock, trypanosomiasis, tsetse fly

### INTRODUCTION

Since the dawn of the 20<sup>th</sup> century human and animal trypanosomiasis, caused by species of trypanosomes and transmitted by tsetse flies has been recognized as the cause of morbidity and mortality to humans and livestock throughout sub-Saharan Africa, Nigeria inclusive, and a major constraint to increased agricultural activity. Currently, approximately 60 million people and 48 million cattle are at risk for this disease in an area of 10 million square kilometers, and is responsible for 5,000 human and 3 million livestock death annually (WHO, 1998; Kristjanson *et al.*, 1999; Fevre *et al.*, 2001; Mulumba, 2003; Abenga *et al.*, 2002). The diseases transmitted by tsetse arguably represent the most debilitating on human development, agricultural production, food security and sustainable human livelihood on the continent, with an estimated loss in

livestock production and mixed agriculture valued at 5 billion US dollars yearly in Africa (Winrock, 1991; Allsopp, 2001; Samdi *et al.*, 2010).

It is nearly 100 years of tsetse and trypanosomiasis control efforts, but today the problem is still far from being solved. In most African countries, tsetse distribution has remained the same and indeed in some areas, the fly has spread to new areas. The incidence of both animal and human trypanosomiasis remained high with occasional endemic outbreak (Okoth, 1999).

There has been extensive international collaboration and extensive expenditure on integrated mechanisms to control the disease and its vector. In 1974, the Food and Agricultural Organization (FAO) was given the UN mandate to coordinate the eradication of tsetse (*Glossina* Spp) and trypanosomiasis from Africa, in ten years. Unfortunately, the tools and infrastructure were not available and this proved over ambitious. It did however;

sow the seeds that eventually led to the development of the FAO/International Atomic Energy Agency (IAEA)/Organization for African Unity (OAU)/WHO, Programme Against African Trypanosomiasis (PAAT) - an international advisory group that facilitates data management and communication between most Sub-Saharan nations in Africa. Yet, as the second millennium slips into history, the impact of trypanosomiasis shows little significant abatement (Smith, 1998) and national control programmes are becoming increasingly dependent on aid to prevent further deterioration (Allsopp, 2001).

The removal of tsetse and trypanosomiasis from Sub-Saharan Africa would bring untold benefits in terms of improved human health and development, and increased cattle production, which would contribute to agricultural consolidation and expansion that the continent so sorely needs. Cattle provide meat, milk, draught power and manure for low fertility soils, and increases in livestock production decrease the average poverty levels of rural communities.

Time has come to re-examine the current control strategies and strengthen the already integrated approaches in light of the changes in ecological and economic realities (Okoth, 1999), which is already causing resurgence. The trend should be towards cheaper and sustainable methods involving the rural communities. NITR in its research and development should strengthen intersectoral and inter-agency collaboration which will contribute to improved human health and development, and increased livestock production, consequently contributing to agricultural consolidation and expansion to bring about food security that Nigeria greatly needs. This is necessary because, there is no control method that can be used alone; rather, the integration of different control approaches will be more effective. The control of human and animal trypanosomiasis in Nigeria is faced with several limitations of cost, inadequate collaborative effort, technical know-how and diminishing funding from the Nigerian government and donor organization for research into the control of tsetse and trypanosomiasis in Nigeria.

#### **Aims and objectives:**

The aims of this review is:

- To highlight the inadequacies involved in the control of African trypanosomiasis in Nigeria
- To provide information on how to strengthen the already integrated control approach in Nigeria
- To provide information on ways on ways of enhancing sustainability by involving the rural communities and embarking on cheap and environmentally friendly control approaches.

#### **Current tsetse and trypanosomiasis control measures:**

Chemotherapy and Chemoprophylaxis: The main approach to controlling the parasite in the host has been

by chemotherapy and chemoprophylaxis (Onyiah, 1997). Escalating costs and other problems of initiating and maintaining tsetse control campaigns, together with the non-availability of a vaccine, have led to the vast tsetse-infested areas of Africa being almost completely reliant on the use of trypanocidal drug, which remain the principal method of trypanosomiasis control in most African countries, to both treat and prevent the disease (Geerts and Holme, 1998). Without these drugs, the situation would be disastrous. However, despite the need and demand for effective trypanocides, there have been growing side effects of these drugs, the expensiveness and absence of new trypanocidal drugs leading to over dependence on the old drugs. There is growing concern that their future effectiveness may be surely curtailed by wide spread drug resistance (Onyiah 1997; Geerts and Holmes, 1998), and the ability of the parasite to survive in cryptic foci poorly accessible to drugs (Diack *et al.*, 1998; Boa, 1997; Toure, 1997). These constitute the most important obstacles in effective chemotherapeutic control of trypanosomiasis.

### **TSETSE CONTROL**

Tsetse control remains the “Sine qua non” of trypanosomiasis control. Attempts to control tsetse have been made for over 60 years. Initially, they included eradication of wildlife, clearing of fly barriers to prevent the advance of the vector and widespread bush clearing to destroy breeding habitats. Following the introduction of modern chemicals, the principal method employed to control tsetse populations has been the use of insecticides, alone or in conjunction with traps and screens. Biological control methods are still under development and consideration.

