Brief review on socioeconomic impacts and control challenges of Human African and Animal Trypanosomiasis in South Sudan

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Abstract: Human and animal African trypanosomiasis had been reported in South Sudan since 1909. Socio-economic impacts and control challenges of human and animal African trypanosomiasis in South Sudan were reviewed to elucidate episode of HAT and AAT impeding production and productivity. Foci of both tsetse transmitted diseases are still active in South Sudan. This is due to epidemic outbreaks from active foci in neighboring countries as a result of widespread distribution of the vectors and political upheavals, social instability and civil disturbance. Sleeping sickness caused the local population living in the sleeping sickness-endemic areas to lose their cattle; contributed to poverty in those foci. The infected individuals are mentally hampered. Challenges to control programmes leading to inadequate knowledge of the disease symptoms and signs, transmission dynamic and treatment at the individual level; massive population movements; lack of funds by stakeholders, role players and partners in controlling the disease. The risk of infection is increased by agricultural developments which increased human-fly contact. Regular active surveillance including active case detection and treatment is the backbone for the strategy of sleeping sickness control.

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Tsetse transmitted human African trypanosomiasis (HAT), or sleeping sickness caused by *Trypanosoma brucei gambiense* is responsible for the chronic form of HAT in West and Central Africa where the main vectors are *Glossina species* of the *palpalis* group (Hoare, 1972). A full description of sleeping-sickness in the Sudan /South Sudan has been given by (Moris, 1961 ;Bloss ,1969).

The only form of the disease present is that due to ***T.b. gambiense*** and this has been confined to a comparatively narrow belt of the country along the southern border of the then Equatoria Province, adjacent to Uganda, the Congo, and the Central African Republic.

At the present, , tsetse flies occur in the extreme South Sudan, along the Nile-Congo watershed, involving the upper parts of the tributaries of the Nile, both *G. palpalis* and *G. morsitans* are prevalent and cattle are absent. Other tsetse-fly species are present in localized areas but are of less importance. The situation is complicated by the activities of tabanids acting as mechanical transmitters of animal trypanosomes in the grazing areas outside the tsetse-fly belt. A small pocket of ***G. morsitans*** in the Nubian mountains has now been eliminated. The interrelation of the present tsetse-fly distribution and the prevalence of mechanical transmission in the southern grazing areas and the prevalence of *T. evansi* in camels have been well shown (Buxton ,1955) .

The present paper reviews the distribution of Sleeping sickness, the socio-economic impacts of the disease, factors that led to the failure of HAT and AAT and control Programmes in South Sudan.

At the beginning of the last century, sleeping sickness was perceived by the colonial powers as the most important public health problem in Africa. Huge epidemics devastated large areas of the continent. In the then Sudan cases of the disease were identified in Raga, Yei, Kajokeji, Nimule ,Tambura and Yambio since 1909, 1910, 1914, 1915, 1918 and 1924, respectively. However, all the aforementioned foci are still active and all epidemic outbreaks in those regions were attributed to the presence of active foci in neighboring countries, particularly those where tribal settlements straddled the borders; widespread distribution of the vectors; and political upheavals, instability and civil disturbance (Duku ,1979).

In 1946 Yambio became the centre of the new Zande Development Scheme (ZDS), this resulted in a massive movement of people to settle in high density in Yambio where numerous ***Glossina palpalis*** infested streams existed. As no control of this fly attempted, the contact between the densely settled population and the fly became easier, provided ideal conditions under which the epidemic arose (Morris, 1960). The administrative changes in 1954-55 which led to the revolt in Southern Sudan had caused the breakdown of

the well-established sleeping-sickness inspection and control.

The Yambio outbreak then arose with alarming suddenness and in contrast to a previous slow increase, reaching 871 cases in 1957. In the 1960s, the prevalence of sleeping sickness was successfully reduced in all endemic countries to less than 0.1%, through historic campaigns by the former colonial powers. Soon after independence, however, national governments were either lacking in resources or had diverted resources to other pressing health problems. Breakdown of specialized mobile teams and health facilities in several countries, as a consequence of war and civil strife or change in health policy, resulted in dramatic resurgence of African trypanosomiasis, the distribution of which corresponds closely with that of major conflicts in sub- Saharan Africa.

However ,some control measures were made possible through external assistance from WHO and the Government of the Kingdom of Belgium between 1974 and 1978, which led to availability of information on the disease epidemiology (Scientific working group Report, 2001).

After a resurgence of the disease in the late 1970s in the then provinces of Western and Eastern Equatoria, a bilateral Belgian Sudanese trypanosomiasis treatment and control programme was implemented. This effort brought the disease under relatively good control within a few years. However, the trypanosomiasis programme collapsed in 1990 during the civil war. In 1997, it became evident that sleeping sickness was staging a comeback. After the American International Medical Corps (IMC) observed a progressive increase in passively detected cases in Tambura County, South Sudan, a population-based prevalence survey documented epidemic levels of trypanosomiasis in the south-western part of the county bordering Central African Republic (CAR) and Democratic Republic of the Congo-DRC (Moore *et al.*, 1999). Consequently,19.4% of the population was seroreactive to Card Agglutination Test for Trypanosomiasis (CATT) (Magnus *et al.*, 1978) and 13% of the population had confirmed infection based on a single parasitological examination.

