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Socio-Economic and Agricultural Factor In Control of Trypanosomiasis in Nigeria A Review

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Abstract: *Trypanosomiasis is a widespread disease in the middle belt states and southern part of Nigeria. Socio-economic activities such as herding, fishing, crop-rotation, collection of fire wood predisposed inhabitant to the disease. A good knowledge and understanding of tsetse dynamics, its habitats, routes of infection parasite life cycle, and available control methods forms an important background in decision making processes within the community and government agencies for successful tsetse and trypanosomiasis control. Biological control using sterile insect technique (SIT), chemotheraphy using trypanocidal drugs, vector control methods through ground and aerial spraying of insecticides, used of trypanotolerant livestock and cultural methods which include shifting cultivation and bush fallow.*

Keyword : ***(****trypanosomiasis, Socio-economic, control)*

I. Introduction

Trypanosomiasis is a widespread constraint on livestock production, mixed farming and human health in tropical Africa. The disease, however, is just one of many constraints faced by rural people and its relative importance depends on specific circumstances. Control may be achieved by a variety of autonomous and/or purposive measures. Autonomous control includes the multiple environmental impacts of human population growth, the expansion of agriculture, settlements and road networks, and the elimination of wildlife, through hunting and habitat loss. Purposive control measures fall into three categories: those related to animal husbandry and breeding; those directed against the trypanosome; and those targeted at the vector: tsetse (*Glossina spp*.). For purposive disease control measures to be sustained and effective in the reduction in poverty, disease control must be a priority concern of livestock producers and/or affected communities, and the benefits of increased production and/or improved human health must exceed the costs of control.

The Nigerian environment is undergoing profound and widespread changes induced by human population growth and agricultural expansion. As land suitable for cultivation becomes increasingly scarce in the more highly populated areas, particularly to the north and south of the country, the relatively underutilized regions of the Nigerian sub-humid zone are becoming more extensively exploited (1). As a result of these artificial changes in the environment, natural vegetation is being transformed into farmland, and wildlife populations are being hunted out. Consequently, the natural habitats and hosts of tsetse fly (*Glossina spp*.), the vectors of animal and human trypanosomiasis, are tending to disappear. Nigeria possesses the largest and most diverse human population of any country in Africa. The population has been, and still is, growing rapidly. As a result, there has been a progressive expansion of agricultural land which has inevitably affected the natural environment. For many years the primary cause of the profound and widespread changes in the Nigerian environment has been the rapid increase in human population, which has led to an ever increasing demand for food and land. This demand has been further exacerbated by the immigration of pastoralists from the Sahel in response to the frequent droughts. As a result there has been greater competition for land in areas of high human population density, and consequently a progressive expansion of agriculture into areas of lower human population density. The latter process has been both encouraged and channeled by the expansion of Nigeria's major road network, particularly into the moderately high rainfall areas of the sub humid zone (2). The increasing extent and intensity of both farming and hunting within this central bridging belt has greatly changed the pattern of vegetation and land use, and inevitably led to an overall reduction in wildlife species, and in many places brought about their local extinction. Thus both natural habitats and hosts of tsetse, the vectors of trypanosomiasis, have declined, which in turn has brought about a widespread reduction in the flies' distribution. The two savanna species, *G. morsitans* and *G. longipalpis*, which typically have high trypanosome infection rates, have been most severely affected by the changes taking place within the sub-humid zone, and their overall distribution has contracted. This, together with the general decline in the wildlife reservoir of trypanosomiasis has resulted in a marked reduction in the silvatic cycle of disease transmission.