**Insecticides:** The use of insecticides is the major method currently employed for tsetse control. There has been significant success where insecticide control measures are properly implemented. For example, using residual sprays applied by hand-spraying machines nearly 200000 km<sup>2</sup> of Nigeria were cleared of *Glossina* spp. Despite the proven efficacy of tsetse control by insecticides, it still has serious limitations. This is due to the severe limitations of this approach on practical, economic and environmental grounds. Currently in Nigeria, there is a lack of inadequate trained personnel, both at the leadership and field levels, to implement insecticide control programmes. The costs of insecticide control programmes are very high. Natural or man-made barriers are required to protect sprayed areas and prevent reinvasion, and constant surveillance for early detection of reinvasion is essential. Finally there are increasing demands to limit the use of insecticides because of their detrimental effect on naturally occurring fauna and flora (Allsopp *et al.*, 2004).

**Use of traps and screens:** Traps and screens have been used for many years as means of sampling tsetse populations. However, with recent developments in the design and colour of traps and with the identification of tsetse attractants, increasing interest is being given to the use of traps as a possible method of tsetse control. It has been found that bovine breath acts as a powerful attractant for tsetse, with carbon dioxide and acetone being its major components (Vale, 1980). Colour is also an important attractant. Insecticide-impregnated traps have produced good results on a limited scale as a means of tsetse control in areas where human sleeping sickness is common. The use of improved traps impregnated with insecticide could develop into a simple and relatively cheap method of control. However, traps can only be applied in some types of areas and are species specific to an extent. Therefore, where the terrain is bad and several species are involved, application of traps is limited. 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 (Allsopp, 2001).

**Biological methods:** The concept of 'sterile male release' is based on the fact that tsetse females copulate only once, and if the male of a copulating pair is sterile the female will not produce during her lifetime. Thus, a series of field trials were carried out to evaluate the impact of the release of  $\gamma$ -irradiated male tsetse on tsetse population in Nigeria and some African countries (Allsopp, 2001). Although under field conditions it has been demonstrated that this approach can significantly reduce tsetse populations, the majority opinion is that sterile male release is not a practical proposition because it is too sophisticated and too expensive (Moloo and Kumunya, 1987; Chater, 2002). It is also estimated that ten sterile males are required per female. In order to reduce the number of sterile males required it is necessary to carry out two to three insecticide sprays and then to release 12,000 sterile males per km<sup>2</sup>, even in areas where the tsetse density is low. As the effect is tsetse-species specific, the cost increases with the number of species to be controlled. Also, the breeding and maintenance of tsetse fly colonies requires microclimate that is cost intensive and also requires skills and technical staff (Seifert, 1996).

**Trypanotolerance:** It has long been recognized that certain breeds of cattle in West and central Africa, mainly the N'Dama and West African Shorthorn, along with their sheep (Djallonke) and goat (Dwarf West African) counterparts, possess the ability to survive and be productive in tsetse-infested areas where other breeds rapidly succumb to trypanosomiasis (ILCA, 1979;

Murray *et al.*, 1979). These cattle have existed in the region for over 5,000 years. Susceptibility studies have shown the N'Dama to be the most resistant breed followed by the smaller West African short-horned cattle, the large and more recently introduced Zebu is the most susceptible (Murray *et al.*, 1979). However, one of the major constraints to the more widespread use of trypanotolerant breeds of cattle is the limited number of animals available. At present, only about 200,000 out of the 10 to 14 million cattle in Nigeria are trypanotolerant (Adeniji, 1993), and can serve as reservoir host of trypanosomiasis. Furthermore, the cost of transport over great distances, along with the period of acclimatization required for adaptation to different environmental conditions, means that a long-term investment is needed before any significant development and economic returns can be expected. It must also be emphasized that the degree of trypanotolerance can be influenced by a number of factors, one of the most important being the level of tsetse challenge. It has been shown that as the level of challenge increases, productivity falls and that when tsetse challenge is high N'Dama can suffer severely from trypanosomiasis as judged by stunting, wasting, abortion, extreme lethargy leading to reduce ability to work and even death. Thus, trypanotolerance is a relative rather than absolute trait, which is severely affected by heavy challenge, malnutrition, stress, breed, age, season, and concurrent disease (Kalu, 1995; Feldmann and Hendrichs, 2001). Trypanotolerant breeds are poorly utilized and accepted in husbandry practice because of their size, productivity and traction power compared with the larger zebu breeds (Shaw and Hoste, 1987; Chater, 2002).