In 1998, the most active focus of trypanosomiasis identified in Western Equatoria was Ibba, in Maridi County, with a confirmed infection prevalence of 29%. Other areas with epidemic disease were Kajo Keji (5.1%) and several sites including Ezo, 13.6%; Source Yubu, 6.4%; Mupoi, 5.4%. In late 1999, 20 months after a cycle of Active Case Detection (ACD) had been conducted in Tambura County, repeat screening in several areas showed that the prevalence of confirmed infection had declined dramatically. Despite an influx of new infections among Sudanese refugees repatriated from DRC, trypanosomiasis prevalence decreased in Ezo from 13.6 to 3.1% and in Source Yubu from 6.4 to 1.6%. The current resurgence of trypanosomiasis is not confined to Western Equatoria or to South Sudan. Epidemic levels of the disease are also present in adjacent areas of CAR and DRC. Bazigbiri, a village in CAR approximately 75 km from the South Sudan border, was nearly too depopulated by sleeping sickness in 1995 (J. Jannin, personal communication).

The close link between agriculture and (HAT) is well illustrated by events in the then Sudan. The start of the Yambio outbreak in 1946 coincided with this town becoming the centre of the new Zande Development Scheme(ZDS), in which a formerly scattered population was settled at a fairly high density in country intersected by numerous ***G. palpalis***-infested streams. No control of this fly was attempted as it was considered impracticable. The resulting situation, of a heavy population in intimate contact with the vector, provided ideal conditions under which the epidemic then arose.

The effect on livestock not only reduces the availability of meat and dairy produce, but most particularly denies the use of cattle and horses for transport and traction. For agricultural communities, this means that only small areas can be tilled by hand, leaving the communities vulnerable to food shortages, starvation, and famine. Studies conducted by Govereh (1999) had indicated that if draught animals were available, a family currently dependent on manual labour alone could increase its income from agricultural work by 45% per unit of land, and 143% per unit of labour (FAO, 2000). Steelman (1976) and FAO (1994) estimated that for the whole of Africa, overall agricultural losses attributable to trypanosomiasis would total more than US$ 4 billion annually which is in line with Budd (1999), who estimated that agricultural benefits accruing to tsetse elimination could reach US$ 4.5 billion per annum.

The Yambio incident is but one among a number of instances elsewhere in Africa in which agricultural developments, without regard to the risks arising from increased contact with *tsetse,* have provoked epidemics of *T. gambiense* (Morris, 1960). Conversely, agricultural development, properly handled, can be the most successful and economic method of reclaiming land from tsetse fly. The first step must be an attack upon the vector species to the point of their elimination. When *G. palpalis* is the vector, as in the Sudan, the terrain it occupies is usually the most fertile and well watered. Consequently the land gained from the fly can be fully developed, for agriculture, livestock, and often fishery. A dual purpose is thus served: justifying the expense of tsetse-fly eradication, and stabilizing the

control. A stable form of control obviates the need for maintenance, which often in the long run proves even more costly than the initial reclamation. Since tsetse-fly eradication removes at once the danger of HAT and AAT, a follow-up with full agricultural development, including mixed farming, is possible, and the eventual benefits to the economy as well as to the health of the country are immense.

Livestock trypanosomosis is an important constraint to livestock productivity in sub-Saharan Africa (Swallow, 1998). It has adverse effects on rural development over vast areas (Holmes, 1997). Unfortunately, the pattern of contact between haematophagous insects, such as tsetse flies, and their hosts is extremely heterogenous and non-random (Kelly, 2001). As a result, some host species are challenged substantially more than others and may contribute more to parasite transmission (Woolhouse *et al.,* 1997).

Animal trypanosomiasis is of tremendous importance to the then Sudan; not only does it affect the distribution of cattle, but it has also strongly affected the distribution and even the habits of the main tribes (Lewis, 1949). In the then Bahr el Ghazal and Equatoria Provinces, the disease is so severe that cattle are almost completely absent in the areas occupied by *G. morsitans*. Trypanosomiasis sets such a limit to the raising of stock as to give rise to serious protein deficiency in the diet of many of the people (Tothill, 1948). It is on the fringe of these fly-belts that animal trypanosomiasis chiefly flourishes, largely in the herds of cattle driven from the fly-free open grass plains into the fly-infested savannah woodland for dry-season grazing. Infected cattle (also game, which are important reservoirs) carry trypanosomiasis back with them into the wet-season grazing areas, where tabanids are so numerous as to set up widespread epizootics, transmission being entirely mechanical. These outbreaks reach such severity that, in 1946-47, one-and-a-half million cattle were affected in an area of over 100 000 square miles (260 000 km²). Most herds were infected, many losing more than half their beasts. At one time the death-rate exceeded 10 000 cattle in a month.