1.1 Trypanosomiasis

African Animal Trypanosomosis is a parasitic infection caused by an extracellular flagellate. Trypanosomes are unicellular protozoan parasites of the phylum Sarcomastigophora, order Kinetoplastida, family Trypanosomatidae, and genus Trypanosoma (1). The Trypanosoma brucei complex comprises three morphological identical subspecies: *T. brucei brucei*, *T. b. rhodesiense*, and *T. b gambiense*. Only *T. b. brucei* is pathogenic to cattle, the other subspecies cause acute sleeping sickness in East Africa and chronic sleeping sickness in West Africa. Recent studies have resulted in a subdivision of the *T. congolense* species in several types which can be distinguished by isoenzymatic differences and molecular techniques (2). These are designated as *T. congolense* (savannah type), *T. congolense* (Tsavo type), *T. congolense* (forest type), *T. congolense* (Kilifi type). *T. congolense, T. vivax* and, to a lesser extent *T. b. brucei*, are the major pathogenic species of African cattle (3). *T. congolense* is considered the most important cause of AAT in East Africa, and *T. vivax* in West Africa (4). However, mixed infections that involve two or three species are frequent in areas of medium to high tsetse challenge. Trypanosomes are able to infect a wide variety of domestic animals and more than 30 species in the wild (4). *T. vivax* and *T. b. brucei* have spread beyond the tsetse fly belt by transmission through mechanical vectors. In cattle, the pathogenesis is dominated by three features: anaemia, tissue lesions and immune suppression. The cause of anaemia is complex and involves a variety of mechanisms. Although haemolysins are released by trypanosomes, intravascular haemolysis is not a prominent feature, and anaemia is rather attributed to erythro phagocytosis by cells of the mononuclear phagocytic system in the spleen, bone marrow, lungs and lymph nodes; these cells are stimulated by the formation of complexes between immunoglobulin specific for trypanosomes and antigen or complement attached to red cells. Pathology in tissues is associated with the ability of the parasites to invade extra vascular spaces and organs. Whereas *T. congolense* remains confined to the vascular system, T. b. brucei is distributed in both the circulation and in the tissues; *T. vivax* although primarily a vascular parasite, has also been found in extra vascular locations (5).

1.2 Socio-economic and Culture.

Socio-economic activities such as herding, fishing, and crop farming may predispose individuals to the disease. Gender roles within the study communities are often structured whereby each gender has assigned duties like livestock herding, fishing, crop farming, and collection of firewood. A good knowledge and understanding of tsetse dynamics, its habitats, routes of infection parasite life cycle, and available control methods forms an important background in decision making processes within the community and government agencies for successful tsetse and trypanosomiasis control (6). Illiteracy and inadequate formal education hampers information flow and understanding on tsetse and disease dynamics. Culture influences human activities and how they perceive disease and their surroundings. Culture determines learned social behavior, occupation and knowledge which are often gender specific and could alter interactions between hosts, parasites and vectors thus impacting on vector-borne diseases. In particular livestock herding, fishing, crop farming, and collection of firewood have been implicated to be major factors that predispose individuals to HAT of which some of this activities are gender specific (7). Mitigation measures applied by exposed communities include wearing protective clothing, and staying indoors during certain hours. The study concentrated on the kind of behaviors that were related to HAT outcome.

Recently, alternative control methods have also been used. The Federal Department of Pest Control Services (FDPCS), in conjunction with the International Atomic Energy Agency and the Food and Agriculture Organization of the United Nations, has initiated a Project for the Biological Control of Tsetse in the Lafia area, which employs a novel form of control, utilizing the sterile male release technique in place of conventional insecticide application. Of the eleven recorded species of Nigerian tsetse (8), six have been found within the boundaries of the sub humid zone. Each of the main species-groups is represented: *G. morsitans* and *G. longipalpis* of the 'savanna' dwelling group; *G. palpalis* and *G. tachinoides* of the 'riverine forest' group; and *G. fusca* and *G. haningtoni* of the 'forest' dwelling group (9). The latter two species are exceptional for the sub humid zone in that they are basically rain forest species and records have been confined to typical forest outliers.

II. METHODOLOGY

The review is based on the information curled from internet and document and online published papers and workshops hold across the globe.

III. RESULT AND DISCUSSION

3.1 The dynamic factors in control of the disease

Disease risk is a dynamic factor in that it is subject to change which can be brought about by the following:

- a) advances in veterinary research bringing new vaccines and drugs, better understanding of the epidemiology of animal diseases and improved control of parasite vectors;

- b) adoption of new production systems with consequent changes in environmental stress and inter-animal contact frequency; also changes in nutritional status;
- c) demographic change which alters vector habitat (agricultural expansion; fuel wood removal);
- d) socio-economic change such as alteration in animal values, efficiency of livestock production support services and government sect oral priorities, etc.