#### **STRENGTHENING INTEGRATED APPROACHES**

NITR has been responsible for planning, implementing, supervising, monitoring and evaluating tsetse and trypanosomiasis control in Nigeria. In its bids for these, NITR has innovated, an appropriate integrated control strategy for tsetse and trypanosomiasis. The sustained employment of this strategy was aimed at reducing the tsetse population and the disease to a subsistence level. The strategy consists of vector control and the treatment of existing cases. The reason for this integrated approach was derived from basic research in the institute that shows that parasite resistance to the few trypanocidal drugs is on the increase, the use of insecticides for large scale control is not only toxic but environmentally unfriendly and the use of drugs and insecticide involves relatively large sums of money which is unaffordable at the village level. There is also a shift in emphasis from using one single method to a combination of techniques. This is because there is no single tool that

can accomplish the control programme. Hence combining the various methods, Viz-drugs, diagnostic test, vector and socio-economic control as package of tools permit integrated control on the vector and the disease (NITR Brief, 2004/2005).

However, there is the urgent need for an inter-ministerial collaboration in the fight against trypanosomiasis, for better control of the disease. The federal and states ministries of health, agriculture, education, science and technology, environment and rural development, information and communication needs to collaborate towards the development of African Trypanosomiasis policies, plans and implementation frameworks. These obviously will become the basis for all stakeholders in Nigeria to support and to ensure uniform control activities and strong partnership. This inter-ministerial collaboration of approach will be responsible for mobilizing resources for the control programme and providing overall coordination, supervision, monitoring and evaluation. They will offer technical support to districts and promote public-private sector partnerships in Nigeria. With this integrated approach, health promotion could be implemented within the context of the national health promotion strategy. Individual and community knowledge of trypanosomiasis can be increased through health education and information-education-communication. Health education should be included in the curricula at primary school level. Trypanosomiasis can be a component of national health education packages and other disease control programmes. Social mobilization can strengthen community action. National programmes should be encouraged to form partnerships with the Nigerian media to disseminate information about trypanosomiasis and its control.

Furthermore, strengthening inter-agency and Intersectoral collaboration is strongly advocated. The WHO should strengthen collaborated efforts with other international organizations and projects such as the African Union, the Food and Agriculture Organization, the United Nations Development Programme, the International Atomic Energy Agency and the PATTEC to Promote Treatment of Animal Reservoirs and Tsetse Control. This collaborative effort will support the development and implementation of national control programmes through technical support and capacity building, including support to research institutions like the Nigeria Institute for trypanosomiasis Research (NITR), based on funding and technical support should be strengthened. This will also promote linkages between this strategy and other relevant regional strategies on strengthening integrated vector management, health promotion and integrated disease surveillance in Nigeria. Intersectoral cooperation by the veterinary, agriculture, and health services is fundamental. Integrated control starts at national level, but also needs to be implemented

at international level, among multilateral and bilateral organizations. Currently, activities are not coordinated; they occur mainly ad hoc and usually in response to an emergency (WHO, 2005) With Intersectoral action, we could better use the tools and funds we have at hand. For instance, control efforts could perhaps be focused around livestock market areas where human cases are concentrated (Fevre *et al.*, 2001). Strengthening control of the animal reservoir also requires intersectoral linkages. All sectors should, therefore, collaborate from planning to implementation phase for control of the animal reservoir in both animal and human trypanosomiasis. The treatment Of African trypanosomiasis could be either selective (after diagnosis) or comprehensive (treating all livestock). Farmers should be sensitized and mobilized to present their animals for examination and treatment. The role of animals in *T.b. gambiense* is not clear; therefore, treatment of livestock in endemic areas needs to be evaluated.

In light of the diminishing resources in vector control, the Nigerian Government and the various Communities should play supplementary roles. Generally it is assumed that Government has the finance and logistical capacity (though this might depend on political and so on situation), motivated manpower, and can respond fast to epidemics. The community on the other hand, is aware of the situation on the ground, their motivation being their own health affected and economic benefit in terms of animal production. The Government is not capable of monitoring tsetse everywhere and that is why they have to wait till cases appear. The supplementary roles, the two approaches need to be integrated. One major problem here is how to maintain community interest after reduction in the tsetse population and disease. It is suggested that there are three major reasons among others, which account for why community-based tsetse control programmers' fail: (a) economic and logistical constraints, (b) lack of continued public interest and (c) lack of voluntary time to devote to tsetse control. These can however be checkmated. There is the urgent need to also develop for the community appropriate technologies and to integrate economic activity with tsetse control so that there are both short-term and long-term benefits to the farmers. The use of low-cost traps to control tsetse should be integrated with awareness on tsetse and trypanosomiasis control. Communities should be given the technology to carryout surveillance and local control of tsetse.

## CONCLUSION

The methods of controlling animal and human trypanosomiasis are numerous and varied. Each possesses its advantages and disadvantages. All the currently available and environmentally acceptable methods for tsetse and trypanosomiasis control have their specific

limitations. Only a combination of the numerous methods in an integrated phase approach can effectively advance the control of tsetse and trypanosomiasis in Nigeria. Effective control of trypanosomiasis also will necessitate close collaboration between public and private sectors and stronger involvement of communities and NGOs. Realistic funding for research should be made available through national and international cooperation. Better control of trypanosomiasis also requires concerted efforts from the veterinary, agriculture, and health sectors, research organizations, and funding bodies. Implementation of this strategy in Nigeria should reduce morbidity and mortality due to trypanosomiasis and hence eliminate the disease as public health problem from Nigeria.

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