In South Sudan, the main sleeping sickness outbreaks are along the Congo-Nile watershed brings forestry interests under consideration. One of the most important functions of a forest being protection of the soil and prevention of run-off on such catchment areas. Hence, tsetse control method by bush-clearing is not desirable under this circumstance. It seems that , a chemoprophylaxis or the removal of tsetse fly by spraying with insecticides or trapping may be preferable (Morris, 1962).

Control of sleeping sickness relies on detection of the parasite and effective treatment of the patient. Routine diagnosis of the disease is based on direct visualization of the parasite in blood, lymph node aspirates and cerebrospinal fluids(CSF) using a microscope (Van Meirvenne, 1999). This method has limited sensitivity due to fluctuating parasitaemia. In efforts to improve detection of trypanosomes, a number of diagnostic methods have been developed, including the mini-anion exchange centrifugation technique (AECT) (Lumsden *et al.,* 1979), polymerase chain reaction(PCR) (Welburn *et al*., 2001; Gibson *et al*., 2002; Radwanska *et al*., 2002; Jamonneau *et al*., 2003) and recently, a dipstick test has been evaluated (Deborggraeve *et al*., 2006). Despite these advances, diagnosis of HAT remains unsatisfactory. The PCR-based tests have good sensitivity. However, the need for precision instruments and elaborate visualization methods are obstacles to their wide application in clinical settings in Africa. Consequently, diagnosis of HAT involves a combination of parameters, such as origin of the patient, symptoms, demonstration of parasites by microscopy, or detection of specific antibodies using the Card Agglutination Test for Trypanosomiasis (Magnus *et al*., 1978). The paucity of definitive tests means that some patients go undetected and therefore become potential sources of infection to other people.

Significant resurgence of the disease has occurred in recent years in South Sudan and new foci of the disease have emerged. The persistence and resurgence of sleeping sickness is attributable to a number of factors which constitutes challenges for control. Means for regular surveillance are often inadequate, while at individual and family levels, there may be inadequate knowledge of disease symptoms, transmission dynamics and treatment. Population movement due to seasonal migration and refugees, may increase human –fly contact and hinder regular medical surveillance of the population at risk.

Regular medical surveillance of the population in the endemic areas, involving case detection and periodic population screening and treatment, and tsetse fly control, where applicable, is the backbone of the strategy for control of sleeping sickness (WHO, 1998). With available tools, control is a continuing effort rather than eradication.

Ministries of health, research organizations and services often lack or do not have adequate economic resources for sleeping sickness control programme due to competing health priorities. Recruitment of medium-level personnel is inhibited by lack of incentives and care prospects. Ministries may lack funds for the purchase of diagnostic tests and drugs.

Central governments often accord sleeping sickness a low priority, until it assumes epidemic proportion.

However, historically, social upheaval has been a contributing factor in outbreaks of trypanosomiasis. Trypanosomiasis control activities are particularly vulnerable to collapse in settings of civil strife. Furthermore, social disruption often leads to population movements and altered relationships of humans with tsetse habitat. The situation in South Sudan suggests that the civil war was associated with a collapse of the public health infrastructure, resulting in this epidemic of trypanosomiasis.

Never-the-less, obtaining adequate resources to maintain active surveillance in ***T. b. gambiense-*** endemic areas and to reestablish abandoned control programmes will remain a challenge. The current cost of implementing these programmes is insignificant compared with the future cost of delayed interventions to contain this expanding epidemic.

This review shades light on the evidence for inequities in trypanosomiasis infection status, epidemiologically relevant living conditions, and access to health care in the studied population.

The resurgence and persistence of the disease in South Sudan might have been attributed to the fact that the South is bordered by countries with still active sleeping sickness foci and especially in the presences of the disease vectors that are moving between the South and these countries. The situation was worsened by the lack of adequate funds by the Ministry of Health to control the disease and the fact that the Central Government gave no priority to Sleeping Sickness Control Programme in its list of emergency and urgency.

These findings make emphases on the need for more equitable and efficient trypanosomiasis control interventions, which may contribute to poverty alleviation. No or little progress has been made in research investigating into the role of socioeconomic factors and the broader socioeconomic environment in the transmission and spread of trypanosomiasis in South Sudan and highlights several additional areas that might benefit from such studies:

I. Continuous monitoring of the Tsetse fly in the endemic areas is necessary to determine its population dynamic and factors favoring and disfavoring its growth.
II. Public awareness of the population at risk on the symptoms and some important clinical signs of the disease.
III. Periodical examination of the natives for the presence of the parasites in their blood.
IV. There is a need for capacity building for research and control of Human HAT through strengthening laboratory diagnostic capacities and research centers, training scientists and encouraging networking.

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12/22/2012

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