Change in disease risk may be relatively gradual, as in the advance of tsetse populations, or sudden as with the advent of render pest tissue-culture vaccine. In considering the disease factor it is necessary to recognize the strategically important diseases which constitute the sequential barriers to progressive livestock development and to consider the reappraisals in breed preferences which may occur as each barrier is breached (10). Until the advent of a safe and effective vaccine this disease constituted the primary threat to survival of trypanotolerant cattle. At the present juncture trypanosomiasis, closely followed by streptothricosis, constitute the main impediments to livestock production and investment at farm level. Effective control of these diseases will open up the possibility of using dual or triple purpose zebu breeds and possibly wider adoption of their crosses, throughout the humid and sub-humid zones (11). At this stage other formidable disease barriers, and in particular the tick-borne diseases, would still confront any initiative to move forward with introduction of temperate zone breeds except under closely monitored controls (11).

3.2 Chemotheraphy of trypanosomiasis

Today, there are only a handful of active drugs available for treatment of human African trypanosomiasis. No significant development has been made over the last 2 decades. The current line of treatment is problematic for many reasons: firstly, the drugs are harmfully toxic requiring extensive hospitalization. Secondly, regular follow-ups to check for relapse is essential but difficult in many of the areas where sleeping sickness is endemic (12).

Summary of drugs available for treatment of human African trypanosomiasis

Drug	**Marketed**	**Spectrum of Activity**	**Stage of disease**
Suramin (Germanin)	1922	*T. b. rhodensiense*	Stage 1
Pentamidine (Pentacarinat)	1937	*T. b. gambiense*	Stage 1
Melarsoprol (Arsobal)	1949	*T.b.gambiense* *T. b. rhodensiense*	Stage1&2 Stage 1&2
Eflormithine (Orindyl)	1981	*T. b. gambiense*	Stage 1&2

Treatment of the hemolymphatic stage is based on *pentamidine* and *suramine* . *Melarsoprol*, an arsenic compound, is the only treatment option available for late stage sleeping sickness because of its ability to penetrate the blood-brain barrier. Unfortunately, even when administered under careful medical attention, the treatment has a mortality rate as high as 12 % (13). *E flornithine* is effective against both stages of *T. b gambiense* infection, but not against *T. b rhodensiense* (11). Although the most recent and effective drug against sleeping sickness, it is not widely available, difficult to administer, and costly for use under African health care conditions (14). So far, only 2000 patients in therapeutic trials have been treated with eflornithine. Use of pentamidine as a form of mass chemoprophylaxis has proven to be an effective form of prevention and control in endemic foci of *T. b. gambiense* (11)

3.3 Other Control methods

Control methods can either be directed against the vector, the tsetse fly, or against the parasite itself, the trypanosome. Vector-control methods include ground and aerial spraying of insecticides, the Sterile Insect Technique (SIT), traps and targets and the use of deltamethrin acaricide treatment for cattle. Parasite control methods include trypanocidal drug treatment and the use of trypanotolerant livestock (3). Avoidance of the areas infested also constitutes a means of dealing with the disease, as does the destruction of the natural habitat of the fly when land is cleared for settlement in response to increasing human population pressure (15).

The term trypanotolerant in livestock is generally applied to small populations of cattle, sheep and goats found in West and central Africa which possess some degree of resistance to trypanosomiasis (16) compared to Nigeria. Trypanotolerance in indigenous eastern and southern African breeds should be further investigated if these are to receive the same recognition (8). In the eastern and southern African region, control operations have been undertaken since colonial times and important efforts are being currently deployed in a regional program covering Zimbabwe, Zambia, Malawi, Botswana, Angola and Mozambique (17).

3.4 Other Disease Control Options

Options available for controlling animal trypanosomosis in Africa are identified in figure 1 Autonomous; anthropogenic impacts that influence and modify the extent and severity of the disease are distinguished from more purposive, managed and intentional control measures. Autonomous control includes the environmental impacts of human population growth, the expansion of agriculture, settlements and road networks, and the elimination of wildlife, through hunting and habitat loss. Purposive control measures fall into three categories: those related to animal husbandry and breeding; those directed against the trypanosome; and those targeted at tsetse (7).

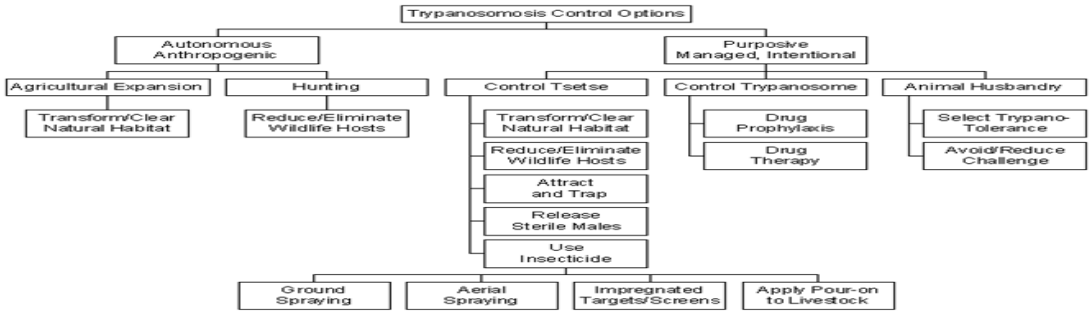

Figure 1: Factors Involved and Options Available for the Control of Trypanosomosis (11)

3.5 Traditional Management

By the mid-1950's good progress had been made in research and on-station development of improved pastures. Large-scale expansion of commercial ranching was envisaged in national development plans. Village livestock on the other hand were for the most part free-roaming or confined overnight and herded in daytime. Production of forage on fallow land was a subject of technical discussion, but the reality seemed fraught with insurmountable problems of distance, time-budgeting and fragmentation of land holdings. Shifting cultivation with long bush fallows was universal. The management factors which predispose to occurrence of clinical trypanosomiasis in trypanotolerant breeds i.e. low plane of nutrition, overwork, inter current disease, change of environment, systematic reactions to certain vaccines etc., were well recognized thirty years ago (3). They were not of major concern in village herds. No strategies had yet evolved for intensifying management other than provision of confinement and herding to reduce the social conflicts resulting from crop damage by free-roaming livestock. A comprehensive and competent review of current management of trypanotolerant livestock in West and Central Africa has been provided by (18). Insufficient reliable information existed to enable quantitative economic assessment of the importance of these animals in either the agropastoral, ranching or crop-farming sectors. However, as his review clearly indicates, their economic role in commercial terms, is lowest among the small farming communities in the high rainfall areas. A few of the salient factors which still influence the performance of trypanotolerant livestock in the high rainfall areas will be outlined briefly here.

3.6 Restriction of grazing opportunity

In the case of West African Dwarf goats, and (9), in the case of West African Dwarf Shorthorn cattle, observed that trypanotolerant livestock in village situations usually perform best when not managed at all. This information can be useful if it indicates where management improvements may be achieved within the framework of production priorities and resources of local livestock owners.

In many villages typical management systems still involve confinement or tethering on bare ground from dusk until around 9 a.m. thus providing only 9 hours or so of grazing time for animals that would spend several of these hours resting and ruminating in the shade under free-choice conditions. This restriction constitutes more of a problem when herdsmen are employees having only limited proprietary interest in performance other than milk yield. It is often a major factor responsible for poor condition and low performance of village herds. Rotational night grazing paddocks could, in theory, compensate for restriction of daytime grazing but they are costly to establish and maintain and consequently are seldom adequate in size or number (10).

3.7 Fragmentation of village grazing

In the rain forest environment particularly, village grazing tends to consist of small isolated areas of derived grassland resulting from land clearing around village schools, playing fields, churches etc., or where roadside verges have been clear felled and kept open. Un husbanded herds utilize all corners of such secondary grassland effectively by dispersing widely during grazing. Herds which are kept intact by herdsman are restricted to the few grassed areas large enough to accommodate the entire herd at one time. This aggravates risk of overgrazing. Coupled with the effect of restricted grazing time, it can account for deterioration of both cattle and available pasture (8).

3.8 Pasture management

Lignifications and protein dilution in rapidly growing, tall grasses during the rains is a frequent cause of poor nutritional status of trypanotolerant cattle in the high rainfall areas. It can occur alongside areas which are heavily overgrazed. If herding is inefficient or stocking density too light during the rains, grazing will be concentrated on limited areas while grass growth proceeds unchecked elsewhere. This can lead to a situation where animals are unable to consume sufficient dry matter to obtain nutritional requirements for maintenance and can be an important factor in increasing susceptibility of trypanotolerant breeds to trypanosomiasis (14). It was a prominent aspect (personal observation) of the poor standard of management alluded to, but not specified, by (6) in their account of a high incidence of trypanosomiasis in a herd comprising trypanotolerant breeds.

III. Conclusion and Recommendations

From the review it was found out that socio-economic and agricultural factors have impact positively in the control of trypanosomiasis such factors include the following crop rotation collection of fire woods fishing as well as herding.